ADMINISTRATIVE RECORD

RECORD OF DECISION

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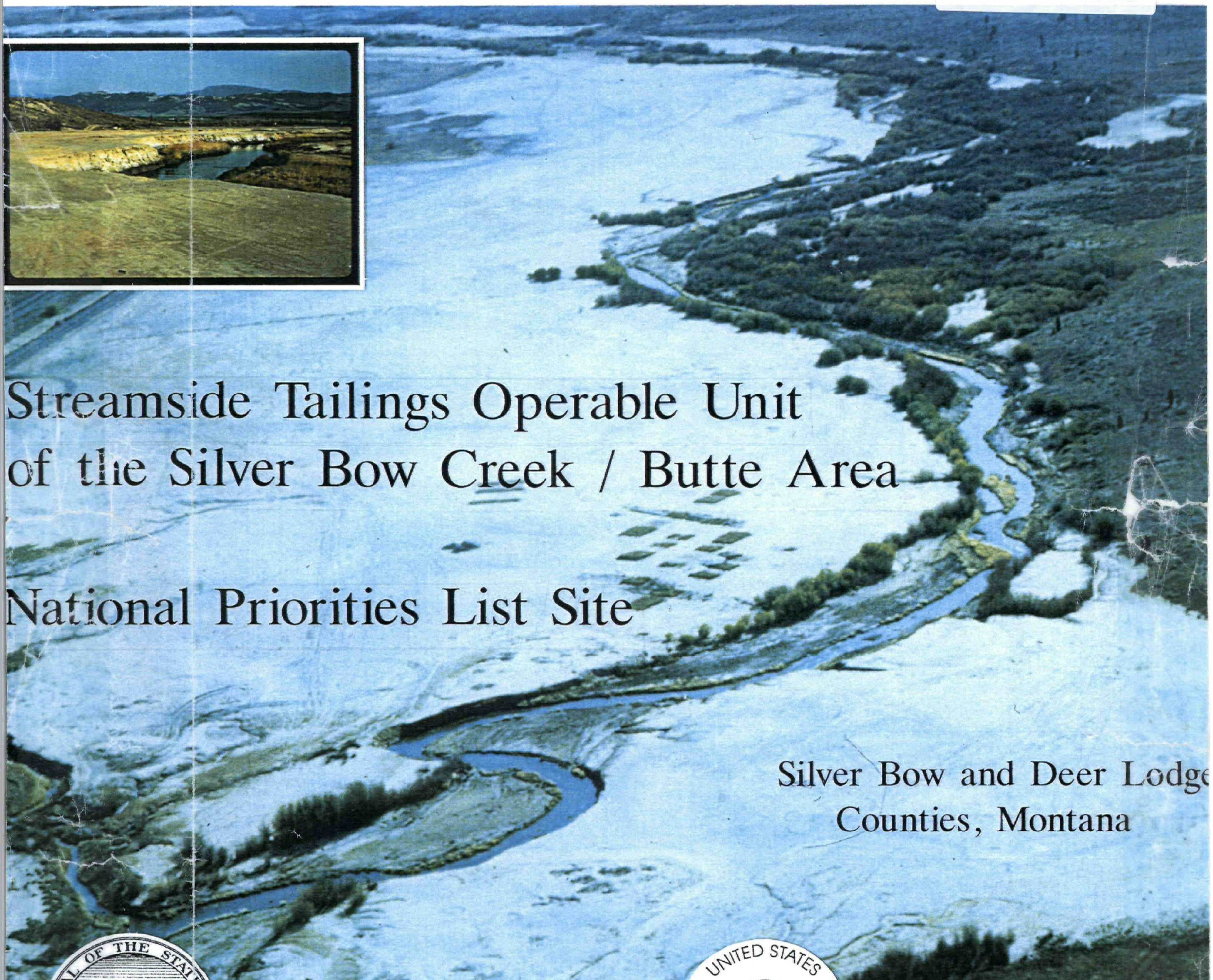

Streamside Tailings Operable Unit of the Silver Bow Creek / Butte Area

National Priorities List Site

Silver Bow and Deer Lodge Counties, Montana

Department of Environmental Quality
Environmental Remediation Division

Environmental Protection Agency
Region VIII - Montana Office

5040700

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RECORD OF DECISION

STREAMSIDE TAILINGS OPERABLE UNIT
SILVER BOW CREEK/BUTTE AREA
(original portion)
NATIONAL PRIORITIES LIST SITE

SILVER BOW AND DEER LODGE
COUNTIES, MONTANA

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November 1995

RECORD OF DECISION

STREAMSIDE TAILINGS OPERABLE UNIT OF THE SILVER BOW CREEK/BUTTE AREA (original portion) NATIONAL PRIORITY LIST SITE

INTRODUCTION

The Montana Department of Environmental Quality (MDEQ)[1] and the U.S. Environmental Protection Agency (EPA) present the record of decision for the Streamside Tailings Operable Unit (the SST OU) of the Silver Bow Creek/Butte Area (original portion) National Priorities List (NPL) Site, Butte, Montana. The record of decision is based on the administrative record, remedial investigation/feasibility study, the proposed plan (MDEQ, 1995a), the public comments received, including those from the potentially responsible party, EPA comments, and other pertinent information. The record of decision presents a brief outline of the remedial investigation/feasibility study, actual and potential risks to human health and the environment, and the selected remedy. MDEQ followed the Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA), the National Contingency Plan (NCP), and EPA guidance in preparation of the record of decision. The record of decision has the following three purposes:

1. To certify that the remedy selection process was carried out in accordance with the requirements of the CERCLA, 42 U.S.C. 9601 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Contingency Plan (NCP);

2. To outline the remedial components and goals of the selected remedy; and

3. To provide the public with a consolidated source of information about the history, characteristics, and risks posed by the conditions at the OU, as well as a summary of the cleanup alternatives considered, their evaluation, the rationale behind the selected remedy, and the agencies' consideration of and responses to the comments received.

The record of decision is organized into three distinct sections:

- The **Declaration** functions as an abstract for the key information contained in the record of decision and is the section of the record of decision signed by the Director of the Montana Department of Environmental Quality and the Assistant Regional Administrator for Ecosystems Protection and Remediation,

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[1] The Montana Department of Environmental Quality was created on July 1, 1995, by consolidating environmental programs from the Departments of Health and Environmental Sciences, Natural Resources and Conservation, and State Lands. The majority of the SST OU investigation was conducted under the authorities of the predecessor Montana Department of Health and Environmental Sciences (MDHES).

EPA Region VIII;

- The **Decision Summary** provides an overview of the OU characteristics, the alternatives evaluated, and the analysis of those options. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements; and

- The **Responsiveness Summary** addresses public comments received on the proposed plan (MDEQ, 1995a), the remedial investigation/feasibility study and other information in the administrative record.

DECLARATION

OPERABLE UNIT NAME AND LOCATION

Streamside Tailings OU of the Silver Bow Creek/Butte Area (original portion) National Priorities List Site in Silver Bow and Deer Lodge Counties, Montana.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for the Streamside Tailings Operable Unit (the SST OU) of the Silver Bow Creek/Butte Area National Priorities List (NPL) Site. The Montana Department of Environmental Quality (MDEQ), in consultation with the United States Environmental Protection Agency (EPA), selected the remedy in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the NCP. The EPA concurs in and adopts the selected remedy. The attached index identifies categories of documents or records that comprise the administrative record upon which the selection of the remedial action is based (Appendix B).

ASSESSMENT OF THE OU

Actual or threatened releases of hazardous substances from this OU, if not addressed by implementing the response action selected in this record of decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

This is the final remedial action for the SST OU. This remedial action addresses the principal threats and provides for treatment and appropriate disposal of contaminated tailings/impacted soils, instream sediments, and railroad materials. Much of the treated materials will remain in the OU. Consequently, the OU will require long-term management and monitoring.

The principal contaminants of concern at the SST OU are arsenic, cadmium, copper, lead, mercury, and zinc. This remedial action is generally described as ***Alternative 5*** in the Feasibility Study (ARCO, 1995b) and the proposed plan (MDEQ, 1995a). Some refinements to Alternative 5 have been made to clarify the criteria used to require excavation of tailings/impacted soils, to more precisely identify excavation of contaminated railroad bed materials, and to specify an institutional controls/maintenance program that will be used to manage the Silver Bow Creek corridor in the future. This record of decision establishes cleanup levels or physical criteria for these and all other contaminants of concern at the SST OU. The major components of the selected remedy include:

Tailings/Impacted Soils

1. Excavation of contaminated tailings/impacted soils from most areas within the present 100-year floodplain as delineated in the CH2M Hill (1989) Flood Modeling Study ("floodplain"). The removed volume will include all tailings/impacted soils continuously or seasonally saturated by groundwater together with the tailings/impacted soils overlying these saturated tailings (collectively, "saturated tailings"), tailings/impacted soils located where in-situ Streambank Tailings and Revegetation Study (STARS) treatment cannot reliably immobilize the contaminants, and tailings/impacted soils subject to erosion and re-entrainment into the stream. These criteria, together with the other details on the selected remedy, are more fully described in the Decision Summary below. The total volume of saturated and overlying tailings/impacted soils to be removed is presently estimated at approximately 700,000 cy. The total volume of tailings/impacted soils subject to erosion and therefore to be excavated is estimated at approximately 850,000 cy (1,550,000 cy collectively). Specific locations and volumes of excavated materials will be determined by the agencies during remedial design/remedial action.

2. To meet the established OU remedial objectives, tailings/impacted soils will be removed from the floodplain where: (1) tailings/impacted soils are saturated by groundwater during any part of the year, (2) in-situ Streambank Tailings and Revegetation Study (STARS) treatment cannot reliably immobilize the contaminants, for example, due to the thickness of the tailings/impacted soils, proximity of the tailings/impacted soils to groundwater, or lack of appropriate buffer materials between the treated tailings/impacted soils and the groundwater, or (3) the treated tailings/impacted soils could be eroded back into the stream by natural lateral stream migration, channel avulsion, overbank flow, or flood events. A detailed discussion of this topic is presented in Section IX (Selected Remedy) of the Decision Summary.

3. All remaining tailings/impacted soils (approximately 950,000 cy) within the OU will be treated in-situ with the STARS technology and appropriately protected from washout or erosion from lateral stream migration and flood flows. In-situ and adjacent repository STARS treated areas will not be placed or left where they can be eroded back into Silver Bow Creek.

4. Excavated tailings/impacted soils will be relocated to safe, local repositories clearly outside of the present 100-year floodplain as defined by CH2M Hill (1989) provided that appropriate locations can be identified and delineated for repository use and that an appropriate institutional controls/maintenance

program can be implemented. Tailings/impacted soils placed in the relocation repositories will be fully treated with lime amendments in 2-foot lifts and will be revegetated in accordance with the STARS technology. If appropriate locations and an appropriate institutional control/monitoring and maintenance program cannot be implemented, excavated tailings/impacted soils and other wastes would be removed to centralized dry repositories and appropriately handled and disposed of there.

5. Replacement fill will be required in most locations where tailings/impacted soils are removed. Replacement fill and streambank reconstruction with suitable growth media having an appropriate texture and particle size distribution will be required. A key to long-term streambank stabilization will be establishment of mature riparian vegetation. Grass, forb, willow, and tree species will be specified based on local climatic conditions, proximity to stream channel, and ability to produce dense root systems at maturity. The overall topography of the replacement fill material will be appropriately sloped toward the stream channel, with the goal of creating geomorphic stability.

6. Because numerous repositories, which will be treated with the STARS technology, will be located near the floodplain in several areas along the length of the stream, and because in Subareas 2 and 4 a substantial amount of tailings will be treated with the STARS technology on the edges or just outside of the floodplain, a permanent monitoring, management, and maintenance program is an integral part of the remedy. Monitoring, management and maintenance will address vegetative performance on both STARS treatment areas and remediated streambanks, streambank stability and channel meander. This remedy will also ensure that the metals are immobilized at all in-situ remediated areas and removal repositories through vadose zone, saturated zone, and overland flow monitoring.

Instream Sediments

7. Fine-grained instream sediments (less than or equal to one millimeter in size [$\leq$1mm]) located in every depositional areas will be removed and placed in repositories with the excavated tailings/impacted soils and railroad materials. This size fraction was identified because it corresponds with the size of the tailings/impacted soils and contains the bulk of instream contamination. Specific volumes and locations to be excavated will be determined by the agencies during remedial design/remedial action. This sediment volume is

presently estimated at 73,000 cy as presented in the RI report (ARCO, 1995a).

8. After removal of contaminated sediments, the channel bed and streambank will be reconstructed to an appropriate slope and other critical dimensions with materials of appropriate size, shape and composition. This reconfigured bed will contain suitable bedform morphology (riffles, bars, pools, etc.) for aquatic habitat. Streambanks will require adequate growth media to allow for immediate establishment of a healthy riparian vegetative system to protect the remedy from high flows.

9. Instream sediment monitoring will be performed during and after the response action to ensure that contaminated instream sediments have been adequately remediated. Monitoring will include sampling of instream sediment for sediment contaminant concentrations as well as macroinvertibrate abundance and diversity. Maintenance to deal with continuing sediment contamination over time may be necessary, depending on the results of long-term monitoring.

Railroad Materials

10. The remedy will excavate, treat and/or cover all contaminated railroad bed materials that pose a risk to human health or the environment. All concentrate spills, which are the primary human health concern for the railroad beds, will be removed and disposed in an appropriate and secure disposal facility in accordance with any applicable RCRA requirements. Railroad materials which directly impact the stream either at bridge abutments or along the streambank will be excavated and disposed in repositories along with the tailings/impacted soils and instream sediments. The actual amount and methods of excavation and/or treatment will be determined during remedial design. The estimated volume of excavated materials is presently 71,000 cy. The in-situ STARS technology or soil capping is expected to be appropriate for all other areas of the inactive grade presenting environmental risk.

11. Monitoring and maintenance of the remediated railroad materials will be required to ensure that contaminant sources are not exposed as a result of erosion and do not cause future contaminant loading to the stream.

Ground and Surface Water

12. While Silver Bow Creek ground and surface water are primary receptors of SST OU contamination, no separate remedial action is being prescribed for these media. Remedial activities for other SST OU media under this record of decision and for sources of contaminants upstream/offsite under other cleanup actions will limit further releases to ground and surface water with the goal of ultimately attaining ground and surface water standards within the OU. Removing the source of groundwater contamination by addressing the tailings/impacted soils and railroad materials, will allow contaminants in groundwater to attenuate over time through dilution, adsorption, precipitation, and dispersion.

13. Removal of the tailings/impacted soils, fine-grained instream sediments, and railroad materials will allow for the attainment of instream sediment and surface water objectives, over time. Removing the sources and interrupting the pathways for surface water contamination by addressing all the contaminated materials should permit eventual attainment of the surface water objectives.

14. Long-term monitoring of ground and surface water is a critical element of the remedy. Surface water will be monitored for compliance at a number of points in the OU to ascertain possible surface water contaminant loading from onsite/nearsite contaminant sources. Groundwater will be monitored at locations of documented or suspected groundwater contamination, all relocation areas, and other locations where STARS treatment has been applied.

Coordination and Schedule

15. An institutional controls program, which must be funded on a permanent basis as part of the remedy, will be coordinated through a joint effort of the Butte-Silver Bow and Anaconda-Deer Lodge local governments. Institutional controls, monitoring, and maintenance will be integrated into a Silver Bow Creek corridor management program. The program will be established and maintained in a manner that will ensure that all aspects of the OU remedial action, both within and outside of the floodplain, are maintained for the long-term, and ensure that the future land use in the area is consistent with the scenarios upon which cleanup decisions for this action have been based.

16. Construction of the proposed remedy will be coordinated with other cleanup activities along Silver Bow Creek. Releases of contaminated instream sediments and surface waters prior to, during, and following remedial action, which might re-contaminate Silver Bow Creek, will be suitably controlled and treated. The design and schedule of the OU remedy will be coordinated with the design and installation of upstream sediment control basins. If adequate upstream control facilities are not in service at the time of initiation of construction of this remedy, then additional sediment control and treatment facilities will be provided as a part of this remedy or other scheduling adjustments will be made. The implementation of the remedy will also be coordinated to the maximum extent possible with the possible implementation of the State's natural resource damage restoration plan in order to avoid duplication of effort and unnecessary costs and to maximize the benefits to the area.

17. Butte-Silver Bow County and ARCO are initiating research on constructed wetlands as a potential treatment technology for waste water nutrient discharge and stormwater metals contamination. To coordinate with this research, the end land use in Subarea 1 has been delineated as wetlands. After removal of all the above mentioned contaminant sources, reconstruction of the Subarea will be designed to incorporate use of the area as wetlands. Constructed wetlands in this area may be used as a treatment system for nutrients and/or metals from upstream, if such treatment is ultimately determined to be appropriate in this area.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action except where a waiver of such requirements has been determined to be appropriate, and is cost-effective. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining in the OU above health or environmental based risk levels, periodic five-year reviews of the remedial action shall be conducted, beginning within five years after initiation of remedial action, to ensure that the remedy continues to provide adequate protection to human health and the environment.

Mark A. Simonich

Mr. Mark A. Simonich
Director
Montana Department of Environmental Quality

11/28/95
Date

Wm Yellowtail

Mr. William Yellowtail
Regional Administrator
Environmental Protection Agency, Region VIII

11/29/95
Date

DECISION SUMMARY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (cont.)

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS

ADL	Anaconda-Deer Lodge County
AMC	Anaconda Copper Mining Company
AOC	Administrative Order of Consent
ARARs	Applicable or Relevant and Appropriate Requirements
ARCO	Atlantic Richfield Company
AWQC	Ambient Water Quality Criteria
ARM	Administrative Rules of Montana
BA&P	Butte, Anaconda and Pacific Railroad
bgs	below ground surface
BRA	Baseline Risk Assessment
BSB	Butte-Silver Bow County
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMSP	Chicago, Milwaukee, St. Paul and Pacific Railroad
COC	contaminants of concern
cy	cubic yards
DNRC	Department of Natural Resources and Conservation
DPS	Development Permit System
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
ft/ft	foot per foot
ICPD	Institutional Controls Planning Document
ICs	Institutional Controls
ICMM	Institutional Controls, Monitoring, and Maintenance
LAO	Lower Area One
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
mg/kg	milligram per kilogram
mm	millimeter
MU	Montana Union
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NP	Northern Pacific
NPL	National Priorities List
OU	Operable Unit
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbons
PCP	Pentachlorophenol
PRAOs	Preliminary Remedial Action Objectives
PRAOR	Remedial Action Objectives Report

ACRONYMS (cont.)

PRGs	Preliminary Remediation Goals
PRP	Potential Responsible Party
RAOs	Remedial Action Objectives
RI	Remedial Investigation
Rocker	Rocker Timber Framing and Treating Plant
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SBC	Silver Bow Creek
SPAOD	Superfund Planning Area Overlay District
SST	Streamside Tailings
STARS	Streambank Tailings and Revegetation Studies
su	Standard Units
TES	Threatened, Endangered and Sensitive (Species)
TTSD	Treatment Technology Screening Document
$\mu g/l$	micrograms per liter
UP	Union Pacific
WSP	Warm Springs Ponds
WQB-7	Montana Water Quality Circular 7

GLOSSARY

Administrative record: The files containing all documents relied upon by the agencies in selecting a remedy at a Superfund site.

Applicable or Relevant and Appropriate Requirements **(ARARs):** Legal requirements, criteria, or limitations which are set forth in federal and state environmental and facility siting laws and regulations.

Backfill: Clean soil used to replace contaminated material which was removed.

Baseline human health and ecological risk assessments: Studies conducted as part of the remedial investigation describing the risks posed to public health and the environment at a Superfund site.

Ground water: The water contained in interconnected pores located below the water table.

Impacted soils: Soils mixed with tailings or which tailings have leached inorganics into.

In-situ: Activity occurring in-place or without removing the contaminated material.

Institutional controls **(ICs)**: Laws, regulations, or covenants that restrict certain activities or uses to ensure the effectiveness of remedy, such as zoning restrictions, deed restrictions, well bans, etc.

Maximum Contaminant Levels **(MCLs)**: Federal drinking water standards which represent the maximum permissible level of a contaminant in a public water system.

Maximum Contaminant Level Goals **(MCLGs)**: Non-enforceable drinking water standards that represent the levels of contaminants that are fully protective of human health and allow an adequate margin of safety.

National Contingency Plan **(NCP)**: The federal regulations implementing Superfund, found at 40 CFR Part 300.

Operable Unit **(OU)**: A term used to describe a designated portion of a Superfund site. An operable unit may be established based on a particular type of contamination, contaminated media (e.g., soils, water), source of contamination, and/or geographical location.

Operation and maintenance costs: The costs of activities conducted to maintain the effectiveness of the remedy, after physical construction and initial implementation of the remedy.

GLOSSARY (cont.)

***Potentially responsible party* (PRP)**: Individual, organization or business who may be liable to implement or pay for a cleanup under Superfund law.

Remedy: The response action that addresses potential or actual threats to public health, welfare and/or the environment at a Superfund site.

***Record of decision* (ROD)**: A public document that selects and describes the remedy that will be used at a Superfund site. The record of decision includes the explanation of the agency's rationale for choosing a remedy.

Relocation: Excavation of tailings/impacted soils from the 100-year floodplain, placement of those wastes in a nearby, local repository, and treatment of those wastes using STARS treatment.

***Remedial investigation/feasibility study* (RI/FS)**: During the remedial investigation, the types, amounts and locations of contamination at a site are identified. In the feasibility study, alternatives for site remedy are identified, screened and evaluated.

Removal: Excavation of tailings/impacted soils located in the floodplain and placement in a regional dry repository. The two potential repository locations identified in the SST OU Feasibility Study were Browns Gulch and the Opportunity Ponds.

***Streambank Tailings and Revegetation Studies* (STARS)**: Chemically amending floodplain tailings *in-situ*. Lab, greenhouse, and field studies, commonly referred to as STARS, developed a technology specifically for consideration at the Streamside Tailings OU.

Tailings: A sand to silt sized by-product of ore milling operations.

Vadose Zone: The zone between land surface and the water table. Pore spaces in this zone contain disconnected water.

WQB-7: A promulgated list of State water quality standards specifying concentrations of contaminants which, if not exceeded, should be protective of human health and should support a healthy ecosystem. Concentrations of contaminants which are toxic to aquatic life are usually expressed in terms of acute (short term) or chronic (long-term) effects. Acute toxicity is usually expressed as a lethal concentration while chronic toxicity refers to effects over an extended time period.

I. OPERABLE UNIT NAME, LOCATION AND DESCRIPTION

Streamside Tailings (SST) Operable Unit (OU) of the
Silver Bow Creek/Butte Area (original portion)
National Priority List (NPL) Site
Butte, Montana

The SST OU is located along Silver Bow Creek in Butte-Silver Bow and Anaconda-Deer Lodge Counties, Montana. Figure 1 displays the general location of the OU. Figure 2 illustrates the SST OU. Silver Bow Creek is the main drainage within the SST OU and is the headwaters of the Clark Fork River. Silver Bow Creek originates in Butte at the confluence of the Metro Storm Drain and Blacktail Creek.

The OU boundary has been defined in the Administrative Order on Consent (AOC) (MDHES, 1991) as the extent of fluvially deposited tailings along Silver Bow Creek, including adjacent railroad beds. The upstream boundary of SST OU is the Lower Area One (LAO) portion of the Priority Soils OU, and the downstream boundary is the Warm Springs Pond (WSP) OU. For the purposes of the remedial action, the operable unit boundary will also include any additional areas in close proximity to the contamination that are necessary for implementation of the remedial action.

The area containing and surrounding the previous location of the Rocker Timber Framing and Treating Plant (Rocker OU) adjacent to Silver Bow Creek in Rocker, Montana, is a separate and distinct OU. The Rocker OU is being investigated and evaluated separately with regard to contaminants associated with historical wood treating activities and mining wastes mixed with such wastes at the Rocker operation. Remediation of the streamside tailings and railroad materials containing contaminants of concern within the Rocker OU will be coordinated with the SST OU.

II. OU HISTORY

The first recorded disturbance of the Silver Bow Creek channel occurred in 1864 when placer mining techniques were used to extract gold along the stream and its tributaries (Freeman, 1900 and Smith, 1952). The gold recovered by placer mining was relatively pure, in the form of dust, flakes, or nuggets. Mercury was sometimes used to "attract" small pieces of gold. This phase of mining activity was short-lived; most placer operations in the area had ceased by 1869, although minor activity continued on a few local streams (Reclamation Research Unit and Schafer and Associates [RRU and Schafer], 1993).

Some evidence of early placer mining along upper portions of Silver Bow Creek is still evident in the form of waterways required to convey water for hydraulic mining and spoils piles (Historical Research Associates [HRA], 1983). The waterways are in disrepair and no longer convey water. As Butte's placer deposits played out during the 1870s, miners turned their attention to the area of hardrock mining. There is no clear record of the amount of mining wastes produced and disposed of by placer miner operations.

Concomitant with placer mining along Silver Bow Creek, hard rock mining started on mineralized vein outcroppings on Butte Hill, north of Silver Bow Creek (Smith, 1952). Some mining claims on the Butte Hill were re-staked in the 1870s because of favorable assays of silver ore found in the area.(Smith, 1952). Silver mill construction during the mid-1870s ushered in the era of industrial mining in Butte. This rejuvenated mining activity in Butte and, by 1878, several small mills were operating in the area. A combination of factors contributed to a boom in Butte's silver production during the early 1880s. Completion of railroads to Butte in 1881 along with favorable silver prices led to a drastic increase in mine production. Most existing mills increased their production.

Between 1879 and 1885, at least six major mills were built along Silver Bow Creek from Meaderville to Williamsburg. These mills were operated more or less continuously until 1910 (Freeman, 1900; Smith, 1952; HRA, 1983). The early mills were steam-powered stamp mills (5-10 stamps) designed to crush, concentrate, and amalgamate silver ore. Mills constructed during this time were the: Centennial, Dexter, Davis, Young and Roudebush, Walker Brothers, Clipper, Silver Bow, Grove Gulch, and Thornton (Gagnon)(HRA, 1983). By 1886 five new mills appeared in the vicinity of Butte's Missoula Gulch and along Silver Bow Creek: the Alice, the Moulton, the Lexington, the Marget Ann, and the Blue Bird (HRA, 1983). The Blue Bird mill was located on Silver Bow Creek east of the town of Rocker (Figure 2) and contained 90 stamps which was unusually large at the time. Production capacities from these new mills were many orders of magnitude greater than previous mills. Butte's silver era ended with the repeal of the Sherman Silver Act in 1893. These mills produced tailings and other mining wastes, which were disposed of near the mills. Some of that waste material was disposed directly into or washed into Silver Bow Creek.

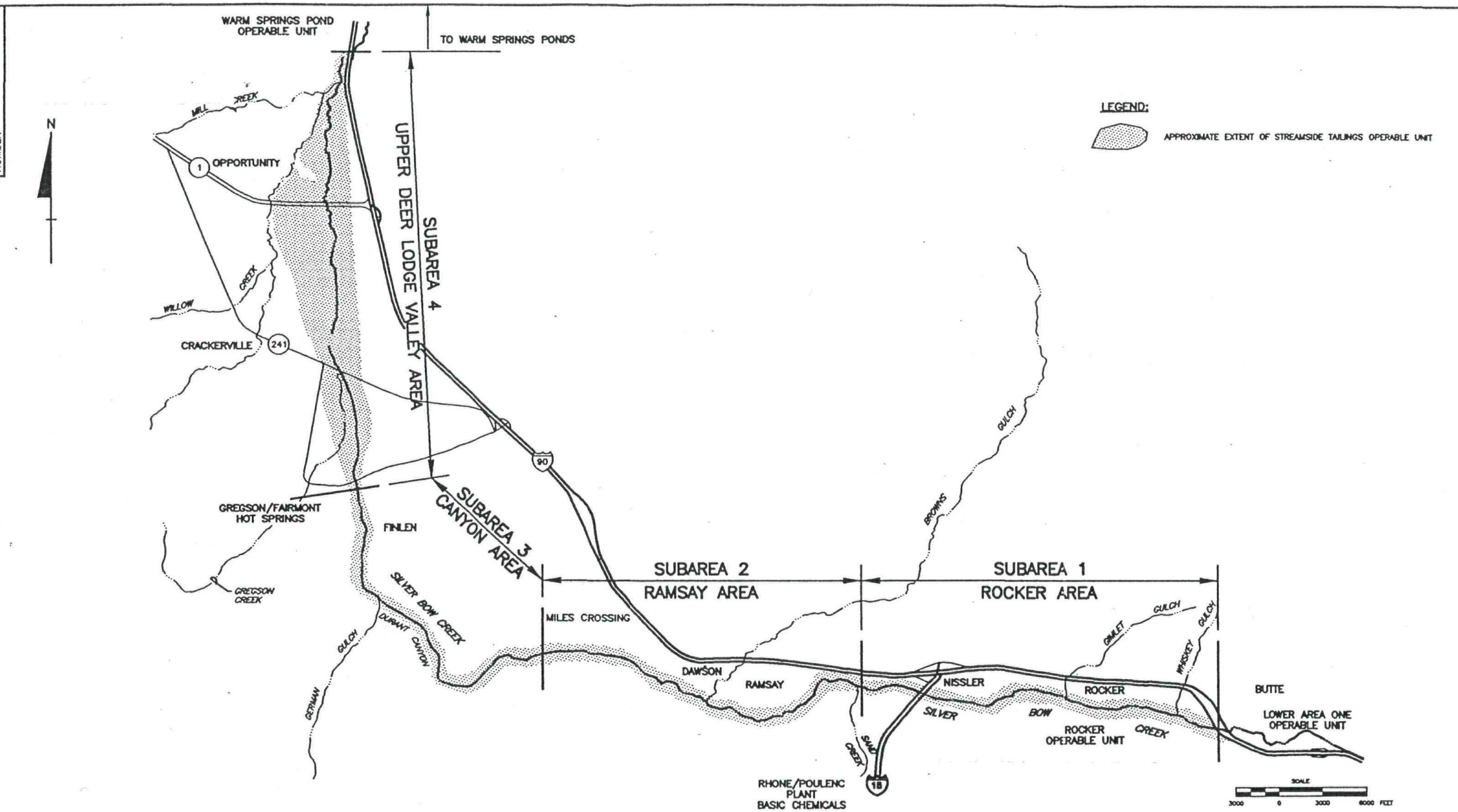
By the late 1880s copper mining had become more important, and Butte became one of the nation's prominent copper mining centers. Many of the previously described mills and smelters were used for copper production, and more mills and smelters were added. Five such facilities located along Silver Bow Creek were especially significant. They are the Colorado Smelter, the Butte Reduction Works facility, the Parrott Smelter, the Montana Ore and Purchasing Company Smelter, and the Butte and Boston Smelter. All of the described facilities along Silver Bow Creek discharged wastes alongside or directly into Silver Bow Creek.

Montana

Montana State Library
NRIS Natural Resource Information System
Map #96epaa4c - 9/14/95

Figure 1

DRAWING NUMBER 3109-B16



STREAMSIDE TAILINGS
VICINITY MAP

Figure 2

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	3/15/95	ISSUED FOR DRAFT FS REPORT	T.M.G.	CKL-R	CKL-R

REFERENCE:
AFTER DRAWING BY ARCO, FIGURE 1, TITLED:
"LOCATION OF STREAMSIDE TAILINGS OPERABLE UNIT
AND GENERALIZED SAMPLING LOCATIONS". DATED: JULY 1991.
SCALE: 1"=6000'.

These facilities operated large concentrators and smelters and disposed of very large volumes of waste directly into or near Silver Bow Creek.

A copper smelter (Old Works) was constructed near the mouth of Warm Springs Creek at the new town of Anaconda, 27 miles west of Butte, in 1884 (Smith, 1952; RRU and Schafer, 1993). The new Washoe Smelter was constructed and began operations on Smelter Hill, directly east of Anaconda, in 1903. The major smelters erected along Silver Bow Creek in the Butte vicinity continued to operate until approximately 1910 (HRA, 1983). The Amalgamated Copper Company and the Anaconda Copper Mining Company took possession and control of almost all other companies and facilities in the Butte area. These companies ultimately combined into the Anaconda Copper Mining Company. After 1910, most of the ore mined in Butte was then shipped via the Butte, Anaconda and Pacific Railway (BA&P) to the Anaconda Copper Mining Company's (AMC) Washoe Smelter for processing (RRU and Schafer, 1993).

By 1917, approximately 150 mines were located in and near Butte. These mines, which were controlled by AMC or its predecessors, produced a total of approximately 934 million pounds of copper (Techlaw, 1985). This corresponds to a maximum of approximately 4.2 million cubic yards of ore assuming a 5 percent copper content and an ore density of 163 pounds per cubic foot (Techlaw, 1985). Water pumped from these mines contributed to the contamination of Silver Bow Creek.

AMC constructed three treatment ponds, the Warm Springs Ponds (WSP), at the headwaters of the Clark Fork River near Warm Springs, Montana, in 1911, 1916, and between 1954 and 1959, respectively. The purposes of the ponds were to settle out mining wastes from Silver Bow Creek and to improve the quality of water released to the Clark Fork River (RRU and Schafer, 1993). The inlet to the WSP represents the downstream extent of the SST OU (Figure 2).

AMC commenced surface mining of low-grade copper ore with the opening of the Berkley Pit in 1955 and built the Weed Concentrator in 1963 to process this ore. These operations contributed contamination to Silver Bow Creek.

In 1977, the assets of AMC were purchased by the Atlantic Richfield Company (ARCO) which expressly assumed liability for AMC. ARCO closed all underground mines in 1980 and continued active mining only in the Berkley Pit. ARCO closed the Berkley Pit in 1982 and the East Berkley Pit in 1983. The Washoe Smelter in Anaconda, the last active smelting facility in the area, was closed in 1980 and subsequently dismantled (RRU and Schafer, 1993).

Waste Transport

Although floods and storm events contributed to the transport of waste into and within the SST OU, they were not the exclusive cause of contamination. As noted, upstream facilities discharged waste directly into or along Silver Bow Creek, and did not exercise due care in anticipating flood events or storm events and taking precautions to avoid waste movement. Waste was transported from these operations downstream via overland flow and surface water transport.

In June of 1908, the largest flood in recorded history in the Silver Bow Creek basin occurred, contributing to the extent of fluvially-deposited tailings found today. Heavy rains (8.12 inches) fell in late May and early June, melting the snow pack and causing extensive flooding (CH2M Hill, 1989a). Flood waters transported tailings from smelting facilities in Butte and along Silver Bow Creek and deposited them downstream as flood waters waned. Flood flows and fluvial deposits were physically constrained by railroad grades constructed parallel to Silver Bow Creek, limiting the areal extent of flood deposited tailings.

Other recorded significant storm events occurred in 1892, 1894, 1938, 1948, 1975 and 1980 (CH2M Hill, 1989a). All of these events occurred during the spring and early summer when precipitation and melting snow combined to produce large runoffs. These events also contributed to the movement of mine wastes from their sources into the Silver Bow Creek floodplain.

Railroad History

The Utah & Northern, a subsidiary of the Union Pacific Railroad (UP) and the first railroad in Montana, reached Butte in December of 1881. It linked the towns of Anaconda and Butte to the UP line from Utah in 1884 when it completed a narrow gage rail line between the mines in Butte and the smelter in Anaconda (GCM, 1991). This was the first railroad constructed within the SST OU.

Immediately following the Utah & Northern advancement into Montana, track laying crews of the Northern Pacific (NP), a predecessor to Burlington Northern Railroad, entered eastern and western Montana to complete a northern transcontinental rail line. By September 1883, construction was complete. The UP and NP then pooled their resources and formed the Montana Union Railroad which ran from Butte to Garrison (GCM, 1991).

Marcus Daly, owner and founder of the AMC, after disagreement with the Montana Union (MU) Railroad over freight rates charged to ship ore from mines in Butte to smelting facilities, suspended mining and smelting operations and announced that the AMC would construct its own railroad. On September 30, 1892, Daly and a group of investors incorporated the BA&P, with close subsidiary links to Anaconda, to construct and operate a separate rail line to transport ore from Butte to the smelter in Anaconda. This was the second rail line construction adjacent to Silver Bow Creek. Additionally, AMC used the BA&P to transport copper concentrate from Butte to Anaconda after construction of the Weed Concentrator in 1964. Today the BA&P track is occupied and operated by the Rarus rail line (Butte Archives, 1994; GCM, 1991).

In 1905, the Chicago, Milwaukee, St. Paul and Pacific Railroad (CMSP) began construction of another railroad line (the third) to run along Silver Bow Creek. Until 1913, the CMSP used the BA&P rails along Silver Bow Creek from Butte to Finlen. At that time, the CMSP constructed its own grade (popularly known as the Milwaukee Road) along Silver Bow Creek (GCM, 1991). In 1980, the CMSP abandoned its rail line. The tracks were removed shortly afterward (GCM, 1991).

In the early twentieth century, the Union Pacific Railroad leased the track near the Fairmont/Gregson area east into Butte under a long-term lease to the Great Northern Railroad. The Great Northern Railroad eventually became the Burlington Northern Railroad. The lease was subsequently transferred to the Montana Western Railroad in 1986, which operates on this line today (GCM, 1991).

Presently, there are three rail lines adjacent to the SST OU area: 1) Rarus (BA&P) from Anaconda to Butte, 2) Montana Western Railroad (leased from UP), and 3) the UP Railroad. Rarus (BA&P) and Montana Western have existing tracks adjacent to Silver Bow Creek. The UP line terminates at its northern extent at the switching yards of Port of Montana near Silver Bow, Montana. The abandoned CMSP grade parallels Silver Bow Creek within the SST OU although the rails and ballast have been removed.

Parts of all three rail lines were constructed with waste materials. The lines which transported concentrate materials for the smelter in Anaconda were additionally contaminated by spillage from this concentrate transportation.

Enforcement Actions

Environmental investigations in the vicinity of the SST OU were initiated by the EPA in 1982 to address mining impacts along Silver Bow Creek. The Silver Bow Creek/Butte Area Site (original portion) was listed on the NPL in 1983 by EPA under the CERCLA and site investigations began in 1984 with the Phase I Remedial Investigation (RI) prepared by MultiTech Services under contract to the MDEQ. A supplemental RI report was prepared by CH2M Hill (1987). The Phase II RI described in the Draft RI Report (ARCO, 1995a) was conducted by ARCO and describes investigation activities, characterizations and interpretations performed since 1991. All pre-1991 studies or data that were determined by ARCO and the MDEQ to be applicable or pertinent to current OU conditions were incorporated in the OU characterization in the Draft RI Report (Phase II). The Draft RI Report complied with Superfund law, defined the nature and extent of the contamination to the extent necessary to determine remedial action and provided information to complete the baseline human health and ecological risk assessments (ARCO, 1995a). The baseline risk assessment was released by MDEQ in December of 1994 (MDEQ, 1994a). The feasibility study, released by ARCO in June 1995, included the development, screening and evaluation of potential OU remedies (ARCO, 1995b). The proposed plan was also released in June 1995 and delineated the preferred alternative (MDEQ, 1995).

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA sections 113 and 117 provide for public participation in the development of the administrative record upon which the remedy selection is based. These sections require that, before adoption of any plan for remedial action, the lead agency shall:

1. Publish a notice and brief analysis of the proposed plan and make such plan available to the public; and

2. Provide a reasonable opportunity for submission of written and oral comments and an opportunity for a public meeting at or near the OU regarding the proposed plan and any proposed findings relating to cleanup standards. The lead agency shall keep a transcript of the meeting and make such transcript available to the public. The notice and analysis published under item #1 shall include sufficient information to provide a reasonable explanation of the proposed plan and alternative proposals considered.

Additionally, notice of the final remedial action plan (record of decision) adopted shall be published and the plan shall be made available to the public before commencing any remedial action. Such a final plan shall be accompanied by a discussion of any significant changes to the preferred remedy presented in the proposed plan along with the reasons for the changes and a response (Responsiveness Summary) to each of the significant comments, criticisms, and new data submitted in written or oral presentations during the public comment period.

MDEQ has conducted extensive community participation activities beyond what is required under the National contingency Plan. Public participation began prior to initiation of the site investigation with the issuance of the draft RI/FS Administrative Order on Consent and draft RI/FS Work Plan. Three public informational meetings (in Missoula, Anaconda, and Butte) and a formal public hearing (in Ramsay) were held in 1991 to gather public input on the proposed study. Comments were incorporated into the final RI/FS AOC and Work Plan, and a responsiveness summary addressing those comments was published. Additional public meetings were held to provide progress updates on the investigation and to gather public comments on the SST OU demonstration projects, as well as the work plan for the draft Baseline Risk Assessment. In addition, ARCO and MDEQ held a series of meetings, moderated by the Headwaters Resource Conservation and Development District, with SST OU landowners during 1992 and 1993 to provide information about alternatives under consideration and to gather input from local landowners. During late 1994 and 1995, as the SST OU investigation was concluding and the major RI/FS reports were prepared and published, community participation activities included the following: nine (9) public "roundtable" meetings, numerous OU tours, two meetings to discuss the Remedial Investigation, three informational meetings on the Baseline Risk Assessment, three Proposed Plan informational meetings, a 60 day public comment period, a public hearing, and presentation of the selected remedy in the Record of Decision. The Record of Decision documents changes to the preferred remedy as a result of public comments.

The proposed plan (MDEQ, 1995a) for the OU was released for public comment on June 9, 1995, and mailed to over 1,300 citizens on various Montana Superfund mailing lists. The proposed plan was made available to the public at the Environmental Protection Agency (EPA) offices in Helena, MT, and information repositories maintained at: MDEQ Superfund office, State Library, EPA Office, and the Montana Historical Society in Helena; Hearst Free Library in Anaconda; Montana State University in Bozeman; Silver Bow Library, Montana Tech Library, Butte Public Library, EPA Office and the Citizens Technical Environmental Committee Office in Butte; Missoula Public Library, University of Montana Mansfield Library, and the Clark Fork Pend-Oreille Coalition Office in Missoula. The notice of availability of the proposed plan (MDEQ, 1995a) was published in the Butte-Montana Standard, the Missoulian, and the Anaconda Leader newspapers on June 9, 1995. The full administrative record is maintained by EPA in Helena. Microfilm copies of the administrative record are also made available to the public at several of the information repositories listed above.

During the 60-day public comment period (June 9 through August 7, 1995) public informational meetings were held at: Fairmont Hot Springs on June 20; Butte Community Center on June 21; and, Missoula Courthouse Annex on June 22, 1995. At these meetings, representatives from MDEQ answered questions about contamination issues, the remedial alternatives under consideration, and the preferred remedy. A public meeting/hearing was held on July 10, 1995, at Fairmont Hot Springs at which MDEQ accepted formal oral comments from the public. A court reporter transcribed the entire meeting/hearing and MDEQ made the transcript available by placing it in the administrative record. A response to the comments received during the public comment period is included in the Responsiveness Summary (Appendix D). Also, community acceptance of the selected remedy is discussed in Section VIII of the Decision Summary, Summary of Comparative Analysis of Alternatives.

MDEQ considered public comments and revised the selected alternative as a result (see Section XI).

IV. SCOPE AND ROLE OF RESPONSE ACTION

The primary focus of the SST OU RI/FS was to evaluate findings of previous investigations, to collect additional data to assist in characterizing current and future risks, and to develop and evaluate remedial action alternatives. The RI/FS was performed in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, and CERCLA Section 104, 42 U.S.C. § 9604.

The overall objectives of the RI/FS were:

- To collect data on the types, concentrations, extent and movement of contaminants present in tailings, subsurface soils, railroad materials, surface water, groundwater, and instream sediment at the OU;

- To provide information for estimating volume, location, transport and fate of contaminated media and materials;

- To provide information on OU physical characteristics and contaminants for use in the risk assessment and the feasibility study;

- To assess the present and potential future risks to human health and the environment at the OU;

- To identify applicable or relevant and appropriate legal requirements (ARARs) for the remedial action; and

- To identify and evaluate remedial alternatives to address human health and environmental risks.

Based on these evaluations, findings of previous investigations and the results of the RI field investigation, the sources and the areas of environmental contamination at the Streamside Tailings Operable Unit have been delineated sufficiently to allow the agencies to evaluate and select an appropriate remedy for the OU contamination.

The remedy outlined in this record of decision represents the final remedial action at the OU and will address the principal threats to human health and the environment which are posed by the contaminated media and materials.

V. SUMMARY OF OU CHARACTERISTICS

This section presents a summary of RI conclusions for each of the four OU geographic subareas and for OU-wide aquatic and terrestrial resources (ARCO, 1995a). Detailed information is presented in Sections 4.3 through 4.8 of the Draft RI Report (ARCO, 1995a). Contamination was found in all media (soil, groundwater, surface water, railroad beds and instream sediments) throughout most of the SST OU. Table 1 enumerates contaminant concentrations found in tailings/impacted soils.

Table 1
Streamside Tailings OU
Median Concentrations - Tailings/Impacted Soil
(mg/kg)

Analyte	Reference[1]	Subarea 1	Subarea 2	Subarea 3	Subarea 4
$pH_{(su)}$	5.6	4.3	4.3	4.0	4.5
Arsenic	39	278	563	215	249
Cadmium	3.2	7.8	16.2	5.5	6.3
Copper	99	739	2,710	1,290	1,315
Lead	55	540	1,510	316	638
Mercury	0.13	2.1	11.0	1.2	2.7
Zinc	126	2,400	5,400	1,445	1,805

REF: SST OU RI (ARCO, 1995a), mg/kg = milligrams per kilogram. su = standard units. 1-"Reference" soils are considered to be outside the influence of flood deposited tailings but could be impacted by other contaminant sources.

The OU has been divided into four subareas based upon geologic and topographic features that control the soil, hydrogeologic, geomorphic, surface water, ecologic, demographic and land use characteristics of the OU (Figure 2). Additionally, Silver Bow Creek was further divided into stream reaches for more detailed evaluation and characterization of OU information. A total of 12 reaches were defined with one to several reaches located in each subarea.

General Description of Subareas

As shown on Figure 2, the SST OU consists of Silver Bow Creek and areas in and near its floodplain from the downstream extent of LAO west of Butte to the I-90 bridge directly upstream of the WSP OU northeast of Opportunity.

Subarea 1 - Rocker

The Rocker Subarea extends from the west end of LAO to approximately 1,000 feet upstream of the confluence of Sand Creek and Silver Bow Creek (Figure 2). Sand Creek is approximately 400 feet west of the bridge adjacent to the community of Silver Bow. During the development of the initial stages of the current RI, Subarea 1 was originally defined at the downstream end by the Rocker Fault, located near the town of Rocker. Subarea 1 was extended to its current boundary because of the nature of the stream and the tailings rather than the bedrock and alluvial geology.

Intermittent tributaries within this subarea include Whiskey Gulch and Gimlet Gulch. The subarea encompasses approximately 5.2 miles of Silver Bow Creek and loses approximately 88 feet in elevation over the subarea. Tailings/impacted soils within the subarea are continuous and confined to a narrow floodplain.

The communities of Rocker, Fredricksburg, and Nissler are adjacent to the SST OU within this subarea. The Rocker OU, ARCO's Demonstration Project I, and the Rocker Streambank Tailings and Revegetation Study (STARS) plots are also located within this subarea.

Subarea 2 - Ramsay

The Ramsay Subarea extends from 1,000 feet upstream of the confluence of Sand Creek and Silver Bow Creek to approximately 700 feet west of Miles Crossing (Figure 2). The communities of Silver Bow, Ramsay, Dawson and Miles Crossing are adjacent to the OU within this subarea. Industries adjacent to the OU include the Rhone-Poulenc Basic Chemicals Plant, the Port of Montana and the Union Pacific switching yards.

The subarea encompasses the Ramsay Flats, a tailings deposit of approximately 160 acres. Tailings/impacted soils within the subarea are continuous along a floodplain wider than that of Subarea 1. Tributaries within the subarea include the intermittent Sand Creek and perennial Browns Gulch. Average flow in Browns Gulch is approximately 0.5 to 5 cubic feet per second (cfs). Other inflows within the subarea include the Silver Lake Pipeline discharge, with an approximate flow of 5 to 20 cfs, and a seep near Rhone-Poulenc, with an approximate flow of 0 to 0.25 cfs. The subarea encompasses approximately 5.6 miles of Silver Bow Creek losing approximately 68 feet in elevation over the length of the subarea.

Subarea 3 - Canyon

The Canyon Subarea extends the length of Durant Canyon from slightly above the mouth of the canyon near Miles Crossing to Fairmont Bridge over Silver Bow Creek near the Fairmont Resort (Figure 2). The small community of Finlen is adjacent to the OU within this subarea.

German Gulch is the main tributary within the subarea with an average flow of 5 to 20 cfs. During summer months, most of German Gulch's flow is diverted just above its mouth for irrigation purposes and does not enter Silver Bow Creek. The subarea encompasses approximately 5.0 miles of Silver Bow Creek losing approximately 174 feet in elevation over the length of the subarea. Tailings/impacted soils within the subarea are discontinuous along the narrow canyon. A limited number of abandoned meander scars and sloughs containing tailings deposits exist on the opposite side of the railroad embankments from Silver Bow Creek.

Subarea 4 - Upper Deer Lodge Valley

The Upper Deer Lodge Valley Subarea extends from the Gregson Bridge to the I-90 bridge just south of the WSP (Figure 2). The communities of Fairmont, Crackerville and Opportunity are adjacent to the SST OU within this subarea.

Gregson Creek is the only notable intermittent tributary within the subarea. Perennial Mill and Willow Creeks are separated from Silver Bow Creek by a diversion dike and diverted away from Silver Bow Creek. The subarea encompasses approximately 6.8 miles of Silver Bow Creek losing approximately 194 feet in elevation over the length of the subarea. Tailings deposits within the subarea are continuous along a wide floodplain, interspersed with some vegetation. Tailings within the subarea were initially deposited along a system of overflow channels. More recently, the stream has been channelized with dikes along the upper portions of this subarea which somewhat limit overbank flow and flow to the overflow channels.

<u>Railroad Materials and Instream Sediments</u>

Two other media are also present throughout the OU but are not necessarily related to the subarea divisions. These media include the railroads and instream sediments. Four types of railroad materials, including bed and ballast construction materials and spilled materials, all contain contaminants of concern. The four material types include waste rock or low grade ore, concentrate spills, impacted material consisting of non-vegetated soil, and slag. Native alluvium, native rock and imported crushed rock were also used to construct the railroad bed and as ballast.

Instream sediments (i.e. sediment within the present active channel of Silver Bow Creek) contain contaminants of concern extending throughout the entire length of the SST OU stream channel. Instream sediments consist of tailings, soil and rock particles that have been deposited instream or are carried through the OU as a result of surface water transport.

Conceptual Model of Contaminant Transport

Data collected during the remedial investigation revealed five primary sources of contamination to Silver Bow Creek:

1) upstream;
2) tailings/impacted soils;
3) groundwater;
4) instream sediments; and
5) railroad embankments

Contaminants move through the area and between environmental media in response to a variety of processes. Some of the primary means by which contaminants move within the SST OU are listed below.

1) Upstream

Upstream sources include, but are not limited to, mine wastes in and near the City of Butte, mine/mill tailings in the Colorado Tailings and Butte Reduction Works areas, and the Butte storm and waste water systems and Butte Operations areas. Contaminants from these source areas enter the SST OU primarily in Silver Bow Creek surface water and instream sediments. Off-OU contaminants also enter via groundwater from the Colorado Tailings area and the Rocker Timber Framing and Treating Plant OU.

Surface water entering (inflow) the SST OU from upstream areas is highly contaminated (Table 2). Water quality data indicate that contaminants are added to Silver Bow Creek in the upper portion of the OU during most flow conditions (Table 2).

However, control of upstream contamination is outside of the scope of this operable unit, but will be addressed in other operable unit or site cleanups, or permit activities under other environmental laws.

Table 2
Silver Bow Creek Surface Water Quality
Geometric Mean Low Flow Concentrations
(μg/l)

Analyte	WQB - 7[1]		SS-07	SS-10 Silver	SS-14 Mile	SS-16	SS-17
	Chronic	Acute	inflow	Bow	Crossing	Fairmont	Opportunity[2]
$pH_{(su)}$	NA	NA	7.3	8.0	7.9	8.2	9.6
Arsenic	190	360	8.7	14.5	11.7	15.4	18
Cadmium	1.1	3.9	1.6	2.5	1.1	1.1	0.7
Copper	12	18	178	322	163	140	140
Lead	3.2	82	5.3	15.2	5.4	4.6	1.9
Zinc	110	120	662	860	532	455	366

NA = not applicable; su = standard units; SS-7 monitoring station on SBC; values in "total recoverable" concentrations, (μg/l).
1 - WQB-7 generally corresponds to "Gold Book" aquatic standards at a total hardness of 100 mg/l $CaCO_3$.
2 - Parameters for station SS-17 represent July 1985 event only. A geometric mean for this station was not calculated.

2) Tailings/Impacted Soils

Persistent and widespread expanses of tailings/impacted soils are present along nearly the entire 24-mile reach of Silver Bow Creek. Impacted soils are defined here as soils which have been mixed with the tailings or where the tailings have leached inorganics into the soils. Tailings/impacted soils are the primary source of contamination for the SST OU. Some tailings/impacted soils are mixed with native soils, which makes visual identification of contaminated materials difficult. The lateral and vertical extent of tailings/impacted soils was determined by analysis of 764 samples. The volume of these materials was estimated at 2.4 to 2.8 million cubic yards lying within 1,270 acres of the historic Silver Bow Creek floodplain with measured thickness ranging from a few inches to greater than seven feet. Most of these tailings/impacted soils contain elevated concentrations of arsenic, cadmium, copper, lead, mercury, and zinc.

Erosion and runoff are the most obvious and damaging contaminant transport mechanisms for the SST OU. Erosion, as it is discussed here, encompasses three major processes: channel migration or avulsion, bank/mass wasting, and surface or overland flow. The channel has and is expected to continue to migrate through many parts of the Silver Bow Creek floodplain (Schumm, 1995). This constant and sometimes dramatic migration re-entrains substantial volumes of tailings/impacted soils back into the Silver Bow Creek ecosystem (CH2M Hill, 1989a). Surface water elevation changes in Silver Bow Creek itself can cause bank storage which causes mechanical failure, high flows which cause tractive force failure, and undercutting of banks, all of which cause direct erosion of metals-laden streambank tailings/impacted soils into the stream. In addition, ice buildup in the stream during winter and spring months can cause streambank erosion and stream avulsion. Precipitation or snowmelt runoff moves metals-bearing materials through erosion and carries the contaminants to Silver Bow Creek. Metallic salts are sometimes wicked to the surface of tailings through capillary action, and are encrusted on the tailings surface as the water evaporates, and are subsequently dissolved or directly eroded by water into the stream during precipitation or runoff events. People and animals can also cause streamside tailings to directly enter the stream by disturbing the tailings/impacted materials on the bank (Figures 3, 4, 5 and 6).

Contaminants not carried into Silver Bow Creek may also be adsorbed to the soil. These metals will remain in this semi-stable form until geochemical conditions alter the chemical stability of the soil system to re-release the metals. Contaminant transport by the many erosive processes described previously is the most significant method of metals introduction into the Silver Bow Creek aquatic and riparian system.

3) Groundwater

The main objectives of the groundwater investigation were to determine if groundwater was contaminated and to define where the contaminated groundwater was located (ARCO, 1991a). A third objective was to quantify the interaction between groundwater and Silver Bow Creek surface water and instream sediments.

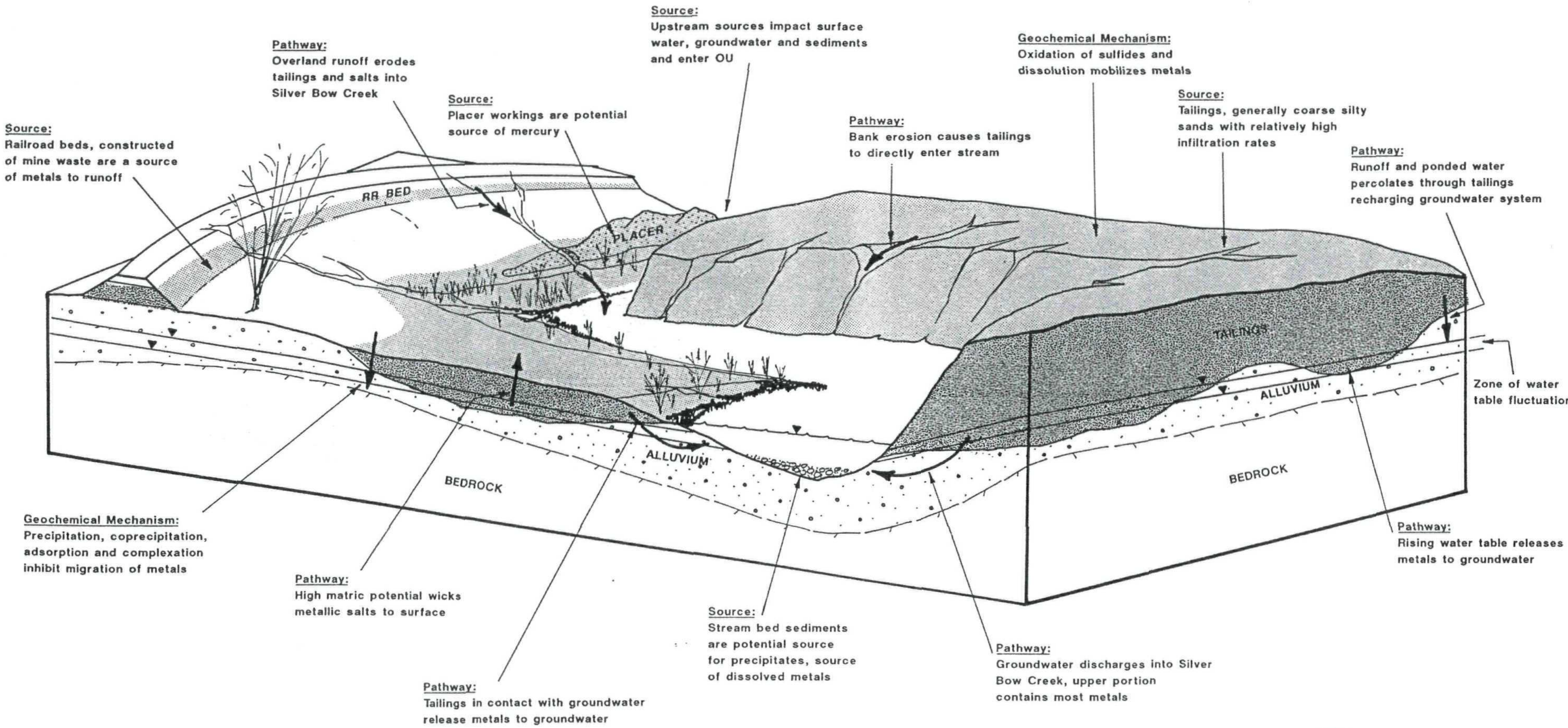
A total of 30 wells were installed in the OU and monitored. Because of the limited number of wells and their spatial distribution throughout the OU's 24-mile length, groundwater characterization is discussed in terms of general OU conditions and does not fully characterize the range of contaminant concentrations or contaminant locations within the OU. The 30 wells installed in the alluvium were screened at two different depths, within 20 feet of the ground surface (upper alluvial) and greater than 20 feet below the ground surface (lower alluvial). The designation between these two units (upper and lower alluvial) was intended only for SST RI data analysis. Both of these units are hydrogeologicly interconnected and should be considered as a single alluvial aquifer.

Generally, groundwater flows toward and into the stream except in several reaches (the most significant being the outlet of Durant Canyon) where surface water flows into groundwater. Elevated concentrations of copper and zinc and exceedances of drinking water standards (Maximum Contaminant Levels [MCLs], or Montana Water Quality Standards (WQB-7), Table 3) for arsenic and cadmium were found in many of the shallow monitoring wells.

In many areas, groundwater is in direct contact with tailings/impacted soils for at least part of a typical year (Figure 3). In the RI/FS documents and in the ROD these materials are designated the term "saturated tailings". The seasonal groundwater level fluctuation averages two feet (Table 4). This direct contact with metals enriched tailings/impacted soil mobilizes metals which in turn contaminate groundwater. The volume of tailings/impacted soils saturated with groundwater for a portion of the year and tailings which overlie them are listed in Table 4. This is a principal mechanism for groundwater contamination at the OU (ARCO, 1995a and Benner et al., 1995).

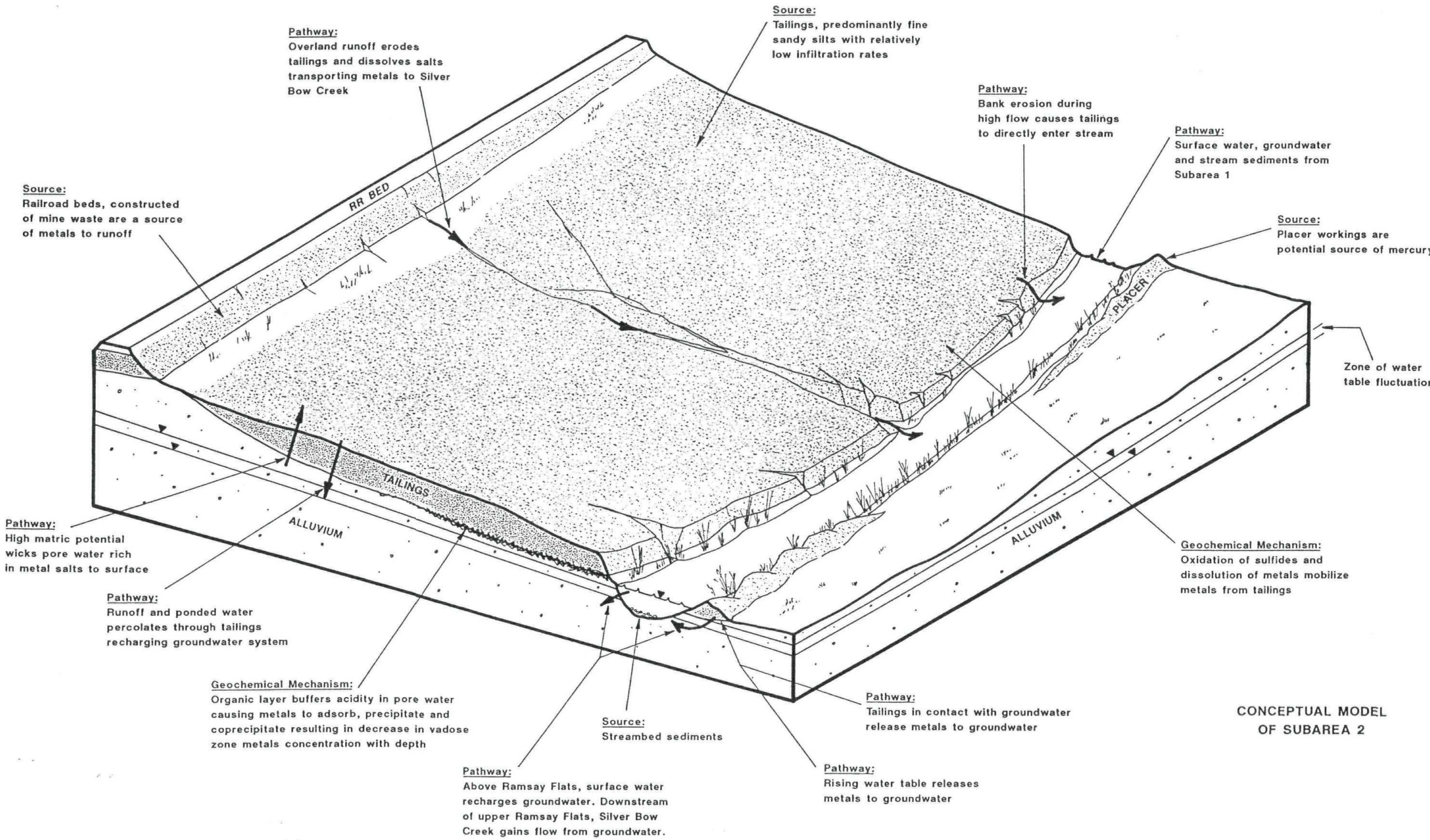
Movement of water from the tailings on the surface through the unsaturated (vadose) zone and into the saturated (groundwater) zone also causes transport of contaminants into underlying soils and groundwater. This is most likely to happen during longer precipitation or snowmelt events. Metals weakly held to tailings are leached by the infiltrating water and eventually can be carried into the underlying native soils and groundwater. Profiles of many soils in the SST OU show evidence of metals migration from the tailings into underlying native materials.

Contaminated groundwater flows into Silver Bow Creek along the majority of stream reaches. This is most likely to happen in areas where the stream gains flow from the groundwater and results in the greatest site related impact to Silver Bow Creek water quality during low-flow conditions. This mechanism is the likely cause for increases in most surface water contaminant concentrations in Subareas 1 and 2 during low or base-flow conditions because many of the other possible pathways, except for instream sediments potential for contaminate release, for contaminant movement are inactive during low-flow (e.g., runoff and infiltration)(Table 2). The opposite of this is true during high-flow conditions in portions of the stream when surface water may flow into and contaminate groundwater. Silver Bow Creek surface water and instream sediments are the primary recipients of contaminants from the streamside tailings as well as from off-OU sources.



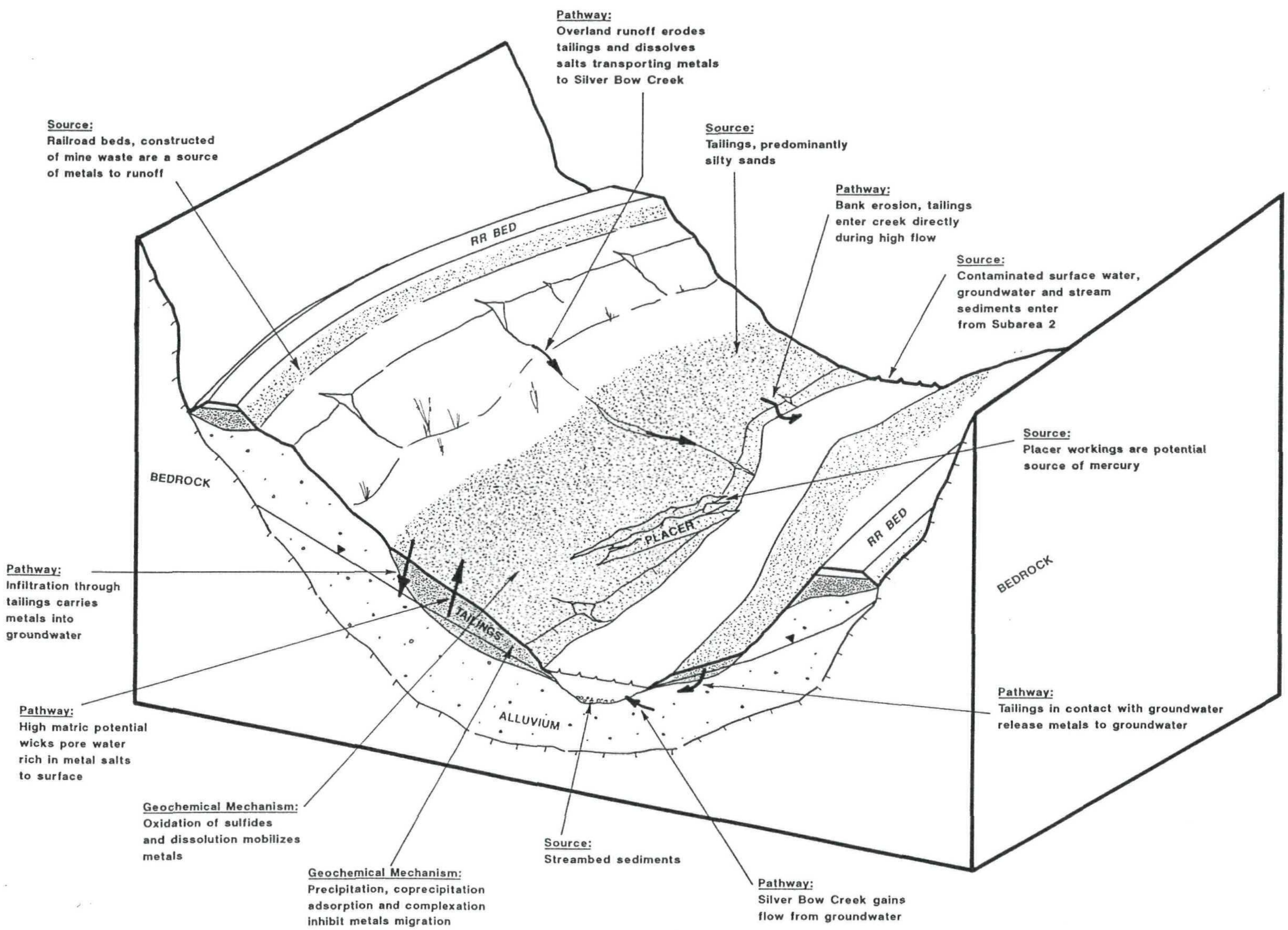
CONCEPTUAL MODEL
OF SUBAREA 1

FIGURE 3



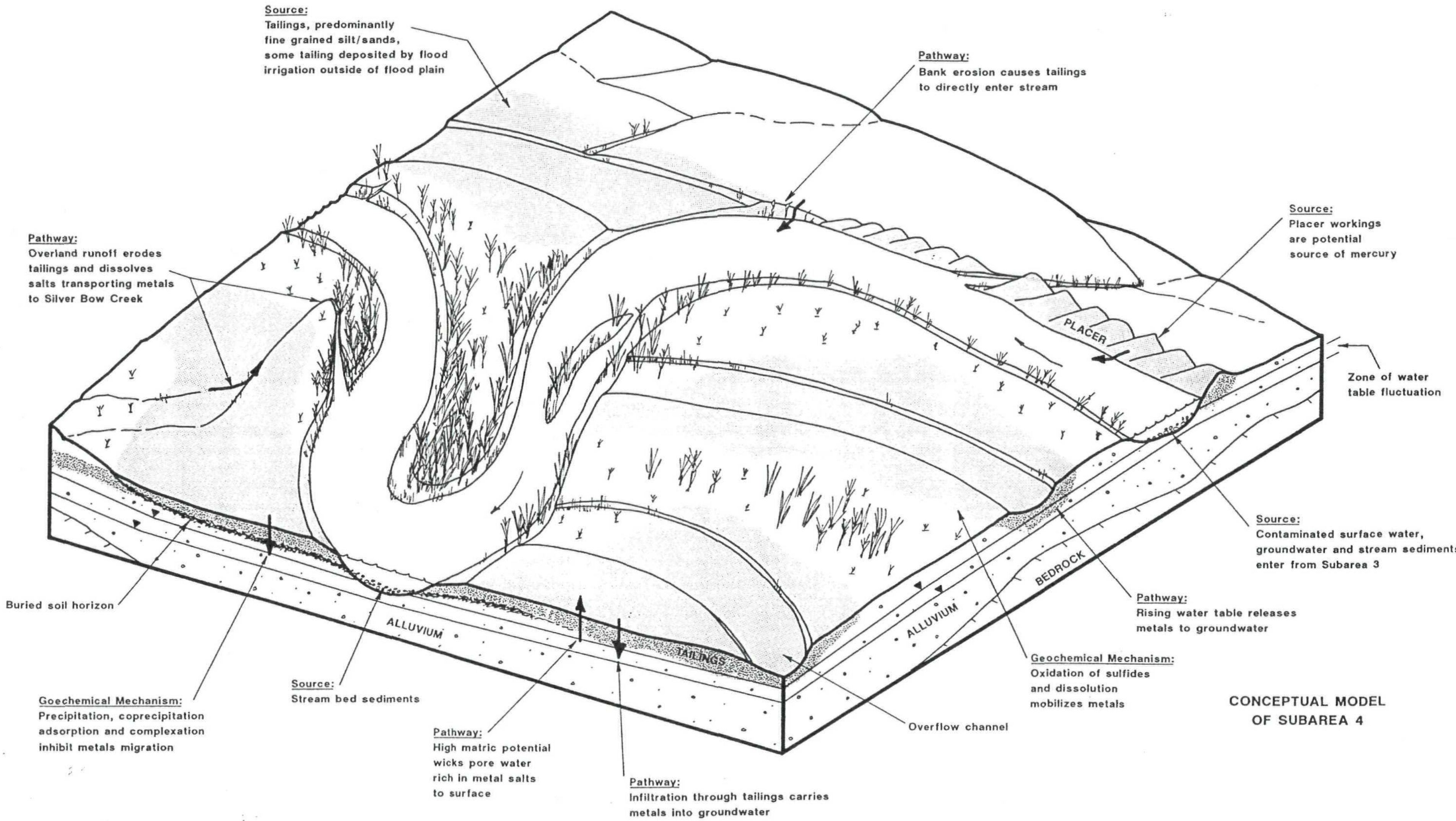
CONCEPTUAL MODEL
OF SUBAREA 2

FIGURE 4



CONCEPTUAL MODEL
OF SUBAREA 3

FIGURE 5



CONCEPTUAL MODEL
OF SUBAREA 4

FIGURE 6

Table 3
SST OU WQB-7 Human Health Groundwater Exceedances (1)

Well No. (2)	Sample Interval (feet)	Date	DTW(3) (feet)	Arsenic (μg/L)	Cadmium (μg/L)	Mercury (μg/L)
C-1	19-24	08/19/93	3.55	3.2	0.0	0.19
C-14	15-20	08/19/93	8.46	6.0	0.04 U	0.15
C-16	2.8-7.1	10/27/92	2.56	11.5	6.2	0.16 U
C-18	3-7	10/27/92	3.25	13.0	12.1	0.16 U
		03/10/93	3.34	5.5	6.8	0.12
		06/07/93	3.80	5.8	R	0.29
		08/19/93	3.70	11.8	6.1	0.30
C-21	5-9.7	10/27/92	5.28	76.8	0.6	*
		03/10/93	4.88	48.3	0.1	*
		06/07/93	4.69	41.7	0.2	*
		08/19/93	4.54	53.1	0.2	*
C-22	4.5-8.9	10/27/92	5.15	72.2	0.8	*
		03/10/93	4.64	28.0	0.3	*
		06/07/93	4.71	20.7	0.2	*
		08/19/93	4.87	18.9	0.2	*
C-23	4.5-8.9	10/27/92	4.40	27.5	0.5	*
		03/10/93	4.82	25.4	0.2	*
		06/07/93	4.88	24.6	0.2	*
		08/19/93	5.06	31.3	0.2	0.12
C-24	4-8.7	03/10/93	4.22	1.9	5.8	0.10 U
		06/07/93	3.60	4.1	9.0	0.13
C-25	4.5-8.9	03/10/93	4.94	3.5	29.8	0.10 U
		06/07/93	4.95	2.3	9.6	0.10
C-26	11.4-16.1	08/19/93	5.53	6.2	0.63 U	0.23
C-3	13-18	11/23/91	6.81	1.6 U	10.4	0.2 U
		10/27/92	6.72	1.9	9.2	0.16 U
		03/10/93	5.30	4.4	10.9	0.10 U

(1) WQB-7 – Montana Water Quality Bureau Standards Numeric Water Quality Standards (Arsenic 18 μg/L; Cadmium 5 μg/L; Mercury 0.14 μg/L); Shading indicates an exceedance; U – Below method detection limit; R – Rejected data.

(2) RH-/DP- – Well and drive points installed in the Rocker Operable Unit; wells represent ground water concentrations at shallow, intermediate, and deep *depths; not inclusive of all wells with exceedances. DW – Domestic wells - 200 series wells are located in Rocker, Nissler, and Miles Crossing areas; 300* series wells are located in the upper Deer Lodge Valley.

(3) DTW – Depth to water below ground surface ! – Unknown * – Not analyzed + – Data not available

Table 3
SST OU WQB-7 Human Health Groundwater Exceedances (1)

Well No.(2)	Sample Interval (feet)	Date	DTW(3) (feet)	Arsenic ($\mu g/L$)	Cadmium ($\mu g/L$)	Mercury ($\mu g/L$)
		06/07/93	5.36	1.0	8.8	0.14
		08/19/93	5.75	1.2 U	8.9	*
C-4	7.5-13	11/25/91	4.86	6.1	25.7	*
C-4	7.5-13	10/27/92	4.34	8.3	29.2	0.16 U
		03/10/93	3.09	5.8	41.1	0.10 U
		06/07/93	3.41	4.1	41.9	0.19
		08/19/93	3.70	3.6	44.2	0.47
C-4S	7.5-9.5	03/10/93	3.21	11.9	0.6	0.15
		06/07/93	3.54	9.1	0.3	0.16
		08/19/93	3.87	12.0	0.5	0.23
C-5	24-29	08/19/93	7.97	3.9	R	0.15
C-6	13-18	08/19/93	4.40	5.2	0.16 U	0.26
C-7	6.8-8.8	03/10/93	7.62	8.8	6.0	*
		08/19/93	7.97	3.5	5.8	*
DP-2	+	09/22/92	+	68.7	*	*
DP-3	+	09/22/92	+	1830.0	*	*
DP-4	+	09/29/92	+	16000.0	*	*
DP-5	5-8.1	09/30/92	2.56	131.0	*	*
DW-203	93-98	01/07/85	+	20.0	0.70 U	*
DW-206	< 30	01/07/85	!	33.0	0.70 U	*
		04/24/85	!	26.0	0.50 U	*
		12/13/85	!	29.0	1.1	*
DW-207	38-43	01/07/85	+	21.0	0.70 U	*
		02/28/85	+	24.0	1.1 U	*
		04/24/85	+	18.0	0.50 U	*
DW-212	30-?	01/07/85	!	23.0	0.70 U	*
		04/24/85	!	22.0	0.50 U	*

(1) WQB-7 – Montana Water Quality Bureau Standards Numeric Water Quality Standards (Arsenic 18 $\mu g/L$; Cadmium 5 $\mu g/L$; Mercury 0.14 $\mu g/L$); Shading indicates an exceedance; U – Below method detection limit; R – Rejected data.

(2) RH-/DP- – Well and drive points installed in the Rocker Operable Unit; wells represent ground water concentrations at shallow, intermediate, and deep depths; not inclusive of all wells with exceedances. DW – Domestic wells - 200 series wells are located in Rocker, Nissler, and Miles Crossing areas; 300 series wells are located in the upper Deer Lodge Valley.

(3) DTW – Depth to water below ground surface ! – Unknown * – Not analyzed + – Data not available

Table 3
SST OU WQB-7 Human Health Groundwater Exceedances (1)

Well No.(2)	Sample Interval (feet)	Date	DTW(3) (feet)	Arsenic (µg/L)	Cadmium (µg/L)	Mercury (µg/L)
		12/12/85	!	19.0	1.0	*
DW-215	!	01/08/85	11.50	22.0	0.60 U	*
		03/10/93	!	22.1	0.2	*
DW-230	< 40	01/08/85	!	39.0	0.60 U	*
		04/24/85	!	73.0	0.50 U	*
		07/25/85	!	36.0	0.20 U	*
DW-230	< 40	12/12/85	!	35.0	1.0	*
		03/10/93	!	39.1	0.1	*
DW-313	< 25	03/10/93	+	99.6	0.2	*
GS-04	3-8	01/16/85	+	41.0	6.9	*
		02/28/85	+	29.0	7.4	*
		03/28/85	+	26.0	6.1	*
		06/11/85	+	27.0	5.0	*
		03/10/93	+	21.0	1.1	0.10 U
		06/07/93	+	26.7	0.7	0.19
		08/19/93	+	R	R	0.18
GS-06	19-29	12/12/85	8.20	17.0	11.0	*
		08/19/88	+	13.0	5.9	*
RH-1	3-13	08/20/87	8.42	10.0	88.0	*
		09/14/88	9.58	16.0	30.0	*
		11/12/91	+	2 U	24.8	*
		09/23/92	+	3.0 U	37.1	*
RH-10	7-17	08/21/87	ND	3100.0	30.0	*
		09/13/88	10.47	5020.0	*	*
		11/07/91	+	1210.0	6.2	*
		09/29/92	+	3000.0	8.5	*
RH-14	29-39	09/13/88	10.25	4940.0	5.00 U	*

(1) WQB-7 = Montana Water Quality Bureau Standards Numeric Water Quality Standards (Arsenic 18 µg/L; Cadmium 5 µg/L; Mercury 0.14 µg/L); Shading indicates an exceedance; U = Below method detection limit; R = Rejected data.

(2) RH-/DP- = Well and drive points installed in the Rocker Operable Unit; wells represent ground water concentrations at shallow, intermediate, and deep depths; not inclusive of all wells with exceedances. DW = Domestic wells - 200 series wells are located in Rocker, Nissler, and Miles Crossing areas; 300 series wells are located in the upper Deer Lodge Valley.

(3) DTW = Depth to water below ground surface ! = Unknown * = Not analyzed + = Data not available

Table 3
SST OU WQB-7 Human Health Groundwater Exceedances (1)

Well No.(2)	Sample Interval (feet)	Date	DTW(3) (feet)	Arsenic (µg/L)	Cadmium (µg/L)	Mercury (µg/L)
		11/08/91	+	1300.0	2 U	*
RH-14	29-39	09/28/92	+	6060.0	2.0 U	*
RH-15	+	11/07/91	+	360.0	2.4	*
RH-15	+	09/24/92	+	955.0	2.0 U	*
RH-18	+	11/07/91	+	35.1 U	2 U	*
RH-3	5-15	11/12/91	+	2.1	5.6	*
RH-33	+	11/07/91	+	24700.0	46.1	*
		09/28/92	+	25700.0	2.0 U	*
RH-4	5-15	08/21/87	5.10	23.0	5.00 U	*
		09/14/88	5.08	34.0	*	*
		11/12/91	+	38.4	2 U	*
		09/24/92	+	53.9	2.0 U	*
RH-47	+	09/23/92	+	9.2	91.6	*
RH-5	8-18	08/20/87	10.81	490.0	78.0	*
		06/03/88	10.79	700.0	90.0	*
		09/13/88	11.23	1270.0	82.0	*
		11/07/91	+	1680.0	42.8	*
		09/28/92	+	2210.0	46.5	*
RH-6	29-39	08/20/87	11.69	1600.0	17.0	*
		06/03/88	10.94	780.0	14.0	*
		09/13/88	12.33	180.0	5.00 U	*
		11/07/91	+	875.0	2 U	*
		09/28/92	+	658.0	2.0 U	*
RH-8	30-40	09/14/88	9.28	19.0	5.00 U	*
		09/23/92	+	18.2	2.0 U	*
RH-9	6-16	08/20/87	8.81	21.0	5.00 U	*

(1) WQB-7 - Montana Water Quality Bureau Standards Numeric Water Quality Standards (Arsenic 18 µg/L; Cadmium 5 µg/L; Mercury 0.14 µg/L); Shading indicates an exceedance; U - Below method detection limit; R - Rejected data.

(2) RH-/DP- - Well and drive points installed in the Rocker Operable Unit; wells represent ground water concentrations at shallow, intermediate, and deep depths; not inclusive of all wells with exceedances. DW - Domestic wells - 200 series wells are located in Rocker, Nissler, and Miles Crossing areas; 300 series wells are located in the upper Deer Lodge Valley.

(3) DTW - Depth to water below ground surface ! - Unknown * - Not analyzed + - Data not available

Because the majority of inorganic compounds are typically most soluble at low (acidic) pH, metals carried with acidic groundwater entering the relatively higher pH water of Silver Bow Creek precipitate out of the water and adsorb onto instream sediments. Researchers working on Silver Bow Creek have documented that instream sediments accumulate the majority of contaminant load from groundwater (Benner et al., 1995; Smart, 1995). Under conditions of extremely acidic (pH = 1.0 to 4.5), low dissolved oxygen (less than 1,000 μg/l), and metal-rich groundwater (avg. Cu = 20,000 μg/l and Zn = 60,000 μg/l) discharging to a neutral to basic (pH = 7.9 to 9.1), oxidized (8,000 μg/l) stream with relatively lower contaminant concentrations (avg. Cu = 100 μg/l and Zn = 1,000 μg/l), the vast bulk of contaminant loading from groundwater to surface water is attenuated in the instream sediments (Benner et al., 1995 and Smart, 1995). The attenuation mechanisms are most likely adsorption and/or precipitation. Contaminated groundwater is doubtless a source of additional contamination to instream sediments and surface water of Silver Bow Creek.

4) Instream Sediments

Instream sediments (i.e. sediment within the active channel of Silver Bow Creek) are severely contaminated with metals arsenic, cadmium, copper, lead, mercury and zinc extending throughout the entire length of the SST OU stream channel (Table 4). Instream sediment concentrations of Silver Bow Creek are similar to the concentrations found in the tailings/impacted soils, so, for conceptual purposes, they can be considered "tailings in the stream". The SST OU risk assessment determined that arsenic, cadmium, copper, lead, mercury and zinc are, individually, major contributors to the impairment of the aquatic community of Silver Bow Creek (MDEQ, 1994a).

Essig and Moore (1992) described concentrations of Silver Bow Creek instream sediments as between 10 and 65 times higher for arsenic, cadmium, lead, and zinc, and 400 times higher for copper than are found in other area streams which drain highly mineralized geologic areas. Like tailings themselves, the majority of contaminated sediments vary in size from a coarse sand (1 mm) to a very fine silt or clay (Table 4).

While in the stream, these sediments are presently toxic to most macroinvertibrates (Besser et al., 1995a,b), serve as a potential future source of metals contamination to the surface water system, and could potentially impact future fish populations by biologic up-take from contaminated benthic invertebrates (Woodward et al., 1994).

Besser et al., (1995a,b) and Kubitz et al. (1995) tested instream sediments in the fall of 1993 from analogous locations to samples tested in the fall of 1991 by Kembel et al. (1994) and Ingersoll et al. (1994).

Table 4
Silver Bow Creek
Mean Instream Sediment Concentrations
(mg/kg)

Analyte	Background[1] (<63 μm)	Sand Fraction[2] (2,000-62 μm)	Clay/Silt Fraction[2] (<62 μm)
Arsenic	7	92	378
Cadmium	0.2	3.8	76
Copper	20	694	10,459
Lead	15	225	6,702
Mercury[3]	NA	0.8	--
Zinc	57	1,357	12,782

NA = not analyzed. 1 - Clark Fork Damage Assessment Bed Sediment Sampling And Chemical Analysis Report, University of Montana - Oct. 1992. 2 - sediment contaminant concentration analysis, data used PTI, ARCO, Essig & Moore, and CH2M Hill - Oct. 1995. 3 - As reported in Titan Oct. 12, 1994 submittal, not analyzed by size fraction. μm = micrometers. mg/kg = milligrams per kilogram.

Kubitz et al. (1995) tested the amphipod *Hyalella azteca* and Besser et al. (1995a,b) tested the midge *Chrionomus tentans*. These studies were conducted in accordance to both USEPA and ASTM standard sediment toxicity and bioaccumulation test methods with the standard test organisms (Ingersoll 1991, Ingersoll et al., 1995a, USEPA 1994, ASTM 1995a,b).

Instream sediment chemistry, toxicity, and bioaccumulation was similar between the 1991 and 1993 sampling dates. The sediments from Silver Bow Creek were consistently the most toxic of the samples collected in the Clark Fork basin and resulted in the highest bioaccumulation of metals by both amphipods and midges (Ingersoll per com. September 27, 1995). Moreover, concentrations of metals in these sediment samples consistently exceeded a variety of sediment quality guideline concentrations (Ingersoll et al. 1995b,c; MacDonald et al. 1995; Smith et al. 1995).

5) Railroad Materials

Certain portions of several historic and existing railroad embankments along Silver Bow Creek were constructed or contaminated with mine waste rock and/or mine and mill tailings.

This material represents a source of metals to groundwater or to Silver Bow Creek via runoff.

Estimated Volumes of Contaminated Materials By Subarea

Contaminated tailings/impacted soils volume estimates are presented in Table 4. These volumes were originally presented in the Draft RI as generated by the Natural Resource Information System (NRIS) Geographic Information System (GIS) database. A more detailed description of the various methods and measures used to calculate these quantities is presented in the Draft RI (ARCO, 1995a).

Subarea 1

There are approximately 285,000 cubic yards (cy) of tailings/impacted soils impacting approximately 154 acres within Subarea 1 (Table 4). Tailings/impacted soils are generally coarse textured, comprised primarily of sand and silt size materials. The coarse nature of these tailings increases the potential for movement of water through the tailings and transport of contaminants into the ground and surface water. Tailings deposits are primarily fluvial bar type deposits. The maximum lateral width of tailings/impacted soils is approximately 1,200 feet and the measured thickness of tailings/impacted soils ranges up to approximately four feet. These deposits are generally narrow and lie close to the stream.

Metals-elevated railroad bed and ballast materials identified in Subarea 1 include approximately 203,000 cy of waste rock, 74,500 cy of slag, and a single small (1.3 cy) concentrate spill. Approximately 95,000 cy (47%) of this total quantity of waste rock are present along the CMSP rail line outside the floodplain, relatively far away from the stream. The only significant means of migration of railroad materials is erosion and transport by runoff from near-stream areas and infiltration through contaminated materials. There are several locations within Subarea 1 where railroad materials are likely to be eroded and transported directly to the stream: at two railroad bridges above and below the Rocker siding; and, near Whiskey Gulch and Nissler where the railroad bed forms one of the streambanks of Silver Bow Creek. Approximately 55,000 cy of waste rock are present in locations proximal to the streambanks or bridge abutments at two stream crossings. About 24,000 cy of this total are located in areas proximal to the stream along the northern and eastern sides of the Rocker Siding, a large multi-track siding used by both the Montana Western and Rarus railroad companies. The volume of slag used as ballast material in these same locations proximal to the stream is approximately 15,000 cy.

Surface water flows into the OU from the LAO OU containing concentrations of cadmium, copper, lead and zinc above chronic and acute aquatic surface water quality standards (Table

2). Generally, Silver Bow Creek gains flow from groundwater inflow throughout Subarea 1 (groundwater recharges the stream), indicating that this is a pathway for contaminated groundwater to move into the stream. Evidence that this pathway exists is the presence of some contaminants measured in groundwater in Subarea 1 at concentrations much greater than those measured in Silver Bow Creek during low flow conditions and the notable increase in all dissolved contaminants in the surface water between Subareas 1 & 2 (Table 2). Runoff from areas of overbank tailings to Silver Bow Creek is considerable in Subarea 1 based on high flow water quality data. The confined nature of the floodplain which slopes toward the stream results in transport of both particulate and metal salts to the stream during runoff events.

The alluvial aquifer system is generally close to the ground surface within Subarea 1, ranging between zero to eight feet below ground surface (bgs) in the floodplain. Groundwater levels within the floodplain were found to have a maximum seasonal fluctuation of up to two feet in monitoring wells further from the stream but within the floodplain during the three year monitoring period. Because of groundwater fluctuation in combination with the near-surface groundwater levels, Subarea 1 contains the second largest quantity of tailings/impacted soils considered to be saturated tailings (Table 5).

Infiltration of water through the vadose zone in tailings deposits and into the saturated zone is another method by which contaminants move into groundwater. This is most likely to occur during longer duration precipitation or snowmelt events or in those locations where groundwater is located close to the ground surface and tailings/impacted soils are of a coarse texture.

MCL exceedances for arsenic in groundwater were measured in wells located proximal to and within the Rocker OU. These exceedances may be partially attributed to sources within the Rocker OU. Exceedances of cadmium MCLs in groundwater appear to be related to the presence of fluvially-deposited streamside tailings and/or railroad materials composed of mining wastes or other industrial sources. Such exceedances appear to be confined to samples obtained from monitoring wells completed in the upper portion of the alluvial aquifer in source areas within the floodplain.

The volume of metals-impacted stream sediment in Subarea 1 is 15,000 cy, as defined in the RI. A recent stream survey identified that 20 percent of the stream channel is classified as riffles, 70 percent is runs, and 9 percent is pools. Runs and riffles contain the bulk of contaminated instream sediments (Maxim, 1995).

Subarea 2

There are approximately 808,000 cy of tailings/impacted soils covering over approximately

320 acres within Subarea 2 (Table 5). Tailings/impacted soil deposits range from the larger deposits on the Ramsay Flats (approximately 160 acres) to the limited deposits in the Miles Crossing region (about 34 acres) (ARCO, 1995a). Of this quantity, only 112,600 cy are considered to be saturated and overlying saturated tailings. The percentage of the total volume of tailings/impacted soils proximal to groundwater is smaller in this subarea than in any other subarea. A sizeable portion of the Ramsay Flats tailings deposit (approximately 280,000 cy) is located outside of the present floodplain boundary.

Table 5
Streamside Tailings OU
Volumes of Saturated Tailings and Relevant Groundwater Information

Subarea	Max. Observed G.W. Fluctuation (ft)	Total Volume Tailings (cy)	Volume Saturated and Overlying (cy)	Volume Residual Tailings (cy)
1	1.98	285,000	187,500	97,500
2	2.09	808,000	112,600	695,400
3	1.68	160,400	78,400	82,000
4	3.06	1,292,000	321,400	970,600
Total		**2,545,400**	**699,900**	**1,845,500**

Note: GW = groundwater, All volumes given in cubic yards (cy). This table represents 50,000 cy which has been removed from Demonstration Projects II.

Tailings in the upper and lower portions of Subarea 2 (near Silver Bow Siding, and Miles Crossing) are primarily linear or impoundment style deposits, close to the stream with surfaces sloping towards the stream. In the central portion of Subarea 2 (Ramsay Flats and Browns Gulch), tailings deposits are primarily wide, flat overbank and channel fill deposits on flat streambanks with very little slope. An internal drainage system has developed in the Ramsay Flats that drains to the west to Browns Gulch, which in turn enters Silver Bow Creek. Tailings are predominantly composed of fine sandy silts with some tailings underlain by a buried organic layer and a clay-silt laminated layer. Tailings/impacted soils generally range in measured thickness from one to four feet although tailings/impacted soils up to five feet thick were measured in several areas.

Tailings/impacted soil samples from Subarea 2 contain most of the highest median concentrations of contaminants of concern for the SST OU (Table 1). The tailings/impacted soils in this reach reflect relatively low-energy overbank deposition of medium to fine grained tailings. A buried soil horizon was penetrated in many of the borings in this subarea, especially in the vicinity of Ramsay Flats. This buried soil horizon provides some protection to groundwater where it is present, since the organic material present in the soil geochemically binds the metals in contaminated pore water moving through the vadose zone.

Railroad materials containing arsenic and metals that were identified in Subarea 2 include approximately 187,000 cy of waste rock, 48,000 cy of slag, and approximately 1,000 cy of impacted material. There are several railroad bridges within Subarea 2 where railroad materials are likely to be eroded and transported directly to Silver Bow Creek or a tributary: at the Silver Bow and Miles Crossing bridges and where the stream crosses Browns Gulch. At these locations, there are about 60,000 cy of waste rock and 5,000 cy of slag out of the total volumes presented above.

Surface water flows into the subarea containing concentrations of cadmium, copper, lead, and zinc above acute and chronic aquatic water quality standards (Table 2). During low flow periods, metals levels in surface water are generally higher at the upstream end of the subarea compared to the downstream end of the subarea. Contaminants of concern in runoff impact Silver Bow Creek substantially during high flows as evidenced by trends of increasing total and dissolved zinc and total copper. Silver Bow Creek appears to slightly gain flow from groundwater inflow in Subarea 2 in the reach of stream adjacent to Ramsay Flats where there is evidence of groundwater impacts to surface water. Silver Bow Creek is less armored within Subarea 2 than any other portion of the OU. Therefore, considerable streambank erosion in many areas is evident. The degree to which surface water is impacted by the groundwater pathway could not be quantified with the data ARCO collected for RI purposes. Data collected on SBC by other researchers quantified the effects of saturated tailings on groundwater and the subsequent impact of contaminated groundwater on instream sediments and surface water (Benner et al., 1995; Smart, 1995).

The alluvial aquifer in Subarea 2 is generally near the surface as in Subarea 1, ranging from approximately zero to eleven feet bgs in the floodplain. In Ramsay Flats, depth to water is approximately five feet below ground surface. Groundwater levels within the floodplain exhibited an observed fluctuation of over two feet in wells further from the streambank. In the larger areas of tailings such as Ramsay Flats, the groundwater elevation is far enough below the surface that a relatively small percentage of tailings are considered saturated. Because of this and the finer grained texture of the tailings/impacted soils deposits, precipitation and adsorption mechanisms may, to a greater extent than in Subarea 1, potentially retard contaminants of concern in the soil. Vadose zone transport of contaminants of concern are limited and less significant within Subarea 2 than anywhere else in the OU. For instance, on Ramsay Flats, the largest single area of tailings with limited data points (monitoring wells), no drinking water MCL exceedances were observed over the Phase II RI monitoring period.

Groundwater MCL exceedances have been detected in several other locations within Subarea 2, primarily where groundwater is close to the surface. Exceedances of the cadmium MCL have been measured in wells in the Silver Bow Siding area. Groundwater samples collected from wells located near the mouth of Browns Gulch and near Miles Crossing have periodically exceeded the arsenic MCL.

The volume of metals-impacted stream sediment in Subarea 2 is 22,700 cy, as defined in the RI. A recent stream survey identified that 21 percent of the stream channel is classified as riffles, 65 percent is runs, and 14 percent is pools. As with Subarea 1 runs and riffles contain the bulk of contaminated instream sediments (Maxim, 1995).

Subarea 3

Subarea 3 is almost wholly contained within Durant Canyon, the canyon setting constituting the main difference between this subarea and the other three subareas. There are no improved roads in the subarea although access can be gained along an unimproved inactive railroad bed which parallels the stream. Within the narrow canyon, the stream channel is generally confined to a narrow floodplain between the railroad embankments.

There are approximately 160,400 cy of tailings and impacted soils covering over approximately 92 acres within Subarea 3 (Table 5). Of this quantity, approximately 78,400 cy of tailings/impacted soils are considered saturated and above. The texture of tailings in this subarea is primarily very fine grained silty sands. Tailing deposits in Subarea 3 are primarily channel bar and impoundment deposits, with minor overbank and channel fill. The maximum lateral width of tailings/impacted soils is approximately 620 feet; tailings deposits are discontinuous through the narrow canyon. Tailings/impacted soils are generally less than two feet thick, averaging 0.5 feet thick. The maximum measured thickness of this material is approximately 4 feet.

Railroad materials containing contaminants of concern identified in Subarea 1 include approximately 60,000 cy of waste rock and approximately 35,000 cy of slag with about 24,000 cy present in areas proximal to the stream. These materials were present in the bed and ballast at five locations within Subarea 3 where railroads cross Silver Bow Creek or where the railroad bed makes up one of the streambanks. Additionally, the confined nature of the canyon and location of the railroads adjacent to Silver Bow Creek increase the area where materials containing contaminants of concern are likely to be eroded and transported directly to Silver Bow Creek. Erosion and transport of these railroad materials is potentially more significant in Subarea 3 than elsewhere in the SST OU.

As in Subarea 2, surface water flows into the subarea at levels above chronic and acute aquatic water quality standards for most metal parameters (Table 2, SS-14). At low flow, contaminant levels in surface water are generally higher at the upstream end of the subarea than at the downstream end of the subarea. This decrease probably occurs primarily from dilution of the input of relatively higher quality German Gulch water to the system. Silver Bow Creek is armored in Subarea 3, more than any other portion of the OU.

Runoff from areas of overbank tailings to Silver Bow Creek is potentially significant. The confined nature and relatively steep slopes of the floodplain near the stream within the canyon may result in transport of both particulate and dissolved salts to the stream during precipitation runoff events.

Based on data from the five monitoring wells located in Subarea 3, the alluvial aquifer is relatively near-surface, ranging from approximately zero to nine feet bgs. Groundwater levels were found to fluctuate between approximately 0 and 1.7 feet. Vadose zone transport of contaminants of concern may be considerable as a result of the fine grained sandy texture, the shallow depth to groundwater and the fluctuation of the water table.

Groundwater MCL exceedances measured in Subarea 3 were from a near-stream well completed in coarse tailings. Samples from this well have exceeded the cadmium MCL three out of five times that it has been sampled. Stream stage and groundwater level data indicate that the surface water is gaining with varying stream stage in the upper end of the subarea near Miles Crossing.

The volume of metals-impacted stream sediment in Subarea 3 is 5,600 cy, as defined in the RI. A recent stream survey identified that 49 percent of the stream channel is classified as riffles, 40 percent is runs, and 11 percent is pools. Runs contain the bulk of contaminated instream sediments for this subarea (Maxim, 1995).

Subarea 4

The character of Subarea 4 is quite different from the other three upstream subareas in that the floodplain is wide and contains numerous overflow channels. These overflow channels are active during various high flow events and contain some of the thicker deposits of tailings/impacted soils and generally contain the majority of off-stream saturated tailings. In the upper half of Subarea 4, Silver Bow Creek flows through a relatively straight man-made channel which limits to some extent potential overbank flows which would normally enter the overflow channels. Below the town of Stuart, the channel is characterized as meandering.

Subarea 4 contains the largest quantity of tailings and impacted soil of all four subareas, approximately 1,300,000 cy over approximately 700 acres (Table 4)(ARCO, 1995a). 50,000 cy has been removed from Demonstration Project II. Of the 1,250,000 cy, approximately 321,400 cy are considered saturated or overlying saturated tailings. Subarea 4 contains about 52% of the volume of tailings/impacted soils within the SST OU. The texture of tailings materials in Subarea 4 is primarily very fine, silty sands. Tailings deposits are discontinuous along a wide floodplain and are sparsely vegetated. Measured tailings/impacted soils thicknesses range from a few inches to over 4.5 feet.

Subarea 4 contains the smallest quantity of railroad materials containing metals and arsenic, including only approximately 8,300 cy of waste rock and approximately 23,000 cy of impacted material. Railroad materials are proximal to Silver Bow Creek at a single location on an abandoned railroad grade at Stuart, which contains approximately 5,000 cy of waste rock. Because the limited quantity of railroad materials containing contaminants of concern is located in the floodplain in a single location in Subarea 4, erosion and transport of railroad materials to Silver Bow Creek is not significant.

Surface water flows into Subarea 4 at levels above chronic and acute aquatic water quality standards for most metal parameters (Table 2, SS-16). With the exception of arsenic, metals levels in surface water are generally higher at the upstream end of the subarea than at the downstream end during low flow with most of the decrease occurring below the Stewart Street Bridge. Conversely, during high flow events, concentrations of both total and dissolved fractions of most contaminants of concern increase by up to an order of magnitude between the upper and lower ends of the subarea.

As Silver Bow Creek flows through the subarea, the upper (southern) part of the subarea loses flow to groundwater and the lower (northern) portion of the OU gains flow from groundwater during low flow. Surface water does not appear to impact groundwater quality in the losing reaches of the subarea.

Runoff of precipitation and snowmelt from the overbank tailings occurs along portions of Subarea 4, primarily through the various overflow channels that meander through the floodplain. Because runoff quality and quantity were not directly measured during the RI, the magnitude of runoff inflow in Subarea 4 could not be quantified.

The alluvial aquifer system is relatively near-surface within Subarea 4, ranging from zero to seven feet bgs in areas away from the active channel. Groundwater levels within the floodplain were found to fluctuate between approximately 0.5 to 3.0 feet. Drinking water MCL exceedances of cadmium in groundwater were detected in two areas, near Crackerville and Stuart. Copper and zinc concentrations where found to be many orders of magnitude greater than surface water standards in near stream wells. This groundwater would be expected to discharge into the creek in gaining sections. These cadmium exceedances were measured along with relatively high concentrations of other metals in the same wells. One of the wells in Subarea 4 that exhibited relatively high metals concentrations was installed in saturated tailings, indicating that the exceedances may be related to the presence of tailings/impacted soils in the saturated interval.

The volume of metals-impacted stream sediment in Subarea 4 is 30,000 cy, as defined in the RI. A recent stream survey identified that 37 percent of the stream channel is classified as riffles, 45 percent is runs, 10 percent is pools, and 8% is dewatered. In this subarea, runs contain the bulk of contaminated instream sediments (Maxim, 1995).

<u>Terrestrial and Aquatic Resources</u>

The Terrestrial and Aquatic Resources Investigations characterized the representative plant communities and the benthic macroinvertebrate community within the SST OU. The Terrestrial Investigation focused on vegetation mapping and vegetation uptake of contaminants of concern. The aquatic investigation focused on benthic macroinvertebrate communities and density of species.

Terrestrial Resources

The general objectives of the Terrestrial Investigation were to characterize representative plant communities within the operable unit in relation to soil conditions and to determine the existence and extent of bioaccumulation of contaminants of concern in tissues of selected plant species. Riparian plant communities were surveyed at stations representing a gradient of contaminant concentrations in soil. The results provide information for assessing potential effects of elevated concentrations of contaminants of concern on plant communities and wildlife that depend on vegetation for habitat and food.

The following conclusions were made on the bases of the limited data collected for the RI:

- Riparian meadow communities within the SST OU consist mainly of stands dominated by tufted hairgrass or redtop, with species of forbs and other grasses occurring in less abundance.

- Concentrations of contaminants of concern in soil and pH levels are the significant variables that affect riparian meadow community characteristics. In some areas of tailings with elevated contaminant concentrations, plant biomass and cover can reach levels characteristic of unimpacted reference areas because soil pH is relatively high (>6.0).

- Willows displayed leaf tip burn, general chlorosis, curling of leaves, and brown margins and brown necrotic spots on leaves that could be attributable to trace metal toxicity. However, it is possible that some of the effects observed are attributable to nutrient deficiency due to localized soil conditions.

Benthic Macroinvertebrate Resources

Since 1986, benthic macroinvertebrate assemblages have been studied at four sampling stations in Silver Bow Creek by the MDEQ (McGuire, 1995). The macroinvertebrate data are analyzed using a series of 10 community metrics that are combined into a single index of biological integrity. Such a measure indicates the severity of mining impacts to Silver Bow Creek. Selected metrics are also combined to develop separate indices of biological integrity for metals and organic effects at each station. The interpretation of the macroinvertebrate data is dependent upon many subjective factors associated with the validity of individual metrics, the combination of metrics used for cumulative assessments, and the impact categorizations based on index scores. Notwithstanding these limitations, the data provide an indication of the current status of macroinvertebrate communities, the degree of recovery over past conditions, and some insight into potential causative agents.

Four macroinvertebrate sampling stations were located along Silver Bow Creek. Two of these stations were located upstream of the SST OU boundary, one below the waste water treatment plant and one below the Colorado Tailings. The other two stations were located at Miles Crossing and at the lower end of the operable unit above the Warm Springs Ponds. The results and conclusions for this reach of stream indicated that biological integrity was severely impaired by metals and organic pollution and that metals remained the primary cause of impacts to macroinvertebrates above the Warm Springs Ponds (McGuire, 1995). Metals toxicity depressed biological integrity and restricted the benthic fauna to a few tolerant species. Biological responses to nutrient and organic inputs were limited in the metals-dominated environment.

Results from these stations also indicated that there was a slight improvement in biological integrity from below the Colorado Tailings to the Warm Springs Ponds. This condition was hypothesized to reflect the buffering effect of organics from the waste water treatment plant effluent and/or the distance from potential sources of contamination.

Algae are useful biomonitors of water quality because they have known environmental requirements and pollution tolerances. The results of this study for the Miles Crossing station and the station upstream of the Warm Springs Ponds indicated that the biological integrity at both stations was poor and the overall impairment at both stations was severe. For comparison, just below the ponds at a station on the Clark Fork River below the mouth of Warm Springs Creek, biological integrity was good and the overall impairment was minor.

VI. SUMMARY OF OU RISKS

The Draft Baseline Risk Assessment for the SST OU was issued by MDEQ for public comment in January 1995 (MDHES, 1994a). The U.S. EPA and MDEQ have defined carcinogenic potential risk in excess of 1 in 10,000 and hazard indices in excess of 1.0 as unacceptable. This definition of unacceptable risk to human health has been incorporated into the Draft Baseline Risk Assessment for the SST OU and the SST OU Preliminary Remediation Goals (PRGs). The BRA Executive Summary is located in Appendix C.

Human Health Conclusions

The Streamside Tailings Baseline Human Health Risk Assessment evaluated three exposure scenarios to determine the health risks related to OU use by residents, workers (occupational), and recreationists. Both existing and reasonably anticipated future exposure scenarios were evaluated. Risks were divided into those which may cause cancer and those which cause adverse health effects other than cancer (non-carcinogenic risks).

Residents

To evaluate potential residential exposure to floodplain contaminants, MDEQ considered a house located outside, but adjacent to, the floodplain with a yard leading down to Silver Bow Creek. Under this scenario, children and adults could be exposed to contaminated soils located outside and inside the floodplain and within the residential yard. Exposure to stream water and instream sediments was evaluated under the recreational scenario. The vast majority of residents in Rocker, Silver Bow, Ramsay, and Opportunity live outside the area of greatest impact from tailings and their exposure to contaminants is expected to be limited.

The primary carcinogenic risk to people living in or near the OU comes entirely from potential exposure to arsenic in soil and groundwater (Table 6). Elevated concentrations of arsenic can be found in tailings areas such as the Ramsay Flats and in upper alluvial (less than 20-feet below ground surface), near-stream groundwater.

Noncarcinogenic risks exceeded acceptable levels for arsenic in soils under the residential scenario (Table 7). As with the carcinogenic risks, the noncarcinogenic risks vary depending on the amount of contamination a person contacts. Noncarcinogenic risks related to arsenic, cadmium, copper and zinc in groundwater were found only in upper alluvial, near-stream groundwater within and directly adjacent to the floodplain. The risks posed by lead contamination in soil are generally within the acceptable range based on the risk model used in Butte.

Limited groundwater data demonstrate that the upper alluvial groundwater exceeds drinking water standards in some areas and also suggest that lower alluvial groundwater does not presently exceed drinking water standards except in Subarea 4. Most, if not all, water supply wells are located in lower alluvial groundwater but could potentially draw water from the upper alluvial system.

Occupational

The occupational scenario evaluates the risk to workers within the OU and focuses on agricultural workers in areas outside the floodplain. The risk assessment indicates that carcinogenic risk falls within an acceptable range (Table 8). Noncarcinogenic risks to agricultural workers are mostly related to arsenic and are also generally acceptable (Table 9). If workers were to equally divide their work time between areas inside and outside the floodplain their risks might be higher by a factor of three and could exceed acceptable levels.

Recreationists

Both carcinogenic and noncarcinogenic risks to OU visitors are posed by future use of the railroad beds which exceed the acceptable EPA risk range (Tables 10 and 11). This could become a concern if present plans for use of railroad beds as a trail system are developed. Elevated levels of arsenic where past ore concentrate spills occurred on the railroad beds create a hazard to recreational users and would therefore require cleanup. As in the residential scenario, using the Butte model, the risks posed by lead are within the acceptable range.

<u>Ecological Conclusions</u>

The Ecological Risk Assessment was conducted in a manner similar to, although less quantitative than, the human health risk assessment. The conclusions generally focus on whether the environment (plant and animal life) is or may be adversely impacted. A summation of the risks is presented in Table 12.

In Silver Bow Creek, which is devoid of fish and most other aquatic life forms, the presence of mine waste contamination is the primary factor limiting the health of the aquatic environment. These contaminants affect both the water quality and instream sediments in Silver Bow Creek and create a toxic environment for fish and most benthic macroinvertebrates. Other physical conditions which may adversely affect the health of Silver Bow Creek include siltation of the stream bottom, channelization, and disturbance of adjacent land and streamside (riparian) habitat.

TABLE 6

Carcinogenic Risks for the Residential Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	2.5×10^{-4}	4.4×10^{-5}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Ingestion of Groundwater	Arsenic	3.11×10^{-4}	6.7×10^{-5}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Dermal Contact with Groundwater	Arsenic	2.99×10^{-9}	NA
Inhalation of Dust	Arsenic	3.17×10^{-5}	9.51×10^{-7}
Total Carcinogenic Risk		5.6×10^{-4}	1.1×10^{-4}

[a] Total carcinogenic risks have been rounded to the nearest tenth.

NC = Not calculated, chemicals are not carcinogens for this exposure pathway, or carcinogenic slope factors are not available.

NA = Only RME exposure is assessed for this pathway.

TABLE 7

Noncarcinogenic Hazard Quotients and Hazard Indices for the Residential Scenario[a]

Pathway	Chemical	RME HQ	Average Risk
Ingestion of Soil/Sediment	Arsenic	1.05×10^{1}	3.03×10^{0}
	Cadmium	8.97×10^{-2}	2.44×10^{-2}
	Copper	5.26×10^{-1}	1.5×10^{-1}
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	7.11×10^{-2}	2.28×10^{-2}
Pathway HI		**1.1×10^{1}**	**3.2×10^{0}**
Ingestion of Groundwater	Arsenic	3.10×10^{0}	2.22×10^{0}
	Cadmium	1.6×10^{0}	7.30×10^{-1}
	Copper	2.73×10^{0}	1.69×10^{0}
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	4.00×10^{0}	4.75×10^{-1}
Pathway HI		**1.2×10^{1}**	**5.1×10^{0}**
Dermal Contact with Groundwater	Arsenic	2.23×10^{-5}	NA
Inhalation of Dust	Arsenic	NC	NC
Total HI		**2.3×10^{1}**	**8.4×10^{0}**

[a] Pathway HIs and total HIs have been rounded to the nearest tenth.
NC = Not calculated, data are insufficient for quantitative analysis.
NA = Only RME exposure is assessed for this pathway.
HQ = Hazard Quotient
HI = Hazard Index

TABLE 8

Carcinogenic Risks for the Occupational Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	5.4×10^{-5}	3.4×10^{-5}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Inhalation of Dust	Arsenic	8.5×10^{-6}	5.1×10^{-6}
Total Carcinogenic Risk		**6.2×10^{-5}**	**8.5×10^{-6}**

[a] Total carcinogenic risks have been rounded to the nearest tenth.

NC = Not calculated, chemicals are not carcinogens for this exposure pathway, or carcinogenic slope factors are not available.

TABLE 9

Noncarcinogenic Hazard Quotients and Hazard Indices for the Occupational Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	8.05×10^{0}	4.99×10^{-2}
	Cadmium	8.0×10^{-3}	6.07×10^{-4}
	Copper	3.29×10^{-2}	2.39×10^{-3}
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	3.64×10^{-3}	2.90×10^{-4}
Pathway HI		8.5×10^{-1}	5.3×10^{-2}
Inhalation of Dust	Arsenic	NC	NC
Total HI		8.5×10^{-1}	5.3×10^{-2}

[a] Pathway HIs and Total HIs have been rounded to the nearest tenth.
NC = Not calculated, data are insufficient for quantitative analysis.

TABLE 10

Carcinogenic Risks for the Recreational Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	6.2×10^{-5}	9.0×10^{-5}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**6.2×10^{-5}**	**9.0×10^{-5}**
Ingestion of Surface Water	Arsenic	3.4×10^{-8}	7.8×10^{-9}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**3.4×10^{-8}**	**7.8×10^{-9}**
Dermal Contact with Surface Water	Arsenic	3.2×10^{-9}	7.3×10^{-10}
Ingestion of Rail Road Bed Materials	Arsenic	1.2×10^{-3}	1.4×10^{-4}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**1.2×10^{-3}**	**1.4×10^{-4}**
Inhalation of Rail Road Bed Materials	Arsenic	1.8×10^{-5}	9.2×10^{-6}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**1.8×10^{-5}**	**9.2×10^{-6}**

[a] Total carcinogenic risks have been rounded to the nearest tenth.

NC = Not calculated, chemicals are not carcinogens for this exposure pathway, or carcinogenic slope factors are not available.

TABLE 11

Noncarcinogenic Hazard Quotients and Hazard Indices for the Recreational Scenario[a]

Pathway	Chemical	4-12 Year Old Child		1-3 Year Old Child	
		RME HQ	Average HQ	RME HQ	Average HQ
Ingestion of Soil/Sediment	Arsenic	8.95×10^{-1}	1.03×10^{-1}	4.17×10^{0}	2.91×10^{-1}
	Cadmium	6.34×10^{-3}	8.14×10^{-4}	3.47×10^{-2}	2.05×10^{-3}
	Copper	3.97×10^{-2}	5.15×10^{-3}	2.18×10^{-1}	1.52×10^{-2}
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	6.28×10^{-3}	8.89×10^{-4}	3.02×10^{-2}	2.31×10^{-3}
Pathway HI		**9.5×10^{-1}**	**1.1×10^{-1}**	**4.5×10^{0}**	**3.1×10^{-1}**
Ingestion of Surface Water	Arsenic	3.89×10^{-4}	9.0×10^{-5}	8.75×10^{-4}	2.02×10^{-4}
	Cadmium	2.25×10^{-5}	5.22×10^{-6}	5.05×10^{-5}	1.17×10^{-5}
	Copper	3.26×10^{-6}	6.94×10^{-6}	7.33×10^{-5}	1.56×10^{-5}
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	1.35×10^{-5}	2.23×10^{-6}	3.04×10^{-5}	5.02×10^{-6}
Pathway HI		**4.6×10^{-4}**	**1.0×10^{-4}**	**1.3×10^{-3}**	**2.3×10^{-4}**
Dermal Contact with Surface Water	Arsenic	1.96×10^{-5}	4.57×10^{-6}	3.06×10^{-5}	7.12×10^{-6}
Ingestion of Rail Road Bed Materials	Arsenic	1.65×10^{1}	2.02×10^{0}	7.44×10^{1}	4.55×10^{0}
	Cadmium	7.42×10^{-2}	1.08×10^{-2}	3.34×10^{-1}	2.43×10^{-2}
	Copper	1.91×10^{0}	1.8×10^{-1}	8.58×10^{0}	4.06×10^{-1}
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	1.56×10^{-1}	8.07×10^{-3}	7.02×10^{-1}	1.82×10^{-2}
Pathway HI		**1.9×10^{1}**	**2.2×10^{0}**	**8.4×10^{1}**	**5.0×10^{0}**
Inhalation of Rail Road Bed Materials	Arsenic	NC	NC	NC	NC
	Cadmium	NC	NC	NC	NC
	Copper	NC	NC	NC	NC
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	NC	NC	NC	NC
Pathway HI		**NC**	**NC**	**NC**	**NC**
Total HI		**2.0×10^{1}**	**2.4×10^{0}**	**9.0×10^{1}**	**5.4×10^{0}**

[a] Pathway HIs and Total HIs have been rounded to the nearest tenth.
NC = Not calculated, data are insufficient for quantitative analysis.
HQ = Hazard Quotient
HI = Hazard Index

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TABLE 12

Simplified Summary of Ecological Risks from Chemical Stressors

Media (units)	Chemical	Arith. Mean Conc/ U95 Conc	Effects Conc [1]	Risk Potential
Surface Water				
mg/L	Ammonia	3.11 / NC	0.53-2.7	Mod to High (location/timing dependent)
µg/L	Arsenic (D)	15.56 / 24.1	48-850	Low
µg/L	Cadmium (D)	1.66 / 2.26	0.47-5.0	Mod
µg/L	Copper (D)	50.74 / 59.56	3.9-54	High
mg/L	Dissolved Oxygen	~9.5 / NC	4.0	Low to High (location/timing dependent)
µg/L	Lead (D)	3.0 / 6.57	0.8-500	Mod
µg/L	Mercury (D)	0.16 / 0.16	0.012-4.0	Low to Mod
mg/L	Nitrogen (total soluble)	1.75-9.19/NC	0.03-1.0	Mod to high (location/timing dependent)
µg/L	PAHs (individual)	0.02 / NC	0.1-5.0	Low
µg/L	PCP	8.01/NC	3.5-14.5	Mod
µg/L	Zinc (D)	336.19 / 585.99	40-277	High
Sediment				
mg/kg	Arsenic	75.16 / 113.11	23.8-24.8	High
mg/kg	Cadmium	4.66 / 7.01	3.9	High
mg/kg	Copper	828 / 1,579.89	325-354	High
mg/kg	Lead	250.5 / 318.66	62.4	High
mg/kg	Mercury	3.49 / 6.7	0.2-2.0	High
mg/kg	PAHs (individual)	0.054-1.563 / NC	4-100	Low
mg/kg	PCP	0.367 / 0.634	4.2-21	Low
mg/kg	Zinc	1,380.13 / 2,120.27	1,064	High

TABLE 12 (continued)

Simplified Summary of Ecological Risks from Chemical Stressors

Media (units)	Chemical	Arith. Mean Conc/ U95 Conc	Effects Conc [1]	Risk Potential
Surface Soil				
mg/kg	Arsenic	303.1 / 514.9	25-100	High
mg/kg	Cadmium	6.45 / 11.95	4-50	Mod
mg/kg	Copper	1,470.4 / 2,484.9	60-100	High
mg/kg	Lead	723.63 / 1,241.4	250-1,000	High
mg/kg	Mercury	1.82 / 5.7	2-10	Low to mod
mg/kg	PAHs (individual)	Not Analyzed	1-10	Unknown/ Probably low
mg/kg	PCP	Not Analyzed	0.5-5.0	Unknown/ Probably low
mg/kg	Zinc	1,835.6 / 2,920.7	200-500	High

[1] Description and source listed in Table 5-17

NC: not Calculated
D: dissolved

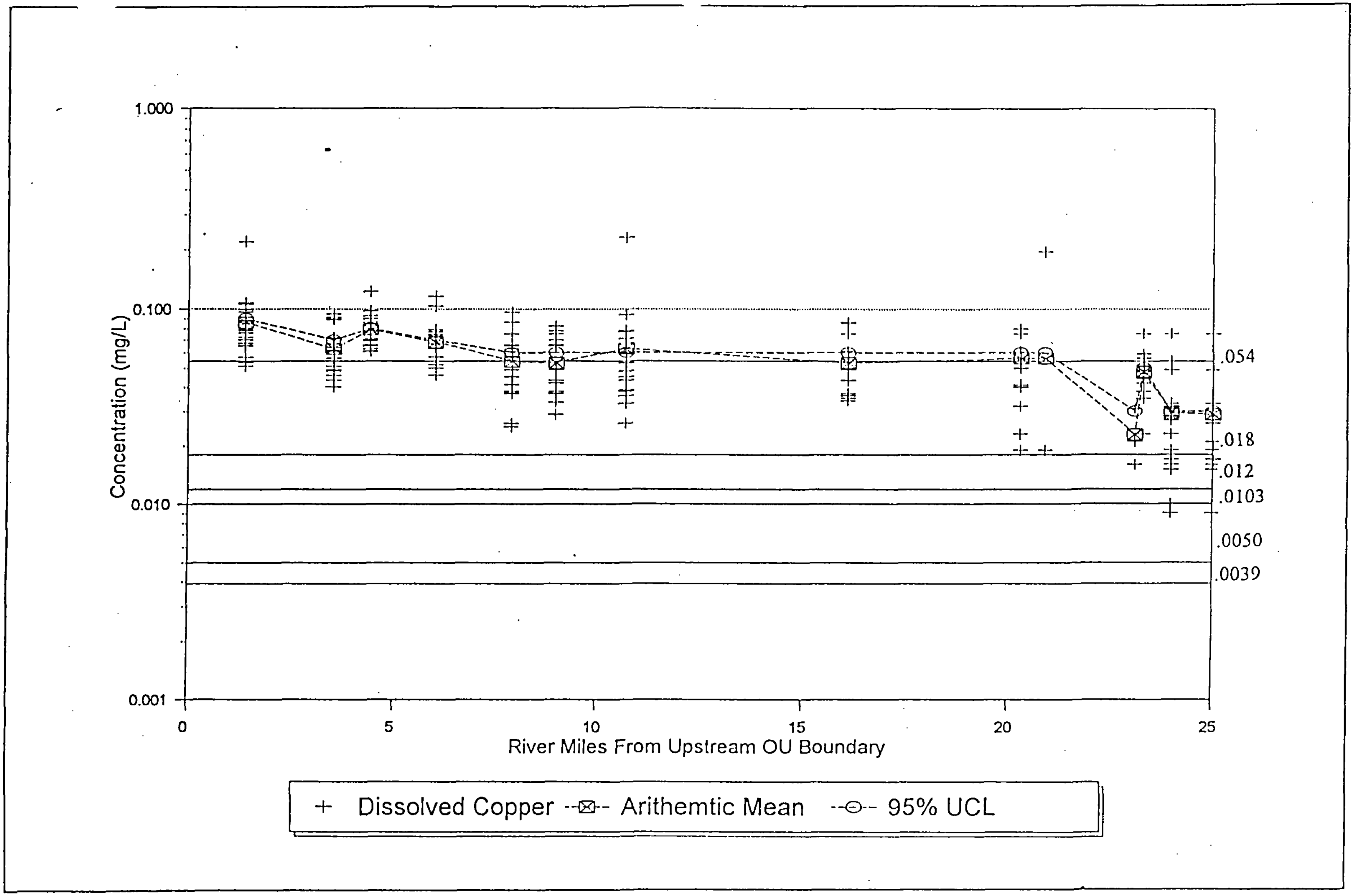


FIGURE 7
Dissolved Copper
SST Surface Water

Effects Concentration (ug/L)	Basis for Effects Concentration
3.9	LOAEC (growth & reproduction), freshwater invertebrates and salmonids (EPA 1985c)
5.0	LOAEC (growth), freshwater plants (EPA 1985c)
10.3	Chronic AWQC (dissolved), hardness = 100 mg $CaCO_3$/L (EPA 1985c)
12	Chronic AWQC, hardness = 100 mg Ca CO_3/L (EPA 1985c)
18	Acute AWQC, hardness = 100 mg Ca CO_3/L (EPA 1985c)
54	Mean 96 hr LC_{50}, Rainbow trout, CFR -- similar water quality (USFWS & VW 1992)

Copper Effects Concentrations
in Surface Water

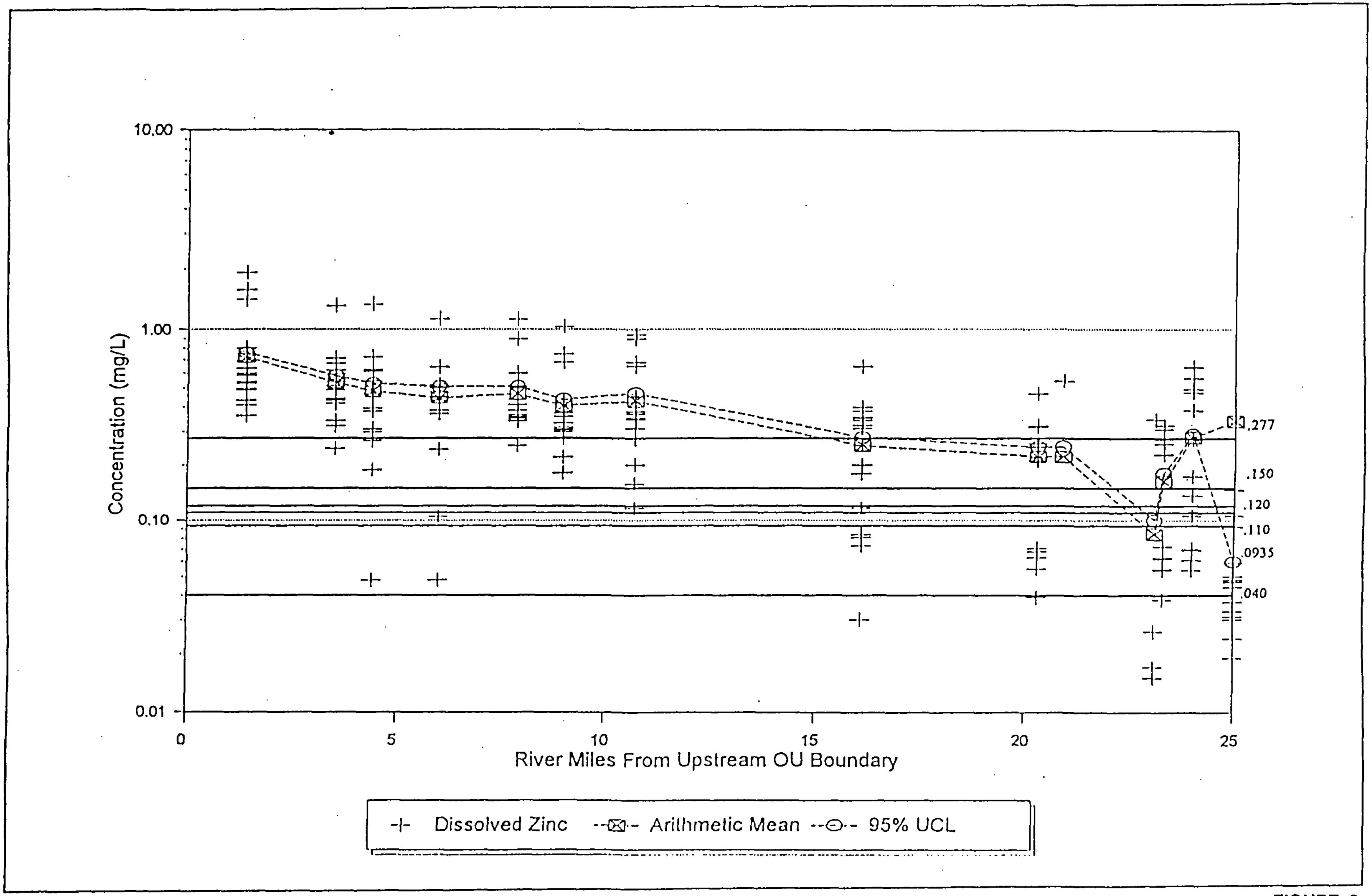


FIGURE 8
Dissolved Zinc
SST Surface Water

Effects Concentration (ug/L)	Basis for Effects Concentration
40	LOAEC (growth), freshwater plants (EPA 1987)
93.5	Chronic AWQC (dissolved), hardness = 100 mg $CaCO_3$/L (EPA 1987)
110	Chronic AWQC, hardness = 100 mg $CaCO_3$/L (EPA 1987)
120	Acute AWQC, hardness = 100 mg Ca CO_3/L (EPA 1987)
150	Mean 96 hr LC_{50}, Rainbow trout, CFR -- similar water quality (USFWS & VW 1992)
277	LOAEC (growth & reproduction), freshwater invertebrates and salmonids

Zinc Effects Concentrations
in Surface Water

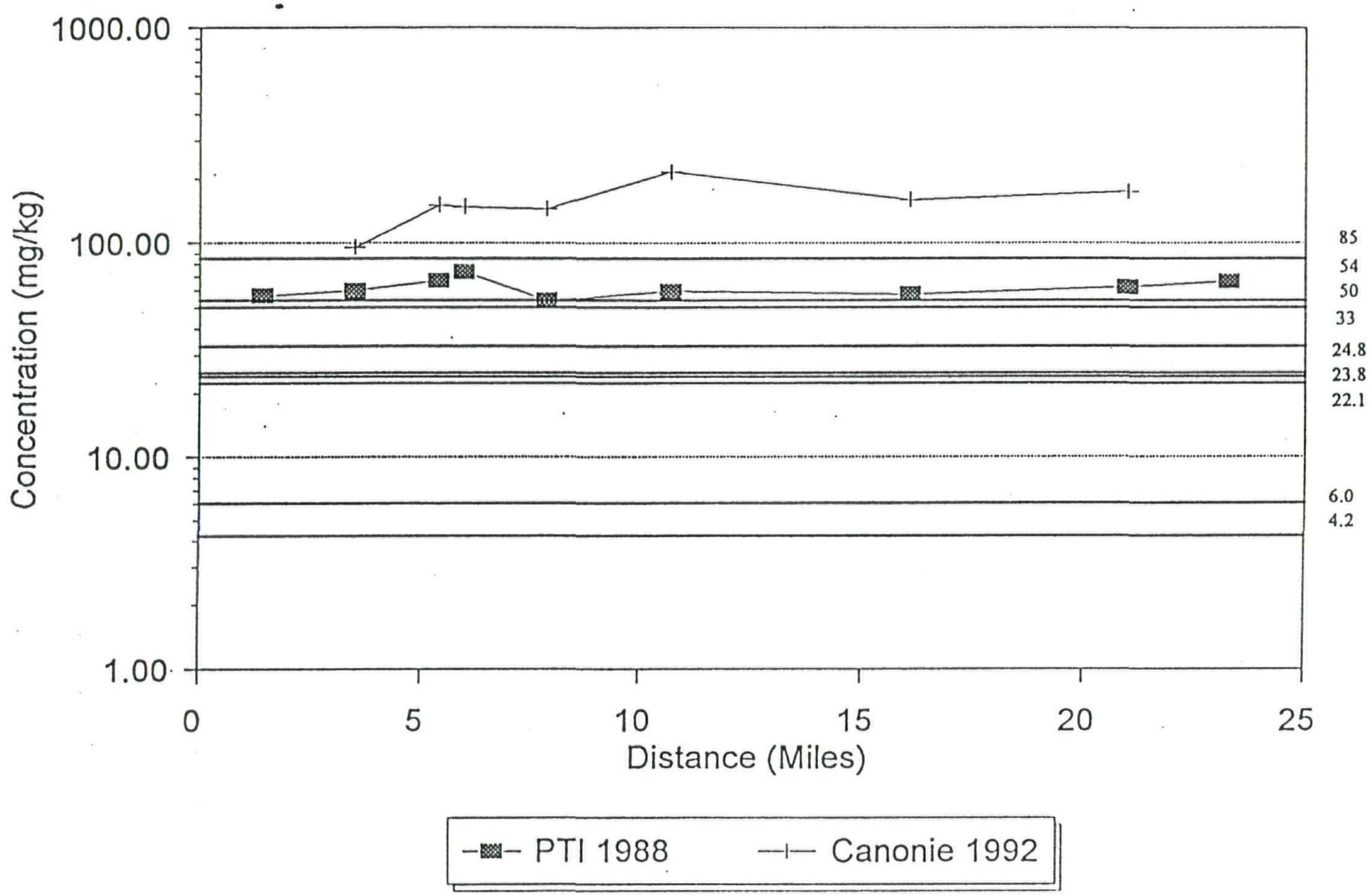


FIGURE 9
Total Arsenic
SST Sediment

Effects Concentration (mg/kg)	Basis for Effects Concentration
4.2	Background concentrations, uncontaminated sediment, Great Lakes precolonial horizon (Persaud . 1993)
6.0	Lowest Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
22.1	Low range of bioassay effects concentrations, co-occurrence analyses (COA), multiple species (Long & Morgan 1990)
23.8	No Effect Concentration (NEC), length, *Hyalella azteca (FWS & UW* 1992)
24.8	NEC, maturation, *Hyalella azteca, (FWS & UW* 1992)
33	Severe Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
50	Concentration at which adverse effects are always observed (Long & Morgan 1990)
54	Low range of apparent effects concentrations (AET), multiple species (Long & Morgan 1990)
85	Effects Range -- Median (ER-M) (Long & Morgan 1990)

Arsenic Effects Concentrations in Sediment

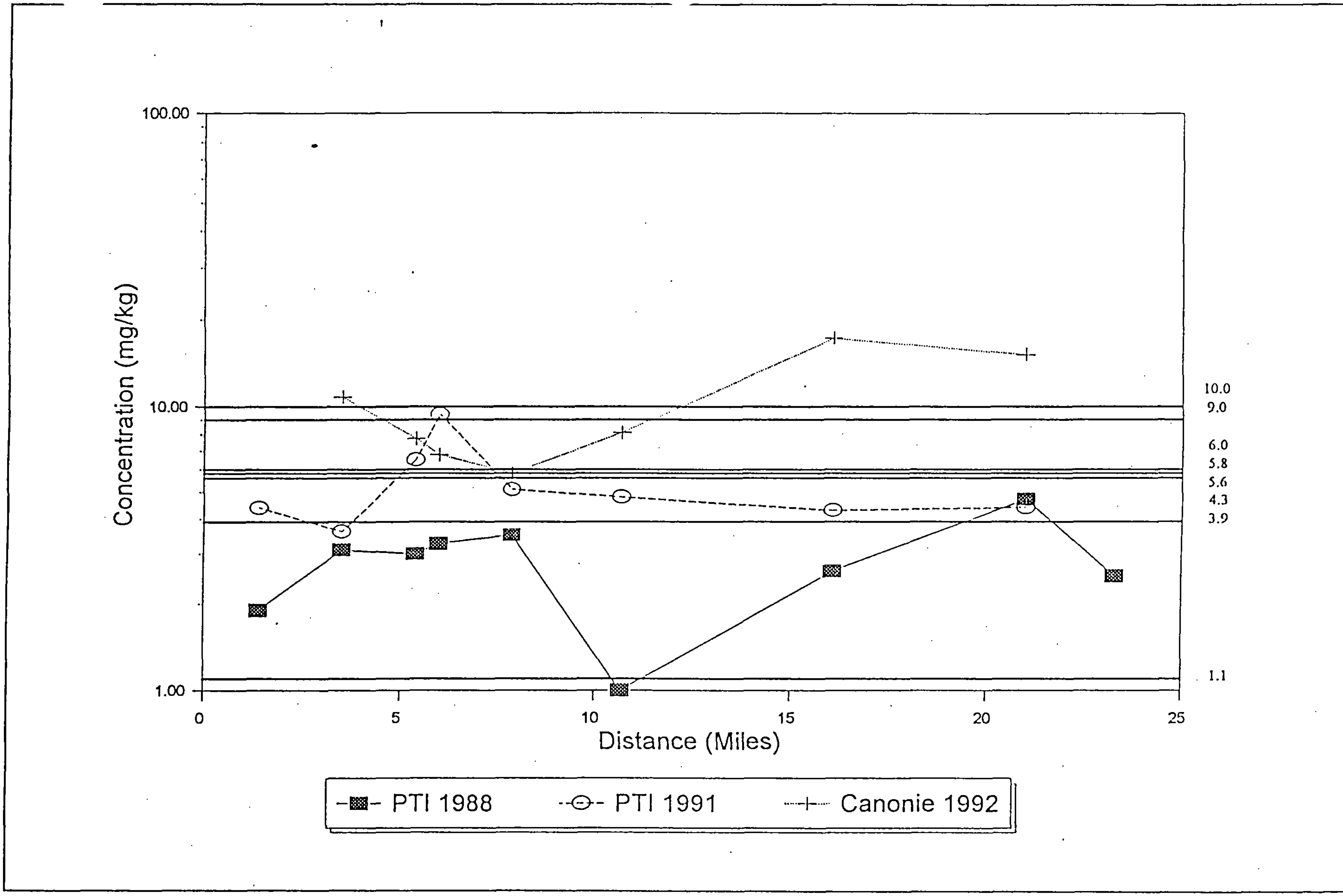


FIGURE 10
Total Cadmium
SST Sediment

Effects Concentration (mg/kg)	Basis for Effects Concentration
1.1	Background concentrations, uncontaminated sediment, Great Lakes precolonial horizon (Persaud . 1993)
3.9	No Effect Concentration (NEC), length and maturation, *Hyalella azteca (FWS & UW* 1992)
4.3	Low range of bioassay effects concentrations, co-occurrence analyses (COA), multiple species (Long & Morgan 1990)
5.6	Low range of spiked sediment bioassay (SSB), multiple species (Long & Morgan 1990)
5.8	Low range of apparent effects concentrations (AET), multiple species (Long & Morgan 1990)
6.0	Lowest Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
9.0	Effects Range -- Median (ER-M) and concentration always associated with adverse effects (Long & Morgan 1990)
10.0	Severe Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)

Cadmium Effects Concentrations
in Sediment

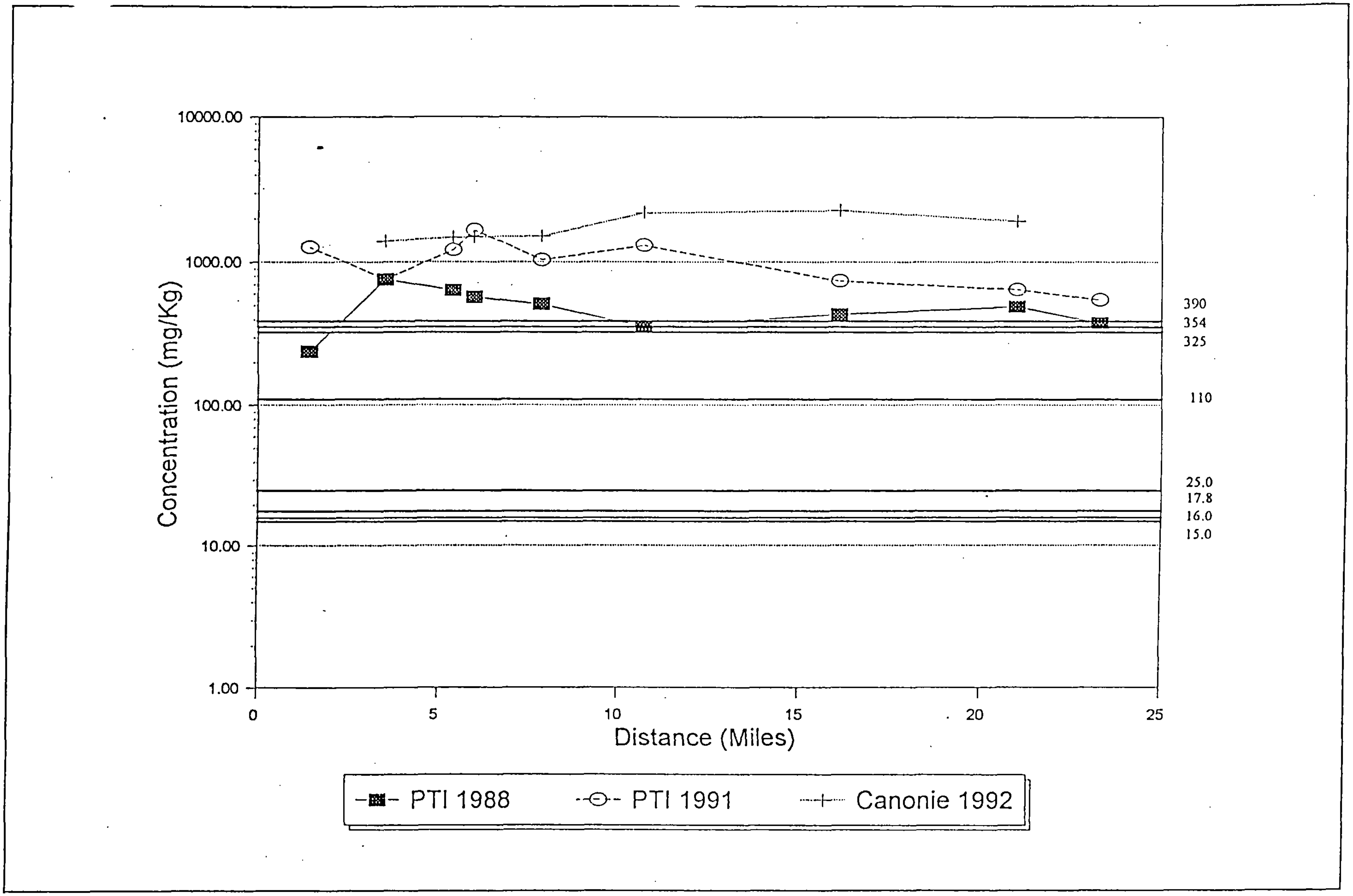


FIGURE 11
Total Copper
SST Sediment

Effects Concentration (mg/kg)	Basis for Effects Concentration
15.0	Low range of bioassay effects concentrations, co-occurrence analyses (COA), multiple species (Long & Morgan 1990)
16.0	Lowest Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
17.8	Low range of spiked sediment bioassay (SSB), multiple species (Long & Morgan 1990)
25.0	Background concentrations, uncontaminated sediment, Great Lakes precolonial horizon (Persaud . 1993)
110	Low range of apparent effects concentrations (AET), multiple species (Long & Morgan 1990) and Severe Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
325	No Effect Concentration (NEC), length, *Hyalella azteca (FWS & UW* 1992)
354	No Effect Concentration (NEC), maturation, *Hyalella azteca (FWS & UW* 1992)
390	Effects Range -- Median (ER-M) and concentration always associated with adverse effects (Long & Morgan 1990)

Copper Effects Concentrations in Sediment

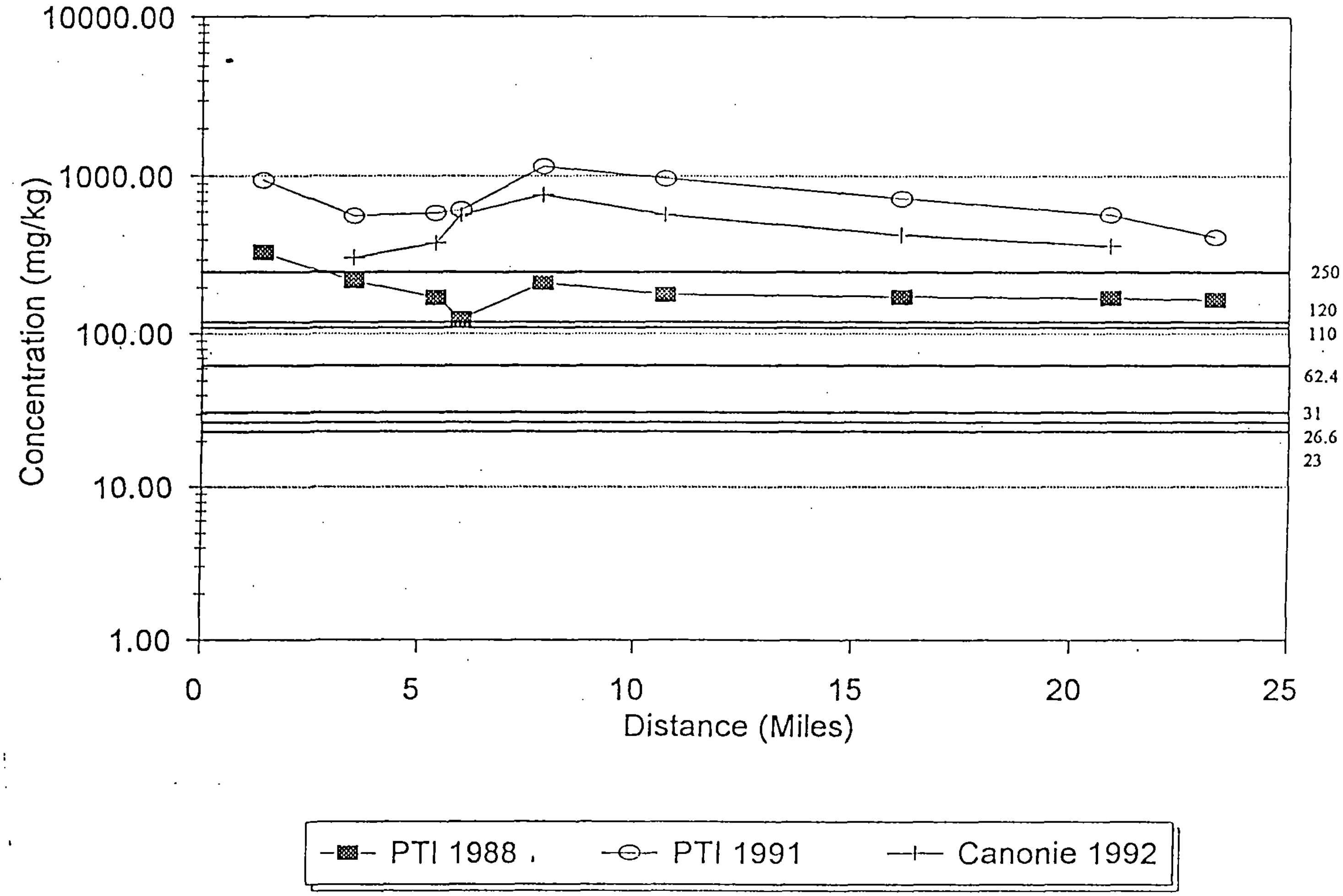


FIGURE 12
Total Lead
SST Sediment

Effects Concentration (mg/kg)	Basis for Effects Concentration
23	Background concentrations, uncontaminated sediment, Great Lakes precolonial horizon (Persaud . 1993)
26.6	Low range of bioassay effects concentrations, co-occurrence analyses (COA), multiple species (Long & Morgan 1990)
31	Lowest Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
62.4	No Effect Concentration (NEC), length and maturation, *Hyalella azteca (FWS & UW* 1992)
110	Effects Range-Median (ER-M)
120	Low range of apparent effects concentrations (AET), multiple species (Long & Morgan 1990)
250	Severe Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)

Lead Effects Concentration
in Sediment

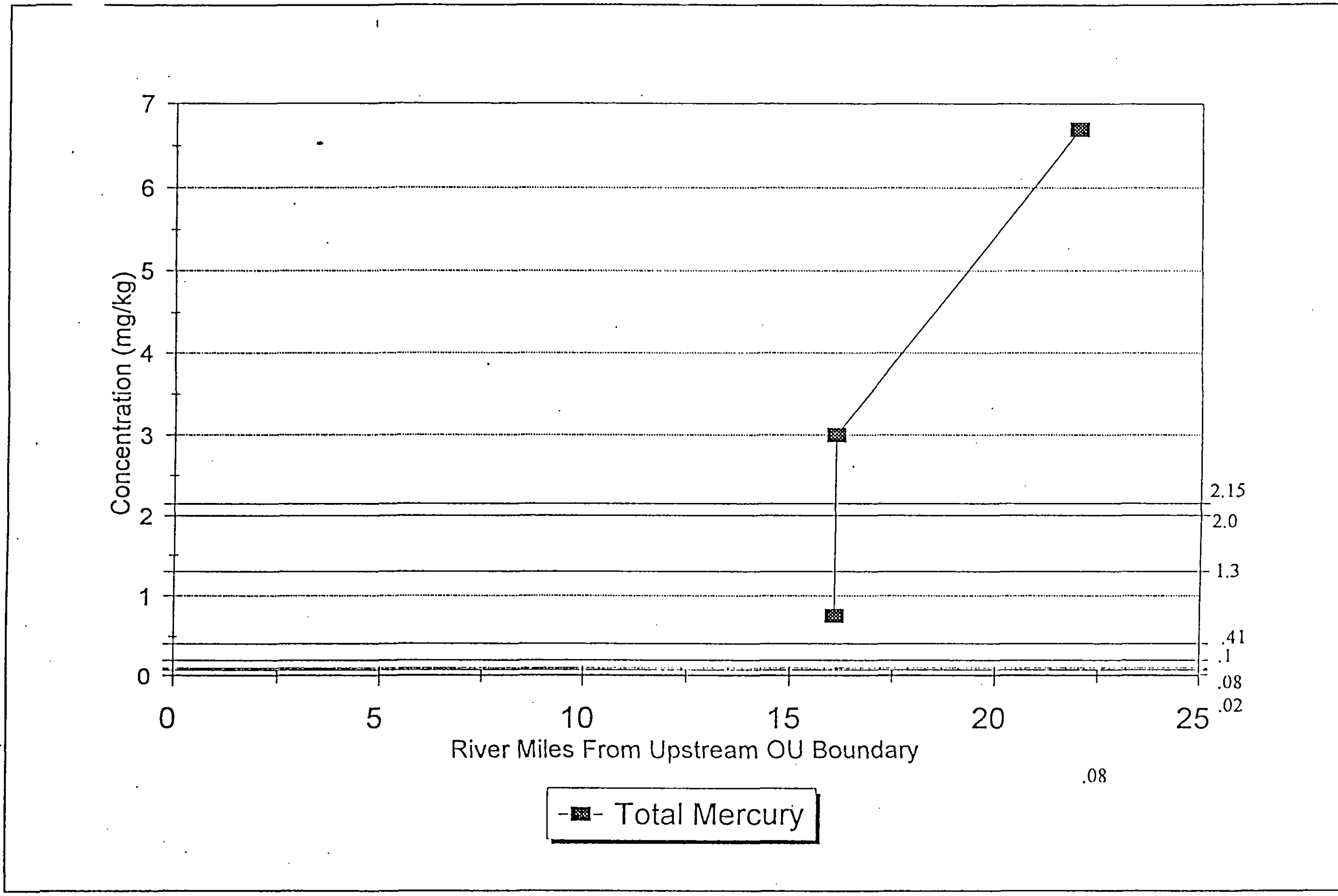


FIGURE 13
Total Mercury
SST Sediment

Effects Concentration (mg/Kg)	Basis for Effects Concentration (EPA 1985e)
0.02	Background concentrations, uncontaminated sediments, South Dakota (Eisler 1987a)
0.08	Range of bioassay effects concentrations, co-occurrence analyses (COA), multiple species (Long & Morgan 1990)
0.1	Background concentration, uncontaminated sediments, Great Lakes pre-colonial horizon (Persaud et. al 1993)
0.2	Lowest Effect Level, benthic organisms, Ontario (Persaud et. al 1993)
0.41	Range of apparent effects concentrations(AET), multiple species (Long & Morgan 1990)
1.3	Effects Range-Median (ER-M) (Long & Morgan 1990)
2.0	Severe Effect Level, benthic organisms, Ontario (Persaud et. al 1993)
2.15	Range of spiked sediment bioassay(SSB), multiple species (Long & Morgan 1990)

Mercury Effects Concentrations in Sediment

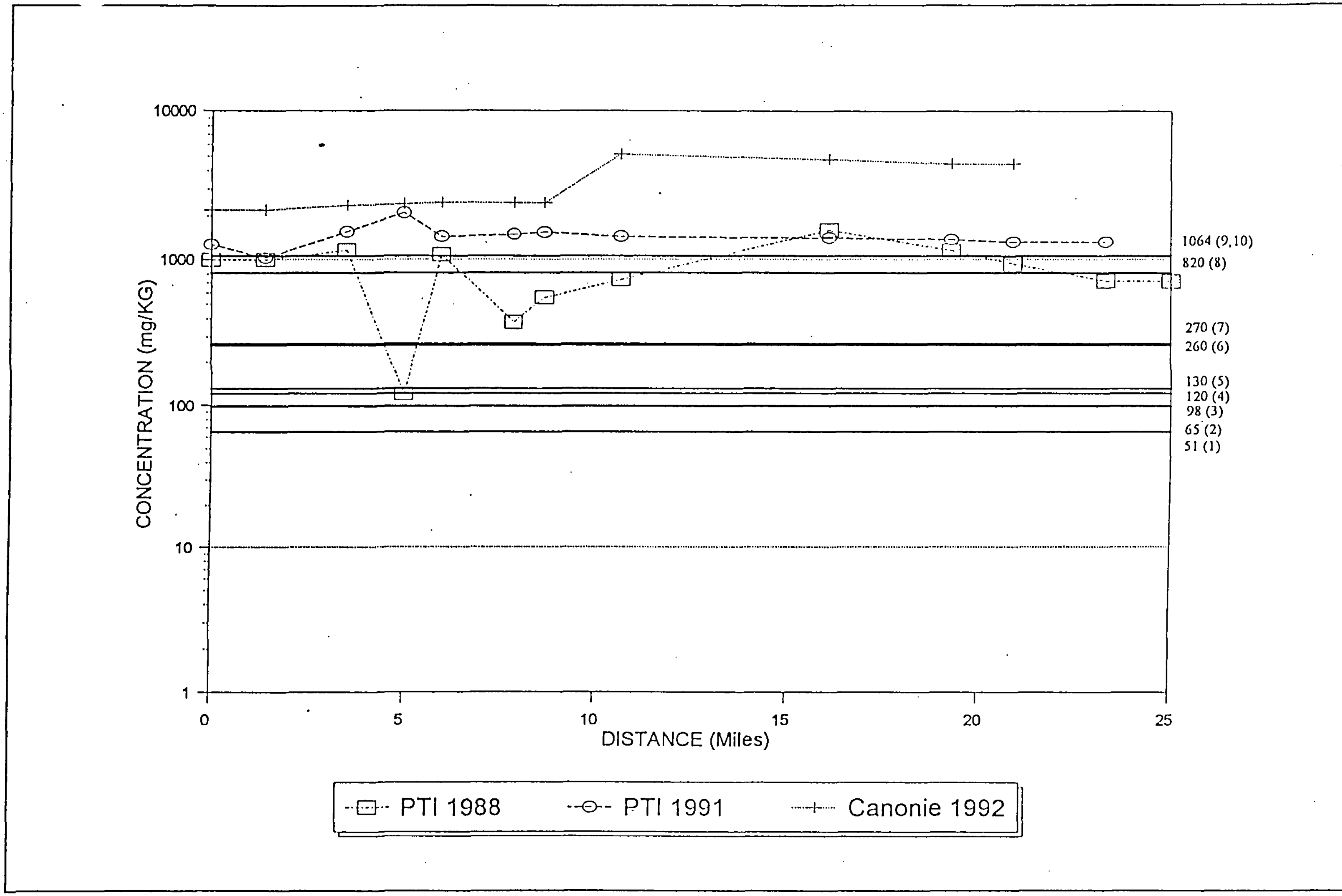


FIGURE 14
Total Zinc
SST Sediment

Effects Concentration (mg/kg)	Basis for Effects Concentration
51	Low range of spiked sediment bioassay (SSB), multiple species (Long & Morgan 1990)
65	Background concentrations, uncontaminated sediment, Great Lakes precolonial horizon (Persaud . 1993)
98	Low range of bioassay effects concentrations, co-occurrence analyses (COA), multiple species (Long & Morgan 1990)
120	Lowest Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
130	Low range of apparent effects concentrations (AET), multiple species (Long & Morgan 1990)
260	Concentration at which adverse effects are always observed (Long & Morgan 1990)
270	Effects Range -- Median (ER-M) (Long & Morgan 1990)
820	Severe Effect Level, benthic organisms, Ontario (Persaud *et al.* 1993)
1064	No Effect Concentration (NEC), length and maturation, *Hyalella azteca (FWS & UW* 1992)

Zinc Effects Concentrations
in Sediment

VII. DESCRIPTION OF ALTERNATIVES

A brief description of the OU cleanup alternatives the agencies considered in the Feasibility Study (FS) report follows. The estimated present worth cost of each alternative includes capital cost and annual operation and maintenance cost. In calculating costs, remedial action time frames are limited to 30 years, even for those alternatives requiring perpetual operation and maintenance.

The development and evaluation of remediation alternatives under consideration for the SST OU is more fully documented in the FS (ARCO, 1995b). Initial screening was reported in the *Preliminary Remedial Action Objectives Report/Treatment Technology Scoping Document* (ARCO, 1993d). Subsequent development and refinement of the alternatives was documented in the FS. A full range of alternatives from no action through total removal of all contaminants was carried through the detailed analysis of the FS. Alternatives were considered for each of the four contaminated media and were evaluated, utilizing the NCP's remedy selection criteria, on a subarea basis in the FS. Those alternatives which were significantly deficient in meeting remedial action objectives in certain subareas for specified media were dropped from further consideration after the detailed analysis. Alternatives carried forward were then subjected to comparative analysis in the FS, again on a media-specific and subarea basis. Finally, representative groupings of the media-specific and subarea alternatives were assembled into comprehensive OU-wide alternative packages to enable MDEQ to evaluate the interaction of alternatives for the different media and to conduct a reasonable comparison of the costs of various alternatives.

The detailed and comparative analyses of the separate media alternatives formed the basis for the assembly of the OU-wide alternatives. The media-specific and subarea-specific analyses identified several alternatives that were not capable of providing adequate levels of performance, either for the OU as a whole, for some subareas, or for certain conditions within a subarea. Those alternatives were eliminated from consideration for use where they were deemed inappropriate.

Of the seven tailings/impacted soils alternatives, Surface Water Controls and Near-stream STARS were determined to be wholly inadequate in meeting OU remediation objectives and were eliminated from consideration for use anywhere in the operable unit. The remaining five site-wide alternatives were used in the OU-wide combinations.

The tailings/impacted soils elements of the four site-wide alternatives include four possible components: STARS, *partial relocation, partial removal, total relocation* or *total removal.* STARS is the application of lime amendments to the tailings/impacted soils and revegetation to treat and stabilize the tailings in place. *Relocation* and *removal* differ only in the location of the repository for excavated materials (numerous local repositories vs. one or two regional repositories, respectively). The difference between *partial relocation/removal* and *total relocation/removal* is how much tailings/impacted soils are excavated. *Total relocation/removal* of materials for the entire OU would excavate all 2.5 million cy of tailings/impacted soils. *Partial relocation/removal* alternatives would excavate only portions of the tailings/impacted soils, as described in each alternative.

Of the railroad alternatives, two active alternatives, Limited Removal and In-situ Amendment, were used in addition to no action.

In addition to no action, two groundwater remediation alternatives, Source Control and Pump and Treat, were considered in the FS. The pump and treat alternative was eliminated from further consideration because the cost of active treatment was not commensurate with benefits gained in actively treating the potentially widespread, but relatively low level, of groundwater contamination found at the OU. Therefore, except for the No Action combined alternative, only Source Control was included in the OU-wide alternatives.

Three alternatives for remediating instream sediments were considered: No Action, Limited Removal, and Total Removal. For either removal option, both on-OU and regional repository locations were evaluated.

The OU-wide alternatives were assembled by building on the No Action alternative, which was used to provide a baseline for comparing the other alternatives. As was the case for the comparative analysis, subarea characteristics pertinent to a specific alternative were considered during the assembly process so that, generally, alternatives that were determined not to be applicable to certain subareas were not used in an OU-wide alternative. One exception to this condition is the STARS alternative which, although determined to have limited applicability in Subareas 1 and 3 and not carried forward through the comparative analysis for these subareas, was used as an OU-wide alternative to provide an option lying between total in-situ treatment and total removal for the entire OU.

Although there were many different combinations possible for OU-wide alternatives due to both the number of alternatives considered and the number of subareas in the SST OU, the progression from simpler and less costly alternatives to more complex and more costly alternatives could be accomplished using only a relatively few combinations. This was done by combining media alternatives that added a clear benefit toward achieving maximum attainment of the evaluation criteria, thereby noticeably improving each progressive combination. Consequently, only a limited number of OU-wide alternatives were assembled for further consideration.

During the process of developing the OU-wide alternatives, MDEQ recognized that overall protection of human health and the environment and long-term effectiveness and permanence could be enhanced in certain subareas by modifying the quantity of material that would be excavated under the partial removal/STARS or partial relocation/STARS alternatives. The partial removal/STARS and partial relocation/STARS options evaluated in the detailed and comparative analyses removed only saturated tailings/impacted soils and overlying tailings, leaving substantial areas of tailings that were to be STARS treated in floodplain. The STARS treated areas would be subject to erosion and re-entrainment of tailings into the stream during stream meander and high-flow events. The considerable residual risk and the need for waiver of the floodplain and solid waste disposal ARARs associated with those alternatives led MDEQ to develop and consider modified partial removal/STARS and partial relocation/STARS alternatives as potential OU-wide alternatives that could provide better protectiveness and better compliance with ARARs. Details of the modified partial removal/STARS and modified partial relocation/STARS alternatives are provided in the FS (ARCO, 1995b) and the proposed plan (MDEQ, 1995).

Alternative No. 1 - No Action

Estimated present worth cost: $700,000 to $1,400,000
Implementation time: 3 - 5 years

This alternative includes the No Action Alternative for tailings/impacted soils, railroad materials, groundwater and instream sediments. The No Action Alternative is included primarily to satisfy NCP requirements and provide a baseline by which to compare other site-wide alternatives.

Under Alternative No. 1, no further action would be taken. Contaminated tailings/impacted soils, instream sediments, railroad materials, and groundwater would remain in the OU and would continue to migrate and impact groundwater, Silver Bow Creek, and instream sediments. The costs for the no-action alternative are those associated with continued administration of monitoring and institutional controls for a period of 30 years. Actual costs and efforts associated with the no action alternative would be incurred indefinitely beyond the 30-year period.

Alternative No. 2 - STARS Treatment of Tailings/Impacted Soils, No Action for Instream Sediments, and In-situ Treatment of Railroad Materials

Estimated present worth cost: $13,000,000 to $24,000,000
Implementation time: 3 - 5 years

The primary component of this alternative is STARS, which was developed as a potential low-cost alternative to the removal and controlled disposal of the tailings/impacted soils that comprise the primary source of contamination at the OU. Although STARS treatment of tailings/impacted soils was not evaluated in the comparative analysis for Subareas 1 and 3 because of potential effects of erosion of STARS treated areas due to stream meander and overbank flows, this alternative was included in the OU-wide analysis so that total in-situ treatment could be compared with the other OU-wide removal alternatives.

Under this alternative, approximately 1,950,000 cy of tailings/impacted soils would be treated in-situ with the STARS technology. An estimated 550,000 cy of tailings underlying the treated materials would remain untreated. This treatment would enable establishment of vegetation thereby reducing overland flow and wind erosion. Instream sediments and groundwater would receive no action and a limited amount of impacted railroad materials posing a risk to human health and the environment would be treated in-situ with lime amendments. In areas of expected residential development (i.e. outside the floodplain) this alternative would use a soil cover where the contaminants pose significant human health risk. Considerable long-term maintenance and monitoring would be required. Restrictions on OU access and use would be necessary.

Alternative No. 3 - Partial Relocation and Partial STARS Treatment for Tailings/Impacted Soils, Limited Removal for Instream Sediments, and In-situ Treatment of Railroad Materials

Estimated present worth cost: $21,000,000 to $40,000,000
Implementation time: 3 - 5 years

This alternative was developed to address one of the primary sources of contaminated groundwater, saturated tailings. Under this alternative, a total of approximately 480,000 cy of tailings/impacted soils and an additional 220,000 cy of tailings/impacted soils which overlie the saturated tailings/impacted soils would be excavated, relocated outside the floodplain, and treated with STARS amendments. Fill material would be brought in to replace a portion of the excavated soils. The remaining approximately 1,800,000 cy of tailings/impacted soils not considered to be saturated would be treated in place with STARS amendments and revegetated.

Instream sediments would be removed and relocated out of the floodplain with the relocated tailings. The volume of instream sediments defined for limited removal represents all fine-grained ($\leq$1mm) instream sediments, which account for the majority of highly contaminated instream sediments. Only limited data exist to estimate the volumes of instream sediments by size fraction. Based on quantities of instream sediments estimated during the RI, about 73,000 cy of fine-grained instream sediments would be removed.

Railroad materials would receive in-situ treatment under this alternative by applying STARS amendments to the impacted railroad grade materials. As part of the STARS treatment, limited soil cover is also considered where recreational users might come into contact with high concentrations of contaminated railroad material.

Alternative No. 4 - Partial Removal and Partial STARS Treatment of Tailings/Impacted Soils, Limited Removal of Instream Sediments, and Limited Removal of Railroad Materials

Estimated present worth cost: $27,000,000 to $47,000,000
Implementation time: 3 - 5 years

This alternative is nearly the same as Alternative No. 3 except that the saturated tailings/impacted soils and instream sediments would be transported to a regional repository at Opportunity Ponds or a location along Browns Gulch. In addition, railroad materials containing contaminants that pose a risk to human health or the environment would be removed and disposed along with the tailings/impacted soils and instream sediments.

Alternative No. 5 - Total Relocation of Tailings/Impacted Soils in Subareas 1 and 3, Partial Relocation and Partial STARS Treatment in Subareas 2 and 4, Limited Instream Sediment Removal, and Limited Removal of Railroad Materials

Estimated present worth cost: $32,000,000 to $55,000,000
Implementation time: 4 - 6 years

This alternative has been developed to address the limitations of STARS in effectively meeting the SST OU's threshold protectiveness standards and ARARs. Under this alternative, an estimated total of 1.76 million cy of tailings/impacted soils which are saturated by groundwater, potentially eroded by natural stream migration and/or flood events would be relocated to dry closure areas located adjacent to the OU but outside of the floodplain. Total excavation of all tailings/impacted soils within the floodplain would be required in Subareas 1 and 3 because those in-situ treatment areas could not be adequately protected from erosion. This alternative modifies partial relocation to include excavation and relocation of all tailings/impacted soils within the floodplain in Subarea 2 and excavation and relocation of additional near-stream tailings in Subarea 4. In Subarea 2, about 280,000 cy of tailings/impacted soils in the Ramsay Flats area located outside of the floodplain would be consolidated and treated with STARS, with a portion covered with top soil if residentially used. In Subarea 4, approximately 540,000 cy out of the 1,300,000 cy identified in the subarea would be relocated and the remainder treated with STARS. Excavated tailings/impacted soils would be fully treated with lime amendments prior to placement in the relocation areas.

As in Alternative No. 3, fine-grained ($\leq$ 1mm) instream sediments would be excavated and placed in the relocation areas with the relocated tailings. The volume of instream sediments defined for limited removal includes all fine-grained instream sediments, which represent those posing the most significant risk to health and the environment. As in OU-wide Alternative No. 4, selected contaminated railroad materials would be excavated and placed into local relocation repositories.

Alternative No. 6 - Total Removal of Tailings/Impacted Soils in Subareas 1 and 3, Partial Removal and Partial STARS Treatment in Subareas 2 and 4, Limited Instream Sediment Removal, and Limited Removal of Railroad Materials

Estimated present worth cost: $39,000,000 to $66,000,000
Implementation time: 4 - 6 years

Alternative No. 6 was the alternative proposed by the agencies in the proposed plan. This alternative is similar to Alternative No. 5, with the exception that tailings/impacted soils, instream sediments, and railroad materials removed would be transported and deposited in a regional dry closure repository instead of adjacent relocation areas. Under this alternative, an estimated total of 1.76 million cubic yards of tailings/impacted soils would be removed to regional repositories located in Browns Gulch and/or at Opportunity Ponds. Total removal of all tailings/impacted soils within the floodplain would be required under this alternative in Subareas 1 and 3. In Subarea 2, about 280,000 cy of tailings/impacted soils in the Ramsay Flats area located outside of the floodplain would be consolidated and treated with STARS and a portion covered with top soil. In Subarea 4, approximately 540,000 cy out of the approximately 1,300,000 cy identified in the subarea would be removed and the remainder treated with STARS.

The same amounts of instream sediments and railroad materials would be removed as under Alternative No. 5, but they also would be hauled to the regional repository.

Alternative No. 7 - Total Removal of Tailings/Impacted Soils, Total Removal of Instream Sediments, and Limited Removal of Railroad Materials

Estimated present worth cost: $48,000,000 to $79,000,000
Implementation time: 4 - 7 years

This OU-wide alternative requires the most rigorous action and essentially removes all identified materials containing contaminants in tailings/soils and instream sediments. Removal of railroad materials would be limited to those areas where they pose a potential risk to human health and the environment. This alternative differs from Alternatives 5 and 6 in that it includes removal of all waste sources in and out of the floodplain to a regional dry repository. A total of approximately 2.55 million cy of tailings/impacted soils would be removed from the OU. In addition, instream sediment removal would address all instream sediments, not just the fine-grained fraction. Sediment volumes for total removal would be approximately 236,000 cy, which would include instream sediments to a depth of about 2.5 feet below the present stream bed. There would be a minor level of long-term maintenance and monitoring associated with this alternative.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 300.430(e)(9) of the NCP requires that the agencies evaluate and compare the remedial cleanup alternatives based on the nine criteria listed below. The first two criteria - overall protection of human health and the environment and compliance with ARARs, are threshold criteria and must be met. The selected remedy must represent the best balance of the selection criteria.

Evaluation and Comparison Criteria

Threshold Criteria

1. Overall protection of human health and environment addresses whether or not a remedy provides adequate protection and describes how potential risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

2. Compliance with applicable or relevant and appropriate requirements (ARARS) addresses whether or not a remedy will comply with federal and state environmental laws or provides grounds for invoking a waiver.

Primary Balancing Criteria

3. Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. Reduction of toxicity, mobility and volume through treatment refers to the degree that the remedy reduces toxicity, mobility and volume of the contamination.

5. Short-term effectiveness addresses the period of time needed to complete the remedy, and any adverse impact on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to carry out a particular option.

7. Cost evaluates the estimated capital costs and operation and maintenance costs, calculated at present value, for each alternative.

Modifying Criteria

8. State agency acceptance indicates whether, based on its review of the information, the state (MDEQ) concurs with, opposes or has no comment on the preferred alternative. However, for this OU, MDEQ is the lead management agency and EPA is the support agency. As such, the State has identified the selected remedy and EPA has concurred with and adopted that identification.

9. Community acceptance is based on whether community concerns are addressed by the selected remedy and whether or not the community has a preference for a remedy. Although public comment is an important part of the final decision, MDEQ and EPA are compelled by law to balance community concerns with all of the other criteria.

In assessing cleanup options, MDEQ and EPA evaluated a wide range of media-specific alternatives for each of the four subareas of the SST OU. After detailed analysis and comparative evaluation of the media-specific alternatives, seven comprehensive alternatives addressing all media in the entire OU were developed and evaluated. The seven alternatives were described and key elements of the evaluation were presented in the preceding section. Following is a brief summary of the agencies' comparative evaluation of the seven alternatives. Additional detail regarding the entire development and evaluation of the SST remediation alternatives is presented in the Feasibility Study (ARCO, 1995b), and additional analysis is presented in the Responsiveness Summary (Appendix D) in response to specific comments regarding the evaluation of alternatives.

1) Overall Protection of Human Health and the Environment: OU-wide Alternatives 1 (No Action) and 2 (STARS) were determined to not meet the threshold criterion of overall protection of human health and the environment. Alternatives 3 (Limited Relocation/STARS) and 4 (Limited Removal/STARS) provided significant improvements in overall protectiveness, but were found deficient in demonstrating long-term protectiveness because of reliance on STARS technology at extensive locations within the floodplain that would be subject to erosion and failure during natural stream meander and high-flow events. Alternatives 5 (Modified Relocation/STARS) and 6 (Modified Removal/STARS) were evaluated to provide acceptable overall protectiveness in the short and long-term. Alternatives 3 through 6 all included limited removal of instream sediments. Limited removal of instream sediments was determined to be adequately protective of human health and the environment, assuming that successful tailings/impacted soils remediation was also completed. Alternative 7 (Total Removal) would provide the greatest overall protection of human health and the environment.

2) Compliance with ARARs: OU-wide Alternative 1 would comply with very few of the ARARs established for the OU. Alternative 2 would not comply with major surface water, groundwater, floodplain, or solid waste disposal ARARs. Alternatives 3 and 4 would be expected to improve surface water quality in the near term, but would likely be a factor in the inability of Silver Bow Creek to meet surface water ARARs in the long-term. This is because MDEQ reasonably expects that STARS applied on a large scale in the floodplain will fail to some degree over time, causing future contaminant loading to the stream. In addition, the application of STARS within the floodplain does not meet the floodplain and solid waste ARARs. Alternatives 5 and 6 comply with all ARARs with the exception of the floodplain and solid waste management ARARs for the areas in which STARS would be applied in the floodplain under these alternatives. As discussed in Section X below, the agencies have determined that, under certain conditions, an ARAR waiver may be invoked for the limited use of in-situ STARS treatment, leaving treated wastes in certain areas of the floodplain, as contemplated under Alternatives 5 and 6. The more extensive use of STARS in the floodplain under Alternatives 3 and 4 would not meet the criteria for invoking the ARAR waiver, which are detailed in Sections IX and X below. Alternative 7 would meet all ARARs without waiver.

3) Long-term Effectiveness and Permanence: OU-wide Alternative 1 provides no long-term effectiveness. Alternative 2 would provide no improvement in groundwater quality where tailings and groundwater are in contact and would have severe limitations in effectiveness and permanence where STARS is applied to near-stream and floodplain locations. Alternatives 3 and 4 are roughly equivalent in terms of long-term effectiveness. Both offer major improvements over Alternative 2 by removing many of the tailings causing groundwater contamination and much of the overland flow sediment loading to the stream. Also, these alternatives remove contaminated fine-grained instream sediments. However, the over-reliance on STARS technology in the floodplain reduces substantially any expectation of long-term effectiveness and permanence of the remedy and the remedy would be expected to unravel over time. Alternative 3 is somewhat downgraded in long-term effectiveness to the extent it would rely on in-situ treatment of impacted railroad materials, which is considered less effective than limited removal. Alternatives 5 and 6 greatly increase the expected long-term effectiveness and permanence by removing most contaminant sources from the floodplain so that any chance of re-entrainment of contaminated materials into the stream is effectively eliminated. Contaminants would be left in the floodplain only in those locations where they could be determined to be safe from future erosion and re-entrainment. Contaminated fine-grained instream sediments would be removed under Alternatives 5 and 6, providing adequate long-term effectiveness for that media. Alternative 7 provides the greatest level of long-term effectiveness and permanence.

4) Reduction of Toxicity, Mobility or Volume Through Treatment: OU-wide Alternative 1 provides no reduction of toxicity, mobility, or volume. Alternative 2 provides for in-situ lime treatment of nearly 2 million cubic yards of tailings/impacted soils that would reduce mobility and therefore phytotoxicity of certain metals in the soil. However, the preference established in CERCLA is for treatment which "permanently and significantly reduces" volume, toxicity or mobility of the contaminants. 42 U.S.C. § 9621(b)(1). The treatment involved here could not be expected to be permanent if the lime amendments are physically separated from the contaminants through erosion or other processes. Alternative 3 provides reduced levels of in-situ treatment in comparison with Alternative 2, but provides more permanent reduction in mobility by placing some treated contaminants into dry repositories not subject to erosion by stream forces. Alternative 3 would treat contaminated railroad materials by lime amendment and therefore further reduce the mobility and toxicity of those contaminants. However, erosion of the amended materials, which would reverse the treatment, is considered possible and even likely in certain locations. Alternative 4 has considerably reduced use of treatment, but would achieve a reduction in mobility by placing the materials in a dry repository. Alternative 5 has the maximum permanent reduction in mobility through treatment because all materials would be treated, either in protected in--situ locations or in the relocation areas. Alternative 6 would provide reduced levels of treatment, but substantial permanent reduction in mobility by removing most contaminants from the floodplain environment. The degree of reduction in toxicity, mobility, or volume through treatment of contaminated instream sediments would depend entirely on whether excavated instream sediments were treated during disposal. This would be possible under Alternatives 3 and 5. However, Alternatives 4 and 6 would attain permanent reduction of mobility by placing the materials in secure repositories. Alternative 7 would provide no treatment, but would accomplish permanent reduction in mobility by placing all materials in a secure repository.

5) Short-term Effectiveness: Alternative 1 has no risks associated with implementation since no action is taken, although future actions would be required because no remedial action objectives would be met. Alternative 2 requires the least construction of any action alternative and therefore provides greater short-term effectiveness, although this again would be offset by the probability that a future action would be required. Alternatives 3 and 4 would have greater short-term impact on both nearby residents and the environment because substantial excavation, haulage, and disposal would be required. Of the two, impact on the local communities would be greater with Alternative 4 because considerably more truck traffic would be necessary to transport excavated materials to regional disposal areas. Alternatives 5 and 6, by requiring excavation of about twice as much tailings/impacted soils as Alternatives 3 and 4, would exhibit even greater short-term impacts during construction of the remedy. Alternatives 3 through 6 are all considered relatively equal with respect to short-term impact on the environment during construction. Alternative 7 would have the greatest risk to local communities and the environment during construction.

6) **Implementability**: All alternatives are considered implementable using standard construction technologies. Alternative 2 is the most easily implemented action alternative since it involves lime application and revegetation using standard construction and agricultural equipment with very little work in areas of shallow groundwater. Alternatives 3 and 4 present greater difficulties because excavation of saturated tailings is required, although standard construction dewatering techniques are expected to be adequate to facilitate excavation. Alternatives 5 and 6 require more substantial excavation, although generally no greater excavation under saturated conditions than for Alternatives 3 and 4. Alternatives 3 through 6 would all require some removal of instream sediments, which presents construction difficulties but should not be substantially different than removal of near-stream tailings saturated in the groundwater. In fact, excavation of saturated tailings and re-routing of the stream into the excavated area will be the likely approach for dewatering the stream so that excavation of instream sediments can proceed. Alternative 7 would require total removal of instream sediments, which would present significantly greater difficulties than any of the alternatives requiring limited removal of fine-grained instream sediments only. Alternatives that require limited removal of railroad material would present implementation difficulties in terms of coordinating construction during use of the active rail lines. Alternatives requiring in-situ treatment of railroad beds could be more easily implemented. If rail haul of excavated materials were used under Alternatives 6 or 7, difficulties in terms of coordinating loading and haul operations with active railroad use would be encountered.

7) **Cost**: The combination of the media-alternatives into OU-wide alternatives presents the range of total costs that could be expected if all four media (tailings/soils, groundwater, railroad materials, and instream sediments) were remediated concurrently. The presentation of costs in this manner eliminates duplicative cost elements, such as road building, monitoring, and operation and maintenance (O&M), between the media.

Total costs include anticipated capital costs to construct the remedy and anticipated operation, maintenance, and monitoring costs over a 30-year period (Table 13). The annual operation, maintenance and monitoring costs have been discounted at a 7 percent annual capitalization rate to obtain a present worth for those costs.

8) **State Agency Acceptance**: The State of Montana has been the lead agency for the development of this record of decision and has selected an amended Alternative 5 as the remedy contained herein. EPA has participated in the remedy selection process as the support agency and has concurred with and adopted the remedy selection.

9) **Community Acceptance**: Public comment on the Remedial Investigation, Risk Assessment, Feasibility Study, proposed plan (MDEQ, 1995a) and all other pertinent documents was solicited during the formal public comment period extending from June 9, 1995, to August 7, 1995. An analysis of and responses to community comments are found in the Responsiveness Summary (Appendix D).

During the public comment period, MDEQ and EPA received extensive comments from ARCO, the potentially responsible party which conducted the RI/FS under an Administrative Order on Consent issued by MDEQ. Comments received from ARCO indicate its opposition to the preferred alternative No. 6 in the proposed plan (MDEQ, 1995a) and the selected remedy, Alternative 5.

Table 13
Total Volumes of Contaminated Materials Removed or Relocated and Cost

Site-Wide Alternative Number	Volume Relocated to Near Site Repository (cy)	Volume Removed to Regional Repository (cy)	Estimated Cost (millions)
1	0	0	$0.7 - $1.4
2	0	0	$13 - $24
3	773,000	0	$21 - $40
4	0	943,800	$27 - $47
5	1,716,940	0	$32 - $55
6	0	1,936,940	$39 - $66
7	0	2740,300	$48 - $79

NOTE: Cost of the remedy described in this ROD are different from those listed in the FS. The main reasons are (1) 50,000 cy has already been removed from ARCO's Demonstration Project II in Subarea 4, (2) in Subarea 4 an additional 170,000 cy of additional tailings/impacted soils would be treated in-situ, (3) use of a soils cover to protect human health in impacted areas outside the floodplain, (4) the volumes of railroad materials to be removed or treated was better delineated, and (5) Ramsay Flats has an additional 40,000 cy outside of the 100-year floodplain.

In its initial comments, ARCO preferred the approach of a combination of site-wide Alternatives 2 and 3; ARCO's proposed action consists primarily of in-situ STARS treatment with removal of approximately 50% of the saturated tailings. ARCO comments with MDEQ and EPA responses are also found in the Responsiveness Summary.

As is clear in the summary text and tables of Appendix D - Responsiveness Summary, the majority of people and entities who commented on the proposed plan (MDEQ, 1995a) supported the proposed alternative, Alternative 6, or preferred a more protective cleanup (Alternative 7). Many people who commented believed that the 100-year floodplain was an unsafe place to store tailings and that STARS technology long-term effectiveness was extremely questionable.

However, comments submitted by ARCO, as well as representatives of local government and various business entities in the area, vehemently objected to certain cost elements of the proposed Alternative 6. Since cost is a primary concern and was a clear focus of certain of the public comments received, the agencies have modified their proposal to substantially reduce the costs of implementing the remedy, still allowing for the design and implementation of a remedy that will protect human health and the environment and attain ARARs, except as appropriately waived.

IX. SELECTED REMEDY

MDEQ and the EPA have selected a remedy that is intended to be the final remedial action for the SST OU. This action addresses the principal threats and provides for treatment and appropriate long-term management of contaminated tailings/impacted soils, instream sediments, and railroad materials. Much of the treated materials will remain in the OU. Consequently, the OU will require long-term management and monitoring.

Based upon consideration of CERCLA requirements, the detailed analysis of alternatives, and public comments, MDEQ and EPA have determined that ***OU-wide Alternative 5***, as generally described in the Feasibility Study (ARCO, 1995b) and the proposed plan (MDEQ, 1995a), with certain clarifications, represents the best balance of considerations using the selection criteria and is the appropriate remedy for the OU. As presented here, this alternative will protect human health and the environment by removing or treating sources of contamination to soils, surface water, groundwater, and instream sediments. The long-term effectiveness and degree of permanence of the selected remedy are high. MDEQ does not expect any unmanageable short-term risks associated with this alternative. This remedy will comply with all applicable or relevant and appropriate requirements, except where a waiver of such requirements has been determined to be appropriate. This remedy is cost-effective because the estimated costs are proportional to its overall effectiveness. This remedy uses permanent solutions and treatment technologies to the maximum extent practicable. All contaminated OU materials will be treated, therefore the selected remedy will also satisfy the preferences for treatment as a principal element of the remedy and for on-site remedies established in CERCLA. While certain other alternatives may better satisfy certain individual selection criteria, the selected remedy best meets the entire range of the selection criteria and achieves, in the determination of both EPA and MDEQ, the appropriate balance, considering OU specific conditions and the criteria identified in CERCLA and the NCP. The criteria described above are discussed in more detail in Section X, Statutory Determinations.

Components of Selected Remedy

Some refinements to OU-wide Alternative 5 have been made to clarify the criteria used to require excavation of tailings/impacted soils, to more precisely identify excavation of contaminated railroad bed materials, to delineate an end land use for Subarea 1, and to specify institutional controls, monitoring, and maintenance requirements that will be used to manage the Silver Bow Creek corridor in the future. This record of decision establishes cleanup levels or physical criteria for the contaminants of concern. The principal contaminants of concern at the SST OU are arsenic, cadmium, copper, lead, mercury, and zinc.

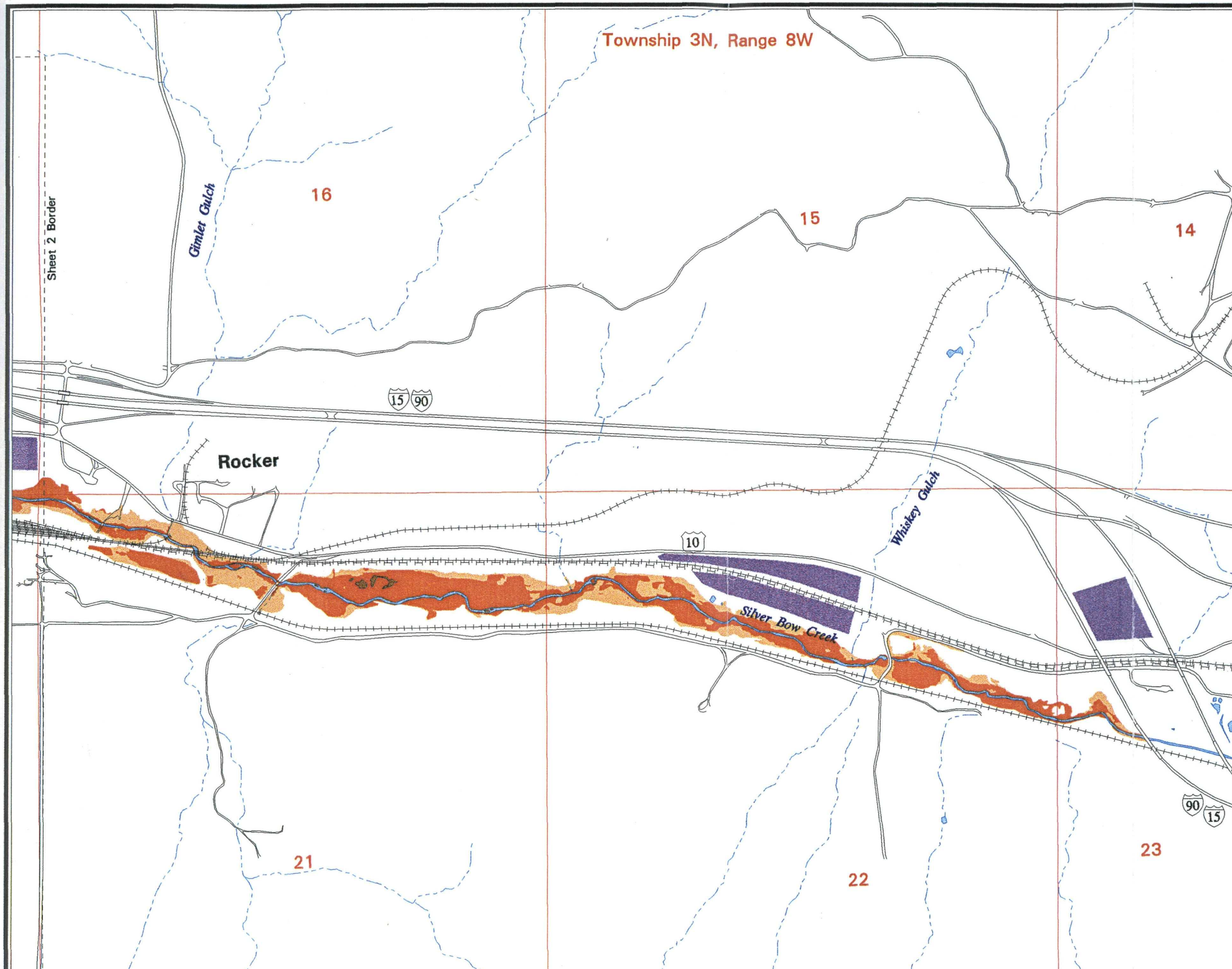
Tailings/Impacted Soils

Tailings/impacted soils are the primary contaminant source for the SST OU (Figure 15). There are three predominant ways in which tailings/impacted soils contaminate other Silver Bow Creek media: tailings in direct contact with groundwater; infiltration of precipitation through tailings; and erosion of tailings into Silver Bow Creek (Figures 3 - 6).

To meet the established OU remedial action objectives, tailings/impacted soils will be removed from the 100-year floodplain, as defined in the CH2M Hill (1989a) report, where: (1) tailings/impacted soils are saturated by groundwater during any part of the year, (2) in-situ Streambank Tailings and Revegetation Study (STARS) treatment cannot reliably immobilize the contaminants, for example, due to the thickness of the tailings/impacted soils, proximity of the tailings/impacted soils to groundwater, or lack of appropriate buffer materials between the treated tailings/impacted soils and the groundwater, or (3) the treated tailings/impacted soils could be eroded back into the stream by natural lateral stream migration, avulsion, overbank flow or flood events and subsequent erosion.

Excavation of contaminated tailings/impacted soils from most areas within the floodplain is required. The specific depth of excavation and the amount of excavated materials will be determined by the agencies during remedial design/remedial action. The removed volume will include all tailings/impacted soils continuously or seasonally saturated by groundwater together with the tailings/impacted soils overlying these saturated tailings (collectively, "saturated tailings"), as well as tailings/impacted soils subject to erosion and reentrainment into the stream over time as determined by the agencies. These two criteria relate primarily to the location of the particular tailings deposit; the agencies having determined that it is not appropriate to leave treated tailings in place in such locations. In addition, in determining whether other tailings must be removed, the agencies are to consider, for the particular tailings deposit, such factors as the depth and thickness of the tailings deposit, the proximity of the tailings to groundwater and the nature of any buffer materials/native soils between the tailings and the groundwater. The basis for and the manner in which all of these criteria are to be applied is further explained later in this section. Tailings that are not in a saturated or threatened location and that are situated so that STARS treatment can reliably immobilize the contaminants will be treated in-situ.

The total volume of saturated and overlying tailings/impacted soils to be removed is presently estimated at approximately 700,000 cy. The total volume of tailings/impacted soils subject to erosion and therefore to be excavated is estimated at approximately 850,000 cy. All remaining tailings/impacted soils (approximately 950,000 cy) within the OU will be treated in-situ with the STARS technology and will include appropriate monitoring, maintenance and protection from washout or erosion from lateral stream migration and flood flows.



Streamside Tailings Operable Unit

Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations

Road
Railroad
Abandoned Railroad
Stream
Intermittent Stream
Section Line
Match Line
Surface Water
Extent of Tailings/ Impacted Soil
Tailings/Impacted Soil saturated by ground water
Conceptual Repository location

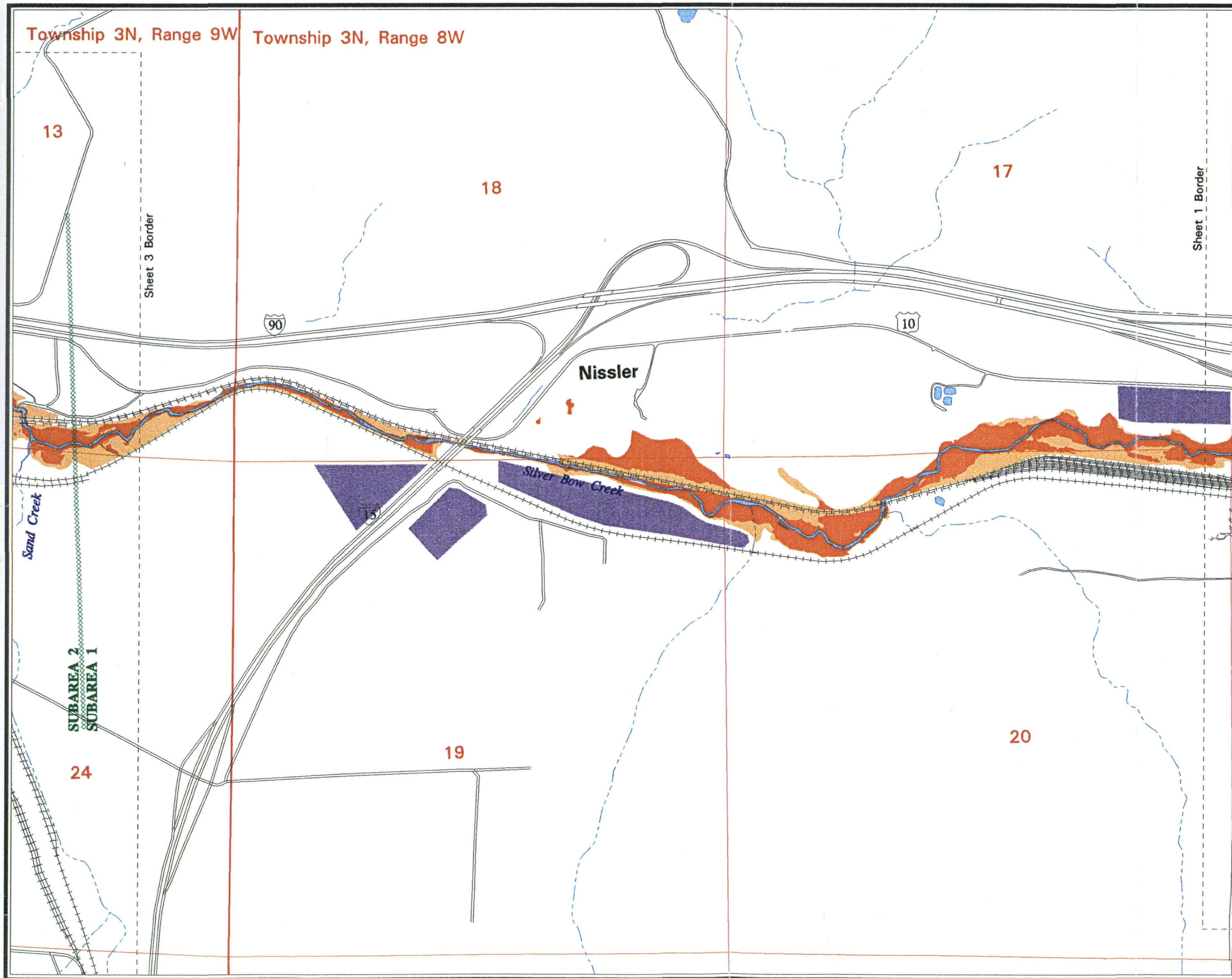
Tailings locations and repository areas provided by Titan Environmental of Bozeman, MT. Saturated tailings extent estimated at the State Library based on tailings and groundwater information provided by Titan. Base map is from aerial photos of 1984 and 1991 digitized by Horizons, Inc., of Rapid City, SD, and from U.S. Geological Survey 1:24,000 scale Digital Line Graphs.

North

Scale in Feet
0 500 1000 1500 2000

Figure 15a

Montana State Library
NRIS Natural Resource Information System
Map #96epaa4a-1, September 20, 1995



Streamside Tailings Operable Unit

Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations

- Road
- Railroad
- Abandoned Railroad
- Stream
- Intermittent Stream
- Section Line
- Match Line
- Surface Water
- Extent of Tailings/ Impacted Soil
- Tailings/Impacted Soil saturated by ground water
- Conceptual Repository location

Tailings locations and repository areas provided by Titan Environmental of Bozeman, MT. Saturated tailings extent estimated at the State Library based on tailings and groundwater information provided by Titan. Base map is from aerial photos of 1984 and 1991 digitized by Horizons, Inc., of Rapid City, SD, and from U.S. Geological Survey 1:24,000 scale Digital Line Graphs.

North

Scale in Feet

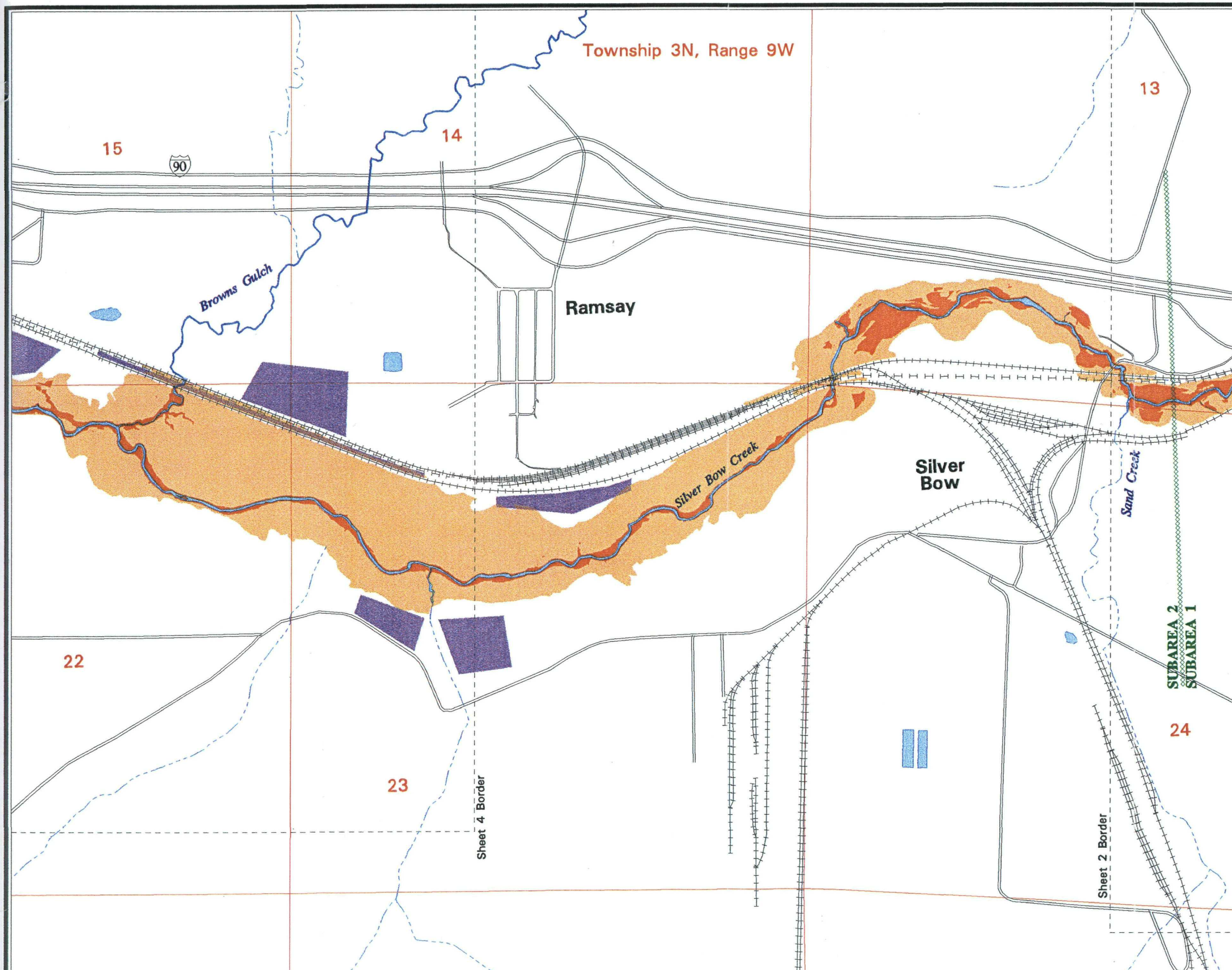
0 500 1000 1500 2000

Figure 15b

Montana State Library
NRIS Natural Resource Information System
Map #96epaa4a-2, September 20, 1995

Streamside Tailings Operable Unit

Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations



Road
Railroad
Abandoned Railroad
Stream
Intermittent Stream
Section Line
Match Line
Surface Water
Extent of Tailings/ Impacted Soil
Tailings/Impacted Soil saturated by ground water
Conceptual Repository location

Tailings locations and repository areas provided by Titan Environmental of Bozeman, MT. Saturated tailings extent estimated at the State Library based on tailings and groundwater information provided by Titan. Base map is from aerial photos of 1984 and 1991 digitized by Horizons, Inc., of Rapid City, SD, and from U.S. Geological Survey 1:24,000 scale Digital Line Graphs.

North

Scale In Feet

0 500 1000 1500 2000

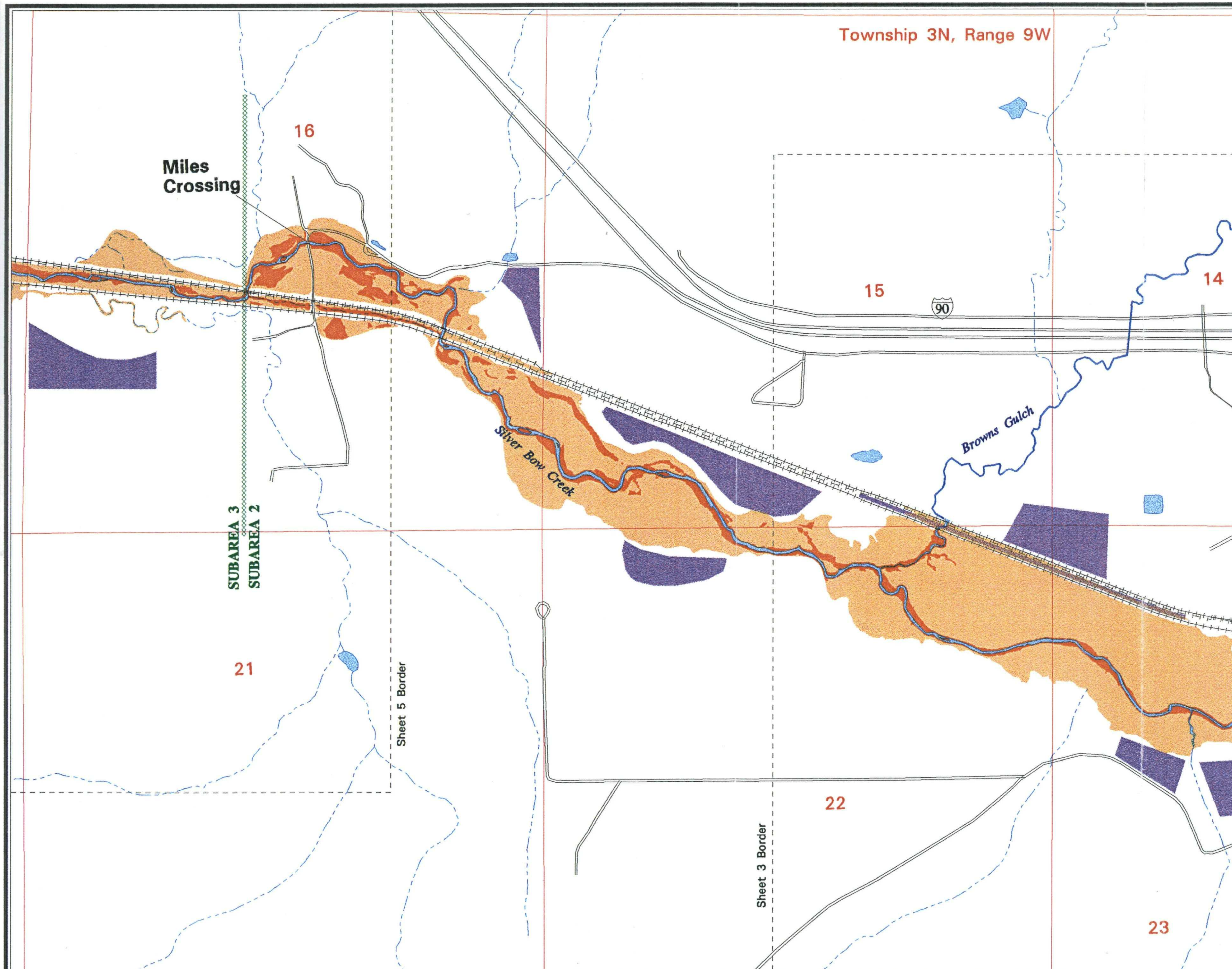
Figure 15c

Montana State Library
NRIS Natural Resource Information System

Map #96epaa4a-3, September 20, 1995

Streamside Tailings Operable Unit

Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations



- Road
- Railroad
- Abandoned Railroad
- Stream
- Intermittent Stream
- Section Line
- Match Line
- Surface Water
- Extent of Tailings/ Impacted Soil
- Tailings/Impacted Soil saturated by ground water
- Conceptual Repository location

Tailings locations and repository areas provided by Titan Environmental of Bozeman, MT. Saturated tailings extent estimated at the State Library based on tailings and groundwater information provided by Titan. Base map is from aerial photos of 1984 and 1991 digitized by Horizons, Inc., of Rapid City, SD, and from U.S. Geological Survey 1:24,000 scale Digital Line Graphs.

North

Scale in Feet

0 500 1000 1500 2000

Figure 15d

Montana State Library
NRIS Natural Resource Information System
Map #96epaa4a-4, September 20, 1995

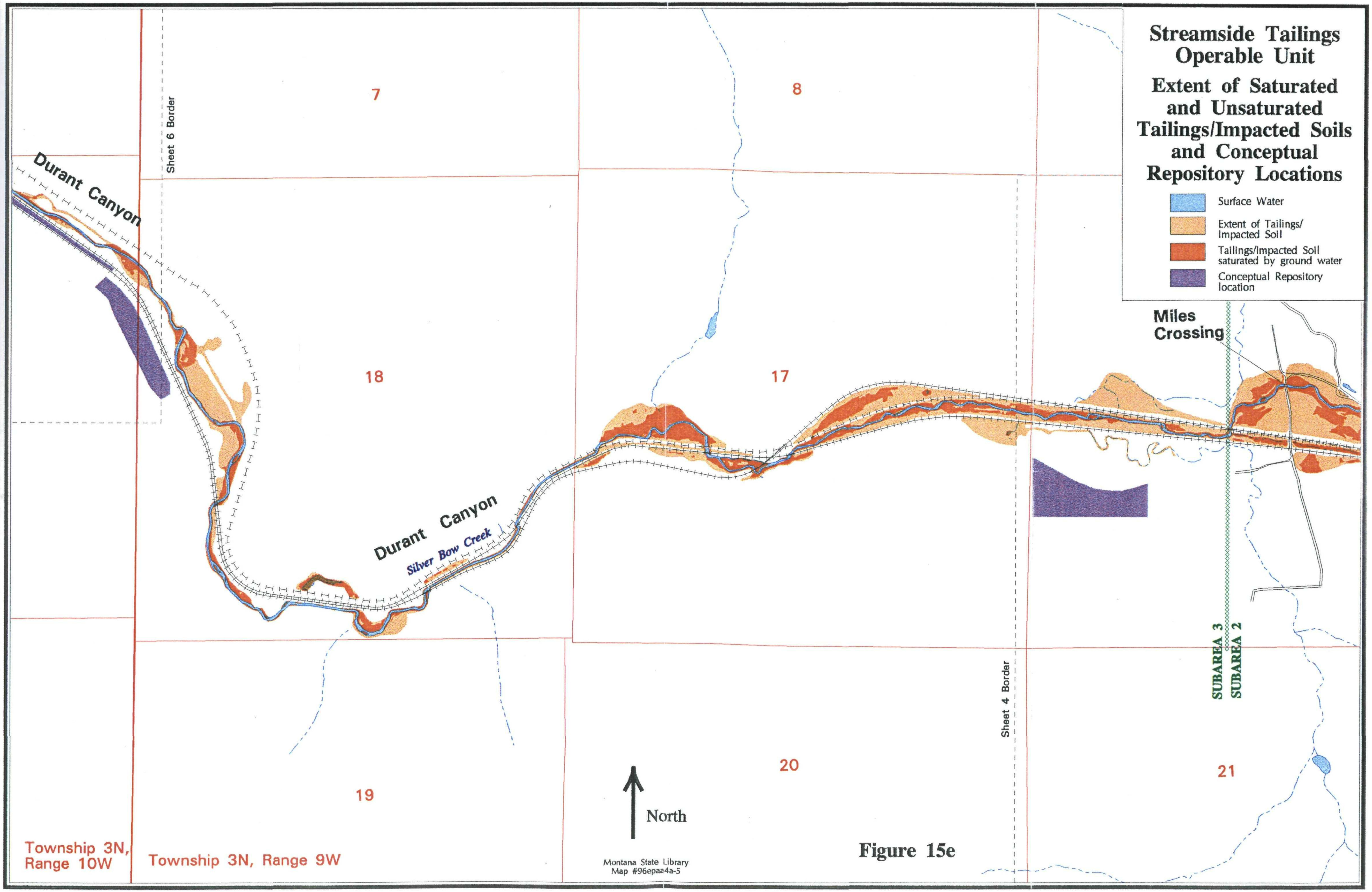

Streamside Tailings Operable Unit
Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations
Surface Water
Extent of Tailings/ Impacted Soil
Tailings/Impacted Soil saturated by ground water
Conceptual Repository location
Sheet 6 Border
Sheet 4 Border
Durant Canyon
Durant Canyon
Silver Bow Creek
Miles Crossing
SUBAREA 3
SUBAREA 2
7
8
18
17
19
20
21
North
Township 3N, Range 10W
Township 3N, Range 9W
Montana State Library Map #96epaa4a-5

Figure 15e

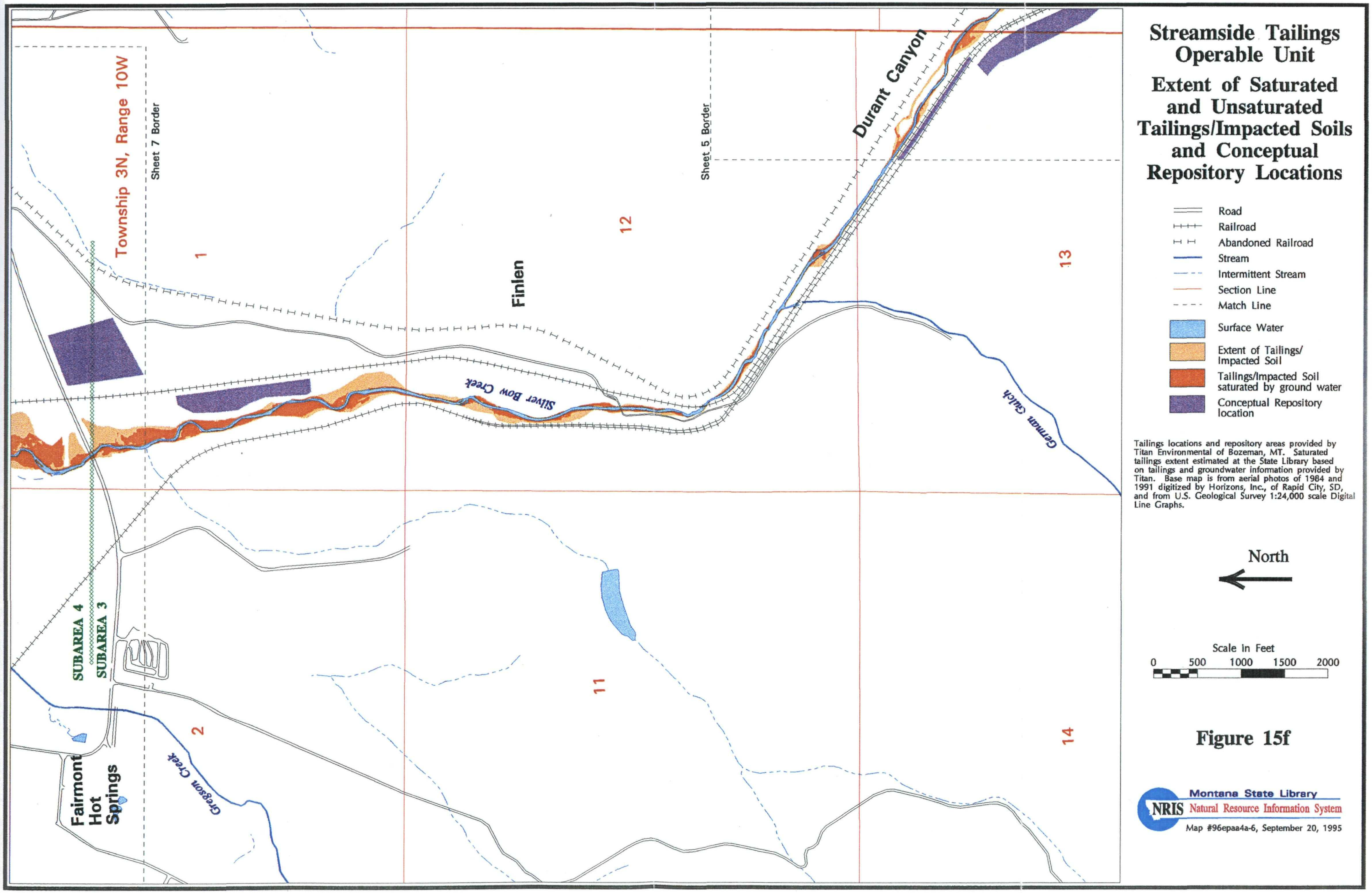
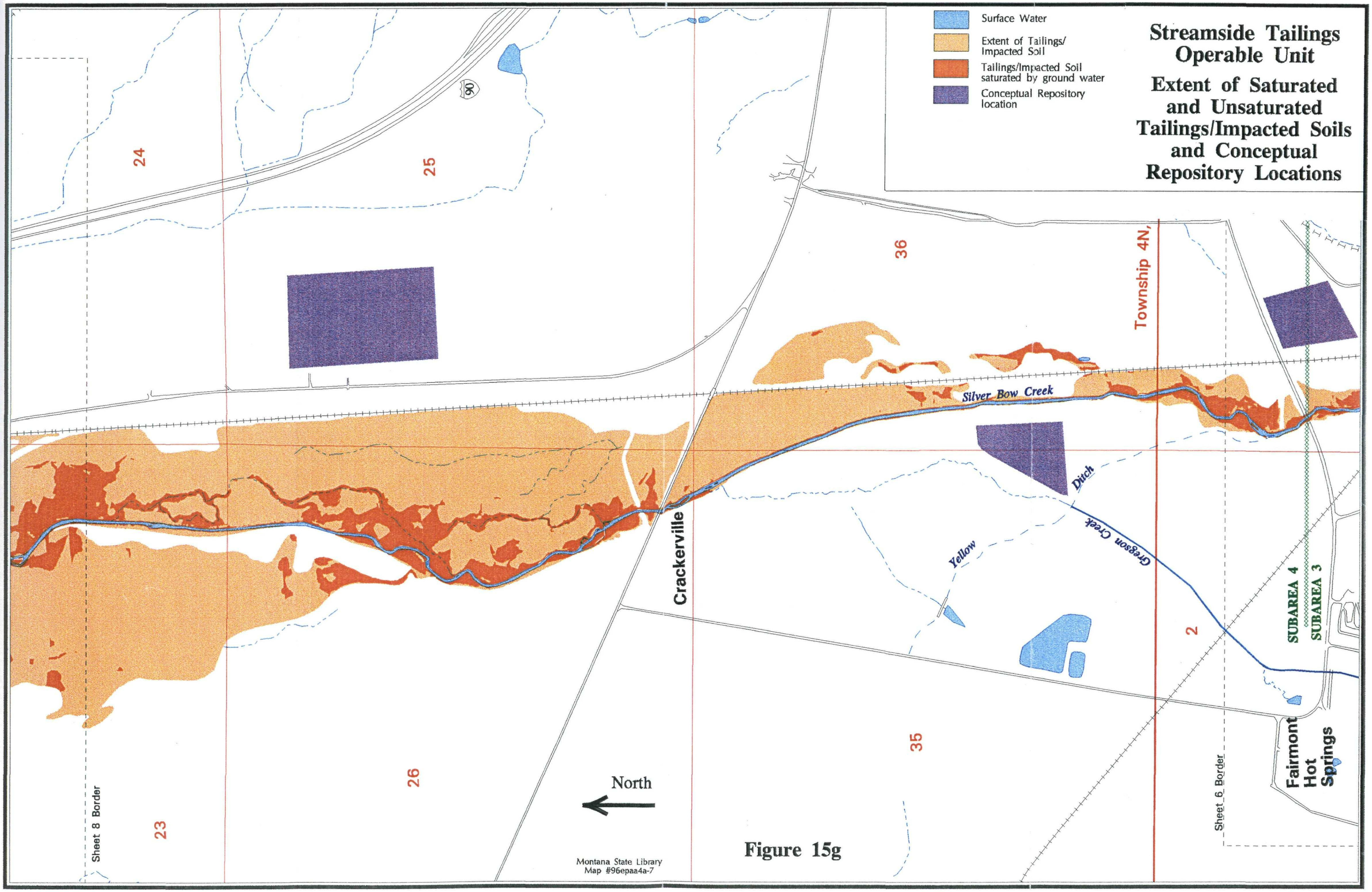
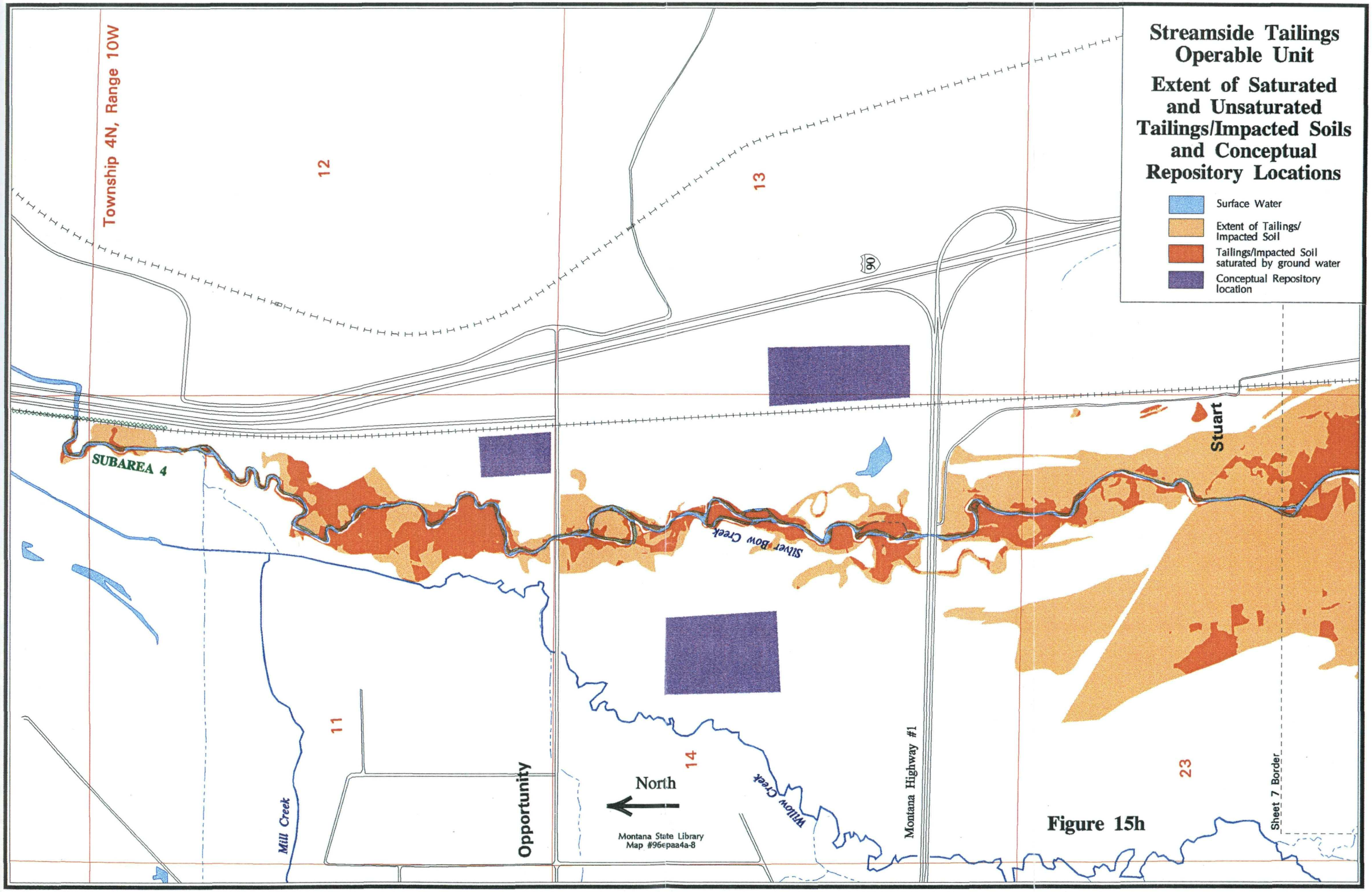

Streamside Tailings Operable Unit
Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations
Road
Railroad
Abandoned Railroad
Stream
Intermittent Stream
Section Line
Match Line
Surface Water
Extent of Tailings/ Impacted Soil
Tailings/Impacted Soil saturated by ground water
Conceptual Repository location
Tailings locations and repository areas provided by Titan Environmental of Bozeman, MT. Saturated tailings extent estimated at the State Library based on tailings and groundwater information provided by Titan. Base map is from aerial photos of 1984 and 1991 digitized by Horizons, Inc., of Rapid City, SD, and from U.S. Geological Survey 1:24,000 scale Digital Line Graphs.
North
Scale in Feet
0 500 1000 1500 2000
Montana State Library
NRIS Natural Resource Information System
Map #96epaa4a-6, September 20, 1995
Township 3N, Range 10W
Sheet 7 Border
Sheet 5 Border
Durant Canyon
Finlen
Silver Bow Creek
German Gulch
Gregson Creek
Fairmont Hot Springs
SUBAREA 4
SUBAREA 3
1
2
11
12
13
14

Figure 15f



Streamside Tailings Operable Unit
Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations
Surface Water
Extent of Tailings/ Impacted Soil
Tailings/Impacted Soil saturated by ground water
Conceptual Repository location
24
25
36
26
23
35
2
90
Township 4N,
Silver Bow Creek
Ditch
Gregson Creek
Yellow
Crackerville
SUBAREA 4
SUBAREA 3
Fairmont Hot Springs
Sheet 8 Border
Sheet 6 Border
North
Montana State Library Map #96epaa4a-7

Figure 15g



Streamside Tailings Operable Unit
Extent of Saturated and Unsaturated Tailings/Impacted Soils and Conceptual Repository Locations
Surface Water
Extent of Tailings/ Impacted Soil
Tailings/Impacted Soil saturated by ground water
Conceptual Repository location
Township 4N, Range 10W
12
13
11
14
23
90
SUBAREA 4
Silver Bow Creek
Stuart
Mill Creek
Opportunity
Willow Creek
Montana Highway #1
Sheet 7 Border
North
Montana State Library Map #96epaa4a-8

Figure 15h

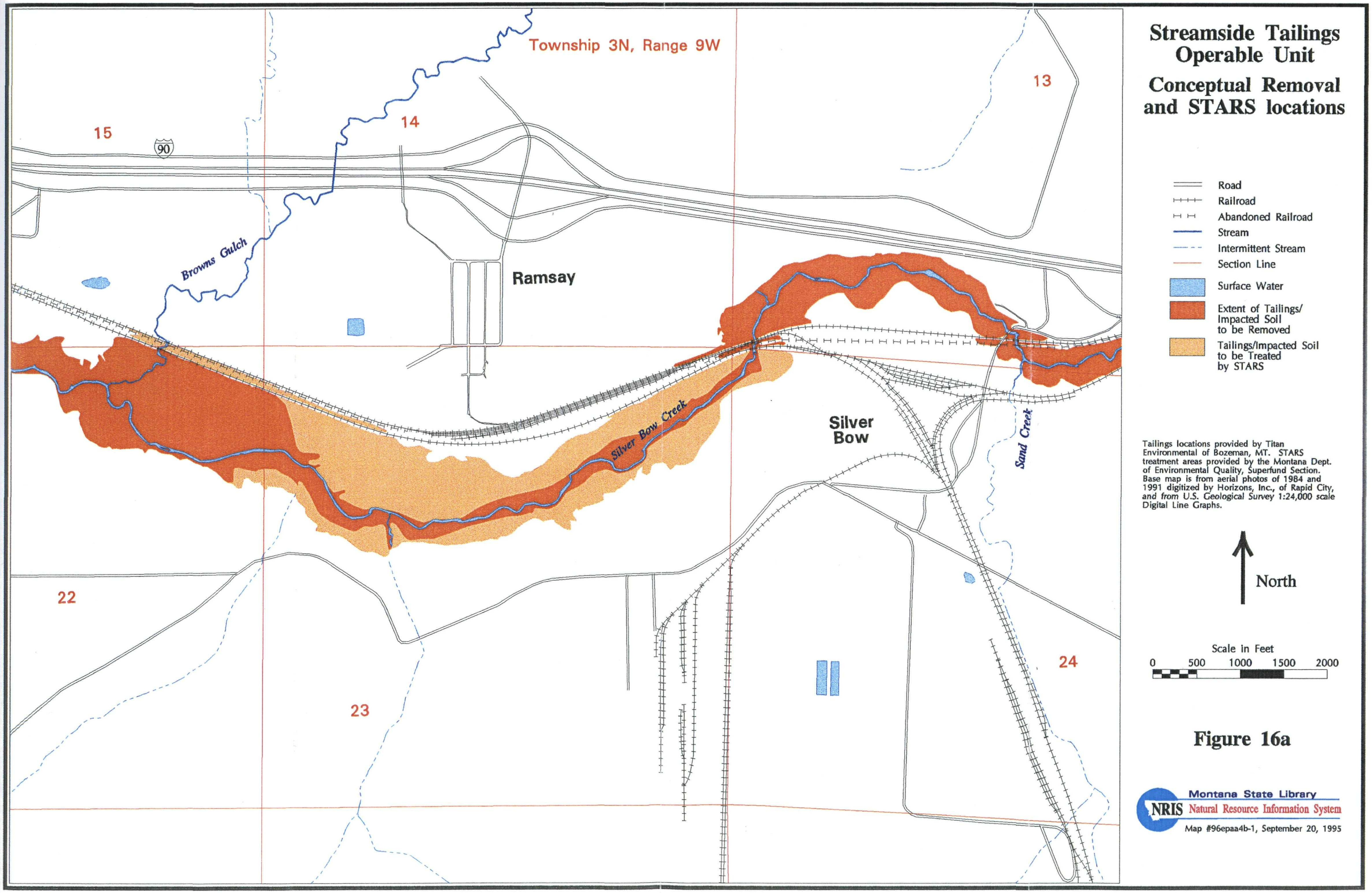
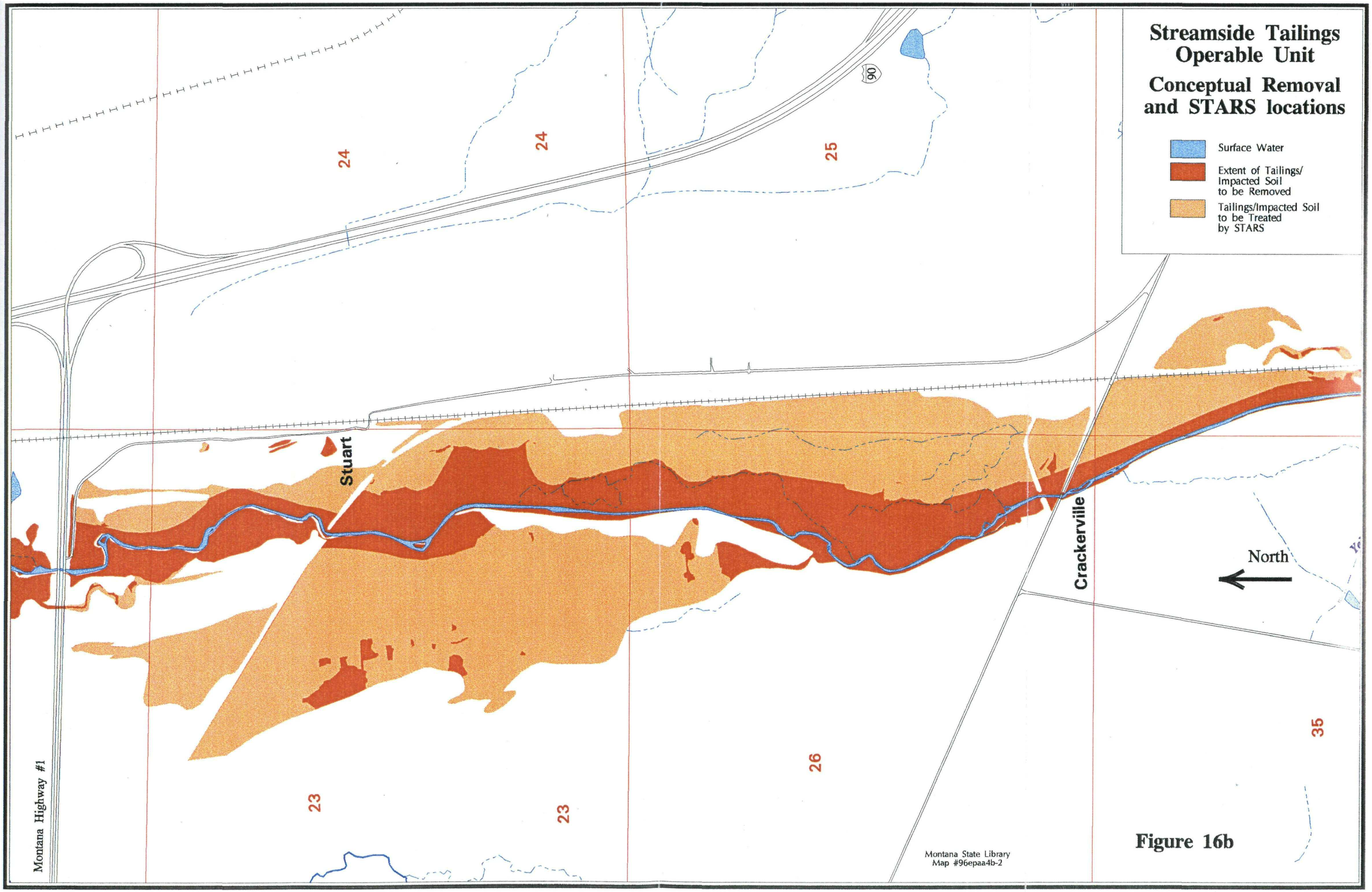

Streamside Tailings Operable Unit
Conceptual Removal and STARS locations
Township 3N, Range 9W
15
14
13
22
23
24
90
Browns Gulch
Ramsay
Silver Bow Creek
Silver Bow
Sand Creek
Road
Railroad
Abandoned Railroad
Stream
Intermittent Stream
Section Line
Surface Water
Extent of Tailings/ Impacted Soil to be Removed
Tailings/Impacted Soil to be Treated by STARS
Tailings locations provided by Titan Environmental of Bozeman, MT. STARS treatment areas provided by the Montana Dept. of Environmental Quality, Superfund Section. Base map is from aerial photos of 1984 and 1991 digitized by Horizons, Inc., of Rapid City, and from U.S. Geological Survey 1:24,000 scale Digital Line Graphs.
North
Scale in Feet
0 500 1000 1500 2000
Montana State Library
NRIS Natural Resource Information System
Map #96epaa4b-1, September 20, 1995

Figure 16a



Streamside Tailings Operable Unit
Conceptual Removal and STARS locations
Surface Water
Extent of Tailings/ Impacted Soil to be Removed
Tailings/Impacted Soil to be Treated by STARS
90
24
24
25
Stuart
Crackerville
North
Montana Highway #1
23
23
26
35
Montana State Library
Map #96epaa4b-2
Figure 16b

Table 14 presents the estimated volumes to be removed by subarea. Figure 15 portrays examples of possible relocation repositories and saturated tailings, while Figure 16 illustrates potential removal and in-situ STARS treatment locations.

Excavated tailings/impacted soils will be relocated to safe, local repositories clearly outside of the 100-year floodplain as defined by CH2M Hill (1989a), provided that appropriate locations can be obtained and an appropriate institutional controls/maintenance program can be implemented (see Contingency Measures at the end of this section). Tailings/impacted soils placed in the relocation repositories will be fully treated with lime amendments in lifts and will be revegetated in accordance with the STARS technology.

Table 14
Summary of Estimated Media Specific Removal Volumes for SST Remedial Action
(cy)

Subarea	Tailings/Impacted Soil (total volume of tailings/impacted soil)	Instream Sediments	Railroad Materials
1	285,000 (285,000)	15,000	17,000
2	529,000 (808,000)	27,000	25,000
3	160,000 (160,000)	5,600	30,000
4	576,000 (1,300,000)	29,700	0
Total	**1,550,000 (2,550,000)[1]**	**73,000**	**72,000**

1 The site contains approximately 2.5 mcy of tailings/impacted soils of which 2,220,000 cy are in the current 100-year floodplain. 280,000 are located within Ramsay Flats and out of the present 100-year floodplain. Approximately 50,000 cy was removed from ARCO's Demonstration Project II in Subarea 4. All volumes are in cubic yards (cy).

Instream Sediments

A portion of the tailings/impacted soil eventually becomes incorporated with instream sediments at the bottom of Silver Bow Creek. These sediments are highly contaminated. Concentrations are between 10 and 65 times higher for arsenic, cadmium, lead, zinc, and 400 times higher for copper than are found in other area streams which drain highly mineralized geologic areas (Essig and Moore, 1992). Numerous researchers have demonstrated that while in the stream, these sediments severely limit the number and types of benthic macroinvertebrates which live in the stream sediments, and these sediments could act as a source of contamination to future cleaner surface water (Ingersoll et al., 1995b,c; MacDonald et al., 1995; Smith et al., 1995; Woodward et al., 1995). Like tailings themselves, the majority of contaminated sediments vary in size from a coarse sand to a very fine silt or clay (PTI, 1989).

To meet the remedial objectives for the SST OU, MDEQ and EPA have determined that all contaminated fine-grained sediments will be removed. Fine-grained (defined here as all instream sediments equal to or less than one millimeter) instream sediments located in all depositional areas will be removed and placed in repositories outside the floodplain with the tailings/impacted soils and railroad materials. This size fraction was identified because it corresponds with the size of the tailings/impacted soils and contains the bulk of instream contamination. Specific volumes and locations to be excavated will be determined by the agencies during remedial design. This sediment volume is presently estimated at 73,000 cy (Table 14), although recent mapping performed by ARCO (Maxim, 1995) has indicated that a lesser volume may be present (approximately 25,000 cy).

After removal of contaminated instream sediments, the channel bed and streambank will be reconstructed to an appropriate slope and other critical dimensions with materials of appropriate size, shape and composition. This reconfigured streambed will contain suitable bedform morphology (riffles, bars, pools, etc.) for aquatic habitat.

Instream sediment monitoring will be performed during and after the response action to verify the locations and concentrations of contaminated instream sediments, and macroinvertebrate abundance and diversity, as well as appropriate geomorphic bed configuration. Maintenance to address continuing sediment contamination over time may be necessary, depending on the results of long-term monitoring. Streambanks will require adequate growth media to allow for immediate establishment of a healthy riparian vegetative system to protect the remedy from high flows.

Railroad Materials

Certain portions of one abandoned historic railroad embankment and two operating railroads along Silver Bow Creek were constructed with mine and mill wastes from the Anaconda Company operations such as waste rock and slag. This material represents a source of contaminants to Silver Bow Creek via runoff, to groundwater via infiltration, and to recreationists who might use the abandoned embankment as a trail for walking or biking. The remedy will excavate, treat and/or cover all contaminated railroad bed materials that pose a risk to human health or the environment. All concentrate spills, which are the primary human health concern, will be removed and disposed in an appropriate and secure disposal facility in accordance with any applicable RCRA requirements. The in-situ STARS technology or soil capping is expected to be appropriate for all other areas of the inactive grade presenting human health risk and not likely to be eroded by the stream. Railroad materials that directly impact the stream either at bridge abutments or where these materials form a streambank will be excavated and disposed in repositories outside the floodplain along with the tailings/impacted soils and instream sediments. The actual amount and methods of excavation and/or treatment will be determined during remedial design. The estimated volumes designated for removal have been refined since the release of the proposed plan (MDEQ, 1995a). The estimated volume of excavated railroad materials is 72,000 cy (Table 14).

Monitoring and maintenance of the remediated railroad areas and materials will be required to ensure that contaminant sources are not exposed from erosion and do not cause contaminant loading to the stream.

Ground and Surface Water

Generally, groundwater within the OU flows towards and into Silver Bow Creek. Elevated concentrations of copper and zinc and exceedances of drinking water standards for arsenic and cadmium are present in groundwater (ARCO, 1995a). Surface water and instream sediment quality is impacted by discharging contaminated groundwater (Benner et al., 1995). While Silver Bow Creek ground and surface water are primary receptors of SST OU contamination, no separate remedial action is being prescribed for these media. Remedial activities for other SST OU media under this record of decision and for sources of contaminants upstream/offsite under other cleanup actions will limit further releases to ground and surface water with the goal of ultimately attaining ground and surface water standards within the OU. The prescribed removal of tailings/impacted soils, fine-grained instream sediments, and railroad materials will allow for the attainment of instream sediment and surface water objectives and standards, over time. Removing the source of groundwater contamination by addressing the tailings/impacted soils and railroad materials, will allow contaminants in groundwater to attenuate over time through dilution, adsorption, precipitation, dispersion, and should allow eventual attainment of groundwater standards.

Long-term monitoring of surface water and groundwater is a critical element of the remedy. Surface water will be monitored for compliance at numerous points in the OU to ascertain possible contaminant loading from onsite/nearsite contaminant sources. Groundwater will be monitored at locations of documented or reasonably suspected groundwater contamination, all relocation areas, and other locations where STARS treatment has been applied.

Monitoring, Coordination, and Schedule

An institutional controls program, which must be funded on a permanent basis as part of the remedy, will be coordinated through a joint effort of the Butte-Silver Bow and Anaconda-Deer Lodge local governments. Institutional controls, monitoring, and maintenance will be integrated into a Silver Bow Creek corridor management program. The program will be established and maintained in a manner to be approved by the agencies that will ensure that all aspects of the OU remedial action, both within and outside of the floodplain, are maintained for the long term, that future land uses in the area are consistent with the scenarios upon which cleanup level decisions for this action have been based (recreational), and that institutional control, monitoring and maintenance mechanisms will be adequate to ensure protectiveness over the long term.

Butte-Silver Bow County and ARCO are initiating research on constructed wetlands as a potential treatment technology for waste water nutrient discharge and stormwater metals contamination. To coordinate with this research, the end land use in Subarea 1 has been delineated as wetlands. After removal of all identified contaminant sources (tailings/impacted soils, instream sediments, railroad materials, etc.), in Subarea 1, reconstruction of the Subarea will be designed to incorporate use of the area as wetlands. Constructed wetlands may be used as a treatment system for nutrient and/or metals treatment, if use of such wetlands treatment in this area is ultimately determined to be appropriate.

Construction of the proposed remedy will be coordinated with other cleanup activities along Silver Bow Creek. Releases of contaminated sediments and surface waters prior to, during, and following remedial action, which might re-contaminate Silver Bow Creek, will be suitably controlled and treated. The design and schedule of the OU remedy will be coordinated with the design and installation of upstream sediment control basins and other cleanup activities. If adequate upstream control facilities are not in service at the time of initiation of construction of this remedy, then additional sediment control and treatment facilities will be provided as a part of this remedy.

The State of Montana and ARCO are engaged in litigation, brought under CERCLA, involving natural resource damages in the Upper Clark Fork River Basin (State of Montana v. Atlantic Richfield Company, U.S.D.C. Case No. CV-83-317-H). That litigation includes claims for damages for injuries to natural resources within the SST OU. As a result of that litigation, the State has developed a restoration plan which would provide for certain actions to restore the injured resources in the OU. (See "Restoration Determination Plan, Upper Clark Fork River Basin," October 1995). As provided by CERCLA and applicable regulations, the restoration plan seeks to accomplish more extensive goals than the remedial action, and would do so by addressing the same contaminated areas. The implementation of the final remedial action plan for the SST OU will be coordinated to the maximum extent possible with any implementation of the State's restoration plan for Silver Bow Creek, in order to maximize the benefits of both efforts and to avoid duplication of effort. Such coordination could include, for example, adjustment of schedules for specific portions of the actions, the combination or coordination of specific actions under the two plans, or allowing a more extensive restoration action to be implemented in certain areas, as long as the restoration action would accomplish all of the goals of the remedial action in those areas.

Description and Limitations of the Streambank Tailings and Revegetation Studies (STARS) Technology

In 1986, the Montana Department of Health and Environmental Sciences (now MDEQ) initiated the Streambank Tailings and Revegetation Studies (STARS) to determine the feasibility of chemically amending tailings materials in-situ adjacent to Silver Bow Creek. The purpose was to attempt to develop an effective alternative less costly than removal.

The purpose of the study was three-fold:

1) Buffer the acid produced by metal sulfides present in the tailings materials.

2) Reduce the mobility of metals that leach through the tailings.

3) Provide a suitable growth medium that will support a vegetative cover consisting of grasses and forbs. Woody species such as willows were not investigated in the STARS study. The vegetative cover would act to reduce the amount of moisture that could percolate through the amended tailings, reduce erosion from surface runoff, and reduce wind blown dust.

The study was conducted by Montana State University's Reclamation Research Unit and Schafer and Associates in three phases. Phase I was designed to test a variety of chemical amendments on tailings in the laboratory and to determine the combination of amendments that best reduced the concentration of metals measured in water leached through the amended tailings. In conjunction with the chemical testing, greenhouse studies were undertaken to determine the mixture of plant species that would grow best in amended tailings. Phase II consisted of field trials to test the most effective chemical amendments determined in Phase I. Several different amendment mixing techniques were tested during this phase to maximize the depth to which the amendments could be incorporated. Several different seed mixtures were also tested based on the results of the greenhouse trials. Phase III consisted of collecting various types of soil, water, and vegetative data over the course of three years and evaluating each of the treatments applied.

The agencies determined that the application of STARS amendments were effective: in reducing runoff production from treated tailings; for reducing (but not eliminating) the acid produced by metal sulfides present in the tailings materials, reducing the toxicity or mobility of most metals that leach through the tailings; providing a favorable growth medium that will support a vegetative cover; reducing the amount of moisture that could percolate through the amended tailings through vegetative management of the annual soil water budget; and reducing wind blown dust.

The agencies discuss below specific concerns which limit the implementation of the STARS technology in the SST OU. The STARS treatability study itself was a scientific, quantitative study which was limited in its scope. However, in evaluating the use of the technology as part of this remedy, the agencies have to consider the full range of issues involving implementation of STARS in the floodplain.

1. **STARS amendments do not appear to completely eliminate contaminant movement in porewater.**

Data collected during the study demonstrated that soil pore water quality was highly variable from treatment to treatment and year to year. General trends in soil pore water chemistry indicated that amended plots generally showed an increase in pore water pH and a decrease in the concentrations of most metals. Due to funding limitations, porewater data was limited to three sampling events without the benefit of replicated instrumentation. Because of this, as well as difficulties in appropriately mixing amendments deeper in the profile, only the 40 cm depth increment (the shallowest depth monitored) conclusively demonstrated effective reductions in porewater metals concentrations. Arsenic concentrations were observed to increase at depth in the amended plots at some of the monitored sites, which may be attributed to the greater solubility of arsenic with increasing pH. The metals aluminum, iron, and copper were substantially less soluble in soil pore water as pH increased while manganese, cadmium, and zinc concentrations did not have a clear correlation with increasing pH until pore water pH could be raised to levels greater than 7.0. Much higher amendment rates may be needed to substantially reduce concentrations of cadmium, manganese and zinc. Because of these findings, there is some uncertainty in the effectiveness of STARS to prevent the movement of some contaminants through the vadose zone.

2. STARS amendments do not mitigate the migration of metals from tailings/impacted soils saturated by groundwater.

Two principal hydrologic processes govern the migration of metals from tailings to groundwater: first, downward movement of precipitation (infiltration) through tailings to the saturated zone; and second, the inundation of tailings by groundwater.

The STARS technology was never intended to remediate groundwater. The STARS study was developed to reduce the mobility of metals in the amended tailings and enhance water use within the rootzone, with the intent of limiting vertical movement of vadose zone water and contaminants. There is still much debate as to the ability of the STARS technology to effectively manage the soil water budget resulting in a substantial reduction in infiltration to groundwater. One associated condition of considerable concern is implementing STARS in riparian areas of shallow groundwater (12 to 18 inches below ground surface) because plant roots may tap the groundwater table, rather than use vadose zone moisture. Reestablishment of a vegetative cover, even if it successfully eliminates infiltration to groundwater, is not capable of addressing metals mobilized by the saturation of tailings/impacted soils by groundwater. OU groundwater was found to fluctuate approximately two feet. In many areas a large volume of tailings/impacted soils are permanently saturated by groundwater or within this two foot fluctuation and are therefore seasonally saturated by groundwater. Saturation of tailings/impacted soils by groundwater releases metals weakly bound to these materials as well as metals associated with acidic vadose zone water.

In addition, it has never been determined if lime amendments can be successfully incorporated into saturated soils. Neither STARS nor any other demonstration studies in the Clark Fork basin investigated this issue or the types of plant species that might be used in saturated conditions. The STARS test plot at the Manganese Stockpile site failed, at least partly because of the saturated conditions at the site during long periods. Also, in MDEQ's analysis of the STARS treatment in saturated tailings conditions, two critical factors concerning STARS implementation indicate that STARS will not be effective: 1) The equipment designed to mix lime amendments into tailings is not likely to be able to adequately mix below the water table; and, 2) Because the highly soluble calcium oxide or calcium hydroxide is used to make up 40% of the STARS amendment, it is likely to be removed from the amended profile in ground water in those amended tailings that are seasonally saturated, primarily during the first year after amendment.

To expand on the first critical factor, mixing STARS amendments below the water table was not demonstrated at any of the ARCO demonstration projects (Demonstration Projects I, II, and III), nor was lime mixed below the water table during Phase II of the STARS investigation at the Manganese Stockpile. MDEQ believes that adequate mixing of lime amendments in ground water would not occur due to the inherent problems of plowing saturated materials and the physical process used to deliver the lime to the tailings to be mixed. Whether saturated tailings were amended during implementation of the Governor's Project could not be confirmed in the published documentation of the project.

The second critical factor is based on the solubility of calcium oxide or calcium hydroxide amendment. When mixed with soil, the pH generally rapidly rises to 9 to 10 standard units after mixing and tends to elevate soil pH for several months. As ground water rises into recently amended tailings, some quantity of the soluble calcium amendments are likely to be solubilized and removed from the soil as the water table lowers, even where ground water has a near neutral pH and is slightly alkaline. While no data is available to quantify the amount of amendment that could be removed, MDEQ believes that the uncertainty associated with this issue, at the very least, limits the application of STARS to tailings located greater than two feet above the 1992 low water table elevation.

Contaminated groundwater results in continuing, long-term contamination of Silver Bow Creek's surface water and instream sediments. Where contaminated groundwater has the potential to discharge to the stream, metals have been shown to precipitate/adsorb on the stream substrate (instream sediments) and potentially remain a source of contamination to surface water. The STARS study was never designed to investigate this contaminant migration pathway.

3. Contaminants could continue to be transported to Silver Bow Creek from a treated floodplain by various hydrologic processes.

Overbank flows and channel migration could be expected to re-entrain amended tailings into the stream and instream sediments, thereby subjecting the tailings to oxidation. This is especially true in the areas immediately adjacent to the active stream channel where channel migration and streambank erosion processes are most prevalent. In addition, under flood conditions, the stream channel is at the greatest risk of making major changes in channel location by avulsion or "jumping" into abandoned channels or migrating into areas susceptible to erosion. Once a STARS treated area is eroded, the amendment is likely to separate from the treated tailings and basic geochemistry suggests that, over-time, these tailings would produce acid and re-mobilize the metals which would be expected to become bioavailable. The impacts of these bioavailable metals would severely limit the ability for remedial actions to meet specified ecologic and possibly surface water quality objectives.

4. Long-term effectiveness

There is substantial debate regarding the long-term effectiveness and permanence of STARS treatment. The STARS study was designed to compare treatments against untreated tailings conditions and to measure relative differences between treatments. Data collected during the three year monitoring period reasonably represents the short-term effects of the treatments. However, it is conceivable that actual long-term effects may be different than trends evident in the three years of data presented in the STARS reports (MDOJ, 1995).

In any event, no single treatment proved to ameliorate metals contamination for all environmental matrices or for the range of environmental conditions represented in the study. Consequently, it is apparent that the STARS treatment is not suited for all the conditions present at the SST OU. The agencies believe that STARS is best suited and has the fewest limitations in tailings locations well away from the active stream channel and well above the seasonal high ground water elevation.

Criteria For Application of the Streambank Tailings and Revegetation Study (STARS) Technology

A critical element of the remedy selection is the determination of which tailings may be left in place and treated with the STARS technology and which tailings must be removed from the floodplain before being treated with STARS. After evaluating STARS fully and considering the limitations inherent in such treatment, MDEQ and EPA have identified certain criteria which define where within the floodplain STARS may effectively and reliably be implemented.

The STARS study was designed to compare treatments against untreated tailings conditions and to measure relative differences between treatments. Data collected during the three year monitoring period reasonably represents the short term effects of the treatments. Because of the extreme heterogeneity encountered at the study sites, however, many statistical comparisons between treatments can not be supported at this time. It is possible that actual long-term effects may be different than trends evident in the three years of data presented in this report. Also, no one single treatment proved to ameliorate metals contamination for all environmental matrices or for the range of environmental conditions represented in the study.

The criteria for determining that specific tailings/impacted soils may be STARS treated in-situ in the floodplain are:

1) The tailings/impacted soils involved cannot be saturated in groundwater during any part of the year. The SST OU Remedial Investigation delineated the location and volumes of saturated tailings/impacted soils (ARCO, 1995a). Generally, groundwater seasonally fluctuates slightly over two feet in the OU. Groundwater movement into and out of tailings, even in STARS treated tailings, will cause continued contaminant migration to groundwater.

2) STARS treatment must effectively immobilize the contaminants in the tailings/impacted soils. The STARS study identified the ability of the technology to successfully immobilize most contaminants of concern in the short term where the amendments can be adequately mixed into the tailings and soils. The depth to which the necessary soil amendments have been demonstrated to be effectively incorporated is limited to two feet. Future techniques may prove capable of effectively incorporating amendments to a greater depth. Moreover, because the STARS technology may not completely immobilize cadmium and zinc and may potentially increase the mobility of arsenic, a minimum thickness of native soils material between STARS treated tailings and groundwater is needed to act as a protective buffer. The nature and chemistry of the buffer materials must be considered in determining how much of a buffer constitutes adequate separation to prevent migration of contaminants into the groundwater. Tailings deposits that are thin enough that underlying native soils can also be tilled into the tailings is a positive consideration under this criterion.

3) The tailings/impacted soils cannot be located where they may be eroded and re-entrained into the stream system through normal stream processes or major flood events. STARS treated tailings could be transported into the stream system if eroded during natural stream channel migration, avulsion or as a result of overbank flows. Erosion and inundation from bank-full and flood events can be estimated based on a number of sources including CH2M Hill's Silver Bow Creek - Flood Modeling Study, which analyzes the lateral extent and water velocity of various flood events from regular bank-full to greater flood events. Another uncomplicated method of determining where the stream might meander to is to examine where the stream has been in the recent past.

Where the STARS technology is applied, regression or failure of a well-established vegetation could occur in the future. Failure could be due to one or more of the following: (1) weathering of pyritic wastes producing acidity, which in turn alters the availability of plant nutrients and toxic metals; (2) depletion of nutrients required for growth; (3) extreme weather or surface water flow conditions; and, (4) upward migration of acidity, metals, or salts into the amended zone (MDOJ, 1995). Because numerous repositories, which will be treated with the STARS technology, will be located near the floodplain in several areas along the length of the stream, and because in Subareas 2 and 4 large areas of tailings will be treated in-situ with the STARS technology at the edges of or outside of the floodplain, a permanent monitoring, management, and maintenance program will be an integral part of this remedy. Monitoring, management and maintenance will address vegetative performance on both STARS treatment areas and remediated streambanks, streambank stability and channel meander, and ensure that metals are immobilized at in-situ remediated areas. Each repository will be monitored through vegetative performance, vadose zone, saturated zone, and overland flow monitoring. The ultimate number and locations of relocation repositories will be determined and approved by the agencies during remedial design.

Replacement fill will be required in most locations where tailings/impacted soils are removed. Replacement fill and streambank reconstruction with suitable growth media having an appropriate texture and particle size distribution will be required. To the extent practicable, clean material excavated from nearby repositories will be used for replacement fill. A key to long-term streambank stabilization will be establishment of mature riparian vegetation. Grass, forb, willow, and tree species will be specified based on local climatic conditions, proximity to stream channel, and ability to produce dense root systems at maturity. The overall topography of the replacement fill material will be appropriately sloped toward the stream channel, with the goal of creating geomorphic stability.

While the exact delineation of STARS-treated areas will be established during remedial design/action, these three criteria were used in analyzing each subarea to preliminarily determine where STARS can be expected to effectively achieve protection of human health and the environment.

In Subarea 1, 67% of tailings/impacted soils are saturated by groundwater. The confined nature of the floodplain and the steeper stream gradient in Subarea 1 increase the probability of adverse flood impacts on STARS treated areas. The negative effects from saturated tailings, streambank erosion, and likely future overbank deposition of sediment on treated areas precludes implementing STARS in this subarea. Reconstruction of excavated areas in Subarea 1 will be designated to accommodate wetlands. These constructed wetlands will be designed in such a manner that they will have the potential for use as organic or inorganic contaminant treatment, if appropriate.

The evaluation of overall protection for Subarea 2 is the same as for Subarea 1 except for a considerable quantity of tailings/impacted soils which lie outside the floodplain. In the Ramsay Flats area, an estimated 280,000 cubic yards of tailings/impacted soils lie outside this demarcation. Because these tailings/impacted soils are located outside the floodplain, are generally unsaturated by groundwater, are finer grained in size, and are located, in areas, above a rich organic soil horizon which helps attenuate metals movement, the application of STARS treatment in this defined area should meet remedial action objectives (RAOs). However, the STARS treatment technology is presently only effective in tailings 2 feet thick and less. With present technology tailings thicker than 24-inches will need to be removed or relocated. These in-situ STARS treated areas will by required to be completely protected from erosion. An estimated 529,000 cy of tailings/impacted soils will be removed from this subarea (Table 14).

Because of the confined nature of the floodplain in Subarea 3 (a relatively steep, narrow canyon), the analysis of these criteria is much the same as for Subarea 1. Overall protectiveness would be compromised by saturated tailings, streambank erosion, and likely future overbank deposition of sediment on treated areas, precluding implementation of STARS in this subarea. An estimated 160,400 cy of tailings/impacted soils will be removed from this subarea (Table 14).

In Subarea 4, the potential for flood impacts to STARS treated tailings at the edge of the floodplain is smaller as a result of the wide floodplain, which allows dispersion of stream energy to a much greater degree than in the upper three subareas. In the near-stream areas there is ample evidence of stream migration in the recent past. Some of the channels are activated during spring snowmelt on an annual basis (MDOJ, 1995). The presence of buried soils and, in many places, the separation of tailings from groundwater is adequate to minimize the movement of metals through the vadose zone. Thus the potential effectiveness of STARS treatment appears to be greater in this subarea than the other three subareas. In Subarea 4 an estimated 724,000 will be treated in-situ with the STARS technology while 576,000 will be removed to a relocation repository (Table 14).

Estimated Costs of the Remedy

The total present worth cost of Alternative 5 was estimated in the feasibility study in the range of $32 million to $55 million (ARCO, 1995b). The estimated cost of the agencies' selected remedy, a modified Alternative 5, is estimated to be $24 to $46 million. These costs are substantially less than originally estimated because of the near stream repositories, the estimated removal volumes of tailings/impacted soils are somewhat lower due to better defined removal criteria, a more accurate quantification of railroad materials that will be treated or removed, and the determination that soil cover materials will not be needed for potential residential areas outside the floodplain. The cost uncertainties that are associated with this revised estimate are listed in Tables 15, 16, amd 17.

Cost-Effectiveness

In determining that the selected remedy is cost-effective, the agencies have considered the incremental cost differences between the available alternatives and the incremental risk reduction or the benefits associated with the additional costs. Those elements of the proposed remedy that did not demonstrate benefits proportional to their costs have been eliminated in the selection of the final remedial plan. The changes made to ensure cost-effectiveness included elimination of substantial haul distances for removal of materials by utilizing local rather than regional repositories and maximizing the amount of material treated in place. The remaining elements of the final remedial action plan are necessary to meet threshold requirements for the selection of the remedy and will achieve overall effectiveness proportional to their costs.

Cost Uncertainties

The agencies believe that the estimate of costs for this alternative as presented by ARCO in the Draft FS report is accurate for decision making purposes. Although the agencies believe that several important line item costs are significantly over-stated in the FS, considering the magnitude of this remedial action and the complexity of OU conditions, the cost for this remedial action has been reasonably delineated (Table 14).

The operation and maintenance costs beyond the thirty year time frame used in the FS, and the discount rate used to evaluate the present worth of operation and maintenance costs are important considerations. MDEQ recognizes that the 7 percent annual discount rate used in the FS and calculation of present worth costs without inclusion of inflation, as required by the NCP, tends to underestimate future costs. Discounting makes the costs of remedies that rely more heavily on future actions such as operations and maintenance, appear less costly than capital intensive remedies.

Some elements of the remedy will be further refined during remedial design. Listed below are cost elements on which ARCO and MDEQ differed when developing the SST OU Feasibility Study. The cost range estimated in Tables 15 - 17 is based on MDEQ's determinations regarding these issues.

- *Quantities of Tailings/Impacted Soils* - Quantities of tailings/impacted soils as calculated by NRIS were used to develop the cost estimates for removal. The quantities of saturated tailings include both the saturated tailings and the tailings that overlie the saturated tailings. This quantity was also calculated by NRIS. The accuracy of locations and amounts of tailings/impacted soils is restricted by limited data points (Table 15).

- *Truck Haul* - Truck haul costs were not altered from those presented in the original cost estimate (ARCO, 1995b). While MDEQ believes that the bulking factor used in ARCO's unit cost calculation is high and the travel speeds used are low, the combination of these two factors provide some conservatism to the quantity estimates and allow for overage that might be expected during tailings removal (Table 15).

- *Clean Fill for Streambank Replacement* - The quantity of clean fill used for streambank replacement was increased from ARCO's draft FS submittal to account for a 4-inch lift of coversoil placed over these areas. This material is expected to be used where necessary to provide an adequate seedbed for germination. Costs associated with truck haulage were used to estimate costs to transport this material from local sources (Table 16).

- *Roadbuilding* - Roadbuilding was broken into two categories, internal and external, along with the minimum and maximum costs developed from the demonstration projects for each category. For each of the alternatives except TS3, one times (1X) the stream length was used for internal roads and one times (1X) the stream length was used for external roads (Table 15).

- *Revegetation (relocation area)* - The costs associated with STARS treatment in the relocation areas were increased to reflect the cost of applying STARS to multiple lifts of relocated tailings. ARCO's original estimate provided only for treating one 12-inch lift without treatment of the remaining 14 lifts of tailings placed in the relocation areas. Unit costs for this item were changed to the STARS unit costs and the acreage of the relocation areas adjusted to reflect applying STARS in seven, 2-foot lifts (Table 15).

- *Operations and Maintenance* - These costs were recalculated to reflect a percent failure expected for each alternative rather than the man hour and equipment hour method used in ARCO's original cost estimate. These costs were also discounted to net present value at an annual discount rate of 7% in accordance with EPA guidance (EPA, 1993) (Table 15).

- *Instream Sediments* - Costs were included to replace the streambank in addition to the backfill placed for the tailings/soils alternatives. Replacement costs were based on the lineal foot of streambank replaced using a minimum and maximum range of $16 to $40, respectively (Table 16).

Final Remediation Goals, Cleanup\Performance Standards, and Points of Compliance

Preliminary remedial action objectives and preliminary remediation goals were identified in the Preliminary Remedial Action Objectives Report/Treatment Technology Scoping Document (PRAOR/TTSD) (ARCO, 1993d). This section clarifies the final remediation objectives, goals, levels, specific cleanup standards, and points of compliance for each of the media addressed under the SST OU record of decision. Not all of the preliminary remediation goals identified in the PRAOR/TTSD are carried forward into the final remediation standards. Where separate preliminary goals are addressed by the same final standard, only a single goal has been identified, and although preliminary goals were established for organic parameters, final standards for organics have not been established because site characterization has determined that separate remedial action under this operable unit is not necessary to address organics.

Surface Water and Instream Sediments

The final remedial action objectives and final remediation standards for surface water are:

1. Meet the more restrictive of the aquatic life or human health standards for surface water identified in MDEQ Circular WQB-7, through application of I-classification requirements.

2. Prevent exposure of humans and aquatic species to instream sediments having concentrations of inorganic contamination in excess of risk-based standards. A physical criterion is used to define those sediments posing the greatest risk to receptor species. A contingency is established to develop metal-specific concentrations which would be risk-based, and allow sediment cleanup standards if the physical criterion standard cannot be employed appropriately.

3. Provided that upstream sources of Silver Bow Creek contaminants are eliminated, meeting the two remediation standards identified above should attain the remedial action objective to improve the quality of Silver Bow Creek's surface water and instream sediments to the point that Silver Bow Creek could support the growth and propagation of fishes and associated aquatic life, one of the designated goals for an I-class stream, including a self-sustaining population of trout species.

Within a reasonable time frame after implementation of the selected remedy, and contingent upon adequate cleanup of upstream sources, ambient surface water quality standards, ultimately including the WQB-7 standards described above, must be attained at all points in Silver Bow Creek within the OU.

Table 15
Remedial Alternative Cost Summary - Tailings/Impacted Soils
Streamside Tailings Operable Unit

Activity	Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price	Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price
	Subarea 1: Partial Relocation, Partial STARS Treatment and ICs						Subarea 3: Partial Relocation, Partial STARS Treatment and ICs					
Roadbuilding (internal)	5.2	mile	$23,800	$31,200	$123,760	$162,240	5	mile	$23,800	$31,200	$119,000	$156,000
Roadbuilding (external)	5.2	mile	$8,200	$20,200	$42,640	$105,040	5	mile	$8,200	$20,200	$41,000	$101,000
Clear/Grub (site)	153.6	acre	$600	$1,300	$92,160	$199,680	92	acre	$600	$1,300	$55,200	$119,600
Grading (site)	153.6	acre	$350	$750	$53,760	$115,200	92	acre	$350	$750	$32,200	$69,000
Clear/Grub (relocation area)	69	acre	$600	$1,300	$41,419	$89,740	38.8	acre	$600	$1,300	$23,253	$50,381
Grading (relocation area)	69	acre	$350	$750	$24,161	$51,773	38.8	acre	$350	$750	$13,564	$29,066
Soil Cover (relocation area)	0.0	cy	$6.30	$8.27	$0	$0	0.0	cy	$6.30	$8.27	$0	$0
Dozer/Loader/Trackhoe	285,000	cy	$2.90	$4.20	$826,500	$1,197,000	160,000	cy	$2.90	$4.20	$464,000	$672,000
Haul (on-site, excavated T/S)	285,000	cy	$0.83	$1.11	$236,550	$316,350	160,000	cy	$0.83	$1.11	$132,800	$177,600
STARS	0.0	acre	$4,000	$7,100	$0	$0	0.0	acre	$4,000	$7,100	$0	$0
Clean Fill Streambank Replacement	85,500	cy	$0.83	$1.11	$70,965	$94,905	48,000	cy	$0.83	$1.11	$39,840	$53,280
Clean Fill Streambank Placement (Dozer)	85,500	cy	$2.90	$4.20	$247,950	$359,100	48,000	cy	$2.90	$4.20	$139,200	$201,600
Riprap (includes placement)	395	cy	$25	$30	$9,875	$11,850	1,978	cy	$25	$30	$49,450	$59,340
Reveg (relocation area)	69	acre	$4,000	$7,100	$276,125	$490,121	92	acre	$500	$1,000	$46,000	$92,000
Revegetation (site)	153.6	acre	$500	$1,000	$76,800	$153,600	38.8	acre	$4,000	$7,100	$155,017	$275,156
				Subtotal	$2,122,664	$3,346,600				*Subtotal*	$1,310,524	$2,056,022
Engineering Design/Construction Oversite	1	ls	13%	18%	$275,946	$602,388	1	ls	13%	18%	$170,368	$370,084
Mob/Demobilization	1	ls	1%	6%	$21,227	$200,796	1	ls	1%	6%	$13,105	$123,361
Construction Overhead	1	ls	8%	15%	$169,813	$501,990	1	ls	8%	15%	$104,842	$308,403
Institutional Controls	1	ls	$38,500	$82,500	$38,500	$82,500	1	ls	$21,000	$45,000	$21,000	$45,000
Operation and Maintenance	11%	ls	2,110,796	2,110,796	$232,188	$232,188	6%	ls	2,110,796	2,110,796	$126,648	$126,648
				Subtotal	$737,674	$1,619,862				*Subtotal*	$435,963	$973,496
				Total	$2,860,338	$4,966,461				*Total*	$1,746,487	$3,029,518
	Subarea 2: Partial Relocation, Partial STARS Treatment and ICs						Subarea 4: Partial Relocation, Partial STARS Treatment and ICs					
Roadbuilding (internal)	5.6	mile	$23,800	$31,200	$133,280	$174,720	6.8	mile	$23,800	$31,200	$161,840	$212,160
Roadbuilding (external)	5.6	mile	$8,200	$20,200	$45,920	$113,120	6.8	mile	$8,200	$20,200	$55,760	$137,360
Clear/Grub (site)	320	acre	$600	$1,300	$192,000	$416,000	700	acre	$600	$1,300	$420,000	$910,000
Grading (site)	320	acre	$350	$750	$112,000	$240,000	700	acre	$350	$750	$245,000	$525,000
Clear/Grub (relocation areas)	128.1	acre	$600	$1,300	$76,879	$166,571	139.5	acre	$600	$1,300	$83,709	$181,370
Grading (relocation areas)	128.1	acre	$350	$750	$44,846	$96,099	139.5	acre	$350	$750	$48,830	$104,637
Soil Cover (relocation area)	0.0	cy	$6.30	$8.27	$0	$0	0.0	cy	$6.30	$8.27	$0	$0
Dozer/Loader/Trackhoe	529,000	cy	$2.90	$4.20	$1,534,100	$2,221,800	576,000	cy	$2.90	$4.20	$1,670,400	$2,419,200
Haul Unit Cost (on-site)	529,000	cy	$0.83	$1.11	$439,070	$587,190	576,000	cy	$0.83	$1.11	$478,080	$639,360
STARS	175	acre	$4,000	$7,100	$700,000	$1,785,269	450	acre	$4,000	$7,100	$1,800,000	$3,549,581
Clean Fill Streambank Replacement	158,700	cy	$0.83	$1.11	$131,721	$176,157	172,800	cy	$0.83	$1.11	$143,424	$191,808
Clean Fill Streambank Placement (Dozer)	158,700	cy	$2.90	$4.20	$460,230	$666,540	172,800	cy	$2.90	$4.20	$501,120	$725,760
Riprap (includes placement)	0.0	cy	$25	$30	$0	$0	791	cy	$25	$30	$19,775	$23,730
Reveg (site)	320	acre	$500	$1,000	$160,000	$320,000	700	acre	$500	$1,000	$350,000	$700,000
Revegetation (relocation areas)	128.1	acre	$4,000	$7,100	$512,526	$909,734	139.5	acre	$4,000	$7,100	$558,062	$990,561
				Subtotal	$4,542,572	$7,873,199				*Subtotal*	$6,536,001	$11,310,526
Engineering Design/Construction Oversite	1	ls	13%	18%	$590,534	$1,417,176	1	ls	13%	18%	$849,680	$2,035,895
Mob/Demobilization	1	ls	1%	6%	$45,426	$472,392	1	ls	1%	6%	$65,360	$678,632
Construction Overhead	1	ls	8%	15%	$363,406	$1,180,980	1	ls	8%	15%	$522,880	$1,696,579
Institutional Controls	1	ls	$112,000	$240,000	$112,000	$240,000	1	ls	$178,500	$382,500	$178,500	$382,500
Operation and Maintenance	32%	ls	2,110,796	2,110,796	$675,455	$675,455	51%	ls	2,110,796	2,110,796	$1,071,403	$1,071,403
				Subtotal	$1,786,821	$3,986,002				*Subtotal*	$2,687,823	$5,865,008
				Total	$6,329,392	$11,859,201				*Total*	$9,223,824	$17,175,534
							OPERABLE UNIT TOTAL - TAILINGS AND SOILS:				$19,422,367	$35,410,854

Revised November 15, 1995

Table 16
Remedial Alternative Cost Summary - In-Stream Sediments
Streamside Tailings Operable Unit

Activity	Minimum Quantity	Maximum Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price
Subarea 1: Limited Removal, On-Site STARS Treatment							
Trackhoe (wet excavation)	15,000	15,000	bcy	$4.35	$6.30	$65,250	$94,500
Sediment Pond (construction)	1,144	3,661	bcy	$2.90	$4.20	$3,318	$15,375
Sediment Pond (loader excavate)	15,000	15,000	bcy	$2.90	$4.20	$43,500	$63,000
Truck Haul (on site)	15,000	15,000	bcy	$0.83	$1.11	$12,450	$16,650
Silt Fence	0.3	0.3	mile	$52,800	$73,920	$13,728	$19,219
Streambank Replacement	5.2	5.2	mile	$84,500	$211,000	$439,400	$1,097,200
Final Grading	1.4	4.5	acre	$350	$750	$496	$3,404
STARS	1.4	4.5	acre	$4,000	$7,100	$5,673	$32,221
Revegetation	1.7	5.4	acre	$500	$1,000	$851	$5,446
					Subtotal	$584,666	$1,347,015
Mob/Demobilization	1		ls	1%	6%	$5,847	$80,821
Construction Overhead	1		ls	8%	15%	$46,773	$202,052
Engineering Design/Construction Oversit	1		ls	8%	13%	$46,773	$175,112
Operation and Maintenance (30 years)	21%		%	$478,358	$478,358	$100,455	$100,455
					Subtotal	$199,848	$558,440
					Total	$784,514	$1,905,455

Activity	Minimum Quantity	Maximum Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price
Subarea 2: Limited Removal, On-Site STARS Treatment							
Trackhoe (wet excavation)	22,700	22,700	bcy	$4.35	$6.30	$98,745	$143,010
Sediment Pond (construction)	1,711	5,476	bcy	$2.90	$4.20	$4,962	$22,997
Sediment Pond (loader excavate)	22,700	22,700	bcy	$2.90	$4.20	$65,830	$95,340
Truck Haul (on site)	22,700	22,700	bcy	$0.83	$1.11	$18,841	$25,197
Silt Fence	0.3	0.3	mile	$52,800	$73,920	$14,784	$20,698
Streambank Replacement	5.6	5.6	mile	$84,500	$211,000	$473,200	$1,181,600
Final Grading	2.1	6.8	acre	$350	$750	$742	$5,091
STARS	2.1	6.8	acre	$4,000	$7,100	$8,485	$48,194
Revegetation	2.5	8.1	acre	$500	$1,000	$1,273	$8,145
					Subtotal	$686,862	$1,550,272
Mob/Demobilization	1		ls	1%	6%	$6,869	$93,016
Construction Overhead	1		ls	8%	15%	$54,949	$232,541
Engineering Design/Construction Oversit	1		ls	8%	13%	$54,949	$201,535
Operation and Maintenance (30 years)	31%		%	$478,358	$478,358	$148,291	$148,291
					Subtotal	$265,058	$675,384
					Total	$951,920	$2,225,656

Activity	Minimum Quantity	Maximum Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price
Subarea 3: Limited Removal, On-Site STARS Treatment							
Trackhoe (wet excavation)	5,000	5,000	bcy	$4.35	$6.30	$21,750	$31,500
Sediment Pond (construction)	1,000	3,000	bcy	$2.90	$4.20	$2,900	$12,600
Sediment Pond (loader excavate)	5,000	5,000	bcy	$2.90	$4.20	$14,500	$21,000
Truck Haul (on site)	5,000	5,000	bcy	$0.83	$1.11	$4,150	$5,550
Silt Fence	0.3	0.3	mile	$52,800	$73,920	$15,840	$22,176
Streambank Replacement	5.0	5.0	mile	$84,500	$211,000	$422,500	$1,055,000
Final Grading	0	0	acre	$350	$750	$0	$0
STARS	0	0	acre	$4,000	$7,100	$0	$0
Revegetation	0	0	acre	$500	$1,000	$0	$0
					Subtotal	$481,640	$1,147,826
Mob/Demobilization	1		ls	1%	6%	$4,816	$68,870
Construction Overhead	1		ls	8%	15%	$38,531	$172,174
Engineering Design/Construction Oversit	1		ls	8%	13%	$38,531	$149,217
Operation and Maintenance (30 years)	7%		%	$478,358	$478,358	$33,485	$33,485
					Subtotal	$115,364	$423,746
					Total	$597,004	$1,571,572

Activity	Minimum Quantity	Maximum Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price
Subarea 4: Limited Removal, On-Site STARS Treatment							
Trackhoe (wet excavation)	29,700	29,700	bcy	$4.35	$6.30	$129,195	$187,110
Sediment Pond (construction)	997	3,191	bcy	$2.90	$4.20	$2,892	$13,404
Sediment Pond (loader excavate)	29,700	29,700	bcy	$2.90	$4.20	$86,130	$124,740
Truck Haul (on site)	29,700	29,700	bcy	$0.83	$1.11	$24,651	$32,967
Silt Fence	0.1	0.1	mile	$52,800	$73,920	$7,181	$10,053
Streambank Replacement	6.8	6.8	mile	$84,500	$211,000	$574,600	$1,434,800
Final Grading	1.2	4.0	acre	$350	$750	$433	$2,967
STARS	1.2	4.0	acre	$4,000	$7,100	$4,945	$28,090
Revegetation	1.5	4.7	acre	$500	$1,000	$742	$4,748
					Subtotal	$830,769	$1,838,879
Mob/Demobilization	1		ls	1%	6%	$8,308	$110,333
Construction Overhead	1		ls	8%	15%	$66,462	$275,832
Engineering Design/Construction Oversit	1		ls	8%	13%	$66,462	$239,054
Operation and Maintenance (30 years)	41%		%	$478,358	$478,358	$196,127	$196,127
					Subtotal	$337,358	$821,346
					Total	$1,168,127	$2,660,225

OPERABLE UNIT TOTAL - IN-STREAM SEDIMENTS: $3,501,564 $8,362,908

Revised November 15, 1995

Table 17
Remedial Alternative Cost Summary - Railroad Materials
Streamside Tailings Operable Unit

Activity	Minimum Quantity	Maximum Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price	Minimum Quantity	Maximum Quantity	Unit	Minimum Cost Unit Price	Maximum Cost Unit Price	Minimum Cost Extended Price	Maximum Cost Extended Price
	Subarea 1: Replacement of Railroad Materials							**Subarea 3: Replacement of Railroad Materials**						
Excavation of Materials (dozer/loader/trackhoe)	11,010	16,515	cy	$2.90	$4.20	$31,929	$69,363	19,704	29,556	cy	$2.90	$4.20	$57,142	$124,135
Haul Cost	11,010	16,515	cy	$2.65	$3.84	$29,177	$63,418	19,704	29,556	cy	$2.65	$3.84	$52,216	$113,495
Land Acquisition	0.55	0.57	acre	$1,000.00	$7,000.00	$551	$4,000	0.99	1.02	acre	$1,000.00	$7,000.00	$985	$7,159
Clear/Grub (dry closure area)	0.55	0.57	acre	$600.00	$1,300.00	$330	$743	0.99	1.02	acre	$600.00	$1,300.00	$591	$1,330
Grade (dry closure area)	0.55	0.57	acre	$350.00	$750.00	$193	$429	0.99	1.02	acre	$350.00	$750.00	$345	$767
Scraper (dry closure area)	3,108	3,227	cy	$4.64	$5.04	$14,423	$16,263	5,563	5,775	cy	$4.64	$5.04	$25,813	$29,105
Dozer/Loader/Trackhoe (dry closure area)	11,010	16,515	cy	$1.25	$2.70	$13,763	$44,591	19,704	29,556	cy	$1.25	$2.70	$24,630	$79,801
Roller (dry closure area)	11,010	16,515	cy	$0.75	$1.25	$8,258	$20,644	19,704	29,556	cy	$0.75	$1.25	$14,778	$36,945
Low Permeability Cover	23,980	24,893	ft^2	$0.60	$1.60	$14,388	$39,828	42,915	44,549	ft^2	$0.60	$1.60	$25,749	$71,278
Revegetation (repository)	0.55	0.57	acre	$500.00	$1,000.00	$275	$571	0.99	1.02	acre	$500.00	$1,000.00	$493	$1,023
Haul Unit Cost (SA 1, import soil)	11,010	11,010	cy	$6.30	$8.27	$69,363	$91,053	19,704	19,704	cy	$6.30	$8.27	$124,135	$162,952
Excavate/Remove ore concentrate spill	8	10	hr	$43.50	$43.50	$348	$435	0	0	hr	$0	$0	$0	$0
Revegetation (replaced materials)	1.0	3.3	acre	$500.00	$1,000.00	$500	$3,300	0.7	0.7	acre	$500.00	$1,000.00	$350	$700
					Subtotal:	$183,496	$354,637					Subtotal:	$327,226	$628,690
Mob/Demobilization	1		ls	1.00%	6.00%	$1,835	$21,278	1		ls	1.00%	6.00%	$3,272	$37,721
Construction Overhead	1		ls	8.00%	15.00%	$14,680	$53,196	1		ls	8.00%	15.00%	$26,178	$94,303
Engineering Design/Construction Oversite	1		ls	8.00%	13.00%	$14,680	$46,103	1		ls	8.00%	13.00%	$26,178	$81,730
Operation and Maintenance (30 yr)	33.0%	33.0%	ls	$124,090	$124,090	$40,950	$40,950	34.0%	34.0%	ls	$124,090	$124,090	$42,191	$42,191
					Subtotal:	$72,144	$161,526					*Subtotal:*	$97,819	$255,945
					Total	$255,641	$516,163					*Total:*	$425,045	$884,635
	Subarea 2: Replacement of Railroad Materials							**Subarea 4: Replacement of Railroad Materials**						
Excavation of Materials (dozer/loader/trackhoe)	16,651	24,977	cy	$2.90	$4.20	$48,288	$104,901	0	0	cy	$2.90	$4.20	$0	$0
Haul Cost	16,651	24,977	cy	$2.65	$3.84	$44,125	$95,910	0	0	cy	$2.65	$7.40	$0	$0
Land Acquisition	0.83	0.86	acre	$1,000.00	$7,000.00	$833	$6,050	0.00	0.00	acre	$1,000.00	$0.00	$0	$0
Clear/Grub (dry closure area)	0.83	0.86	acre	$600.00	$1,300.00	$500	$1,124	0.00	0.00	acre	$600.00	$0.00	$0	$0
Grade (dry closure area)	0.83	0.86	acre	$350.00	$750.00	$291	$648	0.00	0.00	acre	$350.00	$0.00	$0	$0
Scraper (dry closure area)	4,701	4,880	cy	$4.64	$5.04	$21,813	$24,596	0	0	cy	$4.64	$5.04	$0	$0
Dozer/Loader/Trackhoe (dry closure area)	16,651	16,651	cy	$1.25	$2.70	$20,814	$44,958	0	0	cy	$2.90	$4.20	$0	$0
Roller (dry closure area)	16,651	16,651	cy	$0.75	$1.25	$12,488	$20,814	0	0	cy	$0.75	$1.25	$0	$0
Low Permeability Cover	36,265.88	37,646.24	ft^2	$0.60	$1.60	$21,760	$60,234	0	0	ft^2	$0.60	$1.60	$0	$0
Revegetation (repository)	0.83	0.86	acre	$500.00	$1,000.00	$416	$864	0.00	0.00	acre	$500.00	$1,000.00	$0	$0
Haul Unit Cost (SA 1, import soil)	16,651	16,651	cy	$5.50	$7.48	$91,581	$124,549	0	0	cy	$6.30	$8.27	$0	$0
Revegetation (replaced materials)	1.0	2.0	acre	$500.00	$1,000.00	$500	$2,000	0.0	0.0	acre	$500.00	$1,000.00	$0	$0
					Subtotal:	$263,408	$486,647					*Subtotal:*	$0	$0
Mob/Demobilization	1		ls	1.00%	6.00%	$2,634	$29,199	1		ls	1.00%	6.00%	$0	$0
Construction Overhead	1		ls	8.00%	15.00%	$21,073	$72,997	1		ls	8.00%	15.00%	$0	$0
Engineering Design/Construction Oversite	1		ls	8.00%	13.00%	$21,073	$63,264	1		ls	8.00%	13.00%	$0	$0
Operation and Maintenance (30 yr)	33.0%	33.0%	ls	$124,090	$124,090	$40,950	$40,950	0.0%	0.0%	ls	$124,090	$124,090	$0	$0
					Subtotal:	$85,729	$206,410					*Subtotal:*	$0	$0
					Total:	$349,137	$693,057					*Total:*	$0	$0
												OPERABLE UNIT TOTAL - RAILROAD MATERIALS:	$1,029,823	$2,093,855

Revised November 15, 1995

I-classification procedures allow for a gradual attainment of the standards by permitting point source discharges at the higher concentration of (1) the applicable Circular WQB-7 standard, (2) an adopted site-specific standard, or (3) one-half of the mean monthly instream concentration immediately upstream of the discharge. Since no site-specific standards have been developed as of the issuance of this record of decision, any point source discharges under this remedial action must meet one-half the mean monthly concentration in the stream immediately upstream of the discharge point, eventually reducing, as upstream water quality improves, down to the WQB-7 levels.

As effective ambient water quality standards for the stream, the WQB-7 levels also set the contaminant specific goal for the remediation of non-point sources. The remediation is to be designed and implemented to ensure that non-point sources, specifically those contaminant sources identified in this record of decision, do not contribute a contaminant loading to the stream that causes an exceedance of these standards. While upstream water quality continues to exceed these standards, the applicable I-class limitation for these non-point sources is that no discharge from such sources may commence or continue which lowers or is likely to lower the overall quality of the stream waters. Thus discharges from the non-point sources in excess of WQB-7 levels will not actually be in violation of the standards until the water coming into the stream from upstream sources is of a better quality. Therefore the implementation of the remedy and initial monitoring of non-point sources should serve to identify any continuing contaminant loadings from non-point sources, so that these sources can be effectively remediated prior to the improvement of upstream water quality.

Accordingly, monitoring should be designed to identify and locate any continuing contaminant source. For this purpose the stream may be divided into reaches, which could be modified or narrowed, as appropriate, to identify and locate contaminant sources. Potential stream reaches for which performance could be initially measured are the following:

- LAO to the Silver Lake Pipeline discharge point
- Silver Lake Pipeline discharge point to Browns Gulch
- Browns Gulch to head of Durant Canyon
- Head of Durant Canyon to German Gulch
- German Gulch to Fairmont Road bridge
- Fairmont Road bridge to Highway 1 bridge
- Highway 1 bridge to Warm Springs Pond inlet

Where perennial tributaries enter the SST OU (Silver Lake Pipeline, Browns Gulch, and German Gulch), the downstream sampling point for the upper reach will be immediately upstream of the tributary and the upstream sampling point for the downstream reach will be sufficiently downstream of the tributary to allow for mixing of the SBC and tributary flows. Specific stream reaches for monitoring will be delineated during the remedial design and adjusted as necessary to identify continuing contaminant sources.

The intent of the surface water performance standard is to allow determination of whether remedial actions taken at the OU are successful in providing for the improvement of Silver Bow Creek water quality over time in accordance with the I-classification requirements. As remedial action performance data is collected, revisions may be made to the stream reaches used for compliance and monitoring requirements as appropriate. Additional details of the performance standards may be included in any implementing order.

No metals concentration cleanup goal is established for instream sediments by this action. Cleanup performance standards are based on physical size criteria applied to all depositional areas. Specific standards may be identified in any implementing order, and the specific locations requiring instream sediment excavation will be determined prior to or during remedial design, based on more precise sampling and mapping of instream sediment grain size and depositional areas.

The compliance requirements for instream sediments, including locations of compliance, will be specified during remedial design but will entail, at a minimum, multiple locations along Silver Bow Creek. During implementation of the remedial action, compliance will require that sediments mapped for excavation are removed in accordance with design requirements. Instream sediment sampling will be performed during the response action to verify the locations and concentrations of contaminated instream sediments.

The specific performance standards for instream sediments will be removal of the sand sized fraction and less ($\leq$1mm) from all depositional stream locations, regardless of size, as delineated by MDEQ and the EPA. The objective of this standard is to remove the majority of tailings (which also range in size from $\leq$1mm and less) from the stream, which constitute the bulk of the instream sediment contamination. The objectives for instream sediments remedial actions is two fold, (1) remove all tailings and the majority of the contaminant load from the streambed and (2) is to prevent exposure of aquatic species to instream sediments having concentrations of contaminants in excess of published (in peer reviewed journals) risk-based concentrations. The ultimate goal is to improve Silver Bow Creek over time to a condition that supports a self-reproducing fishery for trout species.

Following sediment, tailings/impacted soils, and railroad bed remediation, monitoring of sediment characteristics in specified locations in all pertinent stream reaches will be required. If recontamination of the instream sediments is found to occur, then additional work to address the sources of the recontamination, as well as additional excavation of recontaminated sediments, will be required.

Tailings/Impacted Soils

The final remedial action objectives and final remediation standards for tailings/impacted soils are:

1. Prevent human exposure to tailings/impacted soils from residential or occupational activity within the SST OU. This will be accomplished, in part, through institutional controls that will require the entire OU to be developed into a recreational corridor.

2. Prevent erosion or migration of inorganic contaminants of concern in tailings/impacted soils into Silver Bow Creek or into groundwater that would prevent attainment of groundwater, surface water, and sediment remediation levels.

3. Protect all solid waste within the SST OU from flood displacement, washout, or erosion in accordance with ARARs.

4. Prevent the saturation of tailings/impacted soils by groundwater during any period of the hydrologic year or by bank storage of high-flow stream discharge.

5. Prevent migration of contaminants of concern in tailings/impacted soils that would cause phytotoxicity in terrestrial vegetation.

Because the remediation of tailings/impacted soils is based primarily upon the need to reduce risks to environmental receptors at the SST OU and because adopted soil cleanup levels to address the contaminants of concern are not available, no chemical action level is defined for tailings/impacted soils. Instead, an "order of magnitude definition" as defined in the Draft RI report (ARCO, 1994a) of contaminated tailings/impacted soils is utilized to identify those soils requiring remediation. This methodology is expected to provide for an easily defined performance standard for field implementation, while also yielding a degree of cleanup of tailings/impacted soils that will provide adequate protectiveness for receptor species without setting specific chemical action levels. Specific locations and depths of excavation or in-situ treatment of tailings/impacted soils to be required will be defined during remedial design.

Numerous (possibly hundreds) additional borings will be required to ascertain the base of tailings for the purposes of: (1) the concentration with depth, (2) determining if the tailings/impacted soils are saturated by groundwater, and (3) how much and what tailings will be removed or treated in-situ.

Performance will be monitored by agency oversight during construction to ensure that excavation, backfill, and in-situ treatment and revegetation are conducted in accordance with specifications developed during remedial design. Compliance with remedial design will be required at all locations of remedial action for tailings/impacted soils. During long-term maintenance of the remedy, vegetation and soil monitoring will be required at a representative number of locations within the SST OU. Vegetation will be monitored for cover and density, as well as for signs of chemical stress from contaminants of concern. Soils will be measured for pH while soil pore-water will be monitored for pH and all appropriate analytes, which will include all major cations and anions. The specific locations and requirements for the long-term monitoring program will be developed as part of the remedial design and remedial action at the OU.

An important element of the selected remedy is the establishment of several local repositories for treated, excavated tailings/impacted soils. Although it is expected that these repositories will be designed and constructed to prevent any migration of contaminants to underlying groundwater, it will be important to monitor the vadose zone water of each individual repository to confirm that the technology is performing as designed. Vadose zone pore-water will be monitored for pH and all appropriate analytes which will include all major cations and anions. Vegetation will also be monitored for cover and density, as well as for signs of chemical stress from contaminants of concern. The specific locations of lysimeters and sampling regimen will be determined during remedial design and remedial action (Table 18).

Methodology to Determine the Base of Tailings/Impacted Soil

Soil samples were collected within and adjacent to the SST OU to determine both the nature of tailings/impacted soils ("tailings") and native soil and to provide a frame of reference against which to assess the impact of tailings on the environment. The method used for delineating tailings/impacted soil from "nonimpacted" soils within the SST OU is described below.

To some extent, contaminants of concern mobilized by the chemical reactions have moved out of the tailings and into the underlying soils. This results in a gradual decrease in concentration of contaminants of concern with depth, with no distinct base. In addition, although several of the contaminants of concern behave in a similar manner, the exact mobility of each is unique. These conditions combine to make the determination of the base of the tailings/impacted soils somewhat problematic.

Graphs of data for distinct boreholes showing lithologic, chemical and physical parameters versus depth in the soil reveal that often the point at which the change in each of these parameters is greatest is approximately the same for several parameters. At some depth most metals concentrations decreased an approximate "order of magnitude," or factor of ten, from concentrations measured in the surface to near-surface depth intervals. This order of magnitude decrease in metals concentrations generally coincided with an increase in soil pH and a decrease in electrical conductivity. In other words, although there is no unique base of tailings with an abrupt, step-like change in chemical and physical parameters, the point that most closely approaches that distinct change can be quantitatively chosen by examination of multiple parameters. While this decrease in metals concentrations was not equal to a specific value for any metal, this observation provided a good "rule of thumb" to semi-quantitatively determine the base of tailings impacts for volume determinations.

Using this method, the data for each borehole was examined and the base of tailings was determined. The term "tailings/impacted soils" is used to describe those soils that lie above the order of magnitude change in chemical and physical parameters and the term "nonimpacted" soil is used to describe those soils that lie below the order of magnitude decrease. This definition is used to calculate volumes of tailings/impacted soils and to draw isopach maps of tailings/impacted soils. The phrase "non-impacted soils" is a working phrase, used here to indicate that the soils, as a whole, have lower concentrations of contaminants of concern than tailings/impacted soils.

To determine if this, semi-quantitative manner of determining the base of tailings/impacted soils was applied consistently and if there was a real and distinct difference between the materials that were above and below the point chosen as the base of tailings/impacted soils, a statistical analysis of the two groups was done. Details of this statistical analysis are provided in Appendix C of the Draft Remedial Investigation Report (ARCO, 1995a). This statistical analysis showed there was a distinct difference between the materials in the two categories, "tailings/impacted materials" and "nonimpacted materials." This performance standard will be applied in determination of tailings/impacted soils and nonimpacted soils.

Sampling will be performed during the response action to verify that all tailings/impacted soils contaminated above the order of magnitude cleanup criteria are appropriately addressed. The sampling program shall be developed by the agencies during remedial design.

Railroad Materials

The final remedial action objectives and final remediation levels for railroad materials are:

1. Prevent exposure by recreational users of the railroad beds in excess of acceptable cancer and noncancer risks from arsenic. Risks will be adequately reduced by removal of ore concentrate spills and other impacted railroad materials exhibiting arsenic concentrations in excess of 2,000 mg/kg (MDEQ, 1995b).

2. Prevent erosion of contaminated railroad bed materials into Silver Bow Creek to the degree that surface water standards would be exceeded, or instream sediments would

be contaminated, or vegetation on adjacent relocation or STARS treated areas would be adversely impacted.

The SST OU Baseline Risk Assessment determined that the OU posed unacceptable health risk to recreational users of the railroad beds, but that those risks were primarily related to the existence of a limited number of highly contaminated spills of ore concentrate or fine-grained slag material. The selected remedy for the site requires removal and appropriate disposal of those materials. Specific procedures for sampling and designation of materials to be removed will be developed during remedial design. Compliance will be determined by confirmation sampling of locations where highly-contaminated materials were removed.

The selected remedy requires excavation of contaminated railroad bed materials that form the streambank of Silver Bow Creek. These materials are found primarily at bridge abutments and along certain stream reaches. During implementation of the remedial action, compliance with the construction specifications will be required. During long-term maintenance, repair of eroded materials will be required to ensure structural integrity of the railroad bed.

All concentrate spills will be removed and disposed in an appropriate secure repository in compliance with applicable RCRA requirements. Concentrate spill material will not be placed in relocation repositories. The STARS technology or soil capping is expected for all other areas of the inactive grade. Railroad materials which directly impact the stream either at bridge abutments or along the streambank will be excavated and disposed in the adjacent relocation repositories. The actual amount and methods of excavation and/or treatment will be determined during remedial design.

Groundwater

The final remedial action objectives and final remediation standards for groundwater are:

1. Attain compliance with applicable MDEQ Circular WQB-7 standards, federal MCL's, and federal nonzero maximum contaminant level goals (MCLGs) for all OU groundwater.

2. Prevent discharge of groundwater that would prevent attainment of Silver Bow Creek ambient Circular WQB-7 standards or instream sediment remediation goals.

A primary element of the selected remedy is to excavate and relocate tailings/impacted soils that act as sources of groundwater contamination at the SST OU because the tailings are in contact with groundwater either continually or seasonally. The purpose of these source removals is two fold. First, removal of the sources will allow natural attenuation to restore groundwater to compliance with Circular WQB-7 standards in a reasonable time frame. Second, as groundwater quality improves, contaminant loading to Silver Bow Creek in areas where near-stream groundwater discharges to the stream will be dramatically reduced. Over time, groundwater should not adversely impact water quality or instream sediment quality of the stream. To delineate the potentiometric surface to the degree necessary for saturated tailings quantification, numerous piezometers (possibly hundreds) will need to be installed with accurate horizontal/vertical survey control and monthly groundwater level measurements.

After construction of the remedy, at areas of suspected or known historic exceedances of groundwater standards, monitoring wells will be installed. These wells will be constructed so that the well screen is located in the appropriate hydrostratigraphic zone and monitored at proper time intervals to confirm that the source removals and natural attenuation are working to improve groundwater quality. The specific locations and number of wells required and the necessary sampling regimen will be determined during remedial design and remedial action.

Another element of the selected remedy is the establishment of several local repositories for treated, excavated tailings/impacted soils. Although it is expected that these repositories will be designed and constructed to prevent any migration of contaminants to underlying groundwater, it will be important to monitor the groundwater beneath each individual repository to confirm that they are performing as designed. The specific locations of monitoring wells and sampling regimen will be determined during remedial design and remedial action.

The groundwater levels to be attained consist of the more stringent of the MCL, any non-zero MCLG, or the WQB-7 human health standard for each parameter. More detail on the legal requirements that establish these levels is set forth in Appendix A, which identifies and discusses the ARARs for this remedial action.

Groundwater sampling will be performed during the response action to verify the locations of contaminated groundwater (Table 18). It is anticipated that the treatment prescribed for sources of contamination at the OU will effectively reduce the locations and levels of contamination and shrink the contaminant plumes within a reasonable period of time.

Air Resources

The final remediation standard for air resources is:

1. Compliance with air ARARs within and adjacent to the SST OU during implementation of the remedial action.

During construction of the remedy, dust-suppression measures will be required. In addition, provisions will be specified during remedial design to limit wind-borne dispersion of lime amendments used as part of the in-situ treatment of tailings/impacted soils. Monitoring of particulate matter will be required initially and on an as-needed basis for the duration of construction activities at the OU. The intensity of the monitoring may be reduced over time depending on the results of the initial sampling.

Compliance Monitoring Program

A sampling program for monitoring the remedial action and determining compliance with the performance standards shall be implemented during the remedial action. Table 18 lists minimum monitoring requirements.

In addition, to ensure that performance standards are maintained, it is expected that there will be monitoring at least quarterly for a period of at least ten years following completion of remediation construction. Continued monitoring after that period may be conducted less frequently if MDEQ and EPA determine that a reduced frequency is appropriate. These monitoring programs will be developed during remedial design and shall include, at a minimum, the following parameters to evaluate success of the remedial action.

Physical parameters of geomorphologic stability, macroinvertebrates (diversity and abundance) and aquatic health, riparian vegetation and analytical parameters (focusing on the contaminants of concern including mercury, but analyzing other contaminants, if any, that are not contaminants of concern and are determined to be occurring at levels exceeding performance standards), sampling points, sampling frequency and duration, and statistical methods for evaluating data. Specific performance monitoring points shall be specified and approved by EPA and MDEQ during remedial design and remedial action.

Because residual hazardous substances will be left in the OU and the cleanup is expected to take several years, the selected remedy will require five year reviews under Section 121(c) of CERCLA, Section 300.430(f)(4)(ii) of the NCP, and applicable guidance to ensure the long-term protectiveness of the remedy.

Table 18
Minimum Post-Remedy Monitoring Requirements[1]

Media	Locations/Physical Parameters	Analytical Parameters
Surface Water	SS-07, SS-10, SS-13, SS-14, SS-15, SS-16, SS-17, SS-19	Metals: Total recoverable and dissolved: As, Cd, Cu, Pb, Hg, Zn Commons: Ca, Mg, Na, K, Cl^-, $SO4^{2-}$ Nutrients: Nitrate+Nitrite Nitrogen, Phosphorous Physical: Temperature, pH, Eh, conductance, dissolved O2
Instream Sediments, Geomorphology, Aquatic Biologic Resources	Surface water locations and at each depositional areas. Physical stream parameters such as geomorphologic stability (erosion rates and locations) and bedform morphologic features. Macroinvertebrate diversity, abundance and aquatic health.	Metals: Total As, Cd, Cu, Pb, Hg, Zn. To be analyzed by three size fractions: 1mm and greater, between 1mm and 63 μm, and less then 63 μm.
Groundwater	Upstream end near Colorado Tailings, Rocker, Silver Bow, Nissler, Ramsay Flats, Miles Crossing, Fairmont, Crackerville, Stuart, Opportunity, STARS in-situ treatment areas and every repository location	Metals: Dissolved As, Cd, Cu, Pb, Hg, Zn Commons: Ca, Mg, Na, K, Cl^-, $SO4^{2-}$ Physical: Temperature, pH, Eh, conductance, dissolved O2
Soil	Minimum one (1) sample per 10 acres and three (3) sample per repository	Neutralization potential, sulfur fractionation, conductance, pH
Vegetation	In conjunction with soil sample locations	Percent cover (total and by species), production (total and by species)
Vadose Zone	In conjunction with groundwater sampling locations; three (3) per repository location	Metals: Dissolved As, Cd, Cu, Pb, Hg, Zn Commons: Ca, Mg, Na, K, Cl^-, $SO4^{2-}$ Physical: Temperature, pH, Eh, conductance

[1] - Monitoring will focus on principal contaminants of concern As, Cd, Cu, Pb, and Zn including mercury (Hg), but analyzing other contaminants, if any, that are not principal contaminants of concern and are determined to be occurring at levels exceeding performance standards. The level of monitoring effort described in this table should be considered as minimal requirements. The necessity to meet remediation goals, cleanup/performance standards, and points of compliance might dictate a more substantial effort. The agencies will determine the final level of monitoring which includes sampling locations, frequency and duration, as well as statistical methods for evaluating the data, as needed, during remedial design.

Engineering and Institutional Controls

These controls are required to maintain the protectiveness of the remedy. Since attainment of RAOs for all media are not likely to be met in less than 10 years, measures must be instituted to control risks during implementation of the remedy.

Because all OU contamination will remain on-site, a creative and secure institutional controls, monitoring, and maintenance (ICMM) program will be required. This ICMM program must: (1) ensure adequate land use/access restrictions to safeguard the waste materials treated in-situ and/or relocated to adjacent repositories, (2) be managed, maintained, and monitored in perpetuity, and (3) ensure that shallow contaminated groundwater use is controlled.

An important component will be provisions to physically protect areas of in-situ STARS treatment from stream erosion and to provide for any necessary re-treatment of in-situ or repository STARS treated areas. If necessary, additional work, including engineering controls (e.g., riprap or removal of STARS treated areas) to prevent erosion of STARS treated areas, will be required. A critical component to this ICMM program will be provisions, to be approved by the agencies, which will ensure sufficient arrangements for financial resources to support the entities who will manage, operate, and maintain the institutional controls program.

Stream erosion would be significantly reduced from its present condition by establishment of woody vegetation (i.e., willows and cottonwoods) and backfill to maintain channel geomorphic stability.

The remedial action plan will incorporate the removal of tailings/impacted soils, contaminated instream sediments and certain railroad bed materials from the floodplain, except in those specific locations where such materials can be adequately protected in place and treated with the STARS technology to prevent further migration of the contaminants. The agencies believe that the selected remedy can be implemented in a manner that provides protection of the public health, safety, welfare and the environment and attains legally applicable or relevant and appropriate requirements.

Remedial Design/Remedial Action Process

The evaluation, selection, and description of the remedy identified in the record of decision were conducted at a feasibility study level of detail. The effectiveness and cost evaluations relied on a relatively limited amount of information collected during the remedial investigation. Although the RI/FS information is sufficient to support the setting of cleanup criteria and standards and the selection and conceptual design of the remedy, additional data will be necessary to complete the detailed design and implementation of the remedy.

The conceptual design of the remedy presented in this record of decision provides MDEQ's current best estimates of (1) the volumes and locations of contaminated media to be excavated or STARS-treated in place, (2) potential locations of the repositories for excavated materials, and (3) construction techniques to be employed. These estimates are based on the existing remedial investigation and feasibility study information. Remedy design details and construction specifications will be finalized during the remedial design phase of the cleanup. The actual volumes of excavated materials and in-situ treated materials, lime application rates, stream stabilization features, construction techniques, monitoring and maintenance requirements, etc. ultimately required under the remedy will be determined by the agencies during design, based on the criteria identified in this record of decision. Actual volumes to be excavated or treated in-situ may be either higher or lower than the current estimate. Likewise, the actual locations of excavated areas, in-situ treated areas, and relocation areas may vary from what is presently assumed in the record of decision. The final remedy design, however, must be approved by the agencies and must be able to attain the final remediation goals and compliance and performance standards specified in this record of decision in order to ensure protection of human health and the environment and attainment of ARARs, except where appropriately waived.

Remedial design typically involves primarily the potentially responsible parties and the overseeing agencies, along with their respective technical contractors. Consistent with recent EPA Superfund Administrative Reforms, MDEQ and EPA intend to conduct an open remedial design process that will include, in a consultative role, other parties that have an interest in the Streamside Tailings OU. These parties include Butte-Silver Bow, Anaconda-Deer Lodge, and Missoula county governments, interested state and local environmental permitting agencies, local environmental groups, the Silver Bow Creek/Butte area technical assistance grantee, natural resource trustees, and other interested individuals. As provided by CERCLA and the NCP, the agencies are ultimately responsible for making final determinations regarding remedial design.

Given the disparity of opinions regarding the ability of engineered stream stabilization features to control the hydraulic forces of Silver Bow Creek and offer long-term effectiveness in preventing erosion of STARS-treated areas over time and therefor compliance with performance standards, MDEQ and EPA will make earnest efforts to procure supplemental technical expertise in stream mechanics and stream geomorphology to assist in the design process. The focus of the remedial design process will be to identify and develop detailed specifications of the most cost-effective selected remedy design that will attain the cleanup criteria and performance standards set forth in this record of decision.

Provided that the final design of the SST OU remedy can attain the SST OU cleanup criteria and performance standards, it should to the degree possible incorporate components consistent with the following environmental and community improvement actions in the project area:

- A Silver Bow Creek recreational corridor land uses as designated and adopted by Butte-Silver Bow and Anaconda-Deer Lodge county governments;
- The use of wetlands treatment for Butte wastewater nutrient loadings and/or Butte area storm water runoff metals loadings, if appropriate;
- Preservation and enhancement of significant historical and prehistorical resources in accordance with the Regional Historic Preservation Plan; and
- Coordination with pertinent restoration actions implemented as part of the Upper Clark Fork River Basin natural resource damage restoration plan.

EPA and MDEQ will make concerted efforts to assist Butte-Silver Bow and Anaconda-Deer Lodge counties in obtaining EPA Brownfields redevelopment grants and Montana Resource Development Grants to enhance reclamation projects within the Silver Bow Creek corridor.

<u>Contingency Measures</u>

The decisions to invoke any or all of these contingency measures may be made by the agencies at any time during remedial design or implementation of the remedial action, as appropriate.

Repository Locations

As noted in the description of the selected remedy, the use of numerous near-stream repositories for the treated tailings/impacted soils and other materials is contingent upon obtaining adequate space at suitable locations for such repositories, securing adequate control over land use, access, and management of those sites, and the successful establishment of an adequately funded institutional controls/maintenance program as part of this remedy. In the event these requirements are not met, the remedial action shall incorporate instead the use of centralized repositories as determined appropriate by the agencies.

The use of centralized repositories would substantially reduce the need for land acquisition within the Silver Bow Creek corridor and the need for institutional controls and continued land use restrictions within the stream corridor, as well as the amount of maintenance required for such repositories. In such event, the agencies may also need to determine that a greater amount of tailings/impacted soils needs to be removed from the OU in order to ensure protection of the stream from reentrainment of tailings/impacted soils from STARS treated areas in the absence of a permanent management, monitoring, and maintenance program.

The locations of the centralized repositories would be determined by the agencies based upon the availability of appropriate locations at that time. For some tailings/impacted soils and other contaminated materials, the Opportunity Ponds could still be considered an appropriate location. Although there was some concern expressed during the public comment period regarding the use of the Opportunity Ponds as a disposal area, primarily by local government representatives from Deer Lodge County, the majority of comments addressing this issue recognized the Opportunity Ponds as an appropriate repository for such wastes. Possibly limiting the wastes disposed in this area to those wastes from the lower portion of the OU would address some of the concerns raised by those who objected to the use of the Opportunity Ponds.

By the time that this decision would be made, there may be additional information from studies for other operable units within the site that would assist in identifying additional appropriate repositories. The agencies recognize that there was also substantial opposition during the public comment period to the siting of a repository in the Browns Gulch area. That location could also be avoided, if possible.

Instream Sediments

The use of the $\leq$1mm grain size standard is intended as an indicator that will allow for ease of field implementation, enabling reasonably reliable visual identification of the material to be removed in the field without the need for continued sampling and expensive, slow analytical analysis of instream sediments. MDEQ and EPA believe that this particle size fraction will reasonably identify the tailings/impacted soils located in the active streambed of Silver Bow Creek, particularly that fraction of the instream sediments that poses the greatest threat as a contaminant source, and therefore will serve as a reliable indicator for implementation in the field.

However, if it is demonstrated from design studies or initial field work that this size fraction standard is not a reliable indicator of the contaminated sediments that must be removed in order to eliminate the threat to aquatic life in the stream, sampling and chemical analysis may be used to identify the materials that must be excavated or another appropriate indicator may be selected. In any event, sampling and analysis may be used in coordination with the use of this indicator to establish that a specific deposit of sediments within this particle size are in fact natural, uncontaminated sand or silt size instream sediment and not tailings/impacted soils or contaminated instream sediments that require removal. For example, demonstration that specific materials contain concentrations similar to instream sediment concentrations found in like Montana streams that are located in similar geologic/hydrologic environments, that are relatively unimpacted by mining activity, and that contain a reproducing trout fishery would establish that such instream sediments need not be removed.

X. STATUTORY DETERMINATIONS

While the large majority of the comments received from the community supported the selection of Alternative 6, the alternative initially proposed by the agencies, comments submitted by the primary PRP, with support from both Butte/Silver Bow and Anaconda/Deer Lodge local governments, as well as numerous local business interests promoted implementation of a less extensive and less expensive remedy. After considering all the comments fully, as detailed in the Responsiveness Summary, the agencies have determined that certain changes to the proposed plan (MDEQ, 1995a) can accomplish substantial cost savings and still satisfy the statutory requirements for remedies under CERCLA. MDEQ and EPA have determined that, considering all appropriate factors, including OU specific conditions and the remedy selection criteria specified in CERCLA and the NCP, the remedy presented in this record of decision is the proper remedy for the OU and meets the statutory requirements for remedies under CERCLA, as described below.

Under CERCLA Section 121, MDEQ and EPA must select a remedy that is protective of human health and the environment, complies with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), is cost-effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA provides a preference for remedies that include treatment which permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy will protect human health and the environment through actions designed to address all identified sources of contamination in the OU, including tailings/impacted soil, instream sediments, and railroad materials, together with permanent monitoring and maintenance (including retreatment or replacement, if necessary) of the remediated areas through a comprehensive institutional controls, monitoring, and maintenance program.

This remedial action will reduce much of the potential risk to human health and terrestrial and aquatic flora/fauna by establishing vegetation throughout the entire OU and relocating much of the contaminated materials outside of the 100-year floodplain. Contaminated materials to be relocated will include all tailings deposits that are saturated or within the observed groundwater fluctuation of two feet and all near stream tailings which may reasonably be expected to be eroded through natural stream processes.

Groundwater quality will improve significantly in many areas after the removal of source tailings. Tailings/impacted soils close to or saturated by groundwater and tailings in those areas that may be subject to erosion into the stream will be relocated safely outside of the 100-year floodplain and treated, significantly reducing the potential for impacts to groundwater or re-entrainment of tailings/impacted soils into the stream. Runoff and transport of total and dissolved metals and arsenic to the stream will be significantly reduced or eliminated. In those areas to be treated in-situ with STARS, the treatment will somewhat reduce pore water acidity and mobility of certain contaminants. An institutional controls program will monitor and maintain the integrity of all STARS treated areas, and, if necessary, additional work, including engineering controls to protect STARS treated areas from erosion or retreatment or removal of the STARS treated areas, will be required. Stream erosion would be significantly reduced from its present condition by establishment of woody vegetation (i.e., willows and cottonwoods) and backfill to maintain channel geomorphic stability.

All railroad materials which affect human health or the environment will be removed or treated in-situ. All concentrate spills will be removed and disposed in an appropriate, secure landfill. The STARS technology or soil capping is expected for all other areas of the inactive grade. Railroad materials which directly impact the stream either at bridge abutments or along the streambank will be excavated and disposed in the local relocation repositories.

Instream sediment quality and recovery time will improve dramatically through removal of all depositional areas of fine ($\leq$1mm) grained instream sediments.

After the sources of continuing contamination are addressed, groundwater quality will improve slowly by attenuation and dilution in areas where it is currently impacted. Institutional controls restricting use of and exposure to contaminated groundwater will be necessary until the standards are attained.

After the sources of contamination are addressed as provided for in the selected remedy, (and after upstream sources are addressed by actions in other operable units) protection of affected surface waters will be achieved. Once source control is achieved, flushing and dilution will restore the stream to acceptable and protective levels for contaminants of concern for this OU.

There are no short term threats associated with the selected remedy that cannot be readily controlled. A variety of institutional controls and access restrictions will be implemented with the remedy to ensure protectiveness while the remedy is being implemented.

Accordingly, the agencies have determined that the combination of actions, controls, and contingencies designated in this record of decision for the remedial action at this OU will provide protection of human health and the environment.

Compliance with Applicable or Relevant and Appropriate Requirements

The final determination of ARARs by MDEQ and EPA is set forth in Appendix A attached to this record of decision. The selected remedy will attain most applicable or relevant and appropriate requirements (ARARs). A waiver of certain solid waste and floodplain management ARARs is necessary where the STARS technology will be implemented in the 100-year floodplain. Some significant ARARs compliance issues are discussed below.

Contaminant-specific ARARs

Contaminant-specific ARARs typically set levels or concentrations of chemicals that may be allowed in or discharged to the environment. For groundwater, the contaminant-specific ARARs for this remedial action include the maximum contaminant levels (MCLs) and non-zero maximum contaminant level goals (MCLGs) established under the federal Safe Drinking Water Act, and the human health standards specified in MDEQ Circular WQB-7. The selected remedy is to be designed to address source areas of contamination to groundwater sufficiently to allow natural attenuation and dilution of groundwater to eventually attain these standards in the groundwater throughout the OU.

In addition the remedy will attain the surface water quality standards for OU contaminants in Silver Bow Creek, as designated under Montana law. ARM 16.20.623 specifies the standards for the "I" classification applicable to Silver Bow Creek and, for each contaminant, requires eventual attainment of the more restrictive of the aquatic life standard or the human health standard set forth in MDEQ Circular WQB-7.

Location-specific ARARs

Location-specific ARARs establish requirements or limitations based on the physical or geographic setting of the OU or the existence of protected resources in the OU.

The SST OU lies almost entirely within the 100-year floodplain of Silver Bow Creek. Several different ARARs limit or prohibit storing or disposing the SST mine tailings in the floodplain. The Montana Solid Waste Regulations prohibit placing any facility for the treatment, storage, or disposal of solid wastes in a 100-year floodplain. The Montana Floodplain Management Regulations prohibit solid and hazardous waste disposal or storage of toxic or hazardous materials within the 100-year floodplain.

The remedial action plan provides for the use of STARS treatment of tailings in place in the floodplain in a portion of Subarea 4. Because this will constitute disposal of solid waste in the floodplain, this action will not comply with these location-specific ARARs, and an ARAR waiver is necessary.

MDEQ and EPA have determined that, in those locations satisfying the technical criteria identified in this ROD for where STARS treatment may appropriately be implemented within the floodplain (Section IX), and when consistently and permanently monitored and maintained by an appropriate institutional controls, monitoring, and maintenance program to be established and funded as part of this remedy, the use of STARS treatment, together with any necessary maintenance or replacement actions, will attain a standard of performance that is equivalent to that required by these floodplain and solid waste regulations through use of another method or approach. Accordingly, the agencies invoke the ARAR waiver provided by CERCLA Section 121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D). In determining that this ARAR waiver may properly be invoked in this limited context, MDEQ and EPA have considered that the purpose behind the solid waste and floodplain regulations is to ensure that such wastes do not contaminate the stream or adjacent groundwater and to prevent the washout of solid waste disposal areas by the stream or floodwaters. The criteria used by the agencies to determine where tailings may be left in place within the floodplain, together with an institutional controls program to monitor the effectiveness of STARS and ensure the integrity of STARS treated areas (including the additional use of engineering controls, such as riprap, or re-treatment or removal of STARS treated areas, if necessary) can attain these specific goals at an equivalent level of performance.

Design of the remedy will have to ensure that treated tailings/impacted soils are protected by their location, placement or sufficient engineering controls to ensure that such materials will not be subject to any level of washout or erosion. Appropriately ensuring against any level of washout or erosion is a required condition for the application of this ARAR waiver. All other ARARs identified in Appendix A, including those specifically requiring the protection of solid wastes or toxic or hazardous materials in the floodplain from washout or erosion, remain applicable or relevant and appropriate and must be met by appropriate design and implementation of the remedy.

During design and implementation of the remedy, several other location-specific ARARs must continue to be observed. Several of these, including the Fish and Wildlife Coordination Act, the Endangered Species Act, the Migratory Bird Treaty Act and the Bald Eagle Protection Act, require continued consultation with the U.S. Fish and Wildlife Service. Other location-specific ARARs require consideration of historical resources and continued consultation with the State Historic Preservation Officer. ARCO, EPA, MDEQ, the State

Historic Preservation Officer, the National Council on Historic Preservation, and both local governments in the area have entered into a Programmatic Agreement to ensure the appropriate consideration of cultural and historic resources in the Clark Fork Basin, including those within the SST OU.

Action-specific ARARs

Action-specific ARARs generally provide guidelines for the manner in which specific activities must be implemented. Thus, compliance with many action-specific requirements must be ensured through appropriate design and implementation of the remedy.

The remedy is to be designed and implemented in accordance with dust suppression and air quality regulations, certain reclamation requirements which have been determined to be relevant and appropriate to this action, and other action-specific ARARs identified in Appendix A.

Cost-Effectiveness

MDEQ and EPA have determined that the selected remedy is cost-effective in mitigating the principal risks posed by the tailings/impacted soils, instream sediments, railroad materials and contaminated groundwater. Section 300.430(f)(ii)(D) of the NCP requires evaluation of cost-effectiveness. The remedy must provide overall effectiveness proportional to its costs. Overall effectiveness is determined by the following three balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness.

The estimated costs of the selected remedy, as well as the costs of the other alternatives considered, are described in Tables 15, 16, and 17 of this record of decision. To the extent that the estimated cost of the selected remedy exceeds the costs of other alternatives, the additional cost is reasonably related to the additional benefits in long-term effectiveness and permanence and reduction of toxicity and mobility of the contaminants through the relocation and treatment to be used.

With respect to the short-term effectiveness of the remedy, including consideration of the risks involved to workers and the community as the remedy is being implemented, the agencies have revised the remedy from the preferred alternative identified in the proposed plan (MDEQ, 1995a). The change from Alternative 6, using one or two centralized repositories, to Alternative 5, using numerous local relocation repositories, will reduce concerns regarding the short-term effectiveness of the remedy. The use of numerous local repositories will dramatically reduce the length of trips travelled by trucks hauling the contaminated materials, and consequently will reduce the risk of traffic accidents and the risks/inconvenience to local communities that would be affected by such construction traffic. The remaining risks posed during implementation can be adequately addressed by proper safety precautions in the implementation of the remedy.

The selected remedy, fully addressing the sources of contamination, and provides the best overall effectiveness of all alternatives proportional to its cost. The tailings/impacted soils and railroad remediation are believed necessary in order to adequately protect Silver Bow Creek and the alluvial aquifers, in addition to providing a realistic opportunity to fully stabilize and achieve cleanup goals at the OU in the future. The agencies have determined that, if the tailings/impacted soils designated for relocation were not removed from the floodplain prior to treatment, the reduction in toxicity and mobility resulting from such treatment could well be only temporary. Thus the agencies have determined that such relocation is appropriate and cost-effective. The tailings that will remain in the floodplain are those that the agencies believe can be adequately protected by long-term maintenance activities or the addition of engineering controls, if necessary. In addition, the actions prescribed for sediments are necessary and cost-effective to address threats to and adverse impacts on the environment, including toxicity to aquatic organisms, ranging from macroinvertebrates to fish, as well as to prevent recontamination of the water in the stream.

As detailed above, the agencies have determined that the costs of this remedy are proportional to the overall effectiveness that will be achieved by the selected remedy.

<u>Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable</u>

MDEQ and EPA have determined that the selected remedy represents the maximum extent to which an alternative treatment technology, STARS, can be used within the OU consistent with the need to provide a permanent solution. The specific nature of the STARS treatment technology must be considered in evaluating the appropriate use of STARS. STARS was developed by the State as a low cost, in-situ, alternative treatment technology. Considering the limitations on the effectiveness of the technology, it has been included in the remedy to the maximum extent practicable. Removal of the material from the floodplain prior to using STARS effects a permanent solution, as well as utilizes an alternative treatment technology, since outside the floodplain, the STARS treated areas can be expected to remain intact. Thus by this combination of removal of certain vulnerable tailings/impacted soils from the floodplain along with STARS treatment of all tailings/impacted soils both within and outside the floodplain, the selected remedy attempts to maximize the use of both permanent solutions and alternative treatment technologies.

Of those alternatives that are protective of human health and the environment and comply with ARARs or have an adequate bases for an ARAR waiver, MDEQ and EPA have determined that this selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability and cost, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance. The detailed evaluation of the balance of these criteria among the alternatives considered is set forth in the FS Report and is summarized in Section VIII, Summary of Comparative Analysis of Alternatives, of this record of decision.

The selected remedy includes removal and treatment of contaminated media which will permanently and significantly reduce the principal threats posed by the tailings/impacted soils, instream sediments and railroad materials. The other alternative considered which could achieve similar or more substantial reductions, Alternative #6, would do so at significant additional expense, although there was, overall, widespread support for OU-wide Alternative 6 from communities in the basin. Other alternatives considered, including containment, capping and partial excavation, did not offer similar prospects for protectiveness, effectiveness or permanence.

Preference for Treatment as a Principal Element

As discussed in the section on utilization of alternative treatment technologies above, the selected remedy incorporates the use of STARS treatment of practically all contaminated materials. Such treatment will be used for all the tailings left in the floodplain and will be used extensively in construction of the tailings repositories located outside the floodplain. Thus, by utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

In the proposed plan (MDEQ, 1995a), MDEQ and EPA submitted as the preferred remedy for the OU the combination of actions set out as OU-wide Alternative 6 in Draft Feasibility Study Report (ARCO, 1995b). This remedy was detailed in a proposed plan which was submitted for public comment for 60 days from June 9 through August 7, 1995. Over 580 comments were received from local government entities, a potentially responsible party, environmental groups, business organizations, and numerous individual citizens. Comments were received from the Butte area, the Anaconda area, the Missoula area, and several other areas of Montana, as well as out of state.

The vast majority of the comments supported the preferred remedy as delineated in the proposed plan (MDEQ, 1995a), and most strongly supported full and effective cleanup of the Silver Bow Creek corridor. One distinct group of comments, which included support from local government entities in both the Butte and Anaconda areas, promoted a remedy which would incorporate a "greenway" or recreational corridor conceptual land use proposal. In addition, some comments, including government representatives in the Butte and Anaconda area, strongly objected to use of the two proposed repositories.

After considering the public comments received, especially the concerns expressed by local government representatives, MDEQ and EPA have included certain modifications to the proposed remedy. This record of decision will achieve substantial cost savings by avoiding transport of the excavated materials to a single repository, and by instead allowing the use of several local repositories which would be maintained over the long-term by an institutional controls plan such as a recreational corridor or similar designated recreational use plan.

The agencies' initial proposal for one or two central repositories was founded upon certain advantages including: (1) the wastes would be removed from the stream corridor where the relocation repositories might be incompatible with future residential or other land uses; (2) significantly less restriction on residential, agricultural (grazing, irrigating, etc.) land uses; (3) the amount of presently undisturbed land used for waste repositories would be significantly reduced or eliminated; (4) substantially reduced long-term monitoring and maintenance requirements; and (5) reduced lime requirements for the remedy. The agencies acknowledge the comments by ARCO and other supporters of a designated recreational use plan that a recreational corridor concept allows an implementable means of ensuring long-term monitoring and maintenance of numerous local repositories, thus addressing many of those concerns which led the agencies to propose a central repository. In light of the cost savings that can be achieved if the appropriate maintenance program can be established, as well as reduced short-term risk impacts on local communities during construction, the agencies believe use of numerous local repositories will be more cost effective.

Consequently, the agencies are including in the final remedial action plan the use of local relocation repositories rather than a central repository, if it can be demonstrated that adequate space for such repositories is available outside of the CH2M Hill (1989a) floodplain and that the long-term maintenance and monitoring of such repositories can be ensured through a properly designed and adequately funded institutional controls program.

The cost savings which could be obtained by the changes from the proposed plan (MDEQ, 1995a) remedy is estimated at $15,000,000 - $20,000,000. The savings achieved by this remedial action plan, will allow full funding of the institutional controls/management and monitoring plan, through establishment of a designated recreational use plan, and still provide substantial cost savings in the implementation of the remedy.

The remedial action plan will still incorporate the removal of tailings/impacted soils, contaminated instream sediments and certain railroad bed materials from the floodplain, except in those specific locations where such materials can be adequately protected in place and treated with the STARS technology to prevent further migration of the contaminants. The agencies believe that the final remedial action plan, as described, including the utilization of several local repositories, if appropriate, can be implemented in a manner that provides protection of the public health, safety, welfare and the environment and attains legally applicable or relevant and appropriate requirements. This change also takes into account the Butte-Silver Bow and Anaconda-Deer Lodge Counties' desire for a recreational land use plan for the Silver Bow Creek corridor.

Based on these concerns the agencies have revised the preferred remedy to a **modified Alternative 5** as delineated in the Feasibility Study and proposed plan (MDEQ, 1995a). This change in repository locations does not substantially reduce the protectiveness of the remedy. When implemented correctly, the modified Alternative 5 will be protective of human health and the environment. The differences between the final remedial action plan and the proposed plan are as follows:

- All removed materials will be placed in local relocation repositories and fully treated by the STARS technology in two foot lifts. These repositories will be located safely outside of the 100-year floodplain as delineated by CH2M Hill (1989a), and will be monitored and maintained as part of an institutional controls, monitoring and maintenance program for the Silver Bow Creek corridor.

- Although the specific volumes of tailings/impacted soils to meet the protectiveness criteria will be determined by the agencies during remedial design re-evaluation of the site data have indicated that less excavation than that proposed will be necessary. The approximate volumes have been slightly adjusted to take into account the 50,000 cy removed at the Demonstration Projects in Subarea 4 and to allow for implementation of in-situ STARS treatment for an additional 170,000 cy in Subarea 4.

- Constructed wetlands are designated as the end land use for Subarea 1. After removal of all identified contaminant sources, reconstruction of the Subarea will be designed to incorporate use of the area as wetlands. Constructed wetlands in this area may be used as a treatment system for nutrients and/or metals from upstream, if such treatment is ultimately determined to be appropriate in this area.

- The requirements for removal of instream sediments has been specified that fine-grained ($\leq$1mm) sediments in all depositional areas (regardless of size) will be removed.

- The volume of railroad bed materials to be excavated or treated has been estimated more precisely to include only those materials directly impacting Silver Bow Creek at bridge abutments or along the stream bank.

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APPENDIX A

IDENTIFICATION AND DESCRIPTION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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IDENTIFICATION AND DESCRIPTION OF
APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

STREAMSIDE TAILINGS OPERABLE UNIT
SILVER BOW CREEK/BUTTE ADDITION NPL SITE

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November 1995

TABLE OF CONTENTS

LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency of Toxic Substances and Disease Registry
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BPCTCA	Best Practicable Control Technology Currently Available
BPJ	Best Professional Judgment
BTCA	Best Technology Currently Available
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DNRC	Department of Natural Resources and Conservation (Montana)
DSL	Department of State Lands (Montana)
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
HWM	Hazardous Waste Management
LNAPL	Light Non-aqueous Phase Liquid
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDEQ	Montana Department of Environmental Quality
MGWPCS	Montana Groundwater Pollution Control System
MPDES	Montana Pollutant Discharge Elimination System
NCP	National Contingency Plan
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NPL	National Priorities List
NPDES	National Pollutant Discharge Elimination System
PAH	Polynuclear Aromatic Hydrocarbon
PCP	Pentachlorophenol
POHC	Principal Organic Hazardous Constituents
POTW	Public Owned Treatment Works
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SHPO	State Historic Preservation Officer (Montana)
SIP	State Implementation Plan
TBC	To Be Considered
TU	Turbidity Unit
UIC	Underground Injection Control

INTRODUCTION

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), certain provisions of the current National Contingency Plan (the NCP), 40 CFR Part 300 (1990), and guidance and policy issued by the Environmental Protection Agency (EPA) require that remedial actions taken pursuant to Superfund authority shall require or achieve compliance with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations from state environmental and facility siting laws, and from federal environmental laws at the completion of the remedial action, and/or during the implementation of the remedial action, unless a waiver is granted. These requirements are threshold standards that any selected remedy must meet. See Section 121(d)(4) of CERCLA, 42 U.S.C. § 9621(d)(4); 40 CFR § 300.430(f)(1). EPA calls standards, requirements, criteria, or limitations identified pursuant to section 121(d) "ARARs," or applicable or relevant and appropriate requirements.

ARARs are either applicable or relevant and appropriate. Applicable requirements are those standards, requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are those standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances found at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site such that their use is well suited to the particular site. Factors which may be considered in making this determination are presented in 40 CFR § 300.400(g)(2). Compliance with both applicable and relevant and appropriate requirements is mandatory.[1]

Each ARAR or group of related ARARs is identified by a specific statutory or regulatory citation, a classification describing whether the ARAR is applicable or relevant and appropriate, and a description which summarizes the requirements, and addresses how and when compliance with the ARAR will be measured (some ARARs will govern the conduct of the remedial action, some will define the measure of success of the remedial action, and some will do both).[2] The descriptions given here are provided to allow the reader a reasonable understanding of each requirement without having to refer constantly to the statute or regulation itself and to provide an explanation of how the requirement is to be applied in the specific circumstances involved at this operable unit.

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1 See CERCLA Section 121(d)(2)(A), 42 U.S.C. Section 9621(d)(2)(A).

2 40 CFR Section 300.435(b)(2); Preamble to the Proposed NCP, 53 Fed. Reg. 51440 (December 21, 1988); Preamble to the Final NCP, 55 Fed. Reg. 8755-8757 (March 8, 1990). The Atlantic Richfield Company (ARCO), an identified potentially responsible party for this operable unit, argues that the NCP's application of ARARs during the remedial action is not consistent with the CERCLA statute. However, ARCO did not challenge the NCP in the District of Columbia Court of Appeals in a timely manner, and therefore has waived the right to assert this argument. See Section 113(a) of CERCLA, 42 U.S.C. Section 9613(a).

Also contained in this list are policies, guidance and other sources of information which are "to be considered" in the selection of the remedy and implementation of the record of decision (ROD). Although not enforceable requirements, these documents are important sources of information which EPA and the State of Montana Department of Environmental Quality (MDEQ) may consider during selection of the remedy, especially in regard to the evaluation of public health and environmental risks; or which will be referred to, as appropriate, in selecting and developing cleanup actions.[3]

Finally, this list contains a non-exhaustive list of other legal provisions or requirements which should be complied with during the implementation of the ROD.

ARARs are divided into contaminant specific, location specific, and action specific requirements, as described in the NCP and EPA guidance. Contaminant specific ARARs are listed according to specific media and govern the release to the environment of specific chemical compounds or materials possessing certain chemical or physical characteristics. Contaminant specific ARARs generally set health or risk based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.

Location specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs generally relate to the geographic location or physical characteristics or setting of the site, rather than to the nature of the site contaminants.

Action specific ARARs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous substances.

Only the substantive portions of the requirements are ARARs.[4] Administrative requirements are not ARARs and thus do not apply to actions conducted entirely on-site. Administrative requirements are those which involve consultation, issuance of permits, documentation, reporting, recordkeeping, and enforcement. The CERCLA program has its own set of administrative procedures which assure proper implementation of CERCLA. The application of additional or conflicting administrative requirements could result in delay or confusion.[5] Provisions of statutes or regulations which contain general goals that merely express legislative intent about desired outcomes or conditions but are non-binding are not ARARs.[6]

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3 40 CFR Section 300.400(g)(3); 40 CFR Section 300.415(i); Preamble to the Final NCP, 55 Fed. Reg. 8744-8746 (March 8, 1990).

4 40 CFR Section 300.5. See also Preamble to the Final NCP, 55 Fed. Reg. 8756-8757 (March 8, 1990).

5 Preamble to the Final NCP, 55 Fed. Reg. 8756-8757 (March 8, 1990); Compliance with Other Laws Manual, Vol. I, pp. 1-11 through 1-12.

6 Preamble to the Final NCP, 55 Fed. Reg. 8746 (March 8, 1990).

Many requirements listed here are promulgated as identical or nearly identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by EPA and the states, such as the requirements of the federal Clean Water Act and the Montana Water Quality Act. The preamble to the new NCP states that such a situation results in citation to the state provision as the appropriate standard, but treatment of the provision as a federal requirement. ARARs and other laws which are unique to state law are identified separately by the State of Montana.

This document constitutes MDEQ's and EPA's formal identification and detailed description of ARARs for remedial action at the Streamside Tailings Operable Unit. This ARARs analysis is based on section 121(d) of CERCLA, 42 U.S.C. § 9621(d); CERCLA Compliance with Other Laws Manual, Volumes I and II, OSWER Dirs. 9234.1-01 and-02 (August 1988 and August 1989 respectively); various CERCLA ARARs Fact Sheets issued as OSWER Directives; the Preamble to the Proposed NCP, 53 Fed. Reg. 51394 et seq. (December 21, 1988); the Preamble to the Final NCP, 55 Fed. Reg. 8666-8813 (March 8, 1990); the Final NCP, 40 CFR Part 300 (55 Fed. Reg. 8813-8865, March 8, 1990), and the substantive provisions of law discussed in this document.

FEDERAL ARARS

I. FEDERAL CONTAMINANT SPECIFIC REQUIREMENTS

A. Groundwater Standards - Safe Drinking Water Act (Relevant and Appropriate)[7]

The National Primary Drinking Water Standards (40 CFR Part 141), better known as maximum contaminant levels and maximum contaminant level goals (MCLs and MCLGs), are not applicable to the Streamside Tailings Operable Unit area because the aquifer underlying the area is not a current public water system, as defined in the Safe Drinking Water Act, 42 U.S.C. § 300f(4). These standards are relevant and appropriate standards, however, because the groundwater in the area is a potential source of drinking water. Groundwater use through private wells occurs in the area, and some of the groundwater in the area is a current source of drinking water. In addition, the aquifer discharges to Silver Bow Creek, which is designated as a potential drinking water source. Since Silver Bow Creek is also a potential source of drinking water, these standards are relevant and appropriate for that surface water as well.

Use of these standards for this action is fully supported by EPA regulations and guidance. The Preamble to the NCP clearly states that MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water (55 Fed. Reg. 8750, March 8, 1990), and this determination is further supported by requirements in the regulations governing conduct of RI/FS studies found at 40 CFR § 300.430(e)(2)(i)(B). EPA's guidance on Remedial Action for Contaminated Groundwater at Superfund Sites states that "MCLs developed under the Safe Drinking Water Act generally are ARARs for current

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[7] 42 U.S.C. Sections 300f et seq.

or potential drinking water sources." MCLGs which are above zero are relevant and appropriate under the same conditions (55 Fed. Reg. 8750-8752, March 8, 1990). See also, State of Ohio v. EPA, 997 F.2d 1520 (D.C. Cir. 1993), which upholds EPA's application of MCLs and non-zero MCLGs as ARAR standards for groundwater which is a potential drinking water source.

As noted above, standards such as the MCL and MCLG standards are promulgated pursuant to both federal and state law. Currently, none of the State MCL's is more stringent than the corresponding federal MCL.

Chemical	MCLG	MCL
Arsenic	N.A.[8]	0.05 milligrams per liter (mg/l)[9]
Cadmium	0.005 mg/l[10]	0.005 mg/l[11]
Copper	1.3 mg/l[12]	1.3 mg/l[13]
Lead	N.A.[14]	0.015 mg/l[15]
Mercury	0.002 mg/l[16]	0.002 mg/l[17]

These standards incorporate applicable Resource Conversation and Recovery Act (RCRA) standards for groundwater found at 40 CFR Part 264, Subpart F, which is incorporated pursuant to state law at ARM 16.44.702. The RCRA standards are the same or less stringent than the MCLs or MCLGs identified above.

B. Surface Water - Ambient Standards and Point Source Discharges.

CERCLA and the NCP provide that federal water pollution criteria that match designated or anticipated surface water uses are the usual surface water standards to be used at Superfund cleanups, as relevant and appropriate standards, unless the state has promulgated surface water quality standards pursuant to the delegated state water quality act. The State of

8 The MCLG for arsenic is zero, which is not considered appropriate for Superfund site cleanups.

9 40 CFR § 141.11, 60 Fed. Reg. 33926 (June 29, 1995).

10 40 CFR § 141.51

11 40 CFR § 141.62.

12 40 CFR § 141.51

13 40 CFR § 141.80(c). The requirement is an action level rather than a simple numerical standard.

14 The MCLG for lead is zero, which is not considered appropriate for Superfund site cleanups.

15 40 CFR § 141.80(c), which establishes an action level rather than a pure numerical standard.

16 40 CFR § 141.51.

17 40 CFR § 141.62.

Montana has designated uses for Silver Bow Creek and the Clark Fork River, and has promulgated specific standards accordingly. Those standards and their application to the Streamside Tailings Operable Unit, as well as other surface water standards, are included in the state ARARs identified below. These standards will be applied to all contaminants of concern identified in the Streamside Tailings Operable Unit remedial investigation, both to point sources retained or created by the Streamside Tailings cleanup and to ambient water in the Streamside Tailings Operable Unit.

C. Air Standards - Clean Air Act (Applicable)

Limitations on air emissions resulting from cleanup activities or emissions resulting from wind erosion of exposed hazardous substances are set forth in the action specific requirements, below.

II. FEDERAL LOCATION SPECIFIC REQUIREMENTS

A. Fish and Wildlife Coordination Act (Applicable)

These standards are found at 16 U.S.C. §§ 661 et seq. and 40 CFR § 6.302(g). They require that federally funded or authorized projects ensure that any modification of any stream or other water body affected by a funded or authorized action provide for adequate protection of fish and wildlife resources. Compliance with this ARAR necessitates consultation with the U.S. Fish and Wildlife Service (USFWS) and the State of Montana Department of Fish, Wildlife, and Parks. Further consultation with these agencies will occur during cleanup selection and implementation, and specific mitigative or other measures may be identified to achieve compliance with this ARAR.

B. Floodplain Management Order (Applicable)

This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11,988) mandates that federally funded or authorized actions within the 100 year flood plain avoid, to the maximum extent possible, adverse impacts associated with development of a floodplain. Compliance with this requirement is detailed in EPA's August 6, 1985 "Policy on Floodplains and Wetlands Assessments for CERCLA Actions." Specific measures to minimize adverse impacts may be identified following consultation with the appropriate agencies.

If the remedial action selected for the Streamside Tailings Operable Unit is found to potentially affect the floodplain, the following information will be produced: a Statement of Findings which will set forth the reasons why the proposed action must be located in or affect the floodplain; a description of significant facts considered in making the decisions to locate in or affect the floodplain or wetlands including alternative sites or actions; a statement indicating whether the selected action conforms to applicable state or local floodplain protection standards; a description of the steps to be taken to design or modify the proposed action to minimize the potential harm to or within the floodplain; and a statement indicating how the proposed action affects the natural or beneficial values of the floodplain.

C. Protection of Wetlands Order (Applicable)

This requirement (40 CFR Part 6, Appendix A, Executive Order No. 11,990) mandates that federal agencies and potentially responsible parties (PRPs) avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Section 404(b)(1), 33 U.S.C. § 1344(b)(1), also prohibits the discharge of dredged or fill material into waters of the United States. (See also section III.D below.) Together, these requirements create a "no net loss" of wetlands standard.

Compliance with this ARAR will be achieved through consultation with the U.S. Fish and Wildlife Service and the U.S. Corp of Engineers, to determine the existence and category of wetlands present at the site, and any avoidance or mitigation and replacement which may be necessary. ARCO, USFWS, and EPA have established a protocol for addressing these issues during the RI/FS process.

D. The Endangered Species Act (Applicable)

This statute and implementing regulations (16 U.S.C. §§ 1531 - 1543, 50 CFR Part 402, and 40 CFR § 6.302(h)) require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.

Compliance with this requirement involves consultation with USFWS, and a determination of whether there are listed or proposed species or critical habitats present in the Streamside Tailings Operable Unit, and, if so, whether any proposed activities will impact such wildlife or habitat.

E. The National Historic Preservation Act (Applicable)

This statute and implementing regulations (16 U.S.C. § 470, 40 CFR § 6.310(b), 36 CFR Part 800) require federal agencies or federal projects to take into account the effect of any federally assisted undertaking or licensing on any district, site building, structure, or object that is included in, or eligible for, the Register of Historic Places. If effects cannot be avoided reasonably, measures should be implemented to minimize or mitigate the potential effect. In addition, Indian cultural and historical resources must be evaluated, and effects avoided, minimized, or mitigated.

In order to comply with this ARAR, EPA, MDEQ, and the PRP may consult with the State Historic Preservation Officer (SHPO), who can assist in identifying listed or eligible resources, and in assessing whether proposed cleanup actions will impact the resources and any appropriate mitigative measures. Additionally, in April 1992, ARCO, EPA, MDEQ, SHPO, the National Council on Historic Preservation, and local governments entered into a Programmatic Agreement to ensure the appropriate consideration of cultural and historical resources in a systematic and comprehensive manner throughout the Clark Fork Basin, in connection with response actions at the four Clark Fork Basin Superfund sites. A Second Programmatic Agreement was agreed upon in September 1994. The results of the

Programmatic Agreements may provide additional consideration of the factors to be addressed under this ARAR, and the two historical ARARs described below.

F. Archaeological and Historic Preservation Act (Applicable)

The statute and implementing regulations (16 U.S.C. § 469, 40 CFR § 6.301(c)) establish requirements for evaluation and preservation of historical and archaeological data, including Indian cultural and historical resources, which may be destroyed through alteration of terrain as a result of federal construction projects or a federally licensed activity or program. If eligible scientific, prehistorical, or archaeological data are discovered during site activities, they must be preserved in accordance with these requirements.

G. Historic Sites, Buildings, and Antiquities Act (Applicable)

This requirement states that "in conducting an environmental review of a proposed EPA action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR § 62.6(d) to avoid undesirable impacts upon such landmarks. The Programmatic Agreement activities described above should aid all parties in compliance with this ARAR.

H. Migratory Bird Treaty Act (Applicable)

This requirement (16 U.S.C. §§ 703 et seq.) establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement.

I. Bald Eagle Protection Act (Applicable)

This requirement (16 U.S.C. §§ 668 et seq.) establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagle. Specific mitigative measures may be identified for compliance with this requirement.

J. Resource Conservation and Recovery Act (Relevant and Appropriate)

Any discrete waste units created or retained by the Streamside Tailings site cleanup must comply with the siting restrictions and conditions found at 40 CFR § 264.18(a) and (b). These sections require management units to be designed, constructed, operated, and maintained to avoid washout, because they are within or near the 100 year flood plain.

III. FEDERAL ACTION SPECIFIC REQUIREMENTS

A. Solid Waste (Applicable), Surface Mining Control and Reclamation (Relevant and Appropriate), and RCRA (Relevant and Appropriate) Requirements

The contamination at the Streamside Tailings Operable Unit is primarily mining waste from various man-made sources. For the purposes of this record of decision, EPA and the State have determined that these wastes are not RCRA hazardous waste, in accordance with 40 CFR § 261.4(b)(7) (the Bevill exemption), although certain RCRA hazardous waste requirements have been determined to be relevant and appropriate in the handling of these wastes. For any management (i.e., treatment, storage, or disposal) or removal or retention of that contamination, the following requirements are ARARs.

1. Requirements described at 40 CFR §§ 257.3-1(a), 257.3-3, and 257.3-4, governing waste handling, storage, and disposal, including retention of the waste, in general, and 40 CFR §§ 257.3-5, relating to precautions necessary to ensure that cadmium is not taken up into crops, including pasture grasses, that may enter the food chain.[18]

2. For any discrete waste units which are addressed by the Streamside Tailings cleanup, reclamation and closure regulations found at 30 CFR Parts 816 and 784, governing coal and to a lesser extent, non-coal mining, are relevant and appropriate requirements.[19]

3. RCRA regulations found at 40 CFR §§ 264.116 and .119 (governing notice and deed restrictions), 264.228(a)(2)(i) (addressing de-watering of wastes prior to disposal), and 264.228(a)(2)(iii)(B), (C), and (D) and .251(c), (d), and (f) (regarding run-on and run-off controls), are relevant and appropriate requirements for the waste management units created or retained at the Streamside Tailings Operable Unit.[20]

B. Air Standards - Clean Air Act (Applicable)

These standards, promulgated pursuant to section 109 of the Clean Air Act,[21] are applicable to releases into the air from any Streamside Tailings Operable Unit cleanup activities.

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[18] Solid Waste regulations are promulgated pursuant to the federal Solid Waste Disposal Act, as amended by the Resource Conversation and Recovery Act, 42 U.S.C. 6901 et seq. They are applicable regulations, although the State of Montana has the lead role in regulating solid waste disposal in the State of Montana.

[19] The Surface Mining Control and Reclamation Act is promulgated at 30 U.S.C. Sections 1201 - 1326.

[20] As noted earlier, federal RCRA regulations are incorporated by reference into applicable State Hazardous Waste Management Act regulations. See ARM 17.54.702. Use of select RCRA regulations to mining waste is appropriate when discrete units are addressed by a cleanup and site conditions are distinguishable from EPA's generic determination of low toxicity/high volume status for mining waste. See Preamble to the Final NCP, 55 Fed. Reg. 8763 - 8764 (March 8, 1990), CERCLA Compliance with Other Laws Manual, Volume II (August 1989 OSWER Dir. 9234.1-02) p. 6-4; Preamble to Proposed NCP, 53 Fed. Reg. 51447 (Dec. 21, 1988), and guidance entitled "Consideration of RCRA Requirements in Performing CERCLA Responses at Mining Wastes Sites," August 19, 1986 (OSWER).

[21] 42 U.S.C. §§ 7401 et seq.

1. Lead: No person shall cause or contribute to concentrations of lead in the ambient air which exceed 1.5 micrograms per cubic meter ($\mu g/m^3$) of air, measured over a 90-day average.

These standards are promulgated at ARM 16.8.815 as part of a federally approved State Implementation Plan (SIP), pursuant to the Clean Air Act of Montana, §§ 75-2-101 et seq., MCA. Corresponding federal regulations are found at 40 CFR § 50.12.[22]

2. Particulate matter that is 10 microns in diameter or smaller (PM-10): No person shall cause or contribute to concentrations of PM-10 in the ambient air which exceed:

   - 150 $\mu g/m^3$ of air, 24 hour average, no more than one expected exceedence per calendar year;

   - 50 $\mu g/m^3$ of air, annual average.

These regulations are promulgated at ARM 16.8.821 as part of a federally approved SIP, pursuant to the Clean Air Act of Montana, §§ 75-2-101 et seq., MCA. Corresponding federal regulations are found at 40 CFR § 50.6.

Ambient air standards under section 109 of the Clean Air Act are also promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the site in connection with any cleanup action, these standards would also be applicable. See ARM 16.8.811 and 40 CFR Part 50.

C. Point Source Controls - Clean Water Act (Applicable)

If point sources of water contamination are retained or created by any Streamside Tailings Operable Unit remediation activity, applicable Clean Water Act standards would apply to those discharges. The regulations are discussed in the contaminant specific ARAR section, above, and in the State of Montana identification of ARARs. These regulations would include storm water runoff regulations found at 40 CFR Parts 121, 122, and 125 (general conditions and industrial activity conditions). These would also include requirements for best management practices and monitoring found at 40 CFR §§ 122.44(i) and 440.148, for point source discharges.

[22] The ambient air standards established as part of Montana's approved State Implementation Plan in many cases provide more stringent or additional standards. The federal standards by themselves apply only to "major sources", while the State standards are fully applicable throughout the state and are not limited to "major sources". See ARM 16.8.808 and 16.8.811-.821. As part of an EPA-approved State Implementation Plan, the state standards are also federally enforceable. Thus, the state standards which are equivalent to the federal standards are identified in this section together. A more detailed list of State standards, which include standards which are not duplicated in federal regulations, is contained in the State ARAR identification section.

D. Dredge and Fill Requirements (Applicable)

Regulations found at 40 CFR Part 230 address conditions or prohibitions against depositing dredge and fill material into water of the United States. If remediation activities would result in an activity subject to these regulations, they would be applicable.

E. Underground Injection Control (Applicable)

Requirements found at 40 CFR Part 144, promulgated pursuant to the Safe Drinking Water Act, allow the re-injection of treated groundwater into the same formation from which it was withdrawn for aquifers such as the aquifer beneath the Streamside Tailings Operable Unit, and addresses injection well construction, operation, maintenance, and capping/closure. These regulations would be applicable to any reinjection of treated groundwater.

F. Transportation of Hazardous or Contaminated Waste (Relevant and Appropriate)

40 CFR Part 263 establishes regulations for the transportation of hazardous waste. These regulations would govern any on-site transportation of material. Any off-site transportation would be subject to applicable regulations.

STATE OF MONTANA ARARS

As provided by Section 121 of CERCLA, 42 U.S.C. § 9621, only those state standards that are more stringent than any federal standard and that have been identified by the state in a timely manner are appropriately included as ARARs. To be an ARAR, a state standard must be "promulgated," which means that the standards are of general applicability and are legally enforceable.

IV. MONTANA CONTAMINANT SPECIFIC REQUIREMENTS

A. Water Quality

1. Surface Water Quality Standards (Applicable)

Under the state Water Quality Act, §§ 75-5-101 et seq., MCA, the state has promulgated regulations to protect, maintain, and improve the quality of surface waters in the state. The requirements listed below are applicable water quality standards with which any remedial action must comply.

ARM 16.20.604(1)(b)(Applicable) provides that Silver Bow Creek (mainstem) from the confluence of Blacktail Deer Creek to Warm Springs Creek is classified "I" for water use.

The "I" classification standards are contained in ARM 16.20.623 (Applicable) of the Montana water quality regulations. This section states:

> [T]he goal of the state of Montana is to have these waters fully support the following uses: drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

These beneficial uses are considered supported when the concentrations of toxic, carcinogenic, or harmful parameters in these waters do not exceed the applicable standards specified in department Circular WQB-7 when stream flows equal or exceed the stream flows specified in ARM 16.20.631(4)(10-year 7-day low flow, i.e., minimum consecutive 7-day average flow which may be expected to occur on the average of once in 10 years). Alternatively, site-specific criteria may be developed using the procedures given in the Water Quality Standards Handbook (US EPA, Dec. 1983), provided that other routes of exposure to toxic parameters by aquatic life are addressed.[23] These standards set the contaminant specific requirement for ambient water quality in the stream.

To allow a gradual attainment of these requirements in already impacted streams, the I classification allows point source discharges to be permitted at the higher concentration of (1)

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[23] Such other routes of exposure in this operable unit would include, for example, contaminated sediment/food chain routes of exposure. In any event, no site specific standards have been developed for Silver Bow Creek, as of the issuance of the record of decision, and consequently the applicable numeric standards are those set forth in WQB-7.

the applicable standards specified in department Circular WQB-7, (2) the site-specific standards, or (3) one-half of the mean instream concentrations[24] immediately upstream of the discharge point. This effectively requires eventual attainment of the Circular WQB-7 levels in the stream, while allowing consideration of the current, impacted stream quality (a graduated reduction of point source discharge concentrations based on the mean instream concentration where the stream is substantially degraded). As the quality of the stream improves due to control of other sources, including cleanup of non-point source areas, point source dischargers must improve the quality of their discharges down to the instream standards (either WQB-7 or, for aquatic life only, site specific standards).

With respect to the remediation of non-point sources, the WQB-7 standards effectively set the ambient water quality standards that are to be attained by the remedial action. As an ambient standard, the point of compliance for these standards would be throughout the stream, and compliance should be measured by monitoring at several different points within the stream, as determined by any significant point sources or significant reaches of non-point sources.

For the primary contaminants of concern, the WQB-7 levels are listed below. WQB-7 provides that "whenever both Aquatic Life Standards and Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the numeric Surface Water Quality Standard."

Chemical	WQB-7 Standard
Arsenic	18 μg/l[25]
Cadmium	1.1 μg/l[26]
Copper	12 μg/l[27]
Lead	3.2 μg/l[28]
Mercury	0.012 μg/l[29]

I classification standards also include the following criteria:

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24 Mean instream concentration is the monthly mean instream concentration, as defined by the MDHES Water Quality Bureau.

25 Human Health Standard. The acute and chronic Aquatic Life Standards are 360 μg/l and 190 μg/l, respectively.

26 Chronic Aquatic Life Standard based on 100 mg/l hardness ($CaCO_3$). The method for adjusting the standard for water hardness is provided in WQB-7. See Detailed Note of Explanation 12 in Circular WQB-7. In no event can the level for cadmium exceed the human health standard of 5 μg/l.

27 Chronic Aquatic Life Standard based on 100 mg/l hardness. See Detailed Note of Explanation 12 in Circular WQB-7.

28 Chronic Aquatic Life Standard based on 100 mg/l hardness. See Detailed Note of Explanation 12 in Circular WQB-7. In no event can the level for lead exceed the human health standard at 15 μg/l.

29 Chronic Aquatic Life Standard. The human health standard for mercury is 0.14 μg/l.

1. Dissolved oxygen concentration must not be reduced below 3.0 milligrams per liter.

2. Hydrogen ion concentration (Ph) must be maintained within the range of 6.5 to 9.5.

3. No increase in naturally occurring turbidity, temperature, concentrations of sediment and settleable solids, oils, floating solids, or true color is allowed which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife.

4. No discharges of toxic, carcinogenic, or harmful parameters may commence or continue which lower or are likely to lower the overall water quality of these waters.

Additional restrictions on any discharge to surface waters are included in:

ARM 16.20.633 (Applicable), which prohibits discharges containing substances that will:

(a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
(b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;
(c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
(d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life;
(e) create conditions which produce undesirable aquatic life.

ARM 16.20.925 (Applicable), which adopts and incorporates the provisions of 40 C.F.R. Part 125 for criteria and standards for the imposition of technology-based treatment requirements in MPDES permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, i.e., for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). <u>See</u> CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7.

Applicable for both surface water and ground water, § 75-5-605, MCA, provides that it is unlawful to cause pollution as defined in 75-5-103 of any state waters or to place or cause to be placed any wastes where they will cause pollution of any state waters.

Section 75-5-308, MCA, allows DEQ to grant short-term exemptions from the water quality standards or short-term use that exceeds the water quality standards for the purpose of allowing certain construction or emergency environmental remediation activities. Such exemptions typically extend for a period of 30-60 days. However, any exemption must include conditions that minimize to the extent possible the magnitude of the violation and the length of time the violation occurs. In addition, the conditions must maximize the protection of state waters by ensuring the maintenance of beneficial uses immediately after termination of the exemption. Water quality and quantity monitoring and reporting may also be included as conditions.

2. Groundwater Pollution Control System (Applicable)

In addition to the standards set forth below, relevant and appropriate MCLs and MCLGs are included in the federal ARARs identified above.

ARM 16.20.1002 (Applicable) classifies groundwater into Classes I through IV based on the present and future most beneficial uses of the groundwater, and states that groundwater is to be classified according to actual quality or actual use, whichever places the groundwater in a higher class. Class I is the highest quality class; class IV the lowest. Based upon its specific conductance, the great majority of the groundwater in the Streamside Tailings Operable Unit should be considered Class I groundwater, with the remainder of the groundwater Class II.[30]

ARM 16.20.1003 (Applicable) establishes the groundwater quality standards applicable with respect to each groundwater classification. Concentrations of dissolved substances in Class I or II groundwater (or Class III groundwater which is used as a drinking water source) may not exceed the human health standards listed in department Circular WQB-7. For the primary contaminants of concern these levels are listed below. Levels that are more stringent than the MCL or MCLG identified in the federal portion of the ARARs are set out in **boldface** type.

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[30] ARM 16.20.1002 provides that Class I groundwaters have a specific conductance of less than 1000 micromhos per centimeter at 25° C; Class II groundwaters: 1000 to 2500; Class III groundwaters: 2500 to 15,000; and Class IV groundwaters: over 15,000. The groundwater in the operable unit generally ranges from 298 to 3245 micromhos/cm, with the majority of the wells testing well below 1000. See 1991 Remedial Investigation Activities Data Summary Report, Table 11 (ARCO, August 1993); Final 1992 Data Summary Report, Table 15 (ARCO. September 1994)(showing a range of 331-2092 μmhos/cm).

At the uppermost level of the aquifer, in those locations where the groundwater is in contact with a contaminant source, there are areas that have specific conductance greater than 2500 μmhos/cm. However, the groundwater in this aquifer generally is of Class I quality, with the areas of greater specific conductance constituting discrete areas of contamination. For purposes of applying these standards in this action, the classification of the groundwater in the area should be based on the quality of the groundwater generally, rather than the specific areas of contamination.

In addition, classification of the groundwater is based on actual quality or actual use as of October 29, 1982. See ARM 16.20.1002(3). Considering the history of contamination at the site, there is no reason to assume that the quality of this ground water in 1982 would have been other than Class I or II.

Chemical	WQB-7 Human Health Standard
Arsenic	**18 μg/l**
Cadmium	5 μg/l
Copper	**1000 μg/l**
Lead	15 μg/l
Mercury	**0.14 μg/l**

Concentrations of other dissolved or suspended substances must not exceed levels that render the waters harmful, detrimental or injurious to public health. Maximum allowable concentration of these substances also must not exceed acute or chronic problem levels that would adversely affect existing or designated beneficial uses of groundwater of that classification. ARM 16.20.1003 specifies certain references that may be used as a guide in determining problem levels unless local conditions make these values inappropriate.

An additional concern with respect to ARARs for groundwater is the impact of groundwater upon the surface water. If significant loadings of contaminants from groundwater sources to Silver Bow Creek contribute to the inability of the stream to meet the I class standards (i.e., the WQB-7 levels described in the Surface Water section above), then alternatives to alleviate such groundwater loading must be evaluated and, if appropriate, implemented. Groundwater in certain areas may need to be remediated to levels more stringent than the groundwater classification standards for certain parameters in order to achieve the standards for affected surface water. See Compliance with Federal Water Quality Criteria, OSWER Publication 9234.2-09/FS (June 1990)("Where the ground water flows naturally into the surface water, the ground-water remediation should be designed so that the receiving surface-water body will be able to meet any ambient water-quality standards (such as State WQSs or FWQC) that may be ARARs for the surface water.")

The 1995 Montana Legislature enacted several revisions to the Montana Water Quality Statutes. Except as reflected in the analysis above, none of these changes has altered the application of these water quality requirements to the Streamside Tailings Operable Unit. One bill exempted from the permit requirements certain discharges from a water conveyance structure or certain groundwater discharged to surface water, but these exemptions do not apply if the discharged water contains "industrial waste." See § 75-5-401, MCA, as amended. "Industrial waste" means a waste substance from the process of business or industry or from the development of any natural resource..." § 75-5-103(10), MCA. Since the contamination found in the water in this operable unit is industrial waste, these new exemptions would not apply here.

B. Air Quality

In addition to the standards identified in the federal action specific ARARs above, the State of Montana has identified certain air quality standards in the action specific section of the State ARARs below.

V. MONTANA LOCATION SPECIFIC REQUIREMENTS

A. Floodplain and Floodway Management Act and Regulations (Applicable)

The Floodplain and Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway[31] and floodplain.[32] Since the SST Operable Unit lies primarily within the 100-year floodplain of Silver Bow Creek, these standards are applicable to all actions contemplated for this operable unit.

1. Allowed uses

The law recognizes certain uses as allowable in the floodway and a broader range of uses as allowed in the floodplain. Residential use is among the possible allowed uses expressly recognized in both the floodway and floodplain. "Residential uses such as lawns, gardens, parking areas, and play areas," as well as certain agricultural, industrial-commercial, recreational and other uses are permissible within the designated floodway, provided they do not require structures other than portable structures, fill or permanent storage of materials or equipment. § 76-5-401, MCA; ARM 36.15.601 (Applicable). In addition, in the flood fringe (i.e., within the floodplain but outside the floodway), residential, commercial, industrial, and other structures may be permitted subject to certain conditions relating to placement of fill, roads, floodproofing, etc. § 76-5-402, MCA; ARM 36.15.701 (Applicable). Domestic water supply wells may be permitted, even within the floodway, provided the well casing is watertight to a depth of 25 feet and the well meets certain conditions for floodproofing, sealing, and positive drainage away from the well head. ARM 36.15.602(6).

2. Prohibited uses

Uses prohibited anywhere in either the floodway or the floodplain are:

1. solid and hazardous waste disposal; and
2. storage of toxic, flammable, hazardous, or explosive materials.

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[31] The "floodway" is the channel of a watercourse or drainway and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge the floodwater of the watercourse or drainway. ARM 36.15.101(13).

[32] The "floodplain" is the area adjoining the watercourse or drainway which would be covered by the floodwater of a base (100-year) flood except for sheetflood areas that receive less than one foot of water per occurrence. The floodplain consists of the floodway and flood fringe.

ARM 36.15.605(2) and 36.15.703 (Applicable[33]); see also ARM 36.15.602(5)(b) (Applicable).

In the floodway, additional prohibitions apply, including prohibition of:

1. a building for living purposes or place of assembly or permanent use by human beings;

2. any structure or excavation that will cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway; and

3. the construction or permanent storage of an object subject to flotation or movement during flood level periods.

§ 76-5-402, MCA (Applicable).

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[33] One commenter asserted that these regulations are not applicable to the SST OU. MDEQ has evaluated these arguments and has still determined that these are applicable requirements. Under the NCP, 40 CFR § 300.400(g)(1), MDEQ must make an "objective determination of whether the requirement specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found" at the site. MDEQ has made the determination here that these requirements specifically address the hazardous substances and location involved and are applicable legal requirements. While these prohibitions are applicable requirements, exactly how these prohibitions apply to specific mining wastes being addressed in this operable unit and the manner in which these prohibitions apply to specific actions requires some analysis. The floodplain management regulations include a version of this prohibition in three different provisions. ARM 36.15.605(2) and 36.15.703, applicable to the floodway and the flood fringe, respectively, state this prohibition generally as noted above. ARM 36.15.602(5)(b), applicable to the floodway, allows storage of materials and equipment under certain conditions, but provides "Storage of flammable, toxic, or explosive materials shall not be permitted."

Neither the regulations nor the Floodplain Management Act defines the terms disposal, storage, solid waste, hazardous waste, toxic materials or hazardous materials. In most contexts, the regulations are clear enough, by their plain meaning, to be easily implementable. As applied to the specific circumstances at this operable unit, however, these terms require some interpretation. This interpretation is further complicated by the fact that at least a substantial part of the tailings deposited along Silver Bow Creek can be assumed to have been deposited before the effective date of the regulations here. Thus the initial disposal of these materials does not constitute a violation of the regulations. However, as discussed in footnote 36, below, actions taken to actively manage these materials as part of the remedial action effectively trigger applicability of such requirements in certain circumstances.

These issues are discussed more fully in the responsiveness summary portion of the record of decision, in response to comments submitted by the Atlantic Richfield Company regarding ARARs issues. Summarized here, the department's analysis has determined that the tailings and mining wastes in the SST OU are included in the term solid wastes, as well as the terms toxic materials or hazardous materials, and that the prohibition on the disposal or storage of those wastes/materials within the floodplain applies to actions which constitute the active management/disposal of those wastes as part of the remedial action. The agencies further note that, if there were some jurisdictional prerequisite which were technically not met for applicability, the requirements identified here would be relevant and appropriate requirements as described for this remedial action. In such case, the agencies would apply these requirements as relevant and appropriate considering the factors set forth at 40 CFR § 300.400(g)(2)(i) through (viii).

Finally, in the record of decision, MDEQ and EPA invoke a waiver of this requirement under section 121(d)(4)(D) of CERCLA, 42 USC § 9621(d)(4)(D), to allow the remedial action, under certain conditions, to incorporate certain actions that will attain a standard of performance that is equivalent to that required under the prohibitions described above. The analysis of the ARAR waiver and the conditions on which the agencies have determined that equivalent standard of performance can be attained are set out in the Decision Summary portion of the record of decision.

3. <u>Applicable considerations in use of floodplain or floodway</u>

Applicable regulations also specify factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway. Many of these requirements are set forth as factors that must be considered in determining whether a permit can be issued for certain obstructions or uses. While permit requirements are not directly applicable to remedial actions conducted entirely on site, the substantive criteria used to determine whether a proposed obstruction or use is permissible within the floodway or floodplain are applicable standards. Factors which must be considered in addressing any obstruction or use within the floodway or floodplain include:

1. the danger to life and property from backwater or diverted flow caused by the obstruction or use;

2. the danger that the obstruction or use will be swept downstream to the injury of others;

3. the availability of alternate locations;

4. the construction or alteration of the obstruction or use in such a manner as to lessen the danger;

5. the permanence of the obstruction or use; and

6. the anticipated development in the foreseeable future of the area which may be affected by the obstruction or use.

<u>See</u> § 76-5-406, MCA; ARM 36.15.216 (Applicable, substantive provisions only). Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

1. the proposed activity, construction, or use cannot increase the upstream elevation of the 100-year flood a significant amount (½ foot or as otherwise determined by the permit issuing authority) or significantly increase flood velocities, ARM 36.15.604 (Applicable, substantive provisions only); and

2. the proposed activity, construction, or use must be designed and constructed to minimize potential erosion.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

Excavation of material from pits or pools - ARM 36.15.602(1).

Water diversions or changes in place of diversion - ARM 36.15.603.

Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) - ARM 36.15.606.

Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights) - ARM 36.15.701(3)(c).

Structures and facilities for liquid or solid waste treatment and disposal (must be floodproofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with MDEQ regulations, which include certain additional prohibitions on such disposal) - ARM 36.15.701(3)(d).

Residential structures - ARM 36.15.702(1).

Commercial or industrial structures - ARM 36.15.702(2).

B. Solid Waste Management Regulations (Applicable)

Regulations promulgated under the Solid Waste Management Act, §§ 75-10-201 et seq., MCA, specify requirements that apply to the location of any solid waste management facility.[34] Under ARM 17.50.505 (formerly 16.14.505)(Applicable), a facility for the treatment, storage or disposal of solid wastes:[35]

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[34] These requirements apply, inter alia, to the treatment, storage, or disposal of solid waste. See ARM 16.14.502(17).

[35] The solid waste regulations are applicable to the wastes at issue in this operable unit, which consist of mining wastes, primarily tailings, which have been washed downstream and deposited along Silver Bow Creek for many years. Section 75-10-203(11) provides:

> (a) "Solid waste" means all putrescible and nonputrescible wastes, including but not limited to garbage; rubbish; refuse; ...
>
> (b) Solid waste does not mean municipal sewage, industrial wastewater effluents, mining wastes regulated under the mining and reclamation laws administered by the department of environmental quality, slash and forest debris regulated under laws administered by the department of natural resources and conservation, or marketable byproducts."

As noted, "solid waste" does not include "mining wastes regulated under the mining and reclamation laws administered by the Department of Environmental Quality," see § 75-10-203(11), MCA, as amended by Chapter 418, Laws of Montana 1995. However, the mining wastes found in the Streamside Tailings Operable Unit are not regulated under the mining and reclamation laws administered by the Department of Environmental Quality, because they are not part of any current mining permit or mine reclamation plan.

One commenter argued that "mining wastes are specifically excluded from the definition of 'solid waste.'" This argument may be read as an assertion that the exemption of "mining wastes regulated under the mining and reclamation laws" is broad enough to cover all mining wastes. However, both the plain meaning of the language and other principles of statutory construction weigh against such an interpretation. The words "regulated under the mining and reclamation laws" suggest actual regulation rather than a categorical exclusion of all mining wastes whether specific wastes are actually regulated or not. Where this statute provides a categorical exclusion, it does so in clear categorical language, without the qualification "regulated under ..." For example, the statute categorically exempts "municipal sewage" and "industrial wastewater effluents" without any such qualification.

(a) must be located where a sufficient acreage of suitable land is available for solid waste management;

(b) may not be located in a 100-year floodplain;[36]

The commenter's interpretation of the statute would render the words "regulated under ..." superfluous, in contravention of accepted principles of statutory construction. Moreover, an apparent purpose for the exemption is to avoid duplicative or conflicting regulation of the wastes, which would occur only in the event the wastes were actually subject to both sets of regulations. The language of the statute is not ambiguous, and under the plain meaning of the provision the exemption of mining wastes should be viewed as limited to those wastes which are actually regulated under the mining and reclamation laws. The mining wastes being addressed in this operable unit are not so regulated, and thus are not within this exemption from solid waste regulations.

36 The application of this requirement to certain alternatives considered in the SST OU remedy selection requires some clarification. This regulation was promulgated in the 1970's, and for purposes of this determination, the initial "disposal" of these wastes in the SSTOU can be assumed to have occurred before promulgation of the regulation. Thus as these wastes lie in the ground, no one would be required to remove them in order to comply with the solid waste regulations. However, compliance with such regulations is required if any action taken with respect to such wastes constitutes "active management" of those wastes. EPA has interpreted "active management" as "physically disturbing accumulated wastes within a management unit ..." See, e.g., 57 Fed. Reg. 37298 (August 18, 1992), 54 Fed. Reg. 36597 (September 1, 1989).

Effectively, any "active management" is to be regarded as constituting a new "disposal" of these solid wastes, triggering applicability of the state solid waste regulations, including the prohibition on disposing solid wastes in the floodplain. As applied to the alternatives being considered for the SSTOU, either excavating and placing the wastes in a repository or applying STARS treatment in situ, which consists of tilling lime-based amendments into the tailings in place, would constitute "active management" of the wastes. Thus treating floodplain wastes in place in this manner would not comply with the prohibition on storage or disposal of these wastes within the floodplain, and an ARAR waiver would be required for this alternative.

One commenter has asserted that disposal does not occur where waste is consolidated within a unit, waste is capped in place, including grading prior to capping, or waste is treated in situ. This argument derives from discussion in the CERCLA Compliance with Other Laws Manual: Interim Final (August 1988), p. 2-16. However, this discussion in the manual relates to "land disposal" or "placement" of wastes under RCRA Subtitle C (hazardous waste) and land ban rules, referred to in the manual as "placement/disposal."

A distinction must be made between RCRA's broad jurisdictional definition of "disposal," which is virtually identical to the state's broad definition of disposal, and the specific type of disposal triggering certain RCRA Subtitle C and land ban requirements, referred to as "land disposal." The term "disposal" is often used as shorthand in discussing RCRA's Subtitle C hazardous waste requirements, when technically referring to "land disposal." Thus in some instances the language in the manual and other sources seems to address the definition of disposal generally, rather than placement/disposal for land ban purposes.

However, an analysis of other sources makes clear that the activities addressed in this section of the manual relate only to RCRA's definition of land ban placement or "land disposal," and not to the broader definition of "disposal" under RCRA. The preamble to the final NCP notes the "Congressional choice to define 'land disposal' more narrowly ... than the already existing term 'disposal,'" which has a much broader meaning under RCRA. The Preamble continues:

> Under RCRA section 1004(3), the term "disposal" is very broadly defined and includes any "discharge, deposit, injection, dumping, spilling, leaking, or placing" of waste into or on any land or water. Thus "disposal" [in a statutory, rather than the regulatory subtitle C meaning of the term] would include virtually any movement of waste, whether within a unit or across a unit boundary.... However, Congress did not use the term "disposal" as its trigger for the RCRA land disposal restrictions, but instead specifically defined the new, and more narrow, term "land disposal" in section 3004(k). **The broader "disposal" language continues to be applicable to RCRA provisions other than those in subtitle C,** such as section 7003. (Emphasis added.)

(c) may be located only in areas which will prevent the pollution of ground and surface waters and public and private water supply systems;

(d) must be located to allow for reclamation and reuse of the land;

(e) drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and

(f) where underlying geological formations contain rock fractures or fissures which may lead to pollution of the ground water or areas in which springs exist that are hydraulically connected to a proposed disposal facility, only Class III disposal facilities may be approved.[37]

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55 Fed. Reg. 8759 (March 8, 1990). The state's definition of "disposal" in the Montana Solid Waste Management Act is identical to the broader definition of disposal under RCRA. See § 75-10-203(3), MCA. Thus what constitutes a new disposal triggering applicability of the solid waste requirements should be based on the broader "disposal" test, rather than the narrower "land disposal" test proffered by the commenter.

Such an interpretation of "disposal" is also supported by judicial interpretations of the definition of "disposal" under CERCLA, which also is identical to the definition appearing in the state's Solid Waste Management Act and regulations. *See, e.g.,* Kaiser Aluminum & Chemical Corporation v. Catellus Development Corporation, 976 F.2d 1338 (9th Cir. 1992)("the term 'disposal' should not be limited solely to the initial introduction of hazardous substances onto property. Rather, consistent with the overall remedial purpose of CERCLA, "disposal" should be read broadly to include the subsequent [movement, dispersal, or release] of such substances during landfill excavations and fillings.") (quoting Tanglewood East Homeowners v. Charles-Thomas, Inc., 849 F.2d 1568 (5th Cir. 1988)).

Finally, § 75-10-214(1)(b), MCA, provides that the Solid Waste Management Act does not apply to the operation of a mine, mill, or smelter. This provision exempts any disposal of wastes as part of the operation of a mine, mill, or smelter from the requirements of the Solid Waste Management Act and corresponding regulations. The agencies must still determine, however, whether these requirements are applicable to actions taken as part of a remedial action under CERCLA rather than as part of the operation of a mine, mill, or smelter or whether these requirements should be considered relevant and appropriate requirements for this remedial action.

The agencies have determined that for certain actions that are to be conducted as part of the remedial action for the operable unit, the regulations should be considered applicable legal requirements. As noted above, those actions that constitute "active management," or a new disposal, of the wastes trigger applicability of the regulations to such actions. The exemption for the operation of a mine, mill or smelter does not exempt such an action since the new disposal cannot be regarded as part of the operation of a mine, mill or smelter.

Moreover, if any of the exemptions noted above or any jurisdictional basis for exempting these wastes from the Solid Waste Management Act were justified, the agencies would find, using the criteria specified in the NCP, 40 CFR § 300.400(g)(2)(i) through (viii), that the solid waste management regulations specifically identified in this ARARs analysis are relevant and appropriate requirements for this remedial action. The identified requirements address problems or situations sufficiently similar and are well-suited to the circumstances involved here so that they should be considered relevant and appropriate requirements for this action. Specifically, the identified requirements are intended to address the type and location of wastes and the remedial actions contemplated here. They were developed for the purpose of preventing future problems resulting from the inappropriate storage or disposal of solid wastes, particularly those wastes containing hazardous substances that pose a threat to human health or the environment, such as the tailings and other materials involved here, and particularly those problems that result from inappropriate selection of a disposal site or location, such as areas that are in contact with groundwater or streams.

[37] Group III wastes consist of primarily inert wastes, including "industrial mineral wastes which are essentially inert and non-water soluble and do not contain hazardous waste constituents." ARM 16.14.503(1)(b). The tailings and similar wastes found in the SSTOU do not fall within this category and are at least Group II wastes.

C. Natural Streambed and Land Preservation Standards (Applicable)

Sections 87-5-502 and 504, MCA, (Applicable -- substantive provisions only) provide that a state agency or subdivision shall not construct, modify, operate, maintain or fail to maintain any construction project or hydraulic project which may or will obstruct, damage, diminish, destroy, change, modify, or vary the natural existing shape and form of any stream or its banks or tributaries in a manner that will adversely affect any fish or game habitat. The requirement that any such project must eliminate or diminish any adverse effect on fish or game habitat is applicable to the state in approving remedial actions to be conducted. The Natural Streambed and Land Preservation Act of 1975, §§ 75-7-101 et seq., MCA, (Applicable -- substantive provisions only) includes similar requirements and is applicable to private parties as well as government agencies.

ARM 36.2.404 (Applicable) establishes minimum standards which would be applicable if a remedial action alters or affects a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. No such project may be approved unless reasonable efforts will be made consistent with the purpose of the project to minimize the amount of stream channel alteration, insure that the project will be as permanent a solution as possible and will create a reasonably permanent and stable situation, insure that the project will pass anticipated water flows without creating harmful erosion upstream or downstream, minimize turbidity, effects on fish and aquatic habitat, and adverse effects on the natural beauty of the area and insure that streambed gravels will not be used in the project unless there is no reasonable alternative. Soils erosion and sedimentation must be kept to a minimum. Such projects must also protect the use of water for any useful or beneficial purpose. See § 75-7-102, MCA.

While the administrative/procedural requirements, including the consent and approval requirements, set forth in these statutes and regulations are not ARARs, the party designing and implementing the remedial action for the Streamside Tailings Operable Unit is encouraged to continue to consult with the Montana Department of Fish, Wildlife and Parks, and any conservation district or board of county commissioners (or consolidated city/county government) as provided in the referenced statutes, to assist in the evaluation of factors discussed above.

VI. MONTANA ACTION SPECIFIC REQUIREMENTS

In the following action-specific ARARs, the nature of the action triggering applicability of the requirement is stated in parentheses as part of the heading for each requirement.

A. Water Quality

1. Groundwater Act (Applicable) (Construction and maintenance of groundwater wells)

Section 85-2-505, MCA, (Applicable) precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

2. Public Water Supply Regulations (Applicable) (Reconstruction or modification of public water or sewer lines on the site)

If remedial action at the site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM 16.20.401(3) (Applicable) must be observed.

B. Air Quality

1. Air Quality Regulations (Applicable) (Excavation/earth-moving; transportation)

Dust suppression and control of certain substances likely to be released into the air as a result of earth moving, transportation and similar actions may be necessary to meet air quality requirements. Certain ambient air standards for specific contaminants and particulates are set forth in the federal action specific section above. Additional air quality regulations under the state Clean Air Act, §§ 75-2-101 et seq., MCA, are discussed below.

ARM 16.8.1302 (Applicable) lists certain wastes that may not be disposed of by open burning[38], including oil or petroleum products, RCRA hazardous wastes, chemicals, and treated lumber and timbers. Any waste which is moved from the premises where it was generated and any trade waste (material resulting from construction or operation of any business, trade, industry or demolition project) may be open burned only in accordance with the substantive requirements of 16.8.1307 or 1308.

ARM 16.8.1401(1) and (2) (Applicable) provides that no person shall cause or authorize the production, handling, transportation or storage of any material; or cause or authorize the use of any street, road, or parking lot; or operate a construction site or demolition project, unless reasonable precautions to control emissions of airborne particulate matter are taken. Emissions of airborne particulate matter must be controlled so that they do not "exhibit an opacity of twenty percent (20%) or greater averaged over six consecutive minutes." ARM 16.8.1401(1) and (2) (Applicable) and ARM 16.8.1404 (Applicable).

In addition, state law provides an ambient air quality standard for settled particulate matter. Particulate matter concentrations in the ambient air shall not exceed the following 30-day average: 10 grams per square meter. ARM § 16.8.818 (Applicable).

The Butte area has been designated by EPA as non-attainment for total suspended particulates, as well as PM-10. 40 CFR § 81.327. ARM 16.8.1401(4) (Applicable) requires that any new source of airborne particulate matter that has the potential to emit less than 100 tons per year of particulates shall apply best available control technology (BACT); any new

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38 "'Open burning' means combustion of any material directly in the open air without a receptacle, or in a receptacle other than a furnace, multiple chambered incinerator or wood waste burner ..." ARM 16.8.1301(5).

source of airborne particulate matter that has the potential to emit more than 100 tons per year of particulates shall apply lowest achievable emission rate (LAER). The BACT and LAER standards are defined in ARM 16.8.1430. A significant source of the non-attainment for particulates and PM-10 in the Butte area is road dust. Accordingly, special precautions should be taken in this area to limit dust emissions from remedial activities.

ARM 26.4.761 (Relevant and Appropriate) specifies a range of measures for controlling fugitive dust emissions during mining and reclamation activities. Some of these measures could be considered relevant and appropriate to control fugitive dust emissions in connection with excavation, earth moving and transportation activities conducted as part of the remedy at the site. Such measures include, for example, paving, watering, chemically stabilizing, or frequently compacting and scraping roads, promptly removing rock, soil or other dust-forming debris from roads, restricting vehicle speeds, revegetating, mulching, or otherwise stabilizing the surface of areas adjoining roads, restricting unauthorized vehicle travel, minimizing the area of disturbed land, and promptly revegetating regraded lands.

C. Solid Waste Regulations

As noted in Section V.B above, the state Solid Waste Management Regulations are applicable to the disposal/active management of the tailings and similar wastes within this operable unit. Certain location specific requirements are identified in Section V.B above. Action specific solid waste regulations are discussed below.

ARM 17.50.505(2) (formerly 16.14.505(2))(Applicable) specifies standards for solid waste management facilities, including the requirements that:

1. if there is the potential for leachate migration, it must be demonstrated that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters;

2. adequate separation of such wastes from underlying or adjacent water must be provided, considering terrain, type of underlying soil formations, and facility design (the Waste Management Division of MDEQ has generally construed this to require a minimum separation of 10-20 feet); and

3. no new disposal units or lateral expansions may be located in wetlands.

ARM 17.50.523 (formerly 16.14.523)(Relevant and Appropriate) requires that such waste must be transported in such a manner as to prevent its discharge, dumping, spilling, or leaking from the transport vehicle.

Section 75-10-206, MCA, allows variances to be granted from solid waste regulations if failure to comply with the rules does not result in a danger to public health or safety or compliance with specific rules would produce hardship without producing benefits to the health and safety of the public that outweigh the hardship. In light of the nature of the wastes at issue and the likelihood that any repository would contain only a single type of waste, i.e. tailings and related materials, considering the volume of wastes involved (1.5 to

2.5 million cubic yards) and the cost of full compliance with all solid waste requirements, and considering available Superfund procedures for the maintenance of remedies and the ability of the agencies, within the Superfund process, to consider the characteristics of the particular wastes at issue in appropriately determining and designing repositories, certain of the Solid Waste Regulations regarding design of landfills, ARM 17.50.506, operational and maintenance requirements, ARM 17.50.520-521, and landfill closure requirements and post-closure care, ARM 17.50.530-531, may appropriately be subject to variance in implementing the remedy at this operable unit. The scope and manner of applying the variance can be determined in finalizing and approving of the remedial design by the agencies. For example, the barrier layer (liner) and leachate collection and removal system requirements of ARM 17.50.506 (Design Criteria for Landfills) may be subject to variance as long as the design approved by MDEQ ensures that the concentration values listed in Table 1, ARM 17.50.506, will not be exceeded in the uppermost aquifer. Similarly, the groundwater monitoring requirements of ARM 17.50.701 et seq. can be considered and coordinated with any other monitoring requirements under CERCLA.

D. Reclamation Requirements

The Strip and Underground Mine Reclamation Act, §§ 82-4-201 et seq., MCA, technically applies to coal and uranium mining, but that statute and the regulations promulgated under that statute and discussed in this section, set out the standards that mine reclamation should attain. Those requirements identified here have been determined to be relevant and appropriate requirements for this action. Section 82-4-231 (Relevant and Appropriate) requires the reclamation and revegetation of the land as rapidly, completely, and effectively as the most modern technology and the most advanced state of the art will allow. In developing a method of operation and plans of backfilling, water control, grading, topsoiling and reclamation, all measures shall be taken to eliminate damages to landowners and members of the public, their real and personal property, public roads, streams, and all other public property from soil erosion, subsidence, landslides, water pollution, and hazards dangerous to life and property. Sections 82-4-231(10)(j) and (i) and ARM 26.4.751 (Relevant and Appropriate) provide that reclamation of mine waste materials shall, to the extent possible using the best technology currently available, minimize disturbances and adverse impacts of the operation on fish, wildlife, and related environmental values and achieve enhancement of such resources where practicable, and shall avoid acid or other toxic mine drainage by such measures as preventing or removing water from contact with toxic-producing deposits. ARM 26.4.641 (Relevant and Appropriate) also provides that drainage from acid-forming or toxic-forming spoil into ground and surface water must be avoided by preventing water from coming into contact with such spoil. ARM 26.4.505 (Relevant and Appropriate) similarly provides that acid, acid-forming, toxic, toxic-forming or other deleterious materials must not be buried or stored in proximity to a drainage course so as to cause or pose a threat of water pollution.

1. <u>Reclamation Activities - Hydrology Regulations (Relevant and Appropriate)</u>
(Excavation, earth moving, altering drainage patterns)

The hydrology regulations provide detailed guidelines for addressing the hydrologic impacts of mine reclamation activities and earth moving projects and are relevant and appropriate for addressing these impacts in the Streamside Tailings Operable Unit.

ARM 26.4.631 (Relevant and Appropriate) provides that long-term adverse changes in the hydrologic balance from mining and reclamation activities, such as changes in water quality and quantity, and location of surface water drainage channels shall be minimized. Water pollution must be minimized and, where necessary, treatment methods utilized. Diversions of drainages to avoid contamination must be used in preference to the use of water treatment facilities. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

ARM 26.4.633 (Relevant and Appropriate) provides water quality performance standards that may be invoked in the event that runoff from the treated areas threatens the water quality or sediments in the stream, including the requirement that all surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

ARM 26.4.634 (Relevant and Appropriate) provides that, in reclamation of drainages, drainage design must emphasize channel and floodplain dimensions that approximate the premining configuration and that will blend with the undisturbed drainage above and below the area to be reclaimed. The average stream gradient must be maintained with a concave longitudinal profile, and the channel and floodplain must be designed and constructed to:

1. establish or restore the drainage channel to its natural habit or characteristic pattern with a geomorphically acceptable gradient. The habits or characteristics of individual streams include their particular reactions to general laws related to stream work, whether or not the stream has attained the conditions of equilibrium, and the stream channel morphology and stability;

2. remain in dynamic equilibrium with the system;

3. improve unstable premining conditions;

4. provide for floods; and

5. establish a premining diversity of aquatic habitats and riparian vegetation.

ARM 26.4.635 through 26.4.637 (Relevant and Appropriate) set forth requirements for temporary and permanent diversions.

ARM 26.4.638 (Relevant and Appropriate) specifies sediment control measures to be implemented during operations.

ARM 26.4.640 (Relevant and Appropriate) provides that discharge from sedimentation ponds, permanent and temporary impoundments, and diversions shall be controlled by energy dissipaters, riprap channels, and other devices, where necessary, to reduce erosion, prevent deepening or enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

2. Reclamation and Revegetation Requirements (Relevant and Appropriate) (Excavation)

ARM 26.4.501 and 501A (Relevant and Appropriate) give general backfilling and final grading requirements.

ARM 26.4.514 (Relevant and Appropriate) sets out contouring requirements.

ARM 26.4.519 (Relevant and Appropriate) provides that an operator may be required to monitor settling of regraded areas.

ARM 26.4.702 (Relevant and Appropriate) requires that during the redistributing and stockpiling of soil (for reclamation):

1. regraded areas must be prepared to eliminate any possible slippage potential, to relieve compaction, and to promote root penetration and permeability of the underlying layer; this preparation must be done on the contour whenever possible and to a minimum depth of 12 inches;

2. redistribution must be done in a manner that achieves approximate uniform thicknesses consistent with soil resource availability and appropriate for the postmining vegetation, land uses, contours, and surface water drainage systems; and

3. redistributed soil must be reconditioned by subsoiling or other appropriate methods.

ARM 26.4.703 (Relevant and Appropriate) When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use, and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM 26.4.701 and 702.

ARM 26.4.711 (Relevant and Appropriate) requires that a diverse, effective, and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected shall be established except on road surfaces and below the low-water line of permanent impoundments. The vegetative cover must also be capable of meeting the criteria set forth in § 82-4-233, MCA. Vegetative cover is considered of the same seasonal variety if it consists of a mixture of species of equal or superior utility when compared with the natural vegetation during each season of the year. (See also ARM 26.4.716 below regarding substitution of introduced species for native species.)

ARM 26.4.713 (Relevant and Appropriate) provides that seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed preparation but may not be more than 90 days after soil has been replaced.

ARM 26.4.714 (Relevant and Appropriate) requires use of a mulch or cover crop or both until an adequate permanent cover can be established. Use of mulching and temporary cover may be suspended under certain conditions.

ARM 26.4.716 (Relevant and Appropriate) establishes the required method of revegetation, and provides that introduced species may be substituted for native species as part of an approved plan.

ARM 26.4.717 (Relevant and Appropriate) relates to the planting of trees and other woody species if necessary, as provided in § 82-4-233, MCA, to establish a diverse, effective, and permanent vegetative cover of the same seasonal variety native to the affected area and capable of self-regeneration and plant succession at least equal in extent of cover to the natural vegetation of the area, except that introduced species may be used in the revegetation process were desirable and necessary to achieve the approved intended land use plan.

ARM 26.4.718 (Relevant and Appropriate) requires the use of soil amendments and other means such as irrigation, management, fencing, or other measures, if necessary to establish a diverse and permanent vegetative cover.

ARM 26.4.728 (Relevant and Appropriate) sets forth requirements for the composition of vegetation on reclaimed areas.

VII. TO BE CONSIDERED DOCUMENTS (TBCS)

The use of documents identified as TBCs is addressed on page 2 of the Introduction, above. A list of TBC documents is included in the Preamble to the NCP, 55 Fed. Reg. 8765 (March 8, 1990). Those documents, plus any additional similar or related documents issued since that time, will be considered by EPA and MDEQ in implementation of the remedy.

VIII. OTHER LAWS (NON-EXCLUSIVE LIST)

CERCLA defines as ARARs only federal environmental and state environmental and facility siting laws. Remedial design, implementation, and operation and maintenance must nevertheless comply with all other applicable laws, both state and federal, if the remediation work is done by parties other than the federal government or its contractors.

The following "other laws" are included here to provide a reminder of other legally applicable requirements for actions being conducted at the Streamside Tailings Operable Unit. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not "environmental or facility siting laws." As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

Section 121(e) of CERCLA exempts removal or remedial actions conducted entirely on-site from federal, state, or local permits. This exemption is not limited to environmental or facility siting laws, but applies to other permit requirements as well.

A. Other Federal Laws

1. Occupational Safety and Health Regulations

The federal Occupational Safety and Health Act regulations found at 29 CFR § 1910 are applicable to worker protection during conduct of RI/FS or remedial activities.

B. Other Montana Laws

1. Groundwater Act

Section 85-2-516, MCA, states that within 60 days after any well is completed a well log report must be filed by the driller with the DNRC and the appropriate county clerk and recorder.

2. Water Rights

Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefor except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation. While CERCLA exempts the portion of a remedial action conducted entirely on site from permit requirements, appropriate notification and submission of an application should be performed and a permit should be obtained for all appropriations of water in order to establish a priority date in the prior appropriation system.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;

2. the proposed use of water is a beneficial use; and

3. the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-336, MCA, closes the Upper Clark Fork River Basin to further appropriations of surface water, with certain exceptions, including under certain conditions, appropriations for water to conduct CERCLA response actions.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

3. Controlled Ground Water Areas

Pursuant to § 85-2-507, MCA, the Montana Department of Natural Resources and Conservation may grant either a permanent or a temporary controlled ground water area. The maximum allowable time for a temporary area is four years.[39]

Pursuant to § 85-2-506, MCA, designation of a controlled groundwater area may be proposed if: (i) excessive groundwater withdrawals would cause contaminant migration; (ii) groundwater withdrawals adversely affecting groundwater quality within the groundwater area are occurring or are likely to occur; or (iii) groundwater quality within the groundwater area is not suited for a specific beneficial use.

[39] If a temporary controlled ground water area is granted, the statute requires DNRC to commence studies to determine the designation or modification of a permanent controlled ground water area.

4. Occupational Health Act, §§ 50-70-101 et seq., MCA.

ARM § 16.42.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.95 applies.

ARM § 16.42.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.1000 applies.

5. Montana Safety Act

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

6. Employee and Community Hazardous Chemical Information Act

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

APPENDIX B

ADMINISTRATIVE RECORD FILE GUIDE

THE ADMINISTRATIVE RECORD FOR THE
SILVER BOW CREEK/BUTTE AREA (ORIGINAL PORTION) SITE

This index lists the documents which comprise the administrative record for the Silver Bow Creek/Butte Area (Original Portion) Superfund Site (abbreviated as SBCO Superfund Site). Each record is identified by date, author, addressee, and type (when known), and a short abstract of the document.

The Silver Bow Creek/Butte Area Superfund Site comprises one of the largest Superfund Sites in the nation. Because of the size and complexity of the Site, EPA has divided the site into a Butte Portion and an Original Portion. The Butte Portion, or SBCB, addresses the contamination in and around the city of Butte away from the Silver Bow Creek streambed. The Original Portion, or SBCO, addresses the stream contamination found from the headwaters of Silver Bow Creek through the Warm Springs Ponds area. As stated, this index contains record abstracts for the SBCO Superfund Site.

The SBCO Superfund Site is divided into eight operable units. The name and location of administrative record indexes or locations for these operable units is as follows:

Lower Area One (once known as Area One) ERA operable unit - File numbers 5.02.00.00 through 5.02.37.00

Rocker Timber Framing and Treating Plant operable unit - File numbers 5.03.00.00 through 5.03.18.11

Streamside Tailings operable unit - File numbers 5.04.00.00 through 5.04.19.01

Warm Springs Ponds Active Area operable unit - File numbers 5.05.00.00 through 5.05.06.06 and 5.05.07.00 through 5.05.18.11

Mill Willow Bypass ERA operable unit - File number 5.05.06.07

Warm Springs Ponds Inactive Area operable unit - File number 5.05.06.08

Warm Springs Ponds Final Decision - File numbers 5.05.00.00 through 5.05.18.11

Manganese Stockpile Removal - Because this action was conducted by EPA's Emergency Removal Branch, records are indexed and maintained separately in EPA offices in Denver and Montana. Some duplicated and related documents for this action are found in file number 5.02.35.00.

The index also contains a section on site-wide material, designated under the file numbers 5.01.01.00 through 5.01.29.06. That section contains document or records which provide more general information about the SBCO Superfund Site. Each operable unit specific administrative record listed above incorporates the administrative record documents identified for the "site-wide" section of the SBCO record files.

In addition, each operable unit specific administrative record incorporates the administrative record designated for the Clark Fork Basin General system of records, which are listed in a separate index. In other words, the administrative record for each operable unit includes the administrative records for the specific SBCO Superfund Site operable unit, the administrative records for the SBCO site-wide component, and the administrative records for the Clark Fork Basin General component.

Guidance documents referred to or relied upon by the Environmental Protection Agency are also part of the administrative record, and, although not specifically listed, are incorporated into each operable unit specific administrative record. Those documents are available through EPA's Montana Superfund Records Center, located in Helena, Montana 59626, 301 South Park, Drawer 10096, Federal Building, (406) 449-5728.

Chain of custody documents and other supporting documents for sample collection and data analysis pertaining to a particular operable unit are incorporated into the administrative record of each operable unit, or are specifically listed in the index and contained in the physical files for the site. Those documents are located in one of the following places:

EPA Helena offices, 301 South Park St., Drawer 10096, Helena, Montana 59626
ARCO offices
State of Montana offices
Contractor offices for ARCO, EPA, or State of Montana contractors

Further review of those documents can be obtained by contacting EPA's Montana Superfund Records Center at the above address or telephone number.

A number of the documents contained in the administrative record contain references to primary sources. Those sources are incorporated by reference into each operable unit specific administrative record in which the document which references the material appears. Most of these references are publicly available through libraries or other document repositories. Those primary reference documents that are not publicly available are specifically contained in this record index. Further review of those documents can also be obtained by contacting EPA's Montana Superfund Records Center at the above address or telephone number.

The administrative record index contains some confidential records. Those documents are listed separately, and are abstracted in a manner similar to publicly available documents.

A short summary of the contents of those documents is contained in the abstract entry. Those documents are not available for public review.

This administrative record index, including incorporated documents, is established pursuant to section 113(k) of CERCLA, 42 U.S.C. Section 9613(k). These documents form the basis for EPA's decision concerning response actions taken or to be taken at the SBCO Superfund Site, and also indicate the involvement of the potentially responsible parties and the public in the decision making process. The index will be routinely updated, as additional records or documents are obtained by EPA in relation to each operable unit, unless that operable unit is closed. Administrative record files for the following operable units are closed, as response action was decided upon and taken by EPA for those units.

Manganese Stockpile
Lower Area One ERA
Warm Springs Ponds Active Area
Warm Springs Ponds Inactive Area
Mill Willow Bypass ERA

5.04.00.00 STREAM SIDE TAILINGS OPERABLE UNIT

5.04.01.00 Operable Unit Overview
- 5.04.01.01 Summaries/Meetings
- 5.04.01.02 Briefing Materials
- 5.04.01.03 Operable Unit Management Plans
- 5.04.01.04 Background/Information

5.04.02.00 PRP Information
- 5.04.02.01 Financial Status
- 5.04.02.02 PRP Searches
- 5.04.02.03 AMC

5.04.03.00 Information Requests
- 5.04.03.01 FOIA's
- 5.04.03.02 Congressional Inquiries
- 5.04.03.03 Other

5.04.04.00 RI/FS Planning
- 5.04.04.01 Work Plans/Comments/Guidance
- 5.04.04.02 Quality Assurance Project Plan (QAPP)
- 5.04.04.03 Laboratory Analytical Protocol (LAP)
- 5.04.04.04 Sampling Analysis Plan (SAP)/Field Operations Plan (FOP)
- 5.04.04.05 Standard Operating Procedures (SOP)
- 5.04.04.06 Remedial Action Master Plan (RAMP)
- 5.04.04.07 General
- 5.04.04.08 Health/Environmental Assessment/Comments
- 5.04.04.09 AO/Consent
- 5.04.04.10 Special Notice Letters
- 5.04.04.11 Negotiations

5.04.05.00 ARAR's

5.04.06.00 RI/FS Reports
- 5.04.06.01 Sampling Data
- 5.04.06.02 Preliminary Reports
- 5.04.06.03 Final Reports
- 5.04.06.04 Screening Studies
- 5.04.06.05 Photos/Aerial
- 5.04.06.06 Comments/Responses/Summaries
- 5.04.06.07 Meetings/Agendas/Minutes
- 5.04.06.08 Risk Assessments
- 5.04.06.09 Historical
- 5.04.06.10 Proposed Plan

5.04.07.00 ROD

5.04.08.00 RD/RA

5.04.09.00 O/M

5.04.10.00 Accounting and Cost Recovery

5.04.11.00 Community Relations
- 5.04.11.01 Mailing Lists
- 5.04.11.02 Press Releases
- 5.04.11.03 Press Clippings
- 5.04.11.04 Technical Assistance Grants
- 5.04.11.05 Repository Index
- 5.04.11.06 Fact Sheets
- 5.04.11.07 Public Comments
- 5.04.11.08 Administrative Record Index
- 5.04.11.09 Plans
- 5.04.11.10 Correspondence

5.04.12.00 SCAP

5.04.13.00 References
- 5.04.13.01 Miscellaneous Studies
- 5.04.13.02 Journal Articles
- 5.04.13.03 Other Operable Unit Information

5.04.14.00 State and Other Agency Coordination
- 5.04.14.01 Interagency Agreements (IAG's)
- 5.04.14.02 Fish and Wildlife Service (FWS)
- 5.04.14.03 U. S. Geological Survey (USGS)
- 5.04.14.04 Corp of Engineers (COE)
- 5.04.14.05 Bureau of Mines (BOM)
- 5.04.14.06 Office of Surface Mining (OSM)
- 5.04.14.07 Agency for Toxic Substances Disease Registry (ATSDR)
- 5.04.14.08 Federal Emergency Management Agency (FEMA)
- 5.04.14.09 Historical/Cultural Preservation
- 5.04.14.10 Bureau of Reclamation (BOR)

5.04.15.00 Natural Resource Damage Claims

5.04.16.00 Local Governments
- 5.04.16.01 General
- 5.04.16.02 Institutional Controls

5.04.17.00 Demonstration Projects
- 5.04.17.01 Demonstration Project I
- 5.04.17.02 Demonstration Project II
- 5.04.17.03 Demonstration Project III

5.04.18.00 Correspondence
- 5.04.18.01 Pre-1983/No Dates/Partial Dates
- 5.04.18.02 1983
- 5.04.18.03 1984

5.04.18.04	1985
5.04.18.05	1986
5.04.18.06	1987
5.04.18.07	1988
5.04.18.08	1989
5.04.18.09	1990
5.04.18.10	1991
5.04.18.11	1992
5.04.18.12	1993
5.04.18.13	1994

5.04.19.00 Treatability Projects

5.04.19.01	Proposals
5.04.19.02	Correspondence
5.04.19.03	Studies
5.04.19.04	Comments
5.04.19.05	Reports

APPENDIX C

EXECUTIVE SUMMARY
DRAFT BASELINE RISK ASSESSMENT

Executive Summary

Introduction

The Streamside Tailings (SST) Operable Unit (OU) is one of seven operable units of the Silver Bow Creek/Butte Area (original portion) NPL site. Silver Bow Creek was listed as a Superfund site by the EPA in 1982 pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). CERCLA, as amended by the Superfund Amendment and Reauthorization Act, stipulates that remedial actions at Superfund sites must be protective of both human and ecological receptors. To evaluate the degree to which remedial alternatives are protective, it is necessary to assess both existing environmental and human health risks and potential risks. The baseline Risk Assessment (RA) developed for the Streamside Tailings operable unit of the Silver Bow Creek/Butte Area National Priorities List (NPL) site. The RA uses site-related chemical concentrations, exposure potential, and toxicity information to characterize potential human health and ecological risks which may exist at the site as a result of former mining activities. The RA estimates current and potential future exposure and risk in the absence of future remedial actions. The results of the baseline RA are used to help determine the need for remediation of the site, to establish health-based remediation goals for contaminated media, and to assist in the selection of remedial alternatives.

Site Description

The Streamside Tailings (SST) Operable Unit (OU) is located along Silver Bow Creek in Silver Bow and Deer Lodge Counties, Montana. The SST OU includes approximately 25 miles of Silver Bow Creek from below the Lower Area One portion of the Priority Soils Operable Unit in Butte, Montana to the Warm Springs Ponds Active Area Operable Unit near Opportunity, Montana. The site generally encompasses the 100-year floodplain and areas impacted by fluvially deposited mine, mill, and smelter wastes within and adjacent to Silver Bow Creek. The OU also includes adjacent railroad beds, because mine, mill, and/or smelter wastes were often used as base materials for these beds. Since at least some of these beds may be converted to hiking, biking, and/or riding trails, future human exposure is possible.

The site was divided into four subareas for the purposes of risk assessment, based upon geologic and topographic features that control the soil, hydrogeologic, groundwater, surface water, ecologic, demographic, and land use characteristics. Subarea 1, the Rocker subarea, extends from Colorado Tailings to Nissler at the I-15 bridge over Silver Bow Creek. Subarea 2, the Ramsay subarea, extends from the I-15 bridge to Miles Crossing. Subarea 3, the Canyon subarea, extends from Miles Crossing to the 441 bridge. Subarea 4, the Opportunity subarea, extends from highway 441 to Warm Springs Ponds.

The history of over 100 years of continuous mining and related activities greatly affected the natural environment in and around Silver Bow Creek. Between 2.4 and 2.8 million cubic yards of mill tailings and other mining wastes have been estimated to be present within the SST OU. These mine wastes in and near the creek have contributed to substantial downstream contamination, particularly by the potentially toxic elements arsenic, cadmium, copper, lead, mercury and zinc. Organic pollution in Silver Bow Creek is contributed by municipalities via discharge from the Butte sewage plant, and from other sources, such as wood treating operations, which were located close to the creek. However, compared to the mining impacts such pollution appears to be a minor factor.

There are no cities within the SST OU. Butte, with a population of approximately 30,000, is located just east of the SST OU. Located within or near the SST OU are the small communities of Rocker, Nissler, Silver Bow, Ramsay, Miles Crossing, Finlen, Crackerville, and Opportunity, as well as unnamed communities consisting of several houses scattered throughout the site. A detailed overview of population, land use, economy, and related topics for Deer Lodge County is provided in a 1990 Anaconda/Deer Lodge County comprehensive master plan.

Land use near and within the SST OU also includes industrial activities (railroad, Rhone-Poulenc), mining (gravel), agriculture (grazing), and recreation (dirt biking, hiking, wading, etc.). Occasional irrigated croplands are present on the alluvial plain next to Silver Bow Creek in some areas.

Human Health Risk Assessment

Chemicals of Potential Concerns (COPCs)

The principal contaminants of concern at the SST OU are metals associated with mining activities. Those of particular concern for the HHRA are arsenic, cadmium, copper, lead, mercury, and zinc. All of these materials, except for mercury, have been considered COPCs for OUs upstream and downstream of SST. Mercury data for the site are very limited, but are consistent with elevated levels in sediments and possibly in surface water within the OU. Mercury is therefore discussed qualitatively in the assessment.

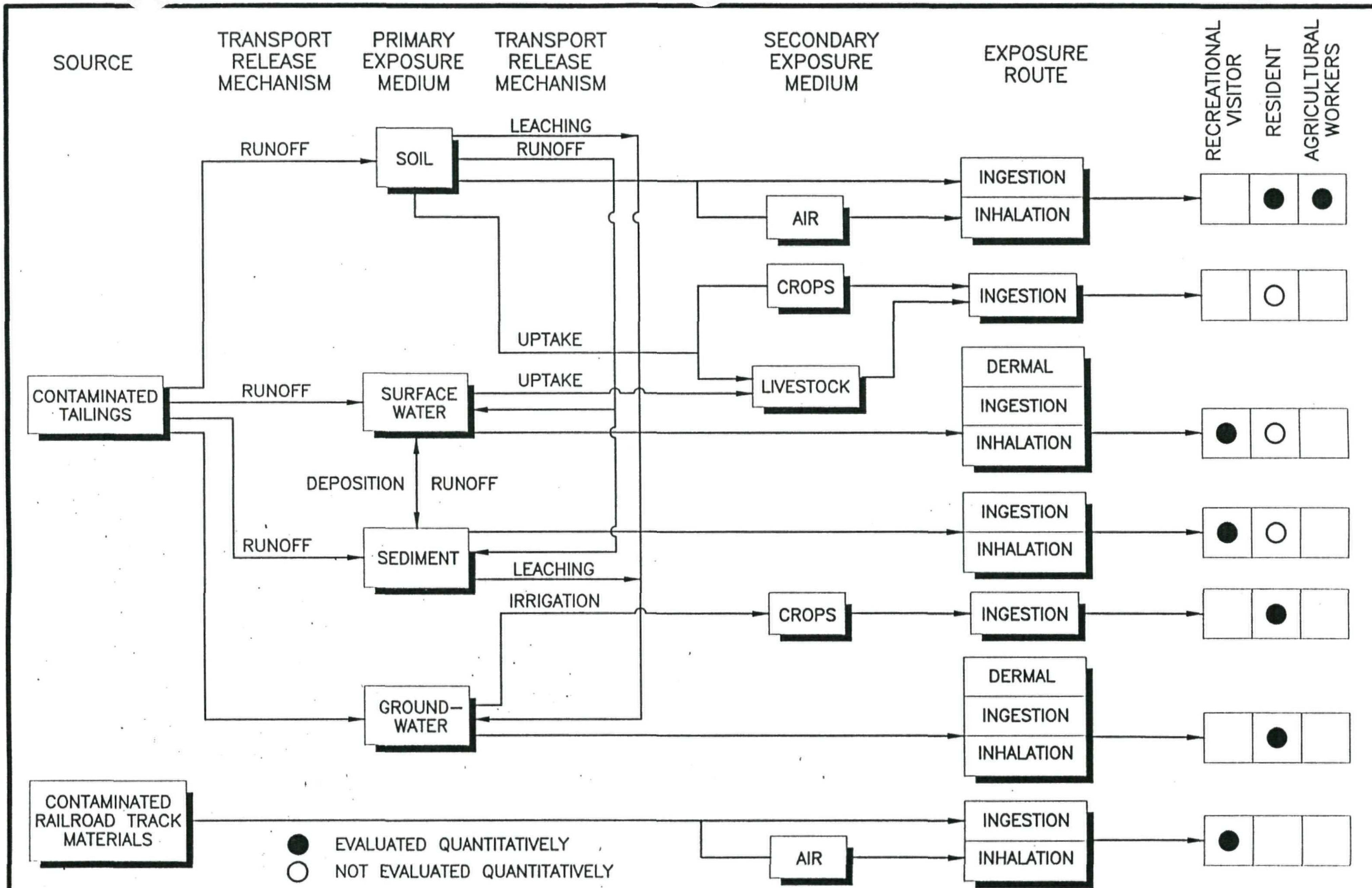
Organic chemicals (pentachlorophenol (PCP) and polycyclic aromatic hydrocarbons (PAH)) have been released from wood treating sites upstream of and within the SST OU. The sources of these contaminants are being addressed by actions at the Rocker Operable Unit and the Montana Pole NPL site.

Exposure Point Concentrations

Two types of exposure estimates are required for Superfund human health RAs, a reasonable maximum exposure (RME), and an average exposure. The RME is defined as an exposure well above the average but still within the range of those that could reasonably be expected to occur for a given exposure pathway at a site. The upper 95 percent confidence limit (UCL) on the arithmetic mean of contaminant concentrations within an exposure area is used to evaluate potential RME exposures. Arithmetic average exposure point concentrations are used to estimate potential average exposures. UCL and average values are also useful for many comparisons made in the ecological risk assessment. Exposure point concentrations for various media are provided in Table ES-1.

Exposure Assessment

This assessment addresses potential pathways by which human receptors could be exposed to contamination within the SST OU in accordance with EPA guidance. This guidance recommends that exposure assumptions were selected so that estimates fall near the reasonable maximum (RME) for that pathway. For most pathways evaluated in this assessment, an average exposure was also calculated to provide a range of exposures and some semi-quantitative information on uncertainties in the assessment. Inclusion of average exposures is intended to provide the risk manager with a range of exposures which encompasses both the typical and upper-range of exposures.



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CDM

STREAMSIDE TAILINGS OPERABLE UNIT
SITE CONCEPTUAL EXPOSURE MODEL - HUMAN EXPOSURE

FIGURE
ES-1

Combinations of exposure pathways and associated human receptors make up exposure scenarios. There are three general exposure scenarios which are considered in this risk assessment, and these are shown in schematic form in the site conceptual exposure model in Figure ES-1.

Residential Scenario

Residents might be exposed to contaminated soils and sediments while working or playing in their yards, might inhale contaminated dust originating from soils in their yards and in neighboring areas, might consume contaminated groundwater and be exposed dermally during bathing to contaminated groundwater from a residential well, and might consume vegetables and/or animal products grown/raised in/on contaminated soils and/or watered with contaminated surface water or groundwater. Where residential properties might extend down to the stream bank, residents might also be exposed to contaminated surface water, sediments and tailings on a regular basis during activities such as wading. In addition, residential exposures might vary significantly over the length of the OU, and residents in one area could potentially receive much higher or lower exposures than their counterparts in other areas of the OU. Evaluation of the residential scenario, then, considers both significant exposures by pathway and the distribution of exposures along the OU.

Occupational Scenario

Workers might be exposed to contaminants while working outdoors within the OU. This could occur, for example, in a lumber or brick yard, while moving cattle, or during planting, working and harvesting crops on agricultural land impacted by the tailings. Likely exposure pathways are incidental ingestion of contaminated soils/sediments, inhalation of contaminated dust suspended in air by wind or other disturbances, and dermal contact with contaminated soils and sediments. An agricultural worker is assumed to be representative for possible occupational exposures.

Recreational Scenario

People recreating in the SST OU may come into contact with contaminated surface water and sediment from Silver Bow Creek and contaminated materials in railroad beds in the SST OU . Recreational activities at the creek most likely include picnicking, swimming, wading, hunting, and dirt-bike riding. During these activities, incidental ingestion of and dermal contact with contaminants in surface water and sediments may occur. In addition, recreational visitors to the site may also be exposed to contaminated materials in railroad beds. The county may consider converting stretches of some railroad beds to recreational trails, and individuals and families who use the trails for jogging, bicycling and hiking in the future may be exposed. Contaminants in railroad bed materials may be incidentally ingested, and/or resuspended in air by wind or other disturbances and inhaled.

Toxicity Assessment

The purpose of the toxicity assessment is to examine the potential for each contaminant of concern (COC) to cause adverse effects in exposed individuals and to describe the relationship between the extent of exposure to a particular contaminant and adverse effects. Adverse effects include both noncarcinogenic (systemic) and carcinogenic health effects in humans.

Toxicity Criteria

Toxicity criteria for carcinogens are slope factors in units of risk per milligram of chemical exposure per kilogram body weight per day ($(mg/kg\text{-}day)^{-1}$). These cancer slope factors (CSFs) are based on the assumption that no threshold for carcinogenic effects exists and any dose, no matter how small, is associated with a finite cancer risk. Toxicity values for noncarcinogens, or for significant noncarcinogenic effects caused by carcinogens, are reference doses (RfDs) in units of milligrams of chemical exposure per kilogram body weight per day (mg/kg-day). RfDs are estimates of thresholds; exposures less than the RfD are not expected to cause adverse effects even in the most sensitive populations. Toxicity criteria for COPCs are presented in Tables ES-2 and ES-3.

Risk Characterization

Residential Scenario

Carcinogenic risks associated with residential exposures (Table ES-4) to COPCs within the SST OU are due entirely to potential exposures to arsenic in soil/sediment and in groundwater. Risks based on average exposure assumptions are estimated at the upper edge of the EPA risk range of 10^{-4} to 10^{-6}, and risks based on RME are greater by a factor of about 6. These risks could vary by a factor of 50 percent based on the variability of arsenic soil concentrations found within the OU. Higher concentrations of arsenic in soil occur in the Ramsay subarea of the site; this area is the most likely location where residents might be exposed to generally higher arsenic concentrations. Arsenic in groundwater is found in higher concentrations in both the Rocker and Ramsay areas. However, all higher concentrations in these locations were found in shallow groundwater. Since any future domestic drinking water well is likely to be installed much deeper than the near-surface monitoring wells, potential for consumption of shallow groundwater is limited. It is, therefore, unlikely that cancer risks are underestimated by a significant factor for exposure via ingestion of groundwater.

Noncancer risks associated with the residential scenario (Table ES-5) exceed the target level (a hazard index of one) for both average and RME. More importantly, individual target levels (hazard quotients) are exceeded for arsenic, cadmium, copper and zinc estimates based on average and/or RME. Noncancer health risk may be unacceptable for exposure to each of these COPCs. Noncancer risks from exposure to arsenic may vary by as much as 50 percent based on variability of arsenic soil concentrations found within the OU. It is unlikely that high concentrations of arsenic in groundwater in subareas would have significant effect on risk estimates. Cadmium, copper and zinc are of potential importance only through ingestion of contaminated groundwater.

Lead exposures within the OU are difficult to interpret. Based on bioavailability assumptions for lead in soil used in nearby Butte, MT, lead risks may generally be in the acceptable range in the OU. Based on the IEUBK model default for bioavailability, however, lead exposures may be excessive in many areas of the OU. A clear determination of bioavailability may be necessary in order to fully evaluate lead exposures. Moreover, in some areas of the site, lead concentrations reach very high levels (up to 9000 mg/kg and greater). If some exposure situations were to be dominated by soils with such high concentrations, lead risks could be significantly underestimated by use of site-wide averages. Specific land-use evaluation on a much smaller scale than those considered in this assessment may be necessary to determine if there are any small subareas of the OU which may present a human exposure hazard above that presented in the risk assessment.

Table ES-2
Carcinogenic Reference Concentrations for COCs
at the Streamside Tailings Site

COC	Carcinogen Classification	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	Source
Pentachlorophenol	B2	1.2×10^{-1}	NA	EPA 1994[a]
Benzo(a)pyrene	B2	$7.3 \times 10^{+0}$	$6.1 \times 10^{+0}$	EPA 1994[a]
Arsenic	A	$1.75 \times 10^{+0}$	$1.5 \times 10^{+1}$	EPA 1994[a]
Cadmium	B1	NA	6.3	EPA 1994[a]
Copper	D	NA	NA	EPA 1994[a]
Lead	B2	NA	NA	EPA 1994[a]
Mercury	D	NA	NA	EPA 1994[a]
Zinc	D	NA	NA	EPA 1994[b]

[a] EPA (U.S. Environmental Protection Agency). 1994. Integrated Risk Information System (IRIS).
[b] EPA (U.S. Environmental Protection Agency). 1994. Health Effects Assessment Summary Tables (HEAST).

Table ES-3
Reference Doses for COCs at the Streamside Tailings Site

COC	Oral RfD (mg/kg-day)	Inhalation RfD (mg/kg-day)	Source
Pentachlorophenol	3×10^{-2}	NA	EPA 1994[a]
Benzo(a)pyrene	NA	NA	—
Arsenic	3×10^{-4}	NA	EPA 1994[a]
Cadmium			
Water	5×10^{-4}	NA	EPA 1994[a]
Food	1×10^{-3}	NA	EPA 1994[a]
Copper	0.0356[c]	NA	EPA 1994[b]
Lead	NA	NA	—
Mercury			
Inorganic	3×10^{-4}	3×10^{-4}	EPA 1994[a]
Methyl Hg	3×10^{-4}	NA	EPA 1994[a]
Zinc	3×10^{-1}	NA	EPA 1994[b]

[a] EPA (U.S. Environmental Protection Agency). 1994. Integrated Risk Information System (IRIS).
[b] EPA (U.S. Environmental Protection Agency). 1994. Health Effects Assessment Summary Tables (HEAST).
[c] As suggested in HEAST, the oral RfD was calculated from maximum Contaminant Level Goal (MCLG).
NA = Not available.

Table ES-4
Carcinogenic Risks for the Residential Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	2.5×10^{-4}	4.4×10^{-5}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Ingestion of Groundwater	Arsenic	3.11×10^{-4}	6.7×10^{-5}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Dermal Contact with Groundwater	Arsenic	2.99×10^{-9}	NA
Inhalation of Dust	Arsenic	3.17×10^{-6}	9.51×10^{-7}
Total Carcinogenic Risk		**5.6×10^{-4}**	**1.1×10^{-4}**

[a] Total carcinogenic risks have been rounded to the nearest tenth.
NC = Not calculated, chemicals are not carcinogens for this exposure pathway, or carcinogenic slope factors are not available.
NA = Only RME exposure is assessed for this pathway.

Table ES-5
Noncarcinogenic Hazard Quotients and Hazard Indices for the Residential Scenario[a]

Pathway	Chemical	RME HQ	Average Risk
Ingestion of Soil/Sediment	Arsenic	1.05×10^{1}	3.03×10^{0}
	Cadmium	8.97×10^{-2}	2.44×10^{-2}
	Copper	5.26×10^{-1}	1.5×10^{-1}
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	7.11×10^{-2}	2.28×10^{-2}
Pathway HI		**1.1×10^{1}**	**3.2×10^{0}**
Ingestion of Groundwater	Arsenic	3.10×10^{0}	2.22×10^{0}
	Cadmium	1.6×10^{0}	7.30×10^{-1}
	Copper	2.73×10^{0}	1.69×10^{0}
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	4.00×10^{0}	4.75×10^{-1}
Pathway HI		**1.2×10^{1}**	**5.1×10^{0}**
Dermal Contact with Groundwater	Arsenic	2.23×10^{-5}	NA
Inhalation of Dust	Arsenic	NC	NC
Total HI		**2.3×10^{1}**	**8.4×10^{0}**

[a] Pathway HIs and total HIs have been rounded to the nearest tenth.
NC = Not calculated, data are insufficient for quantitative analysis.
NA = Only RME exposure is assessed for this pathway.
HQ = Hazard Quotient
HI = Hazard Index

Occupational Scenario

Potential cancer risks for the occupational scenario (Table ES-6), based on potential exposure to agricultural workers, fall within the EPA acceptable risk range. However, risks to agricultural workers are estimated assuming exposures in areas outside the 100-year floodplain only. If workers were to equally divided their work time between areas inside and outside the floodplain, risks could be as much as three times higher than those calculated. This would place worker risks at slightly more than 10^{-4}.

Potential noncancer risks (Table ES-7) are due almost entirely to arsenic and fall near the target HI of one, with arsenic risks based on RME essentially equal to the RfD, or "safe" dose. Upper-range risk estimates are thus at, but do not exceed, an exposure generally recognized as safe, even for lifetime exposure. In general, it does not appear that arsenic concentrations in the SST OU are sufficiently high under the occupational scenario to represent human health risks that exceed common EPA regulatory targets.

Recreational Scenario

Cancer risks for visitors (Table ES-8) to the SST OU are potentially large, with average and RME-based risk estimates exceeding the upper edge of the EPA risk range. Little of this risk is, however, contributed by exposures to visitors to the creek itself. Based on RME, it is future users of railroad beds converted to trails that may suffer the highest risks calculated for the site (over 10^{-3}). These risks are almost totally due to exposure to arsenic. Further, very high arsenic concentrations appear to be associated with areas of past concentrate spills. The methods used in this assessment essentially assume that future trail users will contact railroad bed materials with relatively low concentrations of arsenic much of the time, but will occasionally encounter areas where arsenic concentrations are greatly elevated ("hotspots").

Noncancer risks (Table ES-9) follow a pattern similar to noncancer risks. HIs based on both average and RME exposures exceed unity, suggesting a potential for adverse noncancer effects. Nearly all risk is contributed by arsenic, and, overall, noncancer risks in this scenario are the highest encountered for the site. Arsenic in railroad bed materials again contributes the bulk of the exposure.

Lead exposures within the OU are difficult to interpret. Based on bioavailability assumptions for lead in soil used in nearby Butte, MT, lead risks may generally be in the acceptable range in the OU. Based on the IEUBK model default for bioavailability, however, lead exposures may be excessive in the OU, particularly for the rails-to-trails exposure scenario. A clear determination of bioavailability may be necessary in order to fully evaluate lead exposures. Moreover, in some areas of the site, lead concentrations reach very high levels (up to 11,500 mg/kg in one sample of railroad bed materials). If some exposure situations were to be dominated by soils with such high concentrations, lead risks could be significantly underestimated by use of site-wide averages. Though very small scale variability is high, it is possible that some preferential recreational areas within the site could have average exposure concentrations in excess of those used to estimate lead exposures in this assessment.

In addition, the use of the IEUBK model for assessing lead exposures in non-residential settings is very uncertain. Lead exposures based on occasional exposure in a recreational setting may not be adequately estimated by the IEUBK model, and may, in fact be substantially, overestimated.

ES-6
Carcinogenic Risks for the Occupational Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	5.4×10^{-5}	3.4×10^{-6}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Inhalation of Dust	Arsenic	8.5×10^{-6}	5.1×10^{-6}
Total Carcinogenic Risk		**6.2×10^{-5}**	**8.5×10^{-6}**

[a] Total carcinogenic risks have been rounded to the nearest tenth.

NC = Not calculated, chemicals are not carcinogens for this exposure pathway, or carcinogenic slope factors are not available.

Table ES-7
Noncarcinogenic Hazard Quotients and Hazard Indices for the Occupational Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	8.05×10^{0}	4.99×10^{-2}
	Cadmium	8.0×10^{-3}	6.07×10^{-4}
	Copper	3.29×10^{-2}	2.39×10^{-3}
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	3.64×10^{-3}	2.90×10^{-4}
Pathway HI		**8.5×10^{-1}**	**5.3×10^{-2}**
Inhalation of Dust	Arsenic	NC	NC
Total HI		**8.5×10^{-1}**	**5.3×10^{-2}**

[a] Pathway HIs and Total HIs have been rounded to the nearest tenth.
NC = Not calculated, data are insufficient for quantitative analysis.

Table ES-8
Carcinogenic Risks for the Recreational Scenario[a]

Pathway	Chemical	RME Risk	Average Risk
Ingestion of Soil/Sediment	Arsenic	6.2×10^{-5}	9.0×10^{-6}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**6.2×10^{-5}**	**9.0×10^{-5}**
Ingestion of Surface Water	Arsenic	3.4×10^{-8}	7.8×10^{-9}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**3.4×10^{-8}**	**7.8×10^{-9}**
Dermal Contact with Surface Water	Arsenic	3.2×10^{-9}	7.3×10^{-10}
Ingestion of Rail Road Bed Materials	Arsenic	1.2×10^{-3}	1.4×10^{-4}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**1.2×10^{-3}**	**1.4×10^{-4}**
Inhalation of Rail Road Bed Materials	Arsenic	1.8×10^{-5}	9.2×10^{-6}
	Cadmium	NC	NC
	Copper	NC	NC
	Lead	NC	NC
	Mercury	NC	NC
	Zinc	NC	NC
Pathway Risk		**1.8×10^{-5}**	**9.2×10^{-6}**

[a] Total carcinogenic risks have been rounded to the nearest tenth.
NC = Not calculated, chemicals are not carcinogens for this exposure pathway, or carcinogenic slope factors are not available.

Table ES-9
Noncarcinogenic Hazard Quotients and Hazard Indices for the Recreational Scenario[a]

Pathway	Chemical	4-12 Year Old Child		1-3 Year Old Child	
		RME HQ	Average HQ	RME HQ	Average HQ
Ingestion of Soil/Sediment	Arsenic	8.95×10^{-1}	1.03×10^{-1}	4.17×10^{0}	2.91×10^{-1}
	Cadmium	6.34×10^{-3}	8.14×10^{-4}	3.47×10^{-2}	2.05×10^{-3}
	Copper	3.97×10^{-2}	5.15×10^{-3}	2.18×10^{-1}	1.52×10^{-2}
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	6.28×10^{-3}	8.89×10^{-4}	3.02×10^{-2}	2.31×10^{-3}
Pathway HI		**9.5×10^{-1}**	**1.1×10^{-1}**	**4.5×10^{0}**	**3.1×10^{-1}**
Ingestion of Surface Water	Arsenic	3.89×10^{-4}	9.0×10^{-5}	8.75×10^{-4}	2.02×10^{-4}
	Cadmium	2.25×10^{-5}	5.22×10^{-6}	5.05×10^{-5}	1.17×10^{-5}
	Copper	3.26×10^{-6}	6.94×10^{-6}	7.33×10^{-5}	1.56×10^{-5}
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	1.35×10^{-5}	2.23×10^{-6}	3.04×10^{-5}	5.02×10^{-6}
Pathway HI		**4.6×10^{-4}**	**1.0×10^{-4}**	**1.3×10^{-3}**	**2.3×10^{-4}**
Dermal Contact with Surface Water	Arsenic	1.96×10^{-5}	4.57×10^{-6}	3.06×10^{-5}	7.12×10^{-6}
Ingestion of Rail Road Bed Materials	Arsenic	1.65×10^{1}	2.02×10^{0}	7.44×10^{1}	4.55×10^{0}
	Cadmium	7.42×10^{-2}	1.08×10^{-2}	3.34×10^{-1}	2.43×10^{-2}
	Copper	1.91×10^{0}	1.8×10^{-1}	8.58×10^{0}	4.06×10^{-1}
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	1.56×10^{-1}	8.07×10^{-3}	7.02×10^{-1}	1.82×10^{-2}
Pathway HI		**1.9×10^{1}**	**2.2×10^{0}**	**8.4×10^{1}**	**5.0×10^{0}**
Inhalation of Rail Road Bed Materials	Arsenic	NC	NC	NC	NC
	Cadmium	NC	NC	NC	NC
	Copper	NC	NC	NC	NC
	Lead	NC	NC	NC	NC
	Mercury	NC	NC	NC	NC
	Zinc	NC	NC	NC	NC
Pathway HI		**NC**	**NC**	**NC**	**NC**
Total HI		**2.0×10^{1}**	**2.4×10^{0}**	**9.0×10^{1}**	**5.4×10^{0}**

[a] Pathway HIs and Total HIs have been rounded to the nearest tenth.
NC = Not calculated, data are insufficient for quantitative analysis.
HQ = Hazard Quotient
HI = Hazard Index

Results of IEUBK modeling for site visitors, and rails-to-trails users should be considered screening level only. Such modeling would provide little scientific support for risk management decisions. Once again, hotspots of lead dominate potential exposures and risks.

Uncertainties Associated with Risk Characterization

There is a degree of uncertainty associated with every step of the assessment process. Several important uncertainties were identified in the SST OU risk assessment.

Some exposure parameters, especially those for recreational exposure scenarios are often poorly characterized and may be based solely on professional judgement. Such exposure parameters introduce potentially significant, but substantially unknown amounts of uncertainty, into the assessment process. Generally, exposure parameters based on professional judgement are conservative (i.e., they tend to err on the side of protection of human health). Thus, these exposure parameters are generally more likely to cause overestimation of exposures than underestimation.

Land use in the SST OU is mixed and is likely to remain so in the future. However, it is difficult to predict which areas might be developed for which land uses in the future. This risk assessment does not make specific land use assumptions for specific areas. Instead, risk estimates are developed on a site-wide basis and evaluated for representativeness for different subareas within the OU. These risk estimates, with appropriate consideration given to subarea differences, can thus be applied as needed to different specific areas within the OU.

The relative bioavailability of arsenic in all media is assumed to be high (80 or 100 percent). Because arsenic in soil and sediments in the SST OU is largely derived from mining and milling wastes, and the relative bioavailability of arsenic associated with such wastes may actually be lower, potential risks from arsenic in soil and sediment may have been overestimated.

Several recent studies indicate current toxicity criteria for arsenic could overestimate risks. Metabolic detoxification of arsenic at low doses may lessen the impact of arsenic exposure predicted by linear extrapolation of results from higher exposures. In addition, new studies indicate that background inorganic arsenic intake and skin cancer risks may have been underestimated in the Taiwanese population on which current toxicity criteria are based. These new studies have not been peer-reviewed, however, and current toxicity criteria are therefore not modified for this RA.

The bioavailability of lead used in the RA is based in part on studies conducted for the Butte Priority Soils OU, and on the assumption that mineral species present in Silver Bow Creek would be similar to those found in Butte, since their source was Butte. There is some uncertainty associated with this approach. For example, the geochemistry of tailings deposited as stream sediments may not be identical to those from waste deposits not subject to constant or periodic inundation. Such uncertainties may lead to either over or underestimation of risks associated with lead depending on bioavailability assumptions made.

Quantitative assessment of exposures due to consumption of vegetables grown in contaminated soils, or irrigated with contaminated water, was not carried out even though screening calculations suggested that exposures via this pathway could be significant. It is possible, therefore, that significant exposures and associated risks at the site were omitted from the final estimates.

However, toxicity to plants is likely to restrict gardening within the SST OU to less contaminated soils and/or to soils that have been extensively amended. Baker and Bower (1988) concluded, on the basis of their study in Palmerton soils, that toxicity would limit cadmium exposure to a fraction of current estimates of daily cadmium intake from diet and other "background" sources. It seems likely that similar consideration might apply to gardens in the SST OU. It appears that any underestimation of risk due to elimination of consumption of home-grown vegetables from the quantitative risk assessment does not constitute a significant underestimation of total potential risks in the OU.

The risk assessment assumed that exposures to metals and arsenic from consumption of animals grazed on contaminated pastures and/or watered with contaminated surface or groundwater are not significant contributors to overall exposures. Conservative, though generic, calculations suggest that metal uptake into beef following ingestion of contaminated plants or soils will not be significant in the SST OU. A possible exception is zinc. Uptake of zinc into plants in the more heavily contaminated soils in the SST OU could raise concentrations of zinc in plants to a level that could approach levels toxic to cattle that use the plants as forage. Zinc, however, is expected to be toxic to the plants themselves at the higher concentrations found in the OU. Thus, the theoretical potential for toxic effects to livestock is probably not actually realized at the site.

Arsenic appears to represent the major risk "driver" for the site when considering potential human health impacts. However, arsenic background reference soil samples were collected very near areas of contamination; the higher values could reflect some degree of contamination. Reference concentrations for arsenic ranged from 5.7 to 142 mg/kg. RME and average exposure point concentrations for arsenic are 511 and 296 mg/kg respectively (Table ES-1). Background may thus contribute somewhat to total exposures and risks.

Thus, the high estimate for background contribution (based on comparison of maximum background to the average exposure point concentration) may well overestimate actual background contribution. The low background estimate is very unlikely to have received significant contamination, but could be below the average background for the area. Actual contributions from background for arsenic are likely to be greater than one percent, but may be significantly less than 50 percent.

Ecological Risk Assessment

Introduction

Ecological Risk Assessments (ERAs) evaluate the likelihood that adverse ecological effects may occur or are occurring at a site as a result of exposure to chemical or physical stressors. Risks result from contact between ecological receptors and stressors that are of sufficiently long duration and of sufficient intensity to elicit adverse effects. The primary purpose of this ERA is to identify and describe actual or potential onsite conditions that can result in adverse effects to present or future ecological receptors. These conditions are identified by comparing observed or likely effects with actual or predicted exposures to physical and, primarily, chemical stressors. Another important objective of this ERA is to provide information that can help establish remedial priorities and serve as a scientific basis for regulatory and remedial actions for the Streamside Tailings Operable Unit (SST OU).

The approach used to conduct this ERA is based on site-specific information and on recent EPA guidance, primarily The Framework for Ecological Risk Assessment. The primary components of this ERA are Problem Formulation, Analysis and Risk Characterization. Stressors identified for this ERA are based on their potential to cause adverse ecological effects, especially effects due to chemical contamination of surface water, sediment, and surface soil. This focus is based on the potential for onsite contaminated media to currently preclude the existence of healthy and diverse aquatic and riparian ecosystems in and adjacent to Silver Bow Creek. In addition, mining-related and other activities have caused considerable physical damage to aquatic and terrestrial habitats onsite.

The primary chemical stressors identified for the site include the following:

- Arsenic (surface water, sediment, surface soil)
- Cadmium (surface water, sediment, surface soil)
- Copper (surface water, sediment, surface soil)
- Lead (surface water, sediment, surface soil)
- Zinc (surface water, sediment, surface soil)
- Mercury (surface water, sediment, surface soil)

The following chemicals, are also considered COPCs and are therefore evaluated in this ERA:

- PCP (sediment, surface soil)
- PAHs (surface water, sediment, surface soil)
- Dissolved oxygen (surface water)
- Ammonia (surface water)
- Nitrogen (surface water)

In addition to chemical stressors, ecological receptors that inhabit or use the SST OU may also be exposed to physical or non-chemical stressors. Important physical stressors, related primarily to past mining activities at this site, include the following:

- Degradation of instream substrates
- Channelization of Silver Bow Creek
- Degradation or disturbance of terrestrial and riparian habitats

The major habitats that have potential to be affected by chemical and physical stressors include aquatic habitats, riparian habitats, and terrestrial habitats. The types of organisms that may be exposed to the chemical and physical stressors identified at this site include aquatic and terrestrial plants and animals (i.e., macroinvertebrates, fish, amphibians, reptiles, birds, and mammals) that inhabit or use, or have the potential to inhabit or use, aquatic, streamside/wetland or terrestrial habitats of the SST OU. No threatened, endangered, or sensitive species have been reported within the SST OU.

The primary exposure pathway evaluated in this ERA is the direct contact of ecological receptors with chemical and physical stressors. Although of lesser importance for this ERA, effects due to contaminant transfer through food chains are also evaluated.

Risk Characterization

Potential risks to ecological receptors are evaluated by comparing current or predicted conditions and chemical concentrations in exposure media (exposure assessment) with similar data correlated with potential to cause adverse effects (effects assessment). The risk characterization phase of the ERA integrates exposure assessment and effects assessment to estimate risk potential for ecological receptors, and considers the ecological significance of predicted effects. A weight-of-evidence approach, utilizing various measures of potential adverse effects instead of a single effects value, is employed in this assessment.

A simplified summary of SST-OU wide potential risks to ecological receptors is presented on a media-specific and chemical-specific basis in Table ES-10. Risk potentials (low, moderate, high) are estimated by evaluating the difference or magnitude between average (arithmetic mean) and U95 values and relevant effects concentrations. Risk potential is estimated to be high where average or U95 values greatly exceed relevant effects concentrations.

Surface Water

The assessment of potential risks to aquatic receptors is based on a comparison of dissolved COCs in surface water to relevant effects concentrations. Measurements of total metals concentrations in surface water may overestimate risks to aquatic receptors because only a portion of the total metals measured is bioavailable and toxic.

Ammonia has potential to cause adverse effects on aquatic biota in Silver Bow Creek because of elevated concentrations in some areas. Adverse effects are more likely, and probably more severe, immediately below the Butte wastewater treatment plant (WWTP), which has been identified as the only known point source of ammonia in Silver Bow Creek. Ammonia concentrations in the lower reaches of Silver Bow Creek only rarely exceed site-adjusted (for pH and temperature) chronic ambient water quality criteria (AWQC) for ammonia.

Recent measurements of dissolved arsenic in Silver Bow Creek have remained below important effects concentrations. These effects concentrations range from 0.048 to 0.850 mg/L, and include concentrations expected to protect freshwater plants and sensitive freshwater animals. Ambient concentrations of dissolved arsenic in Silver Bow Creek range from approximately 0.01 to 0.04 mg/L, indicating low potential for risks to aquatic life from arsenic.

Unlike arsenic, dissolved cadmium concentrations in Silver Bow Creek commonly exceed critical effects concentrations. Arithmetic mean values of dissolved cadmium for all sampled reaches of Silver Bow Creek exceed the lowest effects concentrations but remain below the higher, less protective effects concentrations but remain below the higher, less protective effects concentrations. Cadmium appears to be an important and probably moderate contributor to overall toxicity of Silver Bow Creek surface water. Dissolved copper in Silver Bow Creek is elevated throughout the entire OU, with slightly lower concentrations measured in the most downstream reaches. All recent samples of dissolved copper exceed the lowest effects concentrations for freshwater plants, invertebrates, and fish. Site specific acute effects concentrations for rainbow trout are exceeded in about half the samples measured. Dissolved copper is a major contributor to the toxicity of Silver Bow Creek, and ambient concentrations commonly exceed safe levels for aquatic plants, invertebrates, and fish.

Table ES-10
Simplified Summary of Ecological Risks from Chemical Stressors

Media (units)	Chemical	Arith. Mean Conc/ U95 Conc	Effects Conc [1]	Risk Potential
Surface Water				
mg/L	Ammonia	3.11 / NC	0.53-2.7	Mod to High (location/timing dependent)
µg/L	Arsenic (D)	15.56 / 24.1	48-850	Low
µg/L	Cadmium (D)	1.66 / 2.26	0.47-5.0	Mod
µg/L	Copper (D)	50.74 / 59.56	3.9-54	High
mg/L	Dissolved Oxygen	~9.5 / NC	4.0	Low to High (location/timing dependent)
µg/L	Lead (D)	3.0 / 6.57	0.8-500	Mod
µg/L	Mercury (D)	0.16 / 0.16	0.012-4.0	Low to Mod
mg/L	Nitrogen (total soluble)	1.75-9.19/NC	0.03-1.0	Mod to high (location/timing dependent)
µg/L	PAHs (individual)	0.02 / NC	0.1-5.0	Low
µg/L	PCP	8.01/NC	3.5-14.5	Mod
µg/L	Zinc (D)	336.19 / 585.99	40-277	High
Sediment				
mg/kg	Arsenic	75.16 / 113.11	23.8-24.8	High
mg/kg	Cadmium	4.66 / 7.01	3.9	High
mg/kg	Copper	828 / 1,579.89	325-354	High
mg/kg	Lead	250.5 / 318.66	62.4	High
mg/kg	Mercury	3.49 / 6.7	0.2-2.0	High
mg/kg	PAHs (individual)	0.054-1.563 / NC	4-100	Low
mg/kg	PCP	0.367 / 0.634	4.2-21	Low
mg/kg	Zinc	1,380.13 / 2,120.27	1,064	High

Table ES-10 (Cont.)
Simplified Summary of Ecological Risks from Chemical Stressors

Media (units)	Chemical	Arith. Mean Conc/ U95 Conc	Effects Conc [1]	Risk Potential
Surface Soil				
mg/kg	Arsenic	303.1 / 514.9	25-100	High
mg/kg	Cadmium	6.45 / 11.95	4-50	Mod
mg/kg	Copper	1,470.4 / 2,484.9	60-100	High
mg/kg	Lead	723.63 / 1,241.4	250-1,000	High
mg/kg	Mercury	1.82 / 5.7	2-10	Low to mod
mg/kg	PAHs (individual)	Not Analyzed	1-10	Unknown/ Probably low
mg/kg	PCP	Not Analyzed	0.5-5.0	Unknown/ Probably low
mg/kg	Zinc	1,835.6 / 2,920.7	200-500	High

[1] Description and source listed in Table 5-17

NC: not Calculated
D: dissolved

Dissolved oxygen (D.O.) concentrations in Silver Bow Creek are below minimum national coldwater criteria at some times and in some areas of Silver Bow Creek. For the most part, however, D.O. concentrations remain above minimum criteria levels except in the reach immediately below the Butte WWTP. Observed low D.O. concentrations in this and in other reaches are probably the result of excess nutrient inputs and high biological oxygen demand (BOD) discharges from the Butte WWTP. In the upper reaches, low D.O., along with elevated ammonia and dissolved metals, contribute to the biological impairment of Silver Bow Creek.

Dissolved lead appears to be a minimal to moderate contributor to the toxicity of Silver Bow Creek surface water. Although mean and U95 values generally exceed the lowest effects concentrations, they never exceed the highest (least protective) effects concentrations. Dissolved lead in Silver Bow Creek may add to the overall toxicity of the creek but is unlikely to be a major contributor, especially compared to copper and zinc.

Dissolved mercury was only rarely detected in Silver Bow Creek surface water (one sample, 11 percent frequency of detection). Detection limits for mercury commonly exceed critical effects concentrations or established criteria. Therefore, any detection of mercury in surface water can be important. Because dissolved mercury was detected in only one sample, and because of increased uncertainty associated with concentrations in the low µg/L range, dissolved mercury is not expected to be critically important to environmental conditions in Silver Bow Creek.

Nitrogen compounds were detected in all surface water samples, as expected. Elevated nitrogen compounds, measured as total soluble nitrogen or TSN can promote growth of nuisance algae. Excessive algal growth can indirectly cause depletions in dissolved oxygen and can also impair aquatic habitats. Excess nitrogen in Silver Bow Creek can be important and potentially serious problem in some reaches (especially below the Butte WWTP and in areas of uncontrolled cattle grazing).

PCP has moderate potential to cause adverse effects in surface water because it was detected in all of the few surface water samples for which it was analyzed at concentrations similar to national chronic ambient water criteria. The only known Silver Bow Creek PCP source is currently being addressed by remedial actions at the Montana Pole site.

Only one PAH, benzo(b)fluoranthene, was detected in Silver Bow Creek surface water, with all detections (4 of 4 samples) 02 µg/L. Although only limited toxicity data are available for individual PAHs in surface water, 0.02 µg/L is not expected to be acutely toxic to aquatic biota. PAHs in surface water are not likely to be a significant contributor to the biological impairment of Silver Bow Creek within the SST OU.

Elevated zinc concentrations are found throughout Silver Bow Creek, especially within the most upstream 10 miles of the creek. The spatial distribution of dissolved zinc in Silver Bow Creek indicates a general and consistent decrease in dissolved zinc as samples are taken further downstream. However, even the most downstream samples are associated with exceedances of critical effects concentrations. These data indicate that dissolved zinc is a major contributor to toxicity in the upstream reaches of Silver Bow Creek. In the lower reaches, dissolved zinc is at least a moderate contributor to Silver Bow Creek toxicity.

Sediment

There is less confidence (more uncertainty) in effects concentrations used to evaluate sediment toxicity compared to concentrations used for surface water evaluation. For this reason, the list of effects concentrations for assessing sediment toxicity include a greater variety of data, including site specific toxicity data (lowest degree of uncertainty); non-site specific toxicity data (moderate degree of uncertainty); background data; and other data based on co-occurrence of effects and sediments contaminated with a mixture of chemicals (highest uncertainty). The greatest uncertainty is with data that are statistically rather than toxicologically derived, such as Effects Range-Median (ER-M) values of Long and Morgan. ER-M values represent the median value of ranked concentrations associated with observed effects, and are based on sediments contaminated with a mixture of chemicals. These values are therefore not entirely appropriate for comparison to ambient sediments that are contaminated with a single or a few chemicals. ER-M values are included in this risk characterization because they are commonly used by regulatory agencies and others as a screening level tool in assessing potential sediment toxicity. For the most part, site specific sediment toxicity data are preferred over all other effects data and, where available, these serve as the primary effects data for comparison to recently collected sediment chemistry data.

The total arsenic concentrations of Silver Bow Creek sediments change little from upstream to downstream stations. Both PTI and Canonie sampling events confirm the relative consistent distribution of arsenic throughout the OU. The effects concentrations with the greatest confidence and the least uncertainty (No Effect Concentration, sublethal effects, *Hyallela*), are exceeded by the concentrations of all sediment samples taken. Depending on the data source (PTI or Canonie), ambient concentrations of total arsenic in Silver Bow Creek sediments exceed site-specific effects concentrations by a factor of approximately 2 to 8. Total arsenic is a major contributor to the potential toxicity of Silver Bow Creek sediments.

Unlike arsenic, the concentration of total cadmium in Silver Bow Creek sediments appears to vary both spatially and temporally, and may be increasing over time. Based on the 1991 and 1992 data, total cadmium in Silver Bow Creek sediments nearly always exceeds the site specific no adverse effect concentration (NEC) for sensitive benthic invertebrates (3.9 mg/kg, *Hyallela*). Other effects concentrations, including those based on spiked sediment bioassays (SSB) and apparent effects concentrations (AET) are similar in magnitude to the site specific NEC. These data and others indicate that total cadmium in Silver Bow Creek sediments have a high potential to adversely impact sensitive benthic invertebrates and possibly salmonids.

Copper concentrations in Silver Bow Creek sediments remain consistently elevated from the most upstream to the most downstream reaches of the creek.Copper concentrations in Silver Bow Creek sediments remain consistently elevated from the most upstream to the most downstream reaches of the creek. Studies from 1988, 1991, and 1992 reveal increasingly higher concentrations over time. Copper concentrations in Silver Bow Creek sediments are nearly always in excess of most of the relevant effects concentrations used for comparison, even though the effects concentrations are quite high. For example, all sediment samples collected in 1992 reveal copper concentrations in excess of 1000 mg/kg, much higher than relevant effects concentrations of 325-350 mg/kg. Copper in Silver Bow Creek sediments is a major contributor to the impairment of the aquatic community of Silver Bow Creek.

Total lead in Silver Bow Creek sediments changes little with respect to location with the exception of apparent increases approximately 1 and 8 miles downstream of the upstream border of the OU. Lead concentrations measured in Silver Bow Creek sediments always exceed 100 mg/kg. All 1991 and 1992 samples reveal total lead in sediments in excess of 250 mg/kg. For comparison, the most appropriate (i.e., those with the least uncertainty) effects concentrations are within the range of about 30 to 120 mg/kg. Values in excess of 250 mg/kg are likely to result in severe, acute effects to sensitive benthic biota, thereby potentially affecting organisms at several food chain levels, especially upper level consumers of mercury-contaminated prey. This pathway is not a primary concern at this time because it is incomplete in most cases due to limited numbers and types of potential receptors. The toxicity of inorganic mercury can be increased by bacterial methylation in aerobic and especially anaerobic sediments. Methylmercury concentrations in Silver Bow Creek sediments are expected to remain quite low, however, because anaerobic conditions are not expected to predominate.

PCP concentrations in Silver Bow Creek sediments within the SST OU ranged from 0.256 to 0.980 mg/kg. Relevant toxicity data for PCP in sediment are lacking. However, calculation of predicted sediment pore water concentrations, based on the equilibrium partitioning approach, indicate that Silver Bow Creek sediments within the SST OU have little potential to cause adverse ecological effects. PCP is not considered to be a concern in Silver Bow Creek sediments.

Concentrations of individual PAHs in Silver Bow Creek sediments range from 0.0084 to 3.015 mg/kg within the SST OU. The most commonly detected PAHs include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzanthracene, and pyrene. The maximum mean value for any particular PAH (1.563 mg/kg, chrysene), only slightly exceeds the low threshold value (1.0 mg/kg) that serves as a conservative guideline for evaluating surface soil contamination. Based on available data, PAHs are not considered to be significant contributors of biological impairment of Silver Bow Creek within the SST OU.

064 mg/kg is a No Effect Concentration (NEC), The probability and the severity of such adverse effects increase with greater exceedances of the NEC. Therefore, while ambient concentrations around 1,000 mg/kg may or may not cause adverse effects to resident species, depending on the sensitivity of exposed organisms and on zinc bioavailability, values greatly in excess of 1,000 mg/kg are likely to be harmful. Since so many recent measurements of zinc in Silver Bow Creek sediments exceed 1,000 and even 2,000 mg/kg, sediment zinc is likely to adversely impact Silver Bow Creek.

Surface Soil

The primary data source for evaluating surface soil phytotoxicity is CH2M Hill (1987), in which the toxicities of arsenic, cadmium, lead, and zinc on soil, plants, and livestock in the Helena Valley of Montana were assessed. Although not site specific, This document summarizes available phytotoxicity data for most of the metals of concern and derives various threshold values for evaluating phytotoxicity. These threshold values include Tolerable Level (maximum concentration at which no phytotoxicity has been observed), Hazard Level (suggested hazard level based on State, provincial, and national regulatory guidelines), and Phytotoxic Level (toxic level for various crop species and soil parameters found in the Helena Valley). Of these, the Phytotoxic Level is most useful because it provides a reasonable threshold (not to exceed) level based on sensitive crop species found in the Helena Valley. Phytotoxic values are based on near-site (regional) data and they therefore are the best available data for assessing potential phytotoxicity of As, Cd, Pb, and Zn at the SST OU. , Threshold Contamination, Contaminated, and Background Pollution are also used for assessing the ecological risk potential for other chemicals of concern. Several of these values are based on multiple soil uses and are not specifically intended to be used as surface soil criteria for protecting ecological receptors. These values do, however, give a general indication of potential for risks from surface soil contamination within the SST OU. The basis for and limitations of this approach are discussed fully in the ERA.

Arsenic in SST surface soil is probably a major contributor to phytotoxicity within the SST OU because all relevant phytotoxicity effects concentrations, including those based on regional (near-site) studies, are greatly exceeded by site-wide mean, U95, and maximum concentrations measured in SST surface soils.

Cadmium, although elevated in SST surface soils, appears to be less likely to result in phytotoxic effects on local plants compared to arsenic. Site-wide mean, U95, and maximum concentrations of cadmium in SST surface soils remain below phytotoxic concentrations derived for sensitive crop species and regional soils. Site-wide mean, U95, and maximum values do, however, exceed regional baseline, suggested hazard, non-regional phytotoxic, and tolerable levels. There is less confidence in the ability of these values to predict or estimate potential phytotoxicity. Because regional phytotoxicity values are not exceeded in any samples, along with the finding that non-regional phytotoxic levels are exceeded in most samples, cadmium in surface soil is considered to have moderate potential for risk.

Copper in SST surface soil is also expected to be a major contributor to phytotoxicity within the SST OU because all relevant phytotoxicity effects concentrations are exceeded by site-wide mean, U95, and maximum concentrations measured in SST surface soils. There is less certainty in using non-regional or non-site specific effects data to estimate risk potential compared to using site specific data. Selected non-site specific data presented in the ERA clearly reveal a high potential for phytotoxicity. Although site- or regional-specific phytotoxicity data are lacking, it is unlikely that the greatly elevated copper concentrations commonly measured in SST surface soil are conducive to survival, growth, reproduction of sensitive native plant species.

Lead concentrations in SST surface soil are approximately half those of copper.. Comparisons of site-wide mean, U95, and maximum exposure concentrations and regional phytotoxic levels reveal a high potential for phytotoxicity. Site-wide mean (724 mg/kg) and U95 (1,241 mg/kg) values approximate the regional phytotoxic level (1,000 mg/kg), while the maximum detected value (9,130 mg/kg) greatly exceeds the 1,000 mg/kg regional phytotoxic concentration. The risk potential for lead in SST surface soil, based on phytotoxicity, is high.

Recommended threshold concentrations (2.0 mg/kg) are exceeded by U95 and maximum SST surface soil mercury concentrations. On the other hand, levels considered contaminated (10 mg/kg) are not exceeded by any surface soil sample. Because the effects concentrations used in this evaluation are not specifically derived to protect ecological receptors, there is substantial uncertainty in the conclusions reached. Mercury in surface soil is considered to have low to moderate potential for ecological risk within the SST OU compared to other surface soil contaminants (e.g., copper, lead, and zinc).

Site-wide exposure concentrations (average, U95, and maximum) of zinc in Silver Bow Creek surface soil greatly exceed selected comparative data for regional baseline, non-regional phytotoxic level, suggested hazard level, tolerable level, and regional phytotoxic level.

Non-chemical Stressors

The major non-chemical stressors contributing to biological impairment of Silver Bow Creek and adjacent areas are disturbed aquatic and terrestrial habitats. Disturbances of aquatic habitat appear to be primarily caused by sediment inputs from upstream sources and from streambank erosion. Where such sedimentation includes deposition of fine grained materials, preferred habitat is lost for most desirable benthic macroinvertebrates. Future spawning areas for salmonid fish would also be similarly affected where deposition of fine grained sediments predominates. Adult salmonids would also be affected by conditions that impair the colonization, survival, growth, and reproduction of prey species, including benthic macroinvertebrates. Finally, fine grained sediments are expected to be more toxic to aquatic life than large grained sediments because of increased metals sorption on fine grained materials. Sedimentation in Silver Bow Creek is therefore a source of both physical (habitat disturbance) and chemical (metals toxicity) stress on resident or future resident biota.

Terrestrial habitats are disturbed by the physical presence of mine waste and the toxic conditions associated with mine waste and surface soil that precludes the establishment of a diverse and healthy plant community. This in turn adversely affects animals that require sufficient food (herbivorous species) and cover (most all species) for survival and reproduction. Soil-dwelling animals, along with sensitive plant species, are not present where mine waste overlies native soils. This result is due to both physical (displacement or covering of native soil) and chemical (toxicity) causes. Streambank tailings and other mine wastes also contribute to impairment of Silver Bow Creek through erosion and runoff.

APPENDIX D

RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

APPENDIX D

RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

TABLE OF CONTENTS
(continued)

I. INTRODUCTION

MDEQ has accepted comments from the public on SST OU RI/FS documents released to the information repositories beginning with the release of the Preliminary Remedial Action Objectives Report/Treatment Technology Scoping Document (RAOR) in July of 1993 and ending with the close of the public comment period for the Proposed Plan on August 9, 1995. Comments were received from the public on each of the following documents: Draft Baseline Risk Assessment (Draft BRA), Draft Remedial Investigation Report (Draft RI), and the Proposed Plan. In addition, ARCO submitted comments on the Proposed Plan and a disclaimer for each of the above mentioned documents (except for the Draft BRA) and the following other documents: RAOR and Draft Feasibility Study Report (Draft FS).

This Responsiveness Summary reproduces the public comments received during the comment period along with the disclaimers submitted by ARCO. This summary is divided into two sections and seven appendices. The first section presents a summary of public opinion received during the Proposed Plan public comment period between June 7 and August 9, 1995. The majority of public comments were received during this period. The second section presents MDEQ's response to numerous fundamental issues that were frequently identified by many different commenters on the Proposed Plan and during the public hearing. Most of these issues were related in some way to MDEQ's Preferred Alternative submitted in the Proposed Plan.

The first two appendices summarize the individual comments received on the Proposed Plan and during the public hearing. Oral comments were received at the public hearing held at the Fairmont Hot Springs Resort in Anaconda on July 10, 1995 and were transcribed into the written record by Nordhagen Court Reporting. Twenty of the 50 commenters who presented oral comments at the public hearing also submitted their written comments for inclusion in the administrative record.

The last five appendices included in this Responsiveness Summary contain the comments and ensuing responses on each of the documents referenced in the first paragraph of this introduction. For each of the substantial comments received on these documents - such as the detailed comments submitted by ARCO in its disclaimers and other organizations including the Clark Fork-Pend Oreille Coalition, the Confederated Salish and Kootenai Tribes of the Flathead Nation, and the Butte and Anaconda city and county governments - MDEQ provides a direct response. When multiple issues are brought forward by the same commenter, the comment and response are keyed by a common letter designation. To avoid duplication of responses, similar comments are generally addressed only once and thereafter referenced to the appropriate response using the assigned letter designation.

In transcribing the comments presented in this Responsiveness Summary, MDEQ has made a reasonable effort to ensure that the transcriptions are accurate reproductions in content. Since many of the comments were handwritten, it was sometimes difficult to read certain words or phrases. When a word or phrase could not be deciphered, a question mark (?) takes its place. MDEQ apologizes for any errors made in the transcriptions.

II. SUMMARY OF PUBLIC OPINION

Public comment on the remedial action proposed by MDEQ and the EPA for the SST OU was solicited in the Proposed Plan and through the public hearing. Written comments were assigned a number according to the order that they were received by MDEQ. Oral comments presented at the public hearing were transcribed in the order that they were presented. In addition to these avenues of comment, the Citizens' Technical Environmental Committee (CTEC) and the Montana Energy Research and Development Institute (MERDI) sent out mailers to the public soliciting comment on several fundamental issues relative to the remedial action. A summary of the number of comments received according to these four general categories (Proposed Plan, Public Hearing, MERDI, and CTEC) follows:

- Category I — 203 written comments received by MDEQ during the comment period.

- Category II — 50 oral comments presented at the public hearing held on July 10, 1995 in Fairmont.
- Category III — 98 postcards received from people associated with MERDI.
- Category IV — 233 single page mailers from people associated with CTEC.

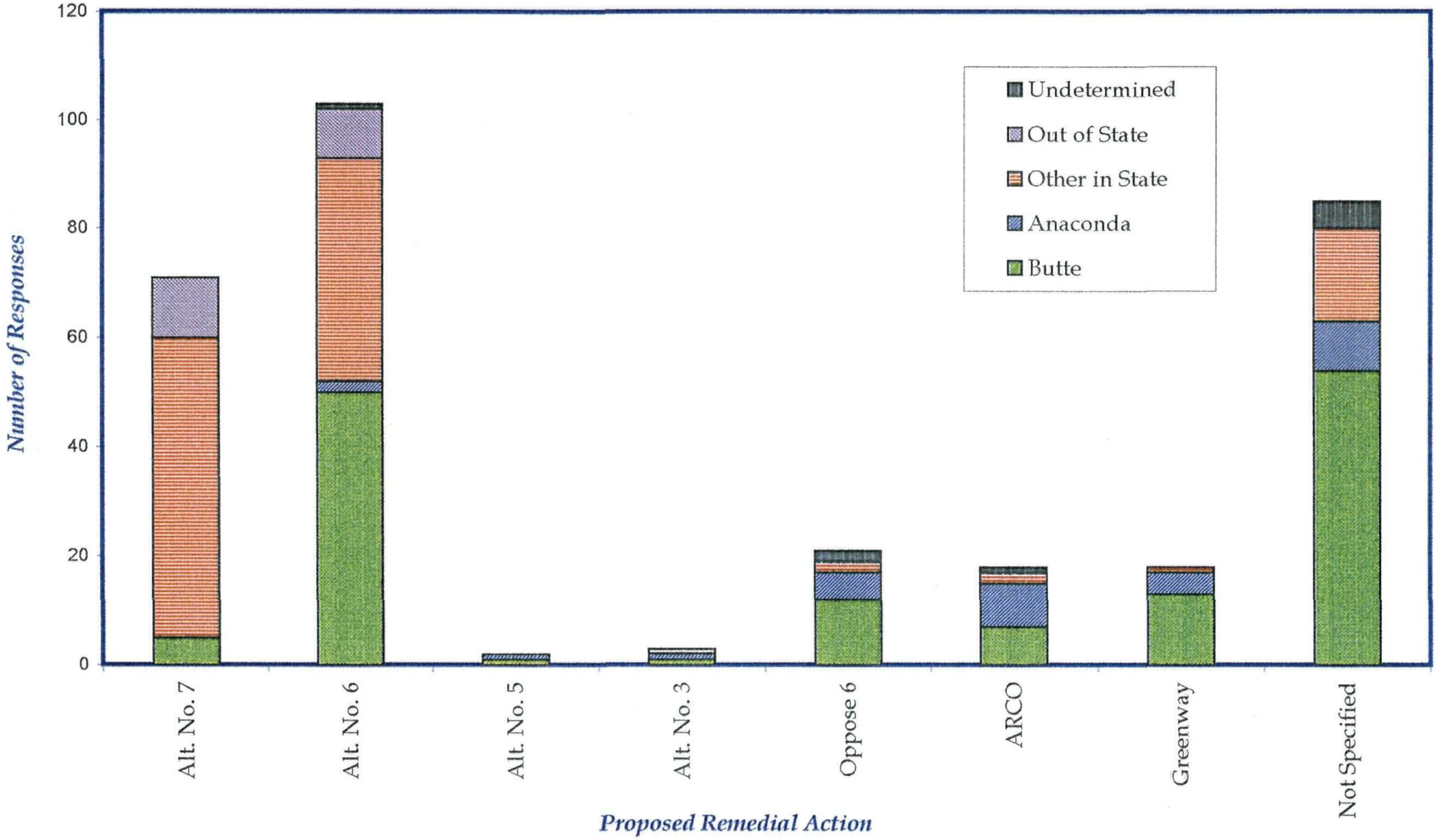
The Butte-Silver Bow Council of Commissioners and the Anaconda-Deer Lodge County Commissioners also solicited public comment on MDEQ's Proposed Plan. Both organizations submitted formal comments which are addressed in the following section. Butte-Silver Bow also submitted meeting minutes and written comments and testimony received from numerous individuals on the Proposed Plan. Anaconda-Deer Lodge transmitted the signatures of 64 people who signed a petition opposed to hauling tailings materials by rail or truck to the Opportunity Ponds.

Many of the commenters from the four categories expressed a preference for a specific alternative(s) offered in the Proposed Plan or they expressed support for other proposals suggested by ARCO or the land use "Greenway" Proposal forwarded by MERDI. Many other commenters either were undecided or their comments were not necessarily expressed with regard to a preferred alternative but rather offered thoughts and opinions on numerous other issues. Some commenters simply opposed MDEQ's Preferred Alternative (Alternative No. 6). Figure 1 summarizes, by category, the expressed public preference for a remedial alternative.

As shown on Figure 1, a majority of commenters (174 out of 321) expressed support for either Alternative 6 (Modified Partial Removal to a Regional Repository) or Alternative 7 (Total Removal to a Regional Repository). Relatively few people expressed direct support for ARCO's alternative (18) or for the Greenway proposal (18). Many others either did not specify a preference or their preference could not be determined (85). Only 21 people expressed opposition to the Preferred Alternative (Alternative No. 6) with many of those people encouraging a compromise between the Preferred Alternative and ARCO's alternative. Figure 1 illustrates how these preferences are distributed by community.

In addition to the preference for a particular alternative and the viewpoints offered by a commenter, MDEQ and the EPA requested feedback on ten important issues relative to implementing a remedial alternative at the site. These ten issues are:

1. What are your views on leaving tailings in the floodplain if such tailings are treated with the STARS technology?
2. Which is preferable, many (15-30) local near-stream relocation repositories or one or two regional repositories?
3. How do you feel about the use of presently uncontaminated areas for waste repositories?
4. How important are land restrictions on relocation repositories?
5. How would you feel about using Opportunity Ponds and/or a location up Browns Gulch for regional repositories?
6. What are your feelings on the use of Ramsay Flats as a relocation or regional repository?
7. How significant is the short-term risk of excavating and hauling waste materials to disposal sites in comparison with the long-term risks of creek contamination?
8. What would be preferable, truck or rail haul to regional repositories?



Public Opinion on Remedy Selection
By Geographic Area
Streamside Tailings Operable Unit
Figure 1

9. How would you feel about the use of size (less than 1 mm) as the remedial criteria for in-stream sediment?

10. What are your views of the remedial action objective of improving Silver Bow Creek to support a self-reproducing trout fishery?

While not all people who submitted comments expressed an opinion on each of these ten issues, many people commented either by directly answering the question or expressing their opinion on one of the ten issues in their written comments. In addition, the CTEC mailer adapted the central issue on five of these ten questions (Nos. 1, 2, 4, 5, and 8). A summary of the response to these questions is presented in Table 1. As shown in Table 1, the following points are evident:

- The majority of people (144 to 36) oppose using STARS in the floodplain. Most respondents voiced the concern that they thought that STARS is not a long-term, permanent solution and needs to be studied for a longer period of time.

- A notable majority of commenters favored hauling removed tailings to one or two regional repositories rather than many near-stream repositories.

- Only 15 respondents provided an opinion on whether uncontaminated land should be used for relocation areas or repositories. Almost all of these respondents opposed establishing repositories on uncontaminated property.

- The response was almost evenly split between respondents regarding the importance of land use restrictions.

- With regard to the location of a regional repository, the public almost unanimously rejected the use of Browns Gulch; most wanted to use the active mine areas of the Berkley Pit/Yankee Doodle Tailings. Thirteen people said no repositories should be used and 27 people favored the use of Opportunity Ponds. As mentioned previously, the Anaconda-Deer Lodge County Commissioners' petition registered 64 people opposed to rail or truck transport of tailings materials to Opportunity Ponds. Of the 13 people who expressed an opinion on the use of Ramsay Flats as a relocation area or repository, it was almost evenly split between those who favored its use and those who opposed its use.

- Of the 15 respondents who replied to the significance of short-term risks associated with excavation and hauling of wastes through the communities, 11 believed it to be insignificant and 4 believed it to be significant.

- As far as transportation, most favored using trucks for hauling tailings.

- The public was unanimously in favor of supporting the objective of maintaining a self-reproducing trout fishery in Silver Bow Creek.

The MERDI mailing contained seven questions which could be supported or opposed (by checking the appropriate box) as well as a section for other comments. The questions as well as the numbers supporting or opposing the questions are listed below:

1. *A cleanup that results in safe, long-term environmental and human protection.*

Support **96** **Oppose** **0**

Table 1 Summary of Responses to Proposed Plan Questions				
Proposed Plan Question	*Public Response*			
What are your views on leaving STARS treated tailings in the floodplain? How do you feel about using STARS technology as a permanent cleanup?	Favor 36	Oppose 144	Uncertain 3	
Which is preferable, many near-stream repositories or one or two regional repositories?	Near-Stream 24	Regional 143	None 1	Uncertain 20
How do you feel about the use of presently uncontaminated areas for waste repositories?	Favor 2		Oppose 13	
How important are land restrictions on relocation repositories along Silver Bow Creek?	Important 54	Not Important 52	Some 7	Uncertain 6
How would you feel about using the following sites as regional repository locations?	Browns Gulch 2	Opportunity Ponds 27	Butte Mine Area 200	None or Other 23
What are your feelings on the use of the Ramsay Flats as a relocation or a regional repository?	Favor 7		Oppose 6	
How significant is the short-term risk of excavating and hauling waste materials to the disposal sites compared to long-term risks of creek contamination?	Significant 4		Not Significant 11	
What would be preferable, truck or rail haul to regional repositories?	Truck 94	Rail 55	Either 22	Neither 8
How would you feel about the use of size (less than 1 millimeter) as the remedial criteria for in-stream sediment?	Use 2		Do Not Use 7	
What are your views of the remedial action objective of improving Silver Bow Creek to support a self-reproducing trout fishery?	Favor 21		Oppose 0	

Note: Table summarizes responses of written public comments that directly referred to specific questions asked in the Proposed Plan (MDHES, 1995) or similarly worded questions posed by the Citizens' Technical Environmental Committee (CTEC) in a mailer sent to interested persons. This summary does not necessarily represent the views of those people whom did not directly respond to the Proposed Plan questions.

2. *A selected remedy which includes future beneficial uses (economic development, historic preservation, recreation, etc.)*

Support	**95**	**Oppose**	**0**

3 *Transportation of 1.8 million cubic yards of wastes to either Opportunity Ponds or Browns Gulch.*

Support	**5**	**Oppose**	**88**

4 *Possible contamination of previously unaffected site (Browns Gulch).*

Support	**2**	**Oppose**	**93**

5. *Relocation of tailings to a safe area near the already affected site.*

Support	**80**	**Oppose**	**13**

6. *Use of innovative technology and effective institutional controls.*

Support	**90**	**Oppose**	**2**

7. *Coordination with other Superfund operable units in a manner that expedites cleanup and solves other environmental concerns (i.e., Metro Sewer issue).*

Support	**93**	**Oppose**	**1**

Along with the many concerned private citizens who commented on the Proposed Plan there were also a number of organizations. A few of the more notable are listed below. The number following the name is the number assigned to the written comment as it was received by MDEQ.

Organization	Ref. No.
Montana Power Company	16
Anaconda-Deer Lodge Reclamation Advocates	20
Pegasus Gold	25
United States Department of the Interior, Fish and Wildlife Service	36
United States Department of the Interior, National Park Service	40
Citizens for Labor and Environmental Justice	44
Missoula County, Board of Commissioners	45 & 101
Montana River Action Network	70
Missoula - Office of the Mayor	80
Trout Unlimited, Montana Council	90
The Pacific Rivers Council	98
Montana Environmental Information Center	102
United States Department of the Interior, Office of the Secretary	105
Anaconda-Deer Lodge County	114 & 130
Missoula County, Health Department	120
National Wildlife Federation	121
Montana Department of Fish Wildlife and Parks	137
Skyline Sportsman's Association, Inc.	141
Western Environmental Trade Association	146
Missoula Technical Assistance Committee (MTAC)	151

Organization	Ref. No.
Citizens Technical Environmental Committee (CTEC)	153
The Confederated Salish and Kootenai Tribes of the Flathead Nation	154
Butte-Silver Bow County	156
Montana Wildlife Federation	157
The Clark Fork - Pend Oreille Coalition	19 & 159
Vivian M. Brooke, Montana State Senator	164
Northern Plains Resource Council	171
Jon E. Ellingson, Montana House Representative	178
Trout Unlimited, Western Chapter	186
Mineral Policy Center	190
Montana Mining Association	203

III. GENERAL ISSUES EXPRESSED DURING THE PUBLIC COMMENT PERIOD

Numerous fundamental issues were identified by many different commenters. These issues were primarily related to the Preferred Alternative proposed by MDEQ and the EPA, although the comments received are also relevant for consideration of any remedial action proposed for the OU. This section summarizes the public comments received on nine different issue categories. These categories are:

1. Coordination with Up-Stream Clean Up Activities
2. Transportation and Disposal
3. STARS
4. In-Stream Sediment Removal
5. Institutional Controls
6. Costs
7. Wetlands as part of the Remedy
8. Community Input/Public Involvement
9. Other Recommendations and Comments

This summary of public comment on each of the nine fundamental issues is followed by the agencies' position on the issue, focusing on the questions raised by the commenters. This summary is not listed in order of importance or by number of individuals commenting. The numbers enclosed in parentheses refer to the number designation assigned to the comment by MDEQ. Numbers preceded by "H" are from the public hearing. While most commenters of these general issues are identified in this summary, some may have been inadvertently omitted.

Coordination with Up-stream Clean Up Activities

Comments: A number of commenters cited the need to deal with up-stream contamination sources before cleaning up Silver Bow Creek (#28, 16, 35, 50, 130, 137, 151, H-1, H-4, H-6). Several commenters noted that the in-stream sediment should only be cleaned up after the Butte Hill is remediated. (166, H-4)

Response: *The Record of Decision (ROD) specifies how the construction of the selected remedy will be coordinated with other Superfund and non-superfund cleanup actions upstream and along Silver Bow Creek so that the SST OU remedial action can be implemented without undermining its success or delaying downstream activities. Releases of contaminated sediments and surface waters prior to, during, and following remedial action, which might re-contaminate Silver Bow Creek, will be suitably controlled and treated. The design and schedule of the OU remedy will be coordinated with the design and installation of upstream sediment control basins. Before cleanup of tailings begins, sediment basins will be built on Butte Hill to manage sediments during spring* *and storm runoff. If adequate upstream control facilities are not in service at the time of initiation of construction of this remedy, then additional sediment control and treatment facilities will be provided as a part of this remedy. The action is also intended to coordinate with possible solutions to the treatment of Metro sewage effluent. See Response below under "Wetlands As Part of the Remedy."*

Transportation and Disposal Options

The majority of commenters presented opinions on the use of regional repositories and the type of transportation that should be used to move the waste from the Silver Bow Creek floodplain. These comments were generally summarized above in the Summary of Public Opinion section of this Responsiveness Summary. Summarized below are the individual comments that could be grouped into more general positions regarding transportation and disposal.

Comments: On Transport to and Disposal at the Opportunity Ponds -

- Supports, haul by rail (#1,14, 38, 41, 69, 90, 102, 105, 117, 152)
- Supports, haul by truck (#6)
- Supports (#19, 21, 87, 168, 184, 190)
- Opposed (#28, 71, 145, 190, H-29, H-34, H-44)
- Opposed to any more waste entering Deer Lodge County (#33)
- Opposed, no plan for ponds (#35, 130)

On Disposal at Ramsay Flats -

- Supports (#13, 107)
- How can Ramsay Flats be used when it is in floodplain? (#38)
- Opposed (#102)

On the Use of Uncontaminated Areas for Disposal -

- OK if small, under 10 acres (#13)
- Opposed (#27, 88, 102)
- Removing contamination from the floodplain more important than not putting repositories in clean areas (#186)

On Relocation -

- Supports (#20, 127, 156, 166)
- Handle tailings at or near site through relocation or STARS (#50)
- Many repositories near site but out of floodplain, use already contaminated site (#30)

Opposed to off-site transport -

- If this cannot be done then prefer Ramsay Flats by truck (#2)
- Every effort should be made to keep material in place. Ramsay would be only acceptable location(#25)
- Opposed to off-site transport (H-30)
- Waste removed from Silver Bow County should be treated in Silver Bow County and waste removed from Deer Lodge County should be treated in Deer Lodge County (#7, 27, 88)

Opposed to Using Browns Gulch - (#28, 34, 35, 50, 156, 158, 166, 168, H-1)

On Using the Active Berkeley Pit/Yankee Doodle Tailings Areas for Disposal - (#38, 87, 181, 184, 201, H-1)

Other Comments Germane to Transportation and Disposal -

- What can be done at Brown's Gulch or at Opportunity that cannot be done on site? (#8)
- Minimize distance hauled by truck (#16)
- Haul by truck (#29)
- Hauling by truck or rail to unknown site, difficult, expensive, and prone to delays (#47)
- All use of repositories should require significant monitoring. Solution must include some provision for loss of institutional memory. A possible solution is to incorporate a solidification and/or stabilization technique in addition to liming. (#151)
- Treaty reserved rights and related interests of the Consolidated Salish and Kootenai Tribes were not considered in the evaluation of repository sites. While the Tribes support the use of repositories, the choice of the location, configuration, and administration of the specific repositories should include all possible affected interests, including the Tribes. (#154)
- 1 or 2 repositories outside of floodplain (#158)
- Public's concern over transporting waste is a surprise since no one would object if this were a gold mine (#172)
- Either it's okay to have truck driving jobs associated with mining or it's not.(#181)
- Prefer 1 or 2 regional repositories (#186)
- Generally agrees with removal criteria but feels tailing could be moved outside floodplain, consolidated with existing tailings and treated with STARS(#1)
- Has reservations about modified removal because it does not address terrestrial habitat (#38)
- Supports modified removal unless ARAR cannot be met then all tailings should be removed as in Alternative 7(#40)
- Removal is more expensive than STARS but in the long term, economic benefits make it more costs effective. Removal produces higher property values, higher property taxes, more jobs, higher quality water, less monitoring costs, lower cost fishery management, better protection for downstream investments and less potential risk that mistakes have to be corrected in the future.(#90)

<u>*Response*</u> *Transportation and disposal of tailings/impacted soils are integral issues associated with five of the seven site-wide alternatives analyzed in the Draft FS. Not only are the locations of repositories or relocation areas and the means to transport the materials to these locations important, but the short-term impacts associated with transport and disposal are significant.*

In accordance with the agencies' Proposed Plan's Preferred Alternative No. 6, the agencies maintain that removal of tailings from the floodplain of Silver Bow Creek to a regional repository would provide the most protective and long-term remedy for the OU. This fact is evident in the discussion of the detailed and comparative analyses of alternatives presented in the Draft FS.

In the Proposed Plan, the Opportunity Ponds were the agencies' preferred site for disposal. The major reason used in selecting the ponds is the fact that disposed within the approximately 2,800 acres covered by the ponds are approximately 300,000,000 to 400,000,000 cubic yards of tailings. The agencies believe that the impacts associated with disposal of less than 1,800,000 additional cubic yards (less than one percent of those presently in the ponds) from the SST OU would be inconsequential. This was a component of the same reasoning used in selecting the Opportunity Ponds as the disposal site for approximately 1,400,000 cubic yards presently located within the Lower Area One.

Another factor examined in the evaluation of potential repository sites centers on the transportation issue. MDEQ's analysis of transportation alternatives indicates that rail transport is both a viable *and cost effective option for transportation of tailings removed from Subareas 1 and 2. Important factors considered in this analysis include the existence of a rail infrastructure within the OU and the presence of an off-loading structure at the ponds that was constructed to facilitate the Colorado Tailings removal. While MDEQ recognizes that issues such as coordinating the use of the rail line with the Colorado Tailings removal and the availability of rail cars have not been evaluated in detail, the presence of the infrastructure goes a long way toward favoring this form of transport.*

Second, from a cost standpoint, MDEQ's analysis of rail transportation costs indicate that rail transport compares very favorably with truck transport for tailings removed from Subareas 1 and 2. This is not true in Subarea 3 where the cost difference between rail and truck is greater and the canyon itself presents logistical problems for locating both sidings and staging areas. Because the rail line leaves the operable unit at the mouth of the canyon, trucking is much more cost effective than rail in Subarea 4.

It is evident from MDEQ's analysis that a combination of rail and truck could be used to transport tailings/impacted soil under any removal scenario, utilizing rail to transport approximately 48% of the tailings identified for removal (Subareas 1 and 2). By using rail transport in Subareas 1 and 2, some of the short-term impacts associated with trucking through the local communities of Rocker, Ramsay, Fredricksburg, and Nissler would be eliminated. Truck traffic would affect the communities of Fairmont, Crackerville, and Opportunity, however, with about 46,000 trucks (20 cubic yard capacity) hauling tailings over the four to six year period needed for tailings removal. This equates to about 50 trucks per day over a four-year project life, assuming a 230-day work-year.

Relocation of removed tailings/impacted soils was not included in the preferred alternative as delineated in the Proposed Plan primarily because of two issues: 1) Land use restrictions would be greatly reduced if a central repository were used; and, 2) Containing the wastes in one central location has fewer long-term risks than containing the wastes in many small but widely distributed locations, particularly with regard to maintenance and monitoring.

However, after considering all public comment and reevaluating the cost of attaining the additional level of protectiveness associated with the removal alternative, the agencies determined that relocation of excavated tailing/impacted soils, railroad materials, and in-stream sediments adjacent to the site would be appropriate. In addition to providing an estimated $9 to $11 million cost savings, many of the short-term impacts from transportation of the excavated materials, of concern in these comments, could be eliminated. The selected remedy therefore incorporates the use of near-stream or local relocation areas. The plan will allow use of numerous local repositories along the Silver Bow Creek corridor rather than centralized off-site repositories.

The use of numerous local repositories for the treated tailings and other materials is contingent upon obtaining adequate space at appropriately safe locations for such repositories and the successful establishment of an adequately funded institutional controls/maintenance program as part of this remedy. In the event these requirements are not met, the remedial action shall incorporate instead the use of regional repositories as determined appropriate by the agencies. The use of centralized repositories would substantially reduce the need for land acquisition within the Silver Bow Creek corridor and the need for institutional controls and continued land use restrictions within the stream corridor, as well as the maintenance requirements for such repositories. In such event, the agencies may also need to determine that a greater amount of tailings/impacted soils needs to be removed from the OU to ensure protection of the stream from reentrainment of STARS treated tailings/impacted soils in the absence of a permanent management, monitoring, and maintenance program.

STARS

Many comments were received on the use of STARS in the floodplain. Some people supported the use of STARS unconditionally in the floodplain while many others opposed its use. Several commenters expressed qualified support for STARS based on certain criteria, such as using STARS if removals were impossible or impractical.

Comments: Qualified Support for Use -

- Tailings outside of floodplain can be treated with STARS.(#1)
- Acceptable if not harmful to humans, animals, or water (#2)
- STARS should be used in floodplains only if removal impossible or impracticable. (#6)
- Acceptable only in areas where it can be used effectively and protected from erosion. (#14)
- STARS not a proven technology although it does have some uses in SST (#15)
- Preferred alternative relies on STARS only where appropriate, i.e. where tailings are not saturated and where erosion back into the creek not possible (#17)
- STARS workable for most of corridor, hot spots should be removed (#23)
- STARS is appropriate in some areas but should not be the primary method of remediation, especially in floodplain. (#69)
- Short term effectiveness of STARS looks good. Long term effectiveness seems doubtful. Once lime or crushed limestone coated with ferric hydroxide precipitate, will loose effectiveness. Believes large areas of easily removable tailings should be excavated. Where tailings thin, or otherwise difficult to excavate, STARS could be used.(#87)
- Should be used to treat some of tailings in place such as proposed in Subarea 4. Use must be conditional with a monitoring program and provision of resources to correct deficiencies and problems. If STARS is used extensively, following problems must be solved to ensure long-term success and protect residents and workers:
  (1) Tailings deeper than three feet will not be treated by STARS
  (2) Complete mixing will not occur, except in upper 30 cm
  (3) Calcium hydroxide is extremely caustic and should not be spread near populated areas when wind is greater than 10 mph. This will especially be a problem near Ramsay. (#156)

Supports -

- Supports stabilization with STARS (#13)
- Will work to revegetate various places along the creek (#21)
- Over majority of area, STARS should be used and is preferable to hauling material elsewhere (#25)
- Tailings should not be removed from floodplain (#28)
- ARCO should be allowed to use STARS and if it does not work, will have to remedy situation (#47)
- Use of STARS should be maximized if ARCO is willing to bear the risk of its failure in perpetuity (#50)
- STARS should be used to the greatest extent possible.(#71, 89, 127, 166)
- Supports use. STARS not a panacea for all problems, but at Governor's project was a distinct improvement.

Opposes -

- Does not believe that STARS technology would attain a standard of performance equivalent to that required by floodplain and solid waste ARARs.(#30)
- STARS should be used to treat tailings in floodplain in places where the hydrology allows for slower stream flows. In restricted areas where streamflows are higher, tailings should be relocated to nearby area outside of floodplain. (#35)

- The natural meandering of SBC may cause erosion of contaminated materials into the creek. Metals associated with these materials would then be available for uptake by both benthic and water column organisms (#36)
- STARS inappropriate within floodplain as lime incorporation will not survive a flood (#38)
- Dynamic flows of SBC and upper Clark Fork River provide empirical evidence that any contaminants in the floodplain will be re-entrained and redeposited downstream. STARS will not adequately protect against recontamination from erosion associated with overbank flows and natural stream meandering and saturation of soils and tailings from fluctuating ground water levels and flows. (#40)
- Historic and geologic records of SBC indicate that floods will continue to occur on SBC and that tailings left in floodplain will find their way back into the stream channel. Tailings left in the floodplain will eventually be reworked. (#41)
- Any cleanup which leaves toxic materials in a position to be reentrained to the creek and floodplain via water contact is insufficient. Any cleanup less than Alternative 6 will result in the need to redo the remedy in the future (#44)
- Oppose use of STARS on tailings near creek (#44)
- Tailings within floodplain should be removed (#49)
- Visited Warm Springs Ponds and was impressed by how much erosion had occurred from rain events that are not rare. Damage done to reconstructed by-pass is further evidence of what can happen during a wet, but not major flood event. Removal of tailings to Opportunity Ponds is the best solution (#65)

  SBC will eventually meander and come into contact with tailings throughout the riparian zone (#62)
- Opposes use of STARS (#66, 70, 72)
- There may be serious risks to downstream users and wildlife in Montana and Idaho if STARS is used (#67)
- Don't use STARS in the floodplains (#186)
- Opposes use. Does not remove metals. Re-entrainment of metals, mobilization of arsenic, protection of groundwater, and plant uptake of cadmium of concern.(H-5)
- Work done at Miles Crossing shows that ground water in contact with tailings acts as a pathway to ground water and that STARS will not help (H-10)
- Has viewed STARS plots at Rocker. The grasses that grow there are not the same as those that grow in the area and there are no trees. Have lived in area for more than 55 years, and have seen stream channel meander 3-4 times to a new channel. STARS won't work. (H-26)
- Doesn't hold up to floods well (H-42)

Other -

- STARS should not be prime element in final remediation because of its uncertainty in immobilizing Cd and Zn and potential for mobilizing As. All STARS applications should be subjected to rigorous monitoring and alternative plans for areas that fail. (#90)
- STARS unproven, may not prevent leaching of some materials. Meandering will cause erosion into streams (#102)
- Any STARS treated areas should be treated as an experiment with a commitment to long term monitoring of their role in achievement of water quality. ARCO should sign an agreement to conduct removal if long term monitoring studies show STARS to fail. (#102)
- As identified by the State, STARS treatment works best only in the top 6 inches of soil. Due to its ineffectiveness below 2 feet, STARS treatment will not allow trees to grow over most of site (#117)

- STARS increases mobility of As which has already contaminated Milltown and Missoula aquifers (#120)
- STARS should not play a prime role in plan. Ability to immobilize Cd and As uncertain as is role in mobilizing As. Effectiveness is undermined by morphological changes in the floodplain. (#121).
- MDHES has placed unnecessary restrictions on the use of STARS, specifically use within the 100 year floodplain and the requirement that areas treated with STARS have at least two feet of separation from seasonal high groundwater. MDHES should re-consider use of the 100 year floodplain as a criteria. The zone of erosion risk should be re-defined based on criteria other than the 100 year floodplain and STARS techniques should be endorsed in reaches of SBC where it is not tightly confined.

  The effectiveness of STARS in seasonally saturated tailings is unknown. The STARS studies did not evaluate this pathway because the input of shallow groundwater was not considered to be of concern. Mass loading studies of SBC indicated that most if not all of the load of metals in SBC is present in Metro Storm Drain or immediately below the Colorado Tailings. During low flow conditions loads of many metals declines in a downstream direction. Therefore the potential for impact to SBC from the influx of contaminated shallow groundwater during low flow is not evident from the available data. The restriction on application of STARS techniques to zones more than 2 feet of separation from groundwater is too conservative. The nature of the soils underlying the tailings is at least as important as the distance from groundwater. A more realistic and equally protective criteria for restriction of STARS use is in zones where groundwater is within 18 inches of the tailings for a month or more of the year. (#122)
- STARS fails on 5 counts as long term remedial technology:

  (1) Short term technology but is proposed for application to a long term problem

  (2) Relies on application of calcium hydroxide (a noxious material) that is short lived in the tailings/soil environment and inappropriate for large scale applications

  (3) Liming rates will not approach the total acid potential of the tailings material and will therefore require regular reapplication

  (4) STARS technology has not addressed plant nutrient cycling, requirement for long term success and

  (5) STARS treated areas will continue to show metal contaminated water drainage from the treated areas.(#136)
- Because of the shortcomings of STARS, it is our position that a 100 year flood, which has a high probability of occurring within our lifetimes, represents a very real threat to redispensing the left in place tailings along SBC and that dispersal will result in deposition in Milltown Reservoir. It has been suggested that the present contamination in Milltown Reservoir is the result of a 100 year event in 1908. The inadequate performance of Warm Springs Ponds during this spring's rains, barely a 5-year event does not give confidence in any scheme that leaves contamination in SBC's 100 year floodplain.(#151)
- STARS is an acceptable remedy only:

  (1) when used minimally due to potential to mobilize As

  (2) where risk of reentrainment of tailings due to surface water or ground water flow, stream meandering or erosion is considered improbable

  (3) in areas where activities such as cattle grazing and recreation are restricted to protect against exposure to hazardous metals

  (4) in areas absolutely free from present or future mercury contamination

  (5) When properly implemented

  (6) Given continued monitoring of STARS(#153)

- The Proposed Plan does not present a specific set of criteria which define "equivalent performance" nor does it identify what activities will be undertaken to judge the meeting of the criteria. Suggests that the criteria be the remedial action goals and objectives and that the complete removal of all tailings in Subarea 4 be assumed to be the necessary remedy until such time as quantitative modeling or other analyses clearly demonstrate otherwise. The use of STARS will require continual monitoring. The Proposed Plan does not describe what monitoring or restrictions will be necessary. (#154)
- Have you looked at how much worse the arsenic will be in the stream and behind the dams after you have allowed 22% of the tailings to be limed and left in the Creek? (#181)
- On behalf of future generations, ask that limits not be placed on future land use and that a perpetual burden of O and M be placed on STARS (#201)
- Long term monitoring and maintenance required. Some form of financial assurance should be required if STARS is used.(#1)
- Depending on actual contaminant levels, not all tailings in floodplain needs to be removed or treated in-place.(#1)
- Specific questions raised about:
  (1) Mass balance of carbonate species and acid-producing species over the long term
  (2) Possibility of increasing water table elevations in areas through sedimentation events or artificially filling an area, and/or irrigation which may lead to acid production
  (3) The long-term viability of using soluble buffering material above the depth of leaching of carbonates in soils
  (4) Adequacy of monitoring in the test plots. Spatial distribution and depth of observation wells is limited. (#15)
- Problems with STARS Technology:(#17)
  (1) Does nothing to reduce the toxicity or volume of contamination
  (2) Because of problems of erosion and stream meandering, does not permanently reduce the mobility of contamination
  (3) In many areas, depth of tailings too great to allow STARS to be used effectively
  (4) Would not adequately deal with mercury and cadmium
  (5) Would mandate extensive use of institutional controls, would limit land use and property rights of owners
  (6) Disparity in STARS technology between pH level necessary to prevent leaching of heavy metals and pH necessary for native vegetation to flourish.
  (7) Not adequately tested.
- STARS has serious limitations:(#19)
  (1) Does nothing to reduce amount or concentration of metals in stream system
  (2) Not effective at immobilizing metals where ground water is in contact with tailings or could be in contact
  (3) Can not withstand erosive flood flows
  (4) Does not immobilize and may increase mobility of arsenic
  (5) May not immobilize cadmium or zinc
  (6) Requires long term maintenance and limits future land use
  (7) Does not take into account dynamic nature of river
- Does not support Alternative 6 because of its reliance on revegetation techniques in place of tailings removal. The agencies' proposed plan suggests revegetation of the farthest downstream portion of the site, which lies in closest proximity to the Clark Fork River and Missoula County. Revegetation techniques do not immobilize arsenic and may increase mobility. Arsenic contamination has already occurred in Milltown and Missoula aquifer. If contamination along SBC not removed from floodplain, anticipate continued recontamination of Milltown aquifer, Clark Fork River, and Missoula aquifer. (#80, 101)
- STARS should not be used on any material left on site with elevated arsenic. No contaminated material should be left in active floodplain. Design and operational phases

of removing contaminated sediments should be coordinated with up-stream cleanups,(#90, 121)

- State should show why wastes deposited by floods are not now in floodplain and should reconsider the floodplain in light of the idea of debris dams. Should treat any STARS treated areas as experiments and commit to long term monitoring to see how well water quality standards are achieved. (H-4)
- If it can be shown that tailings/impacted soils to be STARS treated will not enter SBC will support 6 (#36, 105)

Response: *MDEQ has consistently recognized that STARS has certain limitations that restrict its use under certain conditions. Because MDEQ initiated the STARS study with the Reclamation Research Unit and Schafer and Associates in 1986, the agency has been intimately involved with the study design and the summation of the conclusions determined after three years of monitoring.*

The study was conducted in three phases. Phase I was designed to test a variety of chemical amendments on tailings in the laboratory and to determine the best combination of amendments that reduced the concentration of metals measured in water leached through the amended tailings. In conjunction with the chemical testing, greenhouse studies were undertaken to determine the best mixture of plant species that would grow in amended tailings. Phase II consisted of field trials to test the most effective chemical amendments determined in Phase I. Several different amendment mixing techniques were implemented in Phase II to evaluate the depth to which the amendments could be incorporated. Several different seed mixtures were also tested based on the results of the greenhouse trials. Phase III consisted of collecting various types of soil, water, and vegetative data over the course of three years and evaluating each of the treatments applied.

The agencies determined that the application of STARS amendments were effective in the following areas: reducing runoff produced from treated tailings; reducing the acid producing potential of metal sulfides present in the tailings materials; reducing the phytotoxicity and mobility of most metals that leach through the tailings; providing a favorable growth medium that will support a vegetative cover; reducing the amount of moisture that could percolate through the amended tailings through vegetative management of the annual soil water budget; and, reducing wind blown dust.

However, based on the results of the study and the limitations of data collected during the study, the agencies have three primary concerns which restrict the widespread implementation of the STARS technology in the SST OU.

1. STARS amendments do not appear to completely eliminate contaminant movement in pore water - Data collected during the study demonstrated that soil pore water quality was highly variable from treatment to treatment and year to year. General trends in soil pore water chemistry data indicated that amended plots generally showed an increase in pore water pH and a decrease in the concentrations of most metals. Due to the heterogeneity inherent in the study plot soils and the lack of replicated pore water instrumentation, only the 40 cm depth (the shallowest monitored) conclusively demonstrated effective reductions in pore water metals concentrations. Arsenic concentrations were observed to increase at depth in the amended plots at some of the monitored sites which may be attributed to the greater solubility of arsenic with increasing pH. The metals aluminum, iron, and copper were substantially less soluble in soil pore water as pH increased while manganese, cadmium, and zinc concentrations did not have a clear correlation with increasing pH until pore water pH could be raised to levels greater than 7.0. Much higher amendment rates may be needed to substantially reduce concentrations of cadmium, manganese and zinc. Because of these findings, there is some uncertainty in the effectiveness of STARS to prevent the movement of some contaminants through the vadose zone.

2. *<u>STARS amendments do not mitigate the migration of metals from tailings/impacted soils saturated by groundwater</u> - The STARS study was developed to enhance water use within the rootzone with the intent of limiting vertical movement of vadose zone water and contaminants. There is still much debate as to the ability of the STARS technology to effectively manage the soil water budget resulting in a substantial reduction in infiltration to groundwater. One associated condition of considerable concern is implementing STARS in riparian areas of shallow groundwater (12 to 18 inches below ground surface) because plant roots may tap the groundwater table, rather than use vadose zone moisture. Reestablishment of a vegetative cover, even if it successfully eliminates infiltration to groundwater, is not capable of addressing metals mobilized by the interception of tailings/impacted soils by groundwater.*

In addition, it has never been determined if lime amendments can be successfully incorporated into saturated soils. Neither STARS nor any other demonstration studies in the Clark Fork basin investigated this issue or the types of plant species that might be used in saturated conditions. The STARS test plot at the Manganese Stockpile site failed, at least partly because of the saturated conditions at the site during long periods. Also, In MDEQ's analysis of the STARS treatment in saturated tailings conditions, two critical factors concerning STARS implementation indicate that STARS will not be effective: 1) The equipment designed to mix lime amendments into tailings is not likely able to adequately mix below the water table; and, 2) Because the highly soluble calcium oxide or calcium hydroxide is used to make up 40% of the STARS amendment, it is likely to be removed from the amended profile in ground water in those amended tailings that are seasonally saturated, primarily during the first year after amendment.

To expand on the first critical factor, mixing STARS amendments below the water table was not demonstrated at any of the ARCO demonstration projects (Demonstration Projects I, II, and III), nor was lime mixed below the water table during Phase II of the STARS investigation at the Manganese Stockpile. MDEQ maintains that adequate mixing of lime amendments in ground water would not occur due to the inherent problems of plowing saturated materials and the physical process used to deliver the lime to the tailings to be mixed. Whether saturated tailings were amended during implementation of the Governor's Project could not be confirmed in the published documentation of the project.

The second critical factor is based on the solubility of calcium oxide or calcium hydroxide amendment. When mixed with soil, the pH generally rapidly rises to 9 to 10 standard units after mixing and tends to elevate soil pH for several months. As ground water rises into recently amended tailings, some quantity of the soluble calcium amendments are likely to be solubilized and removed from the soil as the water table lowers, even where ground water has a near neutral pH and is slightly alkaline. While no data is available to quantify the amount of amendment that could be removed, MDEQ believes that the uncertainty associated with this issue limits the application of STARS to tailings located greater than two feet above the 1992 low water table elevation.

Contaminated groundwater results in continuing, long-term contamination of Silver Bow Creek's surface water and in-stream sediments. Where contaminated groundwater has the potential to discharge to the stream, metals have been shown to precipitate/adsorb on the stream substrate (in-stream sediments) and potentially remain a source of contamination to surface water. The STARS study was never designed to investigate this contaminant migration pathway.

3. *<u>Contaminants could continue to be transported to Silver Bow Creek from a treated floodplain by various hydrologic processes</u> - Overbank flows and channel migration could be expected to re-entrain amended tailings into the stream and in-stream sediments, thereby subjecting the tailings to oxidation. This is especially true in the areas immediately adjacent to the active stream channel*

where channel migration and streambank erosion processes are most prevalent. In addition, under flood conditions, the stream channel is at the greatest risk of making major changes in channel location by avulsion or "jumping" into abandoned channels or migrating into areas susceptible to erosion. Once a STARS treated area is eroded, the amendment is likely to separate from the treated tailings and basic geochemistry suggests that, over-time, these tailings would produce acid and re-mobilize the metals which would be expected to become bioavailable. The impacts of these bioavailable metals would severely limit the ability for remedial actions to meet specified biologic and possibly surface water quality objectives.

4. <u>Long-term effectiveness</u> - There is much debate regarding the long-term effectiveness and permanence of STARS treatment. The STARS study was designed to compare treatments against untreated tailings conditions and to measure relative differences between treatments. Data collected during the three year monitoring period reasonably represents the short-term effects of the treatments. However, it is conceivable that actual long-term effects may be different than trends evident in the three years of data presented in the STARS reports.

<u>Summary</u> - No single treatment proved to ameliorate metals contamination for all environmental matrices or for the range of environmental conditions represented in the study. For this reason, it is apparent that the STARS treatment is not suited for all the conditions present at the SST OU. The agencies believe that STARS is best suited and has the fewest limitations in tailings locations further away from the active stream channel and well above the seasonally high ground water elevation. A critical element of the remedy selection is the determination of which tailings may be left in place and treated with the STARS technology and which tailings must be removed from the floodplain before being treated with STARS. After evaluating STARS fully, MDEQ identified certain criteria which define where within the floodplain STARS may effectively and reliably be implemented. The tailings/impacted soils meeting the criteria are:

1. <u>The tailings/impacted soils involved are not saturated in groundwater during any part of the year</u> - The SST OU Draft RI Report delineated the location and volumes of saturated tailings/impacted soils. Generally, groundwater seasonally fluctuates slightly over two feet in the OU. Groundwater movement into and out of tailings, even in STARS treated tailings, will cause continued contaminant migration to groundwater.

2. <u>STARS treatment must effectively immobilize the contaminants in the tailings/impacted soils</u> - The STARS study identified the ability of the technology to successfully immobilize most contaminants of concern where the amendments can be adequately mixed into the tailings and soils. The depth to which the necessary soil amendments can be effectively incorporated is limited. The selected remedy specifies that the full thickness of tailings must be effectively amended. The maximum thickness of tailings allowed will be 2 feet. To attain adequate incorporation of lime at that depth will require multiple tilling with the deep plow. Tailings deposits thicker than 2 feet will have to be excavated or graded to no more than 2 feet in depth. Moreover, because the STARS technology may not completely immobilize cadmium and zinc and may potentially increase the mobility of arsenic, a minimum thickness of natural soils material below the treated tailings is needed to act as a protective buffer between STARS treated material and ground water. Tailings deposits that are thin enough that underlying native soils can also be tilled into the tailings is a positive consideration under this criterion.

3. <u>The tailings/impacted soils are not located where they may be eroded and re-entrained into the stream system through normal stream processes or major flood events</u> - STARS treated tailings could be transported into the stream system if eroded during natural stream channel migration or as a result of overbank flows. Erosion and inundation from bank-full and flood events can be estimated based on a number of sources including CH2M Hill's Silver Bow Creek - Flood

Modeling Study, which analyzes the lateral extent and water velocity of various flood events, from regular bank-full to greater flood events.

Another easy to comprehend method of determining where the stream might meander is to examine where the stream has been in recent past. By examining numerous aerial photographs and walking the OU one can identify and map stream channel meanders and old channel scars which are activated during various flow events. This is the method that MDEQ used for delineating where tailings/impacted soils should be removed.

ARCOs contractor (PTI, 1990), in examining these channel locations states (pg. 6) "Scallops in the valley margins of the creek above the canyon [Durant] and abandoned, but still typographically distinct, meandering channel courses in the upper Deer Lodge Valley also suggest that the channel meandered throughout most of its length prior to any mining activities." The document goes on to state on page 11 "The near-term likelihood of their [tailings] erosion is proportional to their proximity to the present channel. Above the mouth of Silver Bow [Durant] Canyon, the channel appears in the recent past to have actively reworked sediments (tailings) across the entire width of the stream valley, indicating that these tailings deposits will be quickly supplied (geologically) to the stream channel without human intervention." In reference to Subarea 4 the document states (pg. 23) "Abandoned channel courses indicate that the pre-mining channel configuration was highly sinuous." MDEQ agrees with the methods used and the conclusions drawn from this analysis as described above.

In-Stream Sediment Removal

Comments: Supports Removal

- Thinks removal of all fine-grained in stream sediment not a bad idea if it can be done. Maybe a new creek bed would be reasonable.(#3)
- Supports removal of 1 mm and less size fraction (#16)
- Only way to clean up stream is to remove majority of contaminated in-stream sediments (#19)

Opposes Removal

- Removal of 1mm and less not necessary. Key is to prevent additional tailings from entering stream or becoming acidic and releasing metals. If there are areas of substantial in-stream sediment deposits, these should be removed.(#13)
- With regard to streambank sediments, state has conducted simplistic and overly-conservative risk assessment based on literature values which are not valid for estimating risks in SBC. Has resulted in a gross overestimate of risks from sediment metals to aquatic biota and results in a biased perspective concerning the need for sediment removal in the creek. State has also not recognized the present recovery of SBC as indicated by the increasingly abundant populations of aquatic insects and other organisms that live in sediments. Both lab and field data have demonstrated that the sediment bound metals in SBC will not be a significant long term source of dissolved metals to surface water. It is dissolved metals, not the sediment metals that are important as having potential toxic effects to fish and their food items. Silts and clays that contain the highest metals concentration are the most subject to natural flushing from the system during flood events. Any attempt at separation of fines from natural bed sediments would be disruptive to the stream environment, technologically infeasible, and would only be attempting to do what would occur naturally if system left alone. Any active removal of in-stream sediments should be deferred until planned source control actions completed. Channel stabilization and implementation of STARS will cause input to creek to be

minimized. Natural flushing action will then take care of fine-grained sediments. Recommends source control and stabilization of riparian areas with deferral of determination of need for sediment removal. (#24)

- Excavation and removal of stream bed unnecessary and will cause more problems than will solve. Tearing up in-stream will remove present impervious layers of clay-silt-sand-tailings which have "hardened" in-stream and channel(#34)
- State's proposal of removing particles smaller than 1 cm from in-stream impractical and impossible (#47)
- Opposes removal (H-1)

Other

- How would this be done(#6)
- Creating a new stream channel in a clean area, followed by reclaiming the old channel preferable to trying to clean an active channel. (#38)
- Any action taken should be scientifically based and defensible and should be coordinated with up-stream activity(#127)
- Proposed cleanup of contaminated stream sediment a necessary precursor to achieving the ARARs. Not clear how fine sediment removal process would be achieved nor what degree of cleansing could be anticipated. A more effective mechanism might be new channel construction through newly placed clean fill material. If some in-stream toxic metal removal process is attempted, an extremely thorough process must be utilized to achieve the naturally self-sustaining trout fishery goal (#137)
- The proposed plan does not offer any quantitative estimates of the environmental or health benefits to be achieved by the proposed sediment removal. The Proposed Plan does not provide a quantitative estimate of the degree to which the removal of this fine fraction of bed sediments will meet remediation goals. The Plan should be revised to provide such estimates and define procedures which would be used to assess achievement of goals of remediation.(#154)
- ROD should:
  (1) Require determination of actual weathering potential of stream sediments and long term potential to release metals to SBC
  (2) Require monitoring of sediments during and after LAO removal and Butte storm water work
  (3) Precise remedial design can specify the appropriate removal options and volumes (#156)
- Documents did not provide sufficient information to allow reader to understand if it's a good idea or how it is going to be done (H-4)

Response: *MDEQ believes that in-stream sediments must be removed if the overall site remedy is going to achieve the goal of remediating environmental conditions to the point that they would sustain a reproducing trout fishery in Silver Bow Creek and be protective of the environment. MDEQ has focused its preferred remedy on the fine grained in-stream sediments because traditional concepts as well as OU data indicate the relationship between metal content and grain size assumes that the fine fraction carries most of the metals in sediments. MDEQ has defined this "fine grained" size fraction of in-stream sediments which contains unacceptable concentrations of metals as less then one millimeter (< 1mm). As reported in the Draft FS, this concept has been supported in many cases (Salomons and Forstner, 1984; Forstner, 1982; Thorne and Nickless, 1981; Ackermann, 1980; Filipek and Owen, 1979). Fine grained sediments represent the predominant repository for contaminants as well as a pathway for contaminants to surface water and biota (Baudo, Giesy and Muntau, 1990). In Silver Bow Creek, most of the fine sediment can be attributed directly to the erosion of streamside tailings/impacted soils, and the continued reworking by the creek of channel and floodplain deposits which consist largely of tailings/impacted soils.*

The Draft Baseline Risk Assessment and the scientific literature demonstrate that contaminated in-stream sediments can adversely affect benthic organisms that live in or ingest sediment (Axtmann, Cain and Luoma, 1990). While the quantity of metals mobilized from contaminated sediments is a fraction of total, these small quantities represent a substantial environmental impact (Jennett, Effler and Wixson; 1980). The Draft Baseline Risk Assessment determined a "high" risk to aquatic life from each of the contaminants of concern (As, Cd, Cu, Hg, Pb, and Zn). In addition, the sediments in Silver Bow Creek are in a similar geochemical environment and have much higher metal concentrations than samples collected at the Milltown Reservoir Superfund Site where sediments had measurable adverse ecological effects (USFWS and UW, 1992). Available information suggests that the chemistry of the surface water and in-stream sediments is a primary factor in impacting aquatic life (Axtmann, Cain and Luoma, 1990; Luoma, 1989; Moore, Luoma and Peters, 1991; Baudo, Giesy and Muntau, 1990; Trent 1987; USEPA, 1994; Essig and Moore, 1992).

Table 2
Silver Bow Creek
Mean In-Stream Sediment Concentrations

	Background[1] Silt/Clay Fraction (mg/kg)	Sand Fraction (mg/kg)	Clay Fraction (mg/kg)
Arsenic	7	92	378
Cadmium	0.2	3.8	76
Copper	20	694	10,459
Lead	15	225	6,702
Mercury	--	0.8	NA
Zinc	57	1,357	12,782

1 Background developed by Essig & Moore, 1992; No value for Mercury
NA = Sample concentrations not delineated by size fraction

Based on the assumption that the overbank sources of sediment will be reduced significantly by implementation of tailings/impacted soil remedial action alternatives and that the up-stream sources will be reduced by ongoing and future remedial activities, Silver Bow Creek in-stream sediment conditions are expected to change over time. How sediment conditions will change and how long the changes will take are unknown and difficult to predict. Up-stream remediation and tailings/impacted soil remedial alternatives should decrease sediment and contaminant loads in the future but the uncertainty involved with the time required for this to occur compels the agencies to require in-stream sediment removal concurrently with the removal/relocation of tailings/impacted soils.

The agencies firmly assert that removal of fine-grained (< 1mm) in-stream sediments is implementable with standard construction techniques. The planning process for sediment removal would begin with the delineation of stream sediment depositional areas containing the < 1mm size fraction. Current available information gathered during the FS indicate that the primary deposits of in-stream sediment are located in Subareas 1 and 2.

Dewatering of the stream would be integral to sediment removal. If done concurrently with the removal/relocation of saturated tailings, one plausible implementation scenario would rely on diverting the stream into the trench created after the removal of near-stream saturated tailings. Once the active stream channel is dewatered, a variety of conventional construction equipment could be used to perform the removal. It is likely that several other standard construction techniques could be used to dewater the stream, such as diverting stream flow through a temporary *pipe as sediment removal progresses downstream. The agencies believe that there would be a reduction of short-term potential risk, costs, and implementation difficulties related to synchronous handling of materials if in-stream sediments were removed in conjunction with saturated tailings.*

Institutional Controls

Comments:

- Restrictions which prevent future digging of exposed tailings acceptable. No restrictions should be put on low impact recreational activity. Temporary fencing should be allowed only as a last resort. (#13)
- Fence cattle from the riparian zone (#1)
- Trying to restrict access is a waste of time (#6)
- Restrictions on relocation repositories necessary to protect human health and wildlife (#14, 38, 69, 186)
- Preferred alternative would require the least reliance on institutional controls. Property owners would be freer to use property as they want. (#17)
- Restrictions should be such that using the area would present no more risk than using the streamside area that is being cleaned up (#30)
- Any remedy short of Alternative 6 will require management in perpetuity and the imposition of severe institutional controls. (#44)
- Not needed if Project Green implemented (#127)
- ROD should define how institutional controls will be used to sustain the selected remedy and stipulate provision of financial resources. ROD should designate Butte-Silver Bow and Anaconda-Deer Lodge to manage. (#156)
- Cattle should not be allowed to graze on any grasses planted in tailings because of possible cadmium uptake. Children should also be prevented from playing in it. How do you propose to protect plantings? Can't protect hillside grass planting in Butte (#192)

Response: *As outlined in the Draft FS, Institutional Controls (ICs) may take many forms in support of the engineering controls implemented with the remedial action. Numerous statutory ICs will apply to a remedy implemented in the SST OU including land use restrictions imposed by floodplain, zoning, and subdivision regulations, and ground water restrictions imposed by well construction, State, and county permit regulations. In addition, the agencies anticipate that ICs will be directly implemented to manage the Silver Bow Creek corridor and monitor and maintain the SST OU remedy. Those controls will be tied intimately with the establishment and operation, by Butte-Silver Bow and Anaconda-Deer Lodge local governments, of a designated recreational land use within the stream corridor. Certain land used restrictions will be required on repositories locations and in situ STARS treated areas. While the specific land use restrictions will be determined during remedial design, extensive grazing and recreational uses, such as trail-bike riding and four-wheeling, that would disturb the amended vegetation and soils are likely to be prohibited. Other activities are not expected to be limited.*

An institutional controls program, which must be funded on a permanent basis as part of the remedy will be coordinated through a joint effort of the Butte-Silver Bow and Anaconda-Deer Lodge local governments. Institutional controls, monitoring, and maintenance will be integrated into a Silver Bow Creek corridor management program. The program will be established and maintained in a manner that will ensure that all aspects of the OU remedial action, both within and outside of the floodplain, are maintained for the long-term, and ensure that the future land use in the area is consistent with the scenarios upon which cleanup level decisions for this action have been based.

Costs

Comments:
- Range of dollar estimates for each alternative should be narrower. (#7)
- Since the floodplain laws limit possible land uses, costs considerations should be invoked for less than the full spectrum of possible uses. (#16)
- Must not select the cheapest remedy but the one which maximizes protection of human health and the environment. (#17)
- State's costs are high and underestimated (#34, 47, 89, H-1)

Response: *Estimated costs to implement each of the proposed remedial alternatives were developed in accordance with Superfund guidance. The range of the estimates results from the range of estimated unit costs for various elements of the remedy. These estimated costs are used in the comparative analysis of the alternatives to provide an estimate of the relative cost difference between alternatives. Under this guidance, costs are expected to provide an accuracy of +50% to -30% and are prepared using data available from the RI/FS. They are not intended to provide a precise estimate of final remedial costs. However, the agencies believe that the final cost will probably fall within the indicated range.*

In revising the cost estimates in Revision 2 of the Draft FS, MDEQ used the majority of unit costs and unit quantities provided by ARCO in Revision 1. Most of these costs were developed from actual costs incurred on ARCO's three demonstration projects in the SST OU and cost elements pertinent to the project that ARCO had expended on the Warm Springs Ponds Remedial Action. MDEQ believes that the revised cost estimates presented in the Draft FS accurately represent the relative difference between alternatives. Although actual costs could be higher or lower depending on site conditions that could not be anticipated with the current body of data used to characterize the site, as one of the nine evaluation criteria, costs were used accordingly in the remedy selection process.

Wetlands As Part of the Remedy

Comments: Letters #1, 13, 23, 35, 50, 134, and H-19 supported use of Subarea 1 as wetlands to treat Butte's wastewater.

Response: *Butte-Silver Bow County and ARCO are initiating research on constructed wetlands as a potential treatment technology for waste water nutrient discharge and stormwater inorganics contamination. To coordinate with this research, the end land use in Subarea 1 has been delineated as wetlands. After removal of all the above mentioned contaminant sources, constructed wetlands will be appropriately designed to accommodate possible use as treatment for nutrient and/or inorganic treatment, if appropriate.*

Community Input/Public Involvement

Comments:
- More public hearings should have been held. (H-13)
- Feds have consistently left public out of process (H-29)
- State's plan lacks community input (#29)
- State has not considered Greenway and has ignored the public (#165)

Response: *MDEQ has conducted extensive community participation activities beyond what is required under the National Contingency Plan. Public participation began prior to initiation of the site investigation with the issuance of the draft RI/FS Administrative Order on Consent and draft RI/FS*

Work Plan. Three public informational meetings (in Missoula, Anaconda, and Butte) and a formal public hearing (in Ramsay) were held in 1991 to gather public input on the proposed study. Comments were incorporated into the final RI/FS AOC and Work Plan, and a responsiveness summary addressing those comments was published. Additional public meetings were held to provide progress updates on the investigation and to gather public comments on the SST OU demonstration projects, as well as the work plan for the draft Baseline Risk Assessment. In addition, ARCO and MDEQ held a series of meetings, moderated by the Headwaters Resource Conservation and Development District, with SST OU landowners during 1992 and 1993 to provide information about alternatives under consideration and to gather input from local landowners. During late 1994 and 1995, as the SST OU investigation was concluding and the major RI/FS reports were prepared and published, community participation activities included the following: nine (9) public "roundtable" meetings, numerous OU tours, two meetings to discuss the Remedial Investigation, three informational meetings on the Baseline Risk Assessment, three Proposed Plan informational meetings, a 60 day public comment period, a public hearing, and presentation of the selected remedy in the Record of Decision. The Record of Decision documents changes to the preferred remedy as a result of public comments.

The Proposed Plan for the OU was released for public comment on June 9, 1995, and mailed to over 1,300 citizens on various Montana Superfund mailing lists. The Proposed Plan and full copies of all key RI/FS documents were made available to the public in the administrative record located at the Environmental Protection Agency (EPA) offices in Helena, MT, and at Superfund information repositories maintained at: MDEQ Superfund office, State Library, EPA Office, and the Montana Historical Society in Helena; Hearst Free Library in Anaconda; Montana State University in Bozeman; Silver Bow Library, Montana Tech Library, Butte Public Library, EPA Office and the Citizen's Technical Environmental Committee Office in Butte; Missoula Public Library, University of Montana Mansfield Library, and the Clark Fork Pend Oreille Coalition Office in Missoula. The notice of availability of the Proposed Plan was published in the Butte-Montana Standard, Missoulian, and the Anaconda Leader newspapers on June 9, 1995.

During the 60-day public comment period, from June 9 through August 7, 1995, public informational meetings were held at: Fairmont Hot Springs on June 20, Butte Community Center on June 21, and Missoula Courthouse Annex on June 22, 1995. At these meetings, representatives from MDEQ answered questions about contamination issues at the OU and the remedial alternatives under consideration as well as the preferred remedy. A public meeting/hearing was held on July 10, 1995, at Fairmont Hot Springs at which MDEQ accepted formal oral comments from the public. A court reporter transcribed the entire meeting/hearing and MDEQ made the transcript available by placing it in the administrative record. A response to the comments received during the public comment period is included in the Responsiveness Summary, which is part of this Record of Decision.

Other Comments and Recommendations

Comment: Several commenters stated that the proposed plan should consider restoration of riparian, aquatic, and upland habitat. One commenter stated that the State failed to outline the measures that are planned to establish healthy plant communities where tailings are removed and that exposed substrate may need amending in order to support vegetation. Another stated that the amendment technique would not allow the redevelopment of a healthy and diverse riparian biota to develop. (1, 36, 38, 105, 137).

Response: *The Record of Decision sets forth the cleanup requirements developed in accordance with criteria set out in CERCLA and the NCP for the remedy at the site. The purpose of this remedy is to* *attain protection of human health and the environment and to comply with certain standards specified in related environmental laws (ARARs). The ARARs standards include revegetation and habitat consultation requirements which should address many of the concerns expressed.*

Full restoration of riparian, aquatic, and upland habitat to preexisting conditions is beyond the requirements for remediation under CERCLA. The natural resource damage provisions of CERCLA address restoration. The State of Montana is currently in a lawsuit with ARCO which seeks to assess and collect monetary damages for "injuries to natural resources" which have resulted from the release of hazardous substances into Silver Bow Creek, as well as other areas on the Upper Clark Fork Basin. The costs necessary to restore Silver Bow Creek to a defined baseline condition are being sought in that litigation. As a result of the litigation, a restoration plan has been developed which, if implemented, would provide for certain actions to restore the injured resource. While the objectives of this remedy are similar to those of the State of Montana's Restoration Determination Plan for Silver Bow Creek, the remedial action plan is not intended to and will not restore natural resources in and along Silver Bow Creek, including trout and wildlife populations and fish and wildlife habitat, to baseline conditions.

MDEQ's remedy does address the establishment of mature riparian vegetation. Grass, forb, willow, and tree species will be specified based on local climatic conditions, proximity to stream channel, and ability to produce dense root systems at maturity. A growth media will be created through soil amendment to existing or borrowed soil to provide the soil environment necessary to sustain a vegetative community.

Comment: One commenter supported Alternative 3 while another commenter favored the removal of 15-20% of the tailings and treatment of the remainder in place. (#26, 33)

Response: *Alternative 3 in the Proposed Plan was developed to address one of the three limitations of STARS, saturated tailings. Under this alternative, a total of approximately 700,000 cubic yards or 32% of tailings/impacted soils which are seasonally saturated by ground water and tailings overlying these tailings would be relocated outside of the 100-year floodplain.*

Tailings/impacted soils are the primary contamination source for the SST OU. They range in thickness from a few inches to greater than five feet and contain significantly elevated concentrations of arsenic, cadmium, copper, lead, mercury, and zinc. There are three predominant ways in which tailings/impacted soils contaminate other Silver Bow Creek media: direct contact between tailings and groundwater, infiltration of precipitation through tailings, and erosion of tailings into Silver Bow Creek. In many areas, ground water is in direct contact with tailings/impacted soils. This direct contact mobilized metals from the tailings/impacted soils, contaminating the ground water. Seasonal water table fluctuation increases the volume of tailings/impacted soils exposed to ground water. This is a principal mechanism for ground water contamination at the site.

Erosion of tailings/impacted soils by overland flow, over bank flow, and mass wasting/slumping are primary methods of tailings/impacted soils transport to Silver Bow Creek. Over time, Silver Bow Creek will naturally meander in its floodplain, eroding material from cutbanks and depositing material in point-bars and depositional areas. High water and storm events cause a number of concerns with respect to tailings/impacted soils, including erosion of streambanks, channel migration, and erosion by over bank flows.

Alterative 3, which would remove only saturated tailings would leave in place tailings/impacted soils which would be subject to erosion and releasing metals and arsenic to Silver Bow Creek.

Removal of 15-20% of the tailings/impacted soils would leave both saturated tailings/impacted soils and tailings/impacted soils subject to erosion in place. Neither of these proposals would allow the remedy to meet the remedial action objectives for the site.

Comment: Several commenters made suggestions concerning features that should be incorporated into the design of repositories such as concrete retaining walls and leachate collection systems. (#107, 153)

Response: *The selected remedy will use local near-site repositories for tailings/impacted soils, railroad materials, and sediments excavated as part of the remedial action. Elements of the repository construction, including any necessary specific protective measures, will be determined during the remedial design phase. All repositories will include full amendment of placed materials with lime. The agencies do not anticipate that the suggested measures of concrete retaining walls or leachate collection systems, will be necessary to assure that contaminants in the repositories do not migrate.*

Comment: Recommendations were made to consider remedial alternatives other than those in the proposed plan. These included mixing tailings with concrete and using as building blocks, putting tailings in one place and capping to make a parking lot, and neutralizing metallic pollutants in stream by adding limestone (#34, H-1, H-46).

Response: *A study titled "Preliminary Remedial Action Objectives Report and Treatment Technology Scoping Document" was issued in July of 1993. This document screened a wide range of remedial technologies for their potential applicability to the media and conditions of the SST OU based on EPA-accepted screening criteria. Individual remedial technologies were grouped into broad categories, termed general response actions, such as containment, treatment, excavation, or other actions that, singly or in combination, may be implemented to satisfy the Remedial Action Objectives (RAOs) (EPA, 1988). The purpose of this screening was to select a reasonable number of promising technologies to consider in developing remedial alternatives based on general suitability for the site. Remedial technologies similar to those described above were rejected in the screening process according to NCP screening criteria relating to implementability, effectiveness, and cost.*

Comment: Compromise plans which are combinations of the features of several proposals were recommended by some commenters. These included a blend of the State's and ARCO plans, a compromise between Alternative 6 and Project Green, and a solution that requires the full removal of Alternative 7, multi-site repositories of Alternative 5, and a waste solidification technique.(#23, 29, 151).

Response: *MDEQ's final selected remedy can be best described as a variation of Alternative 5 that incorporates key elements of institutional controls and future conceptual land uses proposed by the sponsors of Project Green and the local county governments. Alternative 5 utilizes multiple near site repositories for disposal of tailings. Some refinements have been made to Alternative 5 to clarify the criteria used to require excavation of tailings/impacted soils, to more precisely identify excavation of contaminated railroad beds, and to specify institutional controls that will be used to manage the Silver Bow Creek Corridor in the future. Reasons for the rejection of Alternative*

7 and ARCO's plan are described in more detail in the ROD. The role of Project Green in the implementation of this remedy is described in the response to the Institutional Controls issue above.

Comment: What are the hazards from the creek? What impacts to human or farm animals have occurred downstream?

Response: *MDEQ conducted a Baseline Risk Assessment to identify existing and potential risks to both human health and the environment. Risks from exposure to metals and arsenic by residential, recreational, and occupational users were evaluated. Risk to people living on or near the site from potential exposure to arsenic in soil and groundwater was identified as a concern. Risks for workers fall within an acceptable range. Risks to site visitors are posed by future use of the railroad beds. The ecological risk assessment addressed whether or not the environment (plant and animal life) is or may be adversely impacted. In Silver Bow Creek, which is devoid of fish and many other aquatic life forms, the presence of mine waste contamination is the primary factor limiting the health of the aquatic environment and presents an existing hazard to the creek.*

MDEQ has not conducted any specific health studies of humans or farm animals residing in the vicinity of Silver Bow Creek. However studies made of the effects of arsenic in other places have shown the ingestion of arsenic to be associated with a variety of health problems. A recent incident in the Elkhorn Mountains near Helena, in which 25 cows died after drinking arsenic contaminated water at an abandoned mine, demonstrates the toxicity of arsenic to domestic livestock.

Comment: The State's plan fails to adequately address problems with removing topsoil from other locations. The availability of fill material should be considered. (25, 156)

Response: *MDEQ considered the issue of availability of fill material. Prior to implementing Demonstration Project I near Rocker, ARCO and the agencies were concerned that it would be necessary to procure fill material from locations distant from the site's excavated areas. In fact ARCO was able to obtain adequate fill material from within several hundred yards of the excavated areas, all of which were immediately adjacent to the site. Although the selected remedy will require considerably more backfill material, the agencies believe that all fill material will be obtained from adjacent locations. ARCO has identified numerous near stream areas that are suitable for placement of relocation areas. During evaluation of the relocation areas, ARCO assumed that many would be used as sources for borrow material. It is anticipated that many of these areas will be excavated for fill material prior to placement of relocated tailings, so that the overall topography of the near-stream corridor will not be altered significantly by the excavation of either the tailings/impacted soils or the backfill.*

Comment: Plan does not properly consider the letter or spirit of the CECRA law, S.B. 382, particularly in the areas of anticipated future land use, community acceptance and cost effectiveness. (#25, 146)

Response: *This action is being taken under the authorities of CERCLA and the NCP. Under this law, a selected remedy must meet two threshold factors. It must provide overall protection of human health and the environment and it must comply with applicable or relevant and appropriate requirements (ARARs). If a remedy meets these two thresholds then it is evaluated by other criteria including long-term effectiveness and permanence, reduction of toxicity, mobility, and volume, short-term effectiveness, implementability, cost and community acceptance. The proposed* *plan evaluated the cost effectiveness of each alternative. However other factors such as those described above may result in an alternative being selected that is not the least costly to inplement. Community acceptance is based on whether community concerns are addressed by the proposed remedy and whether or not the community has a preference for a remedy. Superfund guidance directs that future land use be a consideration. Future likely land use at the OU is expected to be agricultural and recreational and that is described in the ROD. Land use is also a consideration in the development of baseline risk assessments. At SST the baseline risk assessment considered three exposure scenarios: residential, recreational, and worker. The Record of Decision does address future land use, community acceptance, and cost effectiveness in compliance with the spirit and letter of both CERCLA and CECRA.*

An institutional controls program, which must be funded on a permanent basis as part of the remedy will be coordinated through a joint effort of the Butte-Silver Bow and Anaconda-Deer Lodge local governments. Institutional controls, monitoring, and maintenance will be integrated into a Silver Bow Creek corridor management program. The program will be established and maintained in a manner that will ensure that all aspects of the OU remedial action, both within and outside of the floodplain, are maintained for the long-term, and ensure that the future land use in the area is consistent with the scenarios upon which cleanup level decisions for this action have been based.

The law referred to in the comment, CECRA, as revised by SB 382, refers to the Montana state law counterpart to CERCLA found at §§ 75-10-701 et seq., MCA. The final remedial action plan does, in fact, comply with the letter and spirit of CECRA, including the amendments to CECRA enacted by the 1995 Montana Legislature in SB 382. As the comment notes these recent amendments include changes in the future land use considerations. The final remedial action plan specifically incorporates a plan for future land use that coordinates with the uses desired by the local governments in the area, i.e., use as a recreational corridor. The proposed plan would have allowed a broader, nearly unlimited range of uses. However, this change is consistent with the need to accommodate one of the other primary changes in CECRA relating to cost-effectiveness.

Finally, the comment refers to the recent change in CECRA regarding the community acceptance criterion, which places new emphasis on the views of local government as a consideration in evaluating community acceptance. In this case it is notable that the great majority of comments received from members of the community supported the proposed plan or a more stringent cleanup. By contrast, the local government representatives were seeking greater cost savings in the remedy. The changes in the final plan were much more accommodating to the concerns of local government representatives than they were of the majority of members of the community who commented. Thus on all three of the issues identified, the final remedial action plan is consistent with CECRA, including the recent changes enacted by the 1995 Legislature. MDEQ notes that, while the remedy decision was based on the superseding federal law in this case, CERCLA and the NCP, the decision is completely consistent with the state law counterpart, CECRA, and is the decision that MDEQ would make under that authority.

Comment: Silver Bow Creek should be capable of supporting native bull trout, westslope cutthroat, and a full range of aquatic species. Bull trout are currently likely to be listed soon, and westslope cutthroat may by proposed. ARARs are required to address the condition of species and any federal or state listing.

Response: *The Endangered Species Act, an ARAR for this site, requires that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat. Compliance with the Act involves* *consultation with the US Fish and Wildlife Service and a determination of whether there are listed or proposed species or critical habitats present. Currently Silver Bow Creek does not provide habitat for any fisheries, and thus no endangered species are present. One of the remedial objectives for Silver Bow Creek is to sustain a self reproducing fishery. Whether this fishery will include bull trout and/or westslope cutthroat is not known at this time. The purpose of this remedial activity is to reduce the threats of metals to the ecological health of Silver Bow Creek. Activities which go beyond remediation to deal with restoration of habitat are being addressed under the State's Natural Resource Damage Assessment Program.*

Comment: Calcium hydroxide is a caustic and its application over large areas will cause problems to surrounding communities. Application should be restricted to when winds are less than 10 mph and special care should be taken in the Ramsay area. (152,156)

Response: *MDEQ recognizes that calcium hydroxide is a caustic and must be handled with care. Difficulties were encountered during the application of lime kiln dust as part of Demonstration Project I near Rocker. Necessary precautions for using this material will be incorporated into Remedial Design.*

Comment: The Proposed Plan should contain provisions for monitoring of groundwater. Quantitative measures of reduction in precipitation infiltration and metals migration of STARS treated areas should be made.(154, 156)

Response: *Long-term monitoring of groundwater is a critical element of the remedy. Groundwater will be monitored at locations of documented groundwater contamination, all relocation areas, and other locations where STARS treatment has been applied. Because numerous repositories, which will be treated with the STARS technology, will be located near the floodplain in several areas along the length of the stream, and because in Subareas 2 and 4 some amount of tailings will be treated with the STARS technology on the edges of the floodplain itself, a permanent monitoring, management, and maintenance program will be an integral part of this remedy.*

Comment: The Tribes should be consulted, on a government to government basis, as remedial design develops. Such consultation must include recognition of the Tribe's traditional cultural properties, specific consultation on fisheries and water related issues, and general technical consultation.(154)

Response: *The State MDEQ and EPA recognize the Confederated Salish and Kootenai Tribes interest in the Clark Fork Basin and in the SST OU. The State, as lead agency, will involve the Tribes during remedial design, along with other governments and interested public members. ARARs addressing protected cultural resources are also included in the final ROD.*

Comment: Some commenters addressed the long-term management of the OU. One felt that since the site was in two counties, that a state entity should manage it. Others felt that Anaconda-Deer Lodge County and Butte-Silver Bow City/County should manage the site. (44, 130, 156) Another commenter pointed out that county government should have a direct oversight role in remedy implementation and in deciding where STARS will be used. Resources should be provided for doing this. (156)

Response: *An institutional controls program, which must be funded or implemented on a permanent basis as part of the remedy, will be coordinated through a joint effort of the Butte-Silver Bow and Anaconda-Deer Lodge local government. Institutional controls, monitoring, and maintenance will* *be integrated into a Silver Bow Creek corridor management program. EPA and MDEQ will consult with local governments and the public throughout the RD/RA process.*

Comment: Discussions should be held with Department of Fish, Wildlife, and Parks to assess the requirements of establishing a self-sustaining fishery. If this cannot be done, a stocked fishery should be provided. (#156)

Response: *The Montana Department of Fish, Wildlife, and Parks (MDFWP) has been consulted throughout the SST OU investigation. MDFWP has noted that its preference is to manage all streams in Montana as self-reproducing fisheries, for the reason that fish stocked in streams do not survive and reproduce as well as wild fish. MDEQ will continue to consult with MDFWP during remedial design, remedial construction, and long-term monitoring regarding the viability of the fishery established in Silver Bow Creek.*

Comment: In-stream flows on Silver Bow Creek must be maintained if objectives are to be meet.(172)

Response: *MDEQ recognizes the importance in sustaining adequate in-stream flow levels for meeting some of the specified remedial action objectives. Issues related to in-stream flows for Silver Bow Creek will be considered during remedial design.*

Comment: Is it a takings for government to restrict land use based on a selected remedy? Does Superfund liability allow a downstream landowner to sue an up-stream landowner if tailings move downstream after a remedy is implemented? (181)

Response: *Takings: Takings issues, controlled generally by court decisions regarding constitutional law, are very complex and require analysis of the specific facts and circumstances involved in a specific case. The determination depends on the nature and extent of the restrictions involved, the reasons for the restrictions, the potential uses of the property involved, and numerous other considerations. It is not possible to give a correct response to this very broad question without having the details of the situation involved.*

EPA and MDEQ will work with the responsible party and local and state government agencies to implement specific institutional controls to prevent uses that may pose a threat to public health or safety. Institutional controls, such as deed restrictions, restrictive covenants, and zoning requirements, are generally not considered to be a taking of property requiring compensation by governmental entities.

Superfund liability: Superfund liability is described in section 107 of CERCLA (42 U.S.C. 9607). That section states that the United States, a State, an Indian Tribe, or any other person may recover response costs which are consistent with the National Contingency Plan (the regulations governing Superfund response actions) against liable parties identified in section 107(a) of CERCLA. A downstream landowner who incurred eligible response costs in cleaning up his or her property would need to examine whether the up-stream landowner fell within the categories of liable parties identified in section 107(a) to determine if he or she could file a CERCLA claim against that up-stream landowner or any other person. That issue is a complicated one, which would depend on the specific facts associated with the up-stream landowner or other persons and the circumstances of the release of tailings.

Comment: How will mercury be controlled if tailings are relocated outside of the floodplain? If removals which are done are less than those in Alternative 6, will the remaining mercury in the floodplain be of concern? (192, 201)

Response: *The locations, concentrations and potential movement of mercury will be monitored for all waste materials in either the relocation repositories or tailings/impacted soils treated in situ. This monitoring will include waste materials sampling, vadose zone monitoring, and groundwater monitoring. The potential end receptors, fish and the aquatic environment, will also be monitored once they have been established.*

Comment: A number of respondents commented on the health risks of arsenic. Some felt that arsenic was not a health concern, should not be a basis of cleanup, and did not justify tearing up the creek. Others felt that arsenic is a health concern. (H-1, H-18, H-26, H-28, H-34, 34, 47, 201)

Response: *Ingestion of high levels of arsenic may cause digestive pain, nausea, vomiting and diarrhea. Ingestion may also lead to decreased production of red and white blood cells, abnormal heart function, blood vessel damage, liver and kidney injury, and impaired nerve function. At lower levels of exposure, ingestion may result in skin problems, a condition known as a "blackfoot" disease, and increased risk of skin, liver, bladder, kidney and lung cancers. In fact, lung disease associated with arsenic inhalation exposure was first recognized in a study of worker health at the old smelter in Anaconda. Although the baseline risk assessment did establish health risk to humans from exposure to arsenic at the one in a million range, the purpose of removal of in-stream sediments is to reduce risk to aquatic life not human health.*

Comment: The State should show why wastes deposited by floods are not in the floodplain and reconsider the floodplain in light of debris dams. (106)

Response: *Debris dams were considered when developing the numerical modeling necessary to delineate the 100-year floodplain. There are many possible but two likely scenarios for the wastes in Ramsay Flats, which are the only substantial tailings outside of the 100-year floodplain ("floodplain"). The first is that the materials were deposited in a flow event who's return interval was greater than 100 years (i.e. 150 or 200 year event). More likely is that the present channel's vertical location is significantly different then it was when these tailings were deposited. This could be concluded because SBC was carrying an enormous amount of excess sediment load which would cause it to braid and agrade. Since that time, sediment load has dramatically decreased causing the stream to down-cut back to its original pre-disturbance elevation through the agraded tailings thus causing the present incised channel.*

Comment: Removal of material to the depth of groundwater will very likely have profound effects on fluvial hydrology of Silver Bow Creek and result in serious short-term effectiveness on the stream sediment system and water quality. (122)

Response: *The agencies believe that there will be some short-term detrimental effects from this remedial action on in-stream sediments and surface water quality. These short-term detrimental effects will be far outweighed by the positive long-term response of this action.*

APPENDIX D-1
Comments Received on the Proposed Plan

APPENDIX D-1a

List of Commenters Submitting Written Comments - Category I

APPENDIX D-1a - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	1	Munday, Assoc. Prof.	Dr. Pat	Montana Tech		Butte	MT	59701
I	2	Scown	Pat		1815 Monroe	Butte	MT	59701
I	3	Van Sice	R.B.		3001 Greens Circle	Butte	MT	59701
I	4	Colaiuta	Ms. Vickie		45 Missoula Ave.	Butte	MT	59701
I	5	Baker	Forrest		70 Frauich Lane	Whitehall	MT	59759
I	6	Helding	Linda	Woods Second Hand Store	111 West Alder	Missoula	MT	59802
I	7	Stokke	Melvin A.		1803 Tammany Ave.	Anaconda	MT	59711
I	8	Richards	Paul		P.O. Box 422	Boulder	MT	59632
I	9	O'Brien	Edna		1643 Farragut Ave.	Butte	MT	59701
I	10	Beer	Mrs. Mary S.		801 N. 3rd Street	Hamilton	MT	59840
I	11	Everhart	Nancy M.		3948 East Ridge Road	Butte	MT	59701
I	12	Heaphy	Larry and Shirley		2116 Lincoln Street	Anaconda	MT	59711
I	13	Waring	Thomas		251 Meadowview	Butte	MT	59701
I	14	Kraus	Susan L.		P.O. Box 386	Deer Lodge	MT	59722
I	15	Smith	Larry N.		27 N. Excelsior	Butte	MT	59701
I	16	Berube	Daniel T.	Montana Power Company	40 East Broadway	Butte	MT	59701
I	17	Ray	John W.		915 West Galena Street	Butte	MT	59701
I	18	Fischer	Susan		600 Sycamore	Anaconda	MT	59711
I	19	Smith	Geoff	The Clark Fork Pen Oreille Coalition	P.O. Box 4718	Butte	MT	59702
I	20	Haeffner, R.PH	Charles	Anaconda-Deer Lodge Reclamation Advocates	218 Evergreen	Anaconda	MT	59711
I	21	Fladagen	Brian		119043 Battle Ridge Road	Silver Bow	MT	59750
I	22	Mullen	Gregory	Natural Resource Damage Litigation Program	P.O. Box 201425	Helena	MT	59620
I	23	Haffey	J. Ray		150 Shirley Way	Anaconda	MT	59711
I	24	Ginn, Ph.D	Thomas C.	PTI Environmental Services				
I	25	Fitzpatrick	John S.	Pegasus Gold Corporation	100 North Park Avenue	Helena	MT	59601
I	26	Fredrickson	Dorothy K.		129 Carney Lane	Whitehall	MT	59759
ID18	27	Fischer	Susan		600 Sycamore	Anaconda	MT	59711
I-III	28	Stosich	Steve		60 Oro Fino Gulch	Butte	MT	59701
I	29	McCarthy	Bea	Leprechaun Village	1906 Ogden	Anaconda	MT	59711
I	30	Minich	Linda M.		P.O. Box 4645	Butte	MT	59702

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CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	31	McGowan	O.		3 Greenwood	Butte	MT	59701
I	32	Tuchscherer, M.D.	Mabel E.		P.O. Box 1266	Anaconda	MT	59711
I	33	Leiss	Nicki		702 Hwy. 1 West #5	Anaconda	MT	59711
I	34	Groff, Ph.D.	S.L.		3106 Floral Blvd.	Butte	MT	59701
I	35	Smitham	Jim		15 Redwood Dr.	Butte	MT	59701
I	36	McMaster	Kemper M.	U.S. Fish and Wildlife Service	100 N. Park, Suite 200	Helena	MT	59601
IA11	37	Everhart	Nancy M.		3948 East Ridge Road	Butte	MT	59701
I	38	Prodgers	Richard A.		2715 Ottawa	Butte	MT	59701
ID22	39	Mullen	Gregory	Natural Resource Damage Litigation Program	P.O. Box 201425	Helena	MT	59620
I	40	Schetzsle	Anthony J.	National Park Service - Grant-Kohrs Ranch	P.O. Box 790	Deer Lodge	MT	59722
I	41	Stickney	Michael C.		1136 West Broadway	Butte	MT	59701
I	42	Karvinen	Ronald D.		620 Sampson Street	Butte	MT	59701
ID17	43	Ray	John W.		915 west Galena Street	Butte	MT	59701
I	44	Waring	George H.	Citizens for Labor & Environmental Justice	518 W. Granite	Butte	MT	59701
I	45	Evans, Chairman	Barbara	Missoula County Board of County Commission	200 W. Broadway St.	Missoula	MT	59802
I	46	Micheletti	Joe		1102 Heather Dr.	Anaconda	MT	59711
I	47	Beaudette	Edward G.	Anaconda-Deer Lodge County Attorney	800 South Main	Anaconda	MT	59711
IA23	48	Haffey	J. Ray		150 Shirley Way	Anaconda	MT	59711
I	49	Luebeck	Al		2710 Amherst	Butte	MT	59701
I	50	Cote	John S. "Harp"		3 Pintlar Peaks Plaza	Butte	MT	59701
I	51	Gooding	Diana H.		P.O. Box 1119	Plains	MT	59859
I	52	Rowik	Pete		Box 485	Ronan	MT	59864
I	53	Roberts	Richard E.		Box 584	Superior	MT	59872
I	54	Nobles	E. Terrill		1321 Eastside Hwy	Corvallis	MT	59828
I	55	Dolese	Thomas		238 E Sussex	Missoula	MT	59801
I	56	Hennessy M.D., M.P.H	P.J.		243 North Ave. East	Missoula	MT	59801
I	57	Gilels	Dori		1209 Harrison St.	Missoula	MT	59801
I	58	Vaneler	Mike		745 Brooks St	Missoula	MT	59801
I	59	Magnuson	Leaf		935 Cooper St.	Missoula	MT	59801
I	60	Johnson	Michael		1515 Jackson St.	Missoula	MT	59801

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APPENDIX D-1a - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	61	Schombel	L.F.		2200 Applewood Lane	Missoula	MT	59801
I	62	Smith	Jeffrey J.		426 west Garfield	Bozeman	MT	59715
I	63	Hoon	Kirby L.		404 Pattee Canyon Drive	Missoula	MT	59803
I	64	Coddington	Lane	Lane Coddington Consulting	628 South Second West	Missoula	MT	59801
I	65	Benson	Robert E.		2325 Valley Drive	Missoula	MT	59802
I	66	Benson	Erik		301 Chestnut #4	Missoula	MT	59801
I	67	Pence	Dennis	Coldwater Creek	One Coldwater Creek Drive	Sandpoint	ID	83864
I	68	Thomas	William R.		2513 Briggs St.	Missoula	MT	59803
I	69	Pally	Barbara Archer & Tom		802 W. Galena	Butte	MT	59701
I	70	Kern	Donald	Montana River Action Network	30 N. Last Chance Gulch	Helena	MT	59624
IA33	71	Leiss	Nicki		702 Hwy 1 West #5	Anaconda	MT	59711
I	72	Onishuk	Martin		5855 Pinewood Lane	Missoula	MT	59803
I	73	Maloney	Joe F.		950 Antimony	Butte	MT	59701
I	74	Kinyon	Mr. & Mrs. W.R.		5025 N. Argonne Road, Unit 9	Spokane	WA	99212
I	75	Parodi	John A.		607 E. Kent Ave.	Missoula	MT	59801
I	76	Turman	Kathleen & George		1525 Gerald Ave	Missoula	MT	59801
I	77	Herbert	John M.		5759 W Fork Rd	Darby	MT	59829
I	78	Childers	Robin L.		1545 W Sussex	Missoula	MT	59801
I	79	Zimet	Andrew		845 Park Ave	Whitefish	MT	59937
I	80	Kemmis	Daniel	Office of the Mayor - Missoula	435 Ryman	Missoula	MT	59802
I	81	Smith, PT	Richard L.	Missoula Physical Therapy Center	715 Kensington	Missoula	MT	59801
I	82	O'Connor	Roy	SAROC, Inc.	5015 Larch Avenue	Missoula	MT	59802
ID10	83	Beer	Mrs. Mary S.		801 N. 3rd Street	Hamilton	MT	59840
I	84	Koons	Richard A.		715 Bottle Bay Road	Sagle	ID	83860
I	85	Griffin	Jim		418 W. Galena	Butte	MT	59701
I	86	Hammer	William & Audrey		42 MT Hwy 135 So, Box 405	St. Regis	MT	59866
I	87	Weight	Willis D.		12 Laird	Ramsay	MT	59748
I	88	Capps	Paul		416 E. 7th St.	Anaconda	MT	59711
I	89	Blackwood	Traci		415 W. Copper Street	Butte	MT	59701
I	90	Farling	Bruce	Montana Council of Trout Unlimited	P.O. Box 7186	Missoula	MT	59807

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CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	91	Morgan	Cindy		P.O. Box 1334	Trout Creek	MT	59874
I	92	Pearce	William B. & Olive M		2621 Amherst Ave.	Butte	MT	59701
I	93	Walker	James	Park High School	314 S. Yellowstone	Livingston	MT	59047
I	94	Marley	Patrick	Cole & Marley	1900 Avenue of the Stars	Los Angeles	CA	90067
I	95	Hutchins	Judith		P.O. Box 104	Heron	MT	59844
I	96	Clifford	Gay & John		5305 S. Van Marter Ct.	Spokane	WA	99206
I	97	Drury	Bill		815 12th St	Butte	MT	59701
I	98	Cooper	Ron	The Pacific Rivers Council	P.O. Box 7011	Bozeman	MT	59771
I	99	Gazzo	Paul		1606 Phillips Street	Missoula	MT	59802
I	100	Lunde	Eric		1602 Jackson St.	Missoula	MT	59802
IA45	101	Evans, Chairman	Barbara	Missoula County Board of Commissioners	200 W Broadway St	Missoula	MT	59802
I	102	Hedges	Anne	Montana Environmental Information Center	P.O. Box 1184	Helena	MT	59624
I	103	St. John, M.D.	Robert M.		834 Montana St.	Butte	MT	59701
I	104	Strong, MD	Paul T.	Paul T. Strong, M.D.	9180 Keegan Trail	Missoula	MT	59802
I	105	Stewart	Robert F.	US Dept. of Interior - Secretary's Office	P.O. Box 25007 (D-108)	Denver	CO	80225
I	106	Watson	Vicki	University of Montana	509 Daly	Missoula	MT	59801
I	107	Ellerman	Edward		P.O. Box 127	Ramsey	MT	59748
I	108	Murphy	Pat		6909 N Division	Spokane	WA	99208
I	109	Casick	Steve		3225 Kossuth	Butte	MT	59701
I	110	Casick	Matt		3135 Kossuth	Butte	MT	59701
I	111	Casick	Agnus		3135 Kossuth	Butte	MT	59701
I	112	Lockwood	Gretchen		3519 Gold Creek	Sandpoint	ID	83864
I	113	Schubert, D.D.S.	Roger S.	Roger S. Schubert, D.D.S.	312 South First Avenue	Sandpoint	ID	83864
I	114	Manning, Planning Director	James M.	Anaconda-Deer Lodge County Planning Dept.	800 South Main	Anaconda	MT	59711
I	115	Ballard	Bill & Lee		5120 Larch	Missoula	MT	59802
I	116	Stebbins	Hannah		160 North Avenue West	Missoula	MT	59801
I	117	Marangelo, Resource Specialist	Glenn	The Ecology Center, Inc.	1519 Cooper Street	Missoula	MT	59802
I	118	Tollefson	Gregory M.		413 Daly	Missoula	MT	59801
I	119	Knight	Ellen		5800 Rattlesnake	Missoula	MT	59802
I	120	Schweber, Chairman	Phil	Missoula City-County Health Dept. Water Qu	301 W Alder St	Missoula	MT	59802

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STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	121	Zygo	Brian H.	National Wildlife Federation	240 N Higgins	Missoula	MT	59802
I	122	Schafer, Ph.D.	William	Schafer & Associates, Inc.	865 Technology Blvd	Bozeman	MT	59715
I	123	Morrison	Bruce H.		63 Brookside	Missoula	MT	59802
I	124	duPont	Mrs. B.G.		1905 Alvina Dr.	Missoula	MT	59802
I	125	Jeske	Mary Frances Laird		1013 Empire St.	Butte	MT	59701
I	126	McGree	Thomas "Tuck"		2001 George	Butte	MT	59701
I	127	Peoples	Don		3440 St. Ann	Butte	MT	59701
I	128	Haas, Jr.	Albert		12 Willow Lane	Sausalito	CA	94965
I	129	Thoma	Heather		429 Daly	Missoula	MT	59801
I	130	Beatty, Chief Executive	Cheryl S.	Anaconda-Deer Lodge County Commission	800 South Main	Anaconda	MT	59711
I	131	Ferguson	Laura		P.O. Box 5321	Missoula	MT	59806
I	132	Kambich	James J.		2835 White Blvd.	Butte	MT	59701
I	133	Ford	Jim		3375 Upper Gold Creek Road	Sandpoint	ID	83864
I	134	Finnegan	William P.	Old Works Golf Course Authority Board		Anaconda	MT	59711
I	135	Larson, M.D., P.S.	Gordon E.	Fifth and Browne Medical Center	W. 104 Fifth Ave., Suite 390	Spokane	WA	99204
I	136	Farmer	Eugene E.		P.O. Box 204	Providence	UT	84332
I	137	Clough, Regional Supervisor	C. Richard	Montana Dept of Fish, Wildlife, & Parks	3201 Spurgin Road	Missoula	MT	59801
I	138	Everingham	Catherine B.		5620 Rattlesnake Road	Missoula	MT	59802
I	139	Mayberry	Jerry	State Farm Insurance Companies	24800 Pacific Hwy. S.	Kent	WA	98032
I	140	Brunsvold	Ed		808 Berverly	Missoula	MT	59801
I	141	Antonioli, President	Steve	Skyline Sportsmen's Association, Inc.	Box 173	Butte	MT	59703
I	142	Tuesday, Geochemist	Mr. David S.		140 Lime Kiln Road	Butte	MT	59701
I	143	Joslin	Kay		114 S. Jackson	Butte	MT	59701
I	144	Mulcaire-Jones	Mary		12 Bittersweet Drive	Butte	MT	59701
I	145	Smith	Ronald J.		Rt. #1, 213 Ayers	Opportunity	MT	59711
I	146	Trenk, Executive Director	Peggy Olson	Western Environmental Trade Association	33 South Last Chance Gulch	Helena	MT	59601
I	147	Gless, Ph.D.	Elmer E.		156 Parrot Castle Road	Whitehall	MT	59759
I	148	Gonshak	Henry		855 West Quartz Street	Butte	MT	59701
I	149	Atcheson	Jack	Jack Atcheson & Sons, Inc.	3210 Ottawa Street	Butte	MT	59701
I	150	Armstrong	Dr. W.E.		2009 Carmen Ct.	Sandpoint	ID	83864

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CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	151	Sherry, President	Brian	Milltown Technical Assistance Committee	P.O. Box 9086	Missoula	MT	59807
I	152	Beul	Cameron		P.O. Box 4807	Butte	MT	59702
I	153	Technical Staff		Citizens' Technical Environmental Committe	P.O. Box 593	Butte	MT	59703
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	Confederated Salish & Kootenai Tribes	P.O. Box 278	Pablo	MT	59855
I	155	Kerr, Research Specialist	Mark A.	MT Dept of Justice-Natural Resource Damage	P.O. Box 201425	Helena	MT	59620
I	156	Lynch, Chief Executive	Jack	Butte-Silver Bow Council of Commissioners	Courthouse	Butte	MT	59701
I	157	Rollo, MWF President	Al	Montana Wildlife Federation	P.O. Box 1175	Helena	MT	59624
I	158	Morrill	Bud		P.O. Box 119	Butte	MT	59703
I	159	Lynch	Elisa L.	The Clark Ford Pend Oreille Coalition	P.O. Box 4718	Butte	MT	59702
I	160	Lund	Kari M.		3816 Timerlane Rd.	Missoula	MT	59802
I	161	Furlong, M.D.	Roger C.	Rocky Mountain Eye & Ear Center, P.C.	700 West Kent	Missoula	MT	59801
I	162	Klinefelter	Angela		425 Madison Apt. 2	Missoula	MT	59801
I	163	Schombel	Stephen		2200 Applewood Ln.	Missoula	MT	59801
I	164	Brooke, State Senator	Vivian M.	Montana State Senate	1610 Madeline Avenue	Missoula	MT	59801
I	165	Gallus	Chris J.		2701 Phillips Street	Butte	MT	59701
I	166	Smitham	Jim	Project Green Steering Committee	15 Redwood Dr.	Butte	MT	59701
I	167	Renfrew	Malcolm		1271 Walenta Drive	Moscow	ID	83843
I	168	Rowling	Mel	Rowling's Technical Services, Inc.	P.O. Box 178	Butte	MT	59703
I	169	Belsey	Jim		8607 Ricky Dr.	Bozeman	MT	59715
I	170	Jeniker	Charles		2110 S. Drive	Butte	MT	59701
I	171	Ore, Chair	Florence	Northern Plains Resource Council	2401 Montana Ave., #200	Billings	MT	59101
I	172	Marchion	Chris		2105 Garfield	Anaconda	MT	59711
I	173	Decker	Bob		726 S. Rodney	Helena	MT	59601
I	174	Stilwell	Charles	Atlantic Richfield Company	307 East Park Street	Anaconda	MT	59711
I	175	Stone-Manning	Tracy		11000 Sleeman Gulch	Lolo	MT	59847
I	176	Glueckert	Bev Beck		636 Toole Ave.	Missoula	MT	59802
I	177	Brown	James K.		1504 Woods Gulch	Missoula	MT	59802
I	178	Ellingson, State Rep.	Jon E.	Montana House of Representatives	141 North Ave. E	Missoula	MT	59801
I	179	Kreisberg	Michael		244 S. 2nd W.	Missoula	MT	59801
I	180	Peters	Doris					

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APPENDIX D-1a - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	ORGANIZATION	STREET	CITY	ST	ZIP
I	181	Craig	Patrick W.		3033 Busch #3	Butte	MT	59701
I	182	Ort	Harold		550 Big Flat Raod	Missoula	MT	59801
I	183	Smith	Marvin		220 Burlington	Missoula	MT	59801
I	184	Waring	George H.		518 west Granite St.	Butte	MT	59701
I	185	Warden, President	Bill	The Shack Restaurant	222 Warren?	Missoula	MT	59802
I	186	Whalen, President	Bob	Trout Unlimited - West Slope Chapter	P.O. Box 7165	Missoula	MT	59807
I	187	Crisp	Fred		1600 S. 6th St. W.	Missoula	MT	59807
ID155	188	Kerr	Mark	MT Dept of Justice-Natural Resource Damage	P.O. Box 201425	Helena	MT	59620
I	189	Grayson	Michael B.		522 Hickory St.	Anaconda	MT	59711
I	190	Lyon, Vice President	James S.	Mineral Policy Center	1612 K Street, NW, Suite 808	Washington	DC	20006
I	191	Coopmans	Jerome & Yvonne		Box 189	Bozeman	MT	59771
I	192	Gassenberg	Sue		1031 Utah Avenue	Butte	MT	59701
I	193	Douglass	Kristin Snyder		221 N Ophir	Butte	MT	59701
I	194	Doggett	Arminda & Victor		6765 W Garfield Bay Road	Sagle	ID	83860
I	195	Gichwald	Linda		4105 Pattee Canyon	Missoula	MT	59803
I	196	Archie	Michele L.		3041 River Bend Drive	Bonner	MT	59823
I	197	Erickson	Nancy N.	Dancing Rabbit Studios	3250 Pattee Canyon	Missoula	MT	59803
I	198	Mueller	Ronald		1114 Creek Crossing	Missoula	MT	59802
I	199	Weaver	Jana		605 E Dufort Road	Sagel	ID	83860
I	200	Slack	David C.			Tampa	FL	
I	201	Craig	Mary Kay		715 W. Park Street	Butte	MT	59701
I	202	Judge	Patrick		1802 Lockey	Helena	MT	59601
I	203	Langley	Gary A.	Montana Mining Association		Helena		

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APPENDIX D-1b
Summary of Responses to Proposed Plan Issues - Category I

APPENDIX D-1b - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

REF NO	LAST NAME	FIRST NAME	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	PLAN 8	PLAN 9	PLAN 10
1	Munday, Assoc. Prof.	Dr. Pat	Remove				Opport			Rail		Yes
2	Scown	Pat	Favor	Region	No		No	Use	NotSig	Truck		Yes
3	Van Sice	R.B.										
4	Colaiuta	Ms. Vickie										
5	Baker	Forrest										
6	Helding	Linda	Remove		No	NotImp	Opport	No	NotSig			Yes
7	Stokke	Melvin A.										
8	Richards	Paul										
9	O'Brien	Edna										
10	Beer	Mrs. Mary S.										
11	Everhart	Nancy M.										
12	Heaphy	Larry and Shirley										
13	Waring	Thomas	Favor	Local	Yes	Import		Use			No	Yes
14	Kraus	Susan L.	Remove	Region		Import	Opport		NotSig	Rail	Yes	Yes
15	Smith	Larry N.										
16	Berube	Daniel T.										
17	Ray	John W.										
18	Fischer	Susan										
19	Smith	Geoff										
20	Haeffner, R.PH	Charles	Favor	Local								
21	Fladagen	Brian	Favor	Region			Opport					
22	Mullen	Gregory										
23	Haffey	J. Ray					Neither					
24	Ginn, Ph.D	Thomas C.									No	
25	Fitzpatrick	John S.	Favor	Local	No	Import	Neither	Use	Sig	Neither	No	Yes
26	Fredrickson	Dorothy K.										

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PLAN 1 - What are your views on leaving STARS treated tailings in the floodplain?
PLAN 2 - Which is prefered, many near stream repositories or one/two regional ones?
PLAN 3 - How do you feel about using uncontaminated areas for repositories?
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PLAN 6 - How do you feel about using Ramsay Flats as a repository?
PLAN 7 - How significant are short-term risks associated with hauling wastes?
PLAN 8 - Would you prefer truck or rail haul to regional repositories?
PLAN 9 - How do you feel about using size as a removal criteria for sediment?
PLAN 10 - What are your views on improving Silver Bow Ck to support trout?

REF NO	LAST NAME	FIRST NAME	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	PLAN 8	PLAN 9	PLAN 10
27	Fischer	Susan										
28	Stosich	Steve	Favor		No		Neither					
29	McCarthy	Bea										
30	Minich	Linda M.	No	Local	No	Import	Opport	Use	NotSig	Truck	No	Yes
31	McGowan	O.										
32	Tuchscherer, M.D.	Mabel E.										
33	Leiss	Nicki	Favor	Local	No		Neither					
34	Groff, Ph.D.	S.L.										
35	Smitham	Jim					Neither					
36	McMaster	Kemper M.										Yes
37	Everhart	Nancy M.										
38	Prodgers	Richard A.	No	Region	No	Import	Opport	No	Sig	Rail		Yes
39	Mullen	Gregory										
40	Schetzsle	Anthony J.	Favor						NotSig			Yes
41	Stickney	Michael C.					Opport			Rail		
42	Karvinen	Ronald D.										
43	Ray	John W.										
44	Waring	George H.										Yes
45	Evans, Chairman	Barbara										
46	Micheletti	Joe										
47	Beaudette	Edward G.								Neither	No	
48	Haffey	J. Ray										
49	Luebeck	Al	Remove									Yes
50	Cote	John S. "Harp"	Favor	Local								
51	Gooding	Diana H.										
52	Rowik	Pete										

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PLAN 8 - Would you prefer truck or rail haul to regional repositories?
PLAN 9 - How do you feel about using size as a removal criteria for sediment?
PLAN 10 - What are your views on improving Silver Bow Ck to support trout?

APPENDIX D-1b - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

REF NO	LAST NAME	FIRST NAME	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	PLAN 8	PLAN 9	PLAN 10
53	Roberts	Richard E.										
54	Nobles	E. Terrill										
55	Dolese	Thomas										
56	Hennessy M.D., M.P.H	P.J.										
57	Gilels	Dori										
58	Vaneler	Mike										
59	Magnuson	Leaf										
60	Johnson	Michael										
61	Schombel	L.F.										
62	Smith	Jeffrey J.										
63	Hoon	Kirby L.										
64	Coddington	Lane										
65	Benson	Robert E.					Opport					
66	Benson	Erik										
67	Pence	Dennis										
68	Thomas	William R.										
69	Pally	Barbara Archer & Tom	Remove	Region	No		Opport			Rail		Yes
70	Kern	Donald										
71	Leiss	Nicki										
72	Onishuk	Martin										
73	Maloney	Joe F.										
74	Kinyon	Mr. & Mrs. W.R.										
75	Parodi	John A.										
76	Turman	Kathleen & George										
77	Herbert	John M.										
78	Childers	Robin L.										

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APPENDIX D-1b - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

REF NO	LAST NAME	FIRST NAME	PLAN 1	PLAN 2	PLAN 3	PLAN 4	PLAN 5	PLAN 6	PLAN 7	PLAN 8	PLAN 9	PLAN 10
79	Zimet	Andrew										
80	Kemmis	Daniel										
81	Smith, PT	Richard L.										
82	O'Connor	Roy										
83	Beer	Mrs. Mary S.										
84	Koons	Richard A.										
85	Griffin	Jim										
86	Hammer	William & Audrey	OK/Con	Region			Opport	No		Rail		
87	Weight	Willis D.		Region			Opport			Rail		
88	Capps	Paul			No							
89	Blackwood	Traci	Favor									
90	Farling	Bruce	Remove				Opport			Rail		
91	Morgan	Cindy										
92	Pearce	William B. & Olive M										
93	Walker	James										
94	Marley	Patrick										
95	Hutchins	Judith										
96	Clifford	Gay & John										
97	Drury	Bill										
98	Cooper	Ron										
99	Gazzo	Paul										
100	Lunde	Eric										
101	Evans, Chairman	Barbara										
102	Hedges	Anne	Remove	Region	No		Opport	No	NotSig	Rail	Yes	Yes
103	St. John, M.D.	Robert M.	Favor				Neither	No				
104	Strong, MD	Paul T.										

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105	Stewart	Robert F.	Remove						NotSig			Yes
106	Watson	Vicki	Favor	Region			Opport			Rail	No	
107	Ellerman	Edward	Remove	Region				Use		Rail		
108	Murphy	Pat										
109	Casick	Steve										
110	Casick	Matt										
111	Casick	Agnus										
112	Lockwood	Gretchen										
113	Schubert, D.D.S.	Roger S.										
114	Manning, Planning Director	James M.										
115	Ballard	Bill & Lee										
116	Stebbins	Hannah										
117	Marangelo, Resource Specialist	Glenn	Remove	Region	No		Opport			Rail		
118	Tollefson	Gregory M.										
119	Knight	Ellen										
120	Schweber, Chairman	Phil										
121	Zygo	Brian H.	Remove	Region			Opport			Rail		
122	Schafer, Ph.D.	William										
123	Morrison	Bruce H.										
124	duPont	Mrs. B.G.										
125	Jeske	Mary Frances Laird										
126	McGree	Thomas "Tuck"		Local		Import			Sig			
127	Peoples	Don	Favor	Local		Import	Neither	Use	Sig	Neither		Yes
128	Haas, Jr.	Albert										
129	Thoma	Heather	Remove				Opport			Rail		
130	Beatty, Chief Executive	Cheryl S.	Favor	Local			No			Neither		

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131	Ferguson	Laura										
132	Kambich	James J.	Favor	Local			Neither			Neither		
133	Ford	Jim										
134	Finnegan	William P.	Favor	Local								
135	Larson, M.D., P.S.	Gordon E.										
136	Farmer	Eugene E.										
137	Clough, Regional Supervisor	C. Richard										
138	Everingham	Catherine B.										
139	Mayberry	Jerry										
140	Brunsvold	Ed										
141	Antonioli, President	Steve	Remove									
142	Tuesday, Geochemist	Mr. David S.										
143	Joslin	Kay										
144	Mulcaire-Jones	Mary										
145	Smith	Ronald J.	Favor	Local			Neither					
146	Trenk, Executive Director	Peggy Olson										
147	Gless, Ph.D.	Elmer E.										
148	Gonshak	Henry										
149	Atcheson	Jack										
150	Armstrong	Dr. W.E.										
151	Sherry, President	Brian										
152	Beul	Cameron		Region			Opport			Rail		
153	Technical Staff											
154	Tourangeau, Coordinator	Phil & Marion Yoder										
155	Kerr, Research Specialist	Mark A.										
156	Lynch, Chief Executive	Jack	Favor	Local								

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157	Rollo, MWF President	Al	Remove									
158	Morrill	Bud		Region								
159	Lynch	Elisa L.	Remove	Region	No		Opport			Rail		
160	Lund	Kari M.										
161	Furlong, M.D.	Roger C.										
162	Klinefelter	Angela										
163	Schombel	Stephen		Region								Yes
164	Brooke, State Senator	Vivian M.										
165	Gallus	Chris J.	Favor	Local			Neither					
166	Smitham	Jim	Favor	Local		Import				Neither	No	Yes
167	Renfrew	Malcolm										
168	Rowling	Mel			No				NotSig			
169	Belsey	Jim										
170	Jeniker	Charles		Region			Opport					
171	Ore, Chair	Florence										
172	Marchion	Chris					Opport		NotSig			
173	Decker	Bob										
174	Stilwell	Charles										
175	Stone-Manning	Tracy										
176	Glueckert	Bev Beck										
177	Brown	James K.										
178	Ellingson, State Rep.	Jon E.										
179	Kreisberg	Michael										
180	Peters	Doris										
181	Craig	Patrick W.	Remove	Region			Opport	Yes	NotSig			
182	Ort	Harold										

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183	Smith	Marvin										
184	Waring	George H.		Region			Opport					Yes
185	Warden, President	Bill										
186	Whalen, President	Bob	Remove	Region	Yes	Import	Opport	No	NotSig	No Pref		Yes
187	Crisp	Fred										
188	Kerr	Mark										
189	Grayson	Michael B.										
190	Lyon, Vice President	James S.		Region			Opport					
191	Coopmans	Jerome & Yvonne										
192	Gassenberg	Sue					Rocker			Truck		
193	Douglass	Kristin Snyder										
194	Doggett	Arminda & Victor										
195	Gichwald	Linda										
196	Archie	Michele L.										
197	Erickson	Nancy N.										
198	Mueller	Ronald										
199	Weaver	Jana										
200	Slack	David C.										
201	Craig	Mary Kay		Region			Either					Yes
202	Judge	Patrick										
203	Langley	Gary A.										

NOTES: PLAN = Propose Plan; REF NO = Reference number assigned by MDEQ; Not all people responded to every question; Responses were cataloged from written comments only

PLAN 1 - What are your views on leaving STARS treated tailings in the floodplain?
PLAN 2 - Which is prefered, many near stream repositories or one/two regional ones?
PLAN 3 - How do you feel about using uncontaminated areas for repositories?
PLAN 4 - How important are land restrictions on relocation repositories?
PLAN 5 - How do you feel about using Opportunity Ponds or Browns Gulch for a repository?
PLAN 6 - How do you feel about using Ramsay Flats as a repository?
PLAN 7 - How significant are short-term risks associated with hauling wastes?
PLAN 8 - Would you prefer truck or rail haul to regional repositories?
PLAN 9 - How do you feel about using size as a removal criteria for sediment?
PLAN 10 - What are your views on improving Silver Bow Ck to support trout?

APPENDIX D-1c
Alternative Preference Summary

ALTERNATIVE PREFERENCE SUMMARY
APPENDIX D-1c - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	1	Munday, Assoc. Prof.	Dr. Pat		X					
I	2	Scown	Pat					X		
I	3	Van Sice	R.B.							X
I	4	Colaiuta	Ms. Vickie							X
I	5	Baker	Forrest							X
I	6	Helding	Linda							X
I	7	Stokke	Melvin A.				X			
I	8	Richards	Paul			X				
I	9	O'Brien	Edna		X					
I	10	Beer	Mrs. Mary S.		X					
I	11	Everhart	Nancy M.				X			
I	12	Heaphy	Larry and Shirley				X			
I	13	Waring	Thomas							X
I	14	Kraus	Susan L.		X					
I	15	Smith	Larry N.		X					
I	16	Berube	Daniel T.							X
I	17	Ray	John W.		X					
I	18	Fischer	Susan				X			
I	19	Smith	Geoff		X	X				
I	20	Haeffner, R.PH	Charles						X	
I	21	Fladagen	Brian					X		
I	22	Mullen	Gregory		X	X				
I	23	Haffey	J. Ray							X
I	24	Ginn, Ph.D	Thomas C.						X	
I	25	Fitzpatrick	John S.						X	
I	26	Fredrickson	Dorothy K.				X			
I	29	McCarthy	Bea						X	
I	30	Minich	Linda M.							X
I	31	McGowan	O.		X					

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REF NO = Reference number; Greenway is MERDI's proposed alternative; Alternative preference indicated only if specific alternative was identified in comment.

APPENDIX D-1c - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	32	Tuchscherer, M.D.	Mabel E.				X			
I	33	Leiss	Nicki	X						
I	34	Groff, Ph.D.	S.L.					X		
I	35	Smitham	Jim						X	
I	36	McMaster	Kemper M.		X	X				
I	38	Prodgers	Richard A.		X					
I	40	Schetzsle	Anthony J.		X					
I	41	Stickney	Michael C.		X	X				
I	42	Karvinen	Ronald D.							X
I	44	Waring	George H.		X					
I	45	Evans, Chairman	Barbara			X				
I	46	Micheletti	Joe					X		
I	47	Beaudette	Edward G.					X		
I	49	Luebeck	Al		X					
I	50	Cote	John S. "Harp"					X		
I	51	Gooding	Diana H.		X	X				
I	52	Rowik	Pete		X					
I	53	Roberts	Richard E.		X	X				
I	54	Nobles	E. Terrill		X					
I	55	Dolese	Thomas			X				
I	56	Hennessy M.D., M.P.H	P.J.			X				
I	57	Gilels	Dori		X	X				
I	58	Vaneler	Mike		X					
I	59	Magnuson	Leaf		X	X				
I	60	Johnson	Michael			X				
I	61	Schombel	L.F.		X	X				
I	62	Smith	Jeffrey J.		X	X				
I	63	Hoon	Kirby L.			X				
I	64	Coddington	Lane		X	X				

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STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	65	Benson	Robert E.		X					
I	66	Benson	Erik		X					
I	67	Pence	Dennis		X					
I	68	Thomas	William R.		X	X				
I	69	Pally	Barbara Archer & Tom		X					
I	70	Kern	Donald		X	X				
I	72	Onishuk	Martin		X	X				
I	73	Maloney	Joe F.			X				
I	74	Kinyon	Mr. & Mrs. W.R.		X	X				
I	75	Parodi	John A.		X	X				
I	76	Turman	Kathleen & George		X	X				
I	77	Herbert	John M.		X					
I	78	Childers	Robin L.		X	X				
I	79	Zimet	Andrew			X				
I	80	Kemmis	Daniel			X				
I	81	Smith, PT	Richard L.		X	X				
I	82	O'Connor	Roy		X	X				
I	84	Koons	Richard A.		X	X				
I	85	Griffin	Jim		X					
I	86	Hammer	William & Audrey		X					
I	87	Weight	Willis D.							X
I	88	Capps	Paul		X	X				
I	89	Blackwood	Traci				X			
I	90	Farling	Bruce		X	X				
I	91	Morgan	Cindy			X				
I	92	Pearce	William B. & Olive M	X						
I	93	Walker	James		X	X				
I	94	Marley	Patrick		X	X				
I	95	Hutchins	Judith			X				

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APPENDIX D-1c - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	96	Clifford	Gay & John			X				
I	97	Drury	Bill		X					
I	98	Cooper	Ron			X				
I	99	Gazzo	Paul		X	X				
I	100	Lunde	Eric			X				
I	102	Hedges	Anne			X				
I	103	St. John, M.D.	Robert M.					X		
I	104	Strong, MD	Paul T.		X	X				
I	105	Stewart	Robert F.		X	X				
I	106	Watson	Vicki		X	X				
I	107	Ellerman	Edward		X					
I	108	Murphy	Pat			X				
I	109	Casick	Steve		X					
I	110	Casick	Matt		X					
I	111	Casick	Agnus		X					
I	112	Lockwood	Gretchen		X					
I	113	Schubert, D.D.S.	Roger S.		X	X				
I	114	Manning, Planning Director	James M.						X	
I	115	Ballard	Bill & Lee		X					
I	116	Stebbins	Hannah			X				
I	117	Marangelo, Resource Speciali	Glenn		X	X				
I	118	Tollefson	Gregory M.		X	X				
I	119	Knight	Ellen		X					
I	120	Schweber, Chairman	Phil			X				
I	121	Zygo	Brian H.			X				
I	122	Schafer, Ph.D.	William						X	
I	123	Morrison	Bruce H.		X	X				
I	124	duPont	Mrs. B.G.			X				
I	125	Jeske	Mary Frances Laird		X					

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APPENDIX D-1c - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	126	McGree	Thomas "Tuck"						X	
I	127	Peoples	Don					X		
I	128	Haas, Jr.	Albert		X					
I	129	Thoma	Heather		X	X				
I	130	Beatty, Chief Executive	Cheryl S.							X
I	131	Ferguson	Laura			X				
I	132	Kambich	James J.						X	
I	133	Ford	Jim		X	X				
I	134	Finnegan	William P.					X		
I	135	Larson, M.D., P.S.	Gordon E.		X	X				
I	136	Farmer	Eugene E.			X				
I	137	Clough, Regional Supervisor	C. Richard			X				
I	138	Everingham	Catherine B.		X	X				
I	139	Mayberry	Jerry		X	X				
I	140	Brunsvold	Ed			X				
I	141	Antonioli, President	Steve							X
I	142	Tuesday, Geochemist	Mr. David S.		X					
I	143	Joslin	Kay		X					
I	144	Mulcaire-Jones	Mary		X	X				
I	145	Smith	Ronald J.	X						
I	146	Trenk, Executive Director	Peggy Olson				X			
I	147	Gless, Ph.D.	Elmer E.			X				
I	148	Gonshak	Henry		X					
I	149	Atcheson	Jack		X					
I	150	Armstrong	Dr. W.E.		X	X				
I	151	Sherry, President	Brian			X				
I	152	Beul	Cameron		X					
I	153	Technical Staff			X					
I	154	Tourangeau, Coordinator	Phil & Marion Yoder							X

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STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	155	Kerr, Research Specialist	Mark A.		X					
I	156	Lynch, Chief Executive	Jack							X
I	157	Rollo, MWF President	Al			X				
I	158	Morrill	Bud							X
I	159	Lynch	Elisa L.			X				
I	160	Lund	Kari M.			X				
I	161	Furlong, M.D.	Roger C.			X				
I	162	Klinefelter	Angela			X				
I	163	Schombel	Stephen		X	X				
I	164	Brooke, State Senator	Vivian M.		X	X				
I	165	Gallus	Chris J.						X	
I	166	Smitham	Jim					X		
I	167	Renfrew	Malcolm			X				
I	168	Rowling	Mel							X
I	169	Belsey	Jim		X					
I	170	Jeniker	Charles		X					
I	171	Ore, Chair	Florence			X				
I	172	Marchion	Chris							X
I	173	Decker	Bob			X				
I	175	Stone-Manning	Tracy		X	X				
I	176	Glueckert	Bev Beck		X	X				
I	177	Brown	James K.			X				
I	178	Ellingson, State Rep.	Jon E.		X					
I	179	Kreisberg	Michael		X	X				
I	180	Peters	Doris		X	X				
I	181	Craig	Patrick W.		X					
I	182	Ort	Harold			X				
I	183	Smith	Marvin		X	X				
I	184	Waring	George H.		X					

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STREAMSIDE TAILINGS OPERABLE UNIT

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
I	185	Warden, President	Bill			X				
I	186	Whalen, President	Bob		X	X				
I	187	Crisp	Fred			X				
I	189	Grayson	Michael B.		X					
I	190	Lyon, Vice President	James S.		X	X				
I	191	Coopmans	Jerome & Yvonne		X	X				
I	192	Gassenberg	Sue		X	X				
I	193	Douglass	Kristin Snyder		X					
I	194	Doggett	Arminda & Victor		X	X				
I	195	Gichwald	Linda			X				
I	196	Archie	Michele L.			X				
I	197	Erickson	Nancy N.			X				
I	198	Mueller	Ronald		X					
I	199	Weaver	Jana			X				
I	200	Slack	David C.		X	X				
I	201	Craig	Mary Kay		X					
I	202	Judge	Patrick		X					
I	203	Langley	Gary A.							X
I-III	28	Stosich	Steve					X		
IA11	37	Everhart	Nancy M.							
IA23	48	Haffey	J. Ray							
IA33	71	Leiss	Nicki							
IA45	101	Evans, Chairman	Barbara							
ID10	83	Beer	Mrs. Mary S.							
ID18	27	Fischer	Susan							
III		Ammondson	Mark						X	
III		Anonymous								X
III		Anonymous								X
III		Barnes	Richard J.						X	

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CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
III		Barry	Edward G.							X
III		Battleson	Dan							X
III		Brooke	T.							X
III		Carlson	Cindy							X
III		Cass	Ron							X
III		Costin	T.				X			
III		Darlington	Sue					X		
III		Erickson	Ralph							X
III		Fitzhugh	Elvin & Patricia							
III		Green	C.W.				X			
III		Gwynne	G.							X
III		Heath	Leo A.							X
III		Hildreth	Ed or Eathal							X
III		Johnson	Keith P.							X
III		Kehler	William							
III		Lewis	John T							X
III		Maney	Richard L.					X		
III		Maxson	William							X
III		McDermitt	Pat							X
III		Mohan	Pat							X
III		Nuthah?	Scott							X
III		O'Donnell	John						X	
III		Parker	Bruce					X		
III		Periman	Nita					X		
III		Reardon	Pat						X	
III		Reynolds	B.							X
III		Richardson	J.					X		
III		Scott			X					
III		Scown	Jim							X

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REF NO = Reference number; Greenway is MERDI's proposed alternative; Alternative preference indicated only if specific alternative was identified in comment.

CAT	REF NO	LAST NAME	FIRST NAME	PARTIAL RELOC. (ALT NO. 3)	MDEQ PREFERRED (ALT NO. 6)	TOTAL REMOVAL (ALT NO. 7)	ARCO PROPOSAL (MODIFIED)	GREENWAY	OPPOSE ALT NO. 6	NO PREFERENCE OR UNDETERMINED
III		Stepam	Ed					X		
III		Thompson	Jim & Margie							X
III		Ulrich	Don							X
III		Verstraete	Richard							X
III		Williams	Brian E.							X
III		Winter	Steve							X
IV		Antenioli	Tim							
IV		Bahr	Greg							X
IV		Berube	Louise						X	
IV		Black	Dan							
IV		Blom	Michael S.		X					
IV		Both	Dennis		X					
IV		Bower	William							X
IV		Bradshaw	Stan		X					
IV		Brulla	Ed		X					
IV		Burke	William S.							X
IV		Casey	John							X
IV		Cashell	Jennifer							X
IV		Cerise	Ted		X					
IV		Compton	Don E.							X
IV		Crosby	Lawrence							X
IV		Denny	Mike		X					
IV		Dummir?	Dave		X					
IV		Dunmire	Dan							X
IV		Friesz	Gale							X
IV		Garcia	P.							X
IV		Gelle?	Tyke							X
IV		Getz	Gerald							
IV		Giacomino	Brad							

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IV		Goodwin	Charles W.							X
IV		Graham	Keith		X					
IV		Gransbery	Ron		X					
IV		Groves	Larry		X					
IV		Hall	Robert J.							X
IV		Halloway	Jim							X
IV		Harrington	Brian			X				
IV		Holland								X
IV		Hoppe	L.							
IV		Hunter	Dan L.							X
IV		Johnson	Jim L.							X
IV		Jorensen	Joey A.							X
IV		Kachtyn	Duane							X
IV		Kinghorn	Thomas E.							X
IV		Konerny, M.D.	A.M.							
IV		Kramer	Raymond							
IV		Leary	Jim							X
IV		Leathers	L.R.							X
IV		Lewis	Jim							X
IV		Lewis	John							
IV		Lubick	Thomas							
IV		Lutz	John		X					
IV		Martinez	Fred							X
IV		McBride	Jon P.							X
IV		McGinnis	Matthew							X
IV		McGowan	Ed							X
IV		Merrick	Mike							X
IV		Motland	Norman							
IV		Myers	Serge			X				

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IV		Niland	George			X				
IV		Nugent	Dan							X
IV		O'Redli	Steve		X					
IV		Peaslee	Art		X					
IV		Pelter	Gabe		X					
IV		Piazzola	Frank		X					
IV		Puccinelli	Larry							X
IV		Radcliffe	T							X
IV		Robbins	Doug							
IV		Robbins	Ron		X					
IV		Robinson	Neil							X
IV		Seitz	Mark							X
IV		Shea	Jimmy							
IV		Stanley	Cal							
IV		Stepper	David							
IV		Stiles	John							X
IV		Sullivan	Pierce		X					
IV		Taylor	Darrell		X					
IV		Tiovanen	John		X					
IV		Truzzolino	Rick							X
IV		Wright	Jeffrey C.		X					

APPENDIX D-1d
Summary of MERDI Postcard Mailing Comments - Category III

SUMMARY OF MERDI POSTCARD MAILING COMMENTS - CATEGORY III
APPENDIX D-1d - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	MERDI 1	MERDI 2	MERDI 3	MERDI 4	MERDI 5	MERDI 6	MERDI 7
1	Ammondson	Mark	904 W. Porphyry	Butte	MT	59701	S	S	0	0	S	S	S
2	Anonymous						S	S	0	0	0	0	0
3	Anonymous						S	S	0	0	S	S	S
4	Anonymous						S	S		0		S	S
5	Anonymous						S	S	0	0	S	?	?
6	Barnes	Richard J.	1300 Sunrise Lane	Butte	MT	59701	S	S	S	0	S		S
7	Barry	Edward G.	102 Renz	Butte	MT	59701	S	S	0	0	0	S	S
8	Bartlett	Ed	P.O. Box 18	Butte	MT	59701	S	S	0	0	S	S	S
9	Battleson	Dan	2608 Hancock	Butte	MT	59701	S	S	0	0	S	S	S
10	Beagley	Larry	223 E. Gagnon St.	Butte	MT	59701	S	S	0	0	S	S	S
11	Bennie	Mr. & Mrs. Robert T.	120 Rocky Mountain Lane	Butte	MT	59701	S	S	0	0	S	S	S
12	Blackwood	John & Traci	415 W. Copper St.	Butte	MT	59701	S	S	0	0	0	S	S
13	Brooke	T.	3420 Neighborly Ln.	Butte	MT	59701	S	S	0	0	S	S	S
14	Brugger?	Richard	2100 Harrison Ave.	Butte	MT	59701	S	S	0	0	S	S	S
15	Carlson	Cindy	2630 Meadowbrook Dr.	Butte	MT	59701	S	S	0	0	S	S	S
16	Carosone	V.	1301 W. Park	Anaconda	MT	59711	S	S	0	0	S	S	S
17	Cass	Ron	2061 Carolina	Butte	MT	59701	S	S	0	0	S	S	S
18	Clark	Leslie	674 Dakota	Butte	MT	59701	S	S	0	0	S	S	S
19	Costin	T.	1952 Elm St	Butte	MT	59701	S	S	0	0	S	S	S
20	Cromer	John W.	100 Aspen Way H Way	Butte	MT	59701	S	S	0	0	S	S	S
21	Darlington	Sue	843 Hornet St.	Butte	MT	59701	S	S	0	0	0	S	S
22	Dolan	Cindy	628 W. Quartz	Butte	MT	59701	S	S	0	0	S	S	S
23	Elich	Charlotte	P.O. Box 3788	Butte	MT	59701	S	S	S	0	S	S	S
24	Erickson	Ralph	German Gulch Rd.	Silver Bow	MT	59750	S	S	0	0	0	S	S
25	Estep	Claire	205 Vista Ct.	Butte	MT	59701	S	S	0	0	S	S	S
26	Fischer	Matt	600 Sycamore	Anaconda	MT	59711	S	S	0	0	S	S	S
27	Fitzhugh	Elvin & Patricia	315 W. Broadway	Butte	MT	59701	S	S	0	0	S	S	S

NOTES: MERDI = Montana Energy Research and Development Institute; S = Support; 0 = Oppose; U = Uncertain; ? = Undetermined.
MERDI 1 - A cleanup that results in safe, long-term environmental and human protection.
MERDI 2 - A selected remedy which includes future beneficial uses.
MERDI 3 - Transportation of 1.8 mcy of wastes to either Opportunity Ponds or Browns Gulch.
MERDI 4 - Possible contamination of a previously unaffected site.
MERDI 5 - Relocation of tailings to a safe area near the already affected site.
MERDI 6 - Use of innovative technology and effective ICs.
MERDI 7 - Coordination with other Superfund operable units in a manner that expedites cleanup and solves other environmental concerns.

SUMMARY OF MERDI POSTCARD MAILING COMMENTS - CATEGORY III
APPENDIX D-1d - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	MERDI 1	MERDI 2	MERDI 3	MERDI 4	MERDI 5	MERDI 6	MERDI 7
28	Flack	P.	580 Little Basin Cr. Rd	Butte	MT	59701	S	S	0	0	S	S	S
29	Foley	Debbie	2720 Locust	Butte	MT	59701	S	S	0	0	S	S	S
30	Gallus	John	2701 Phillips St.	Butte	MT	59701	S	S	0	0	S	S	S
31	Grace	Richard J.	605 W. Galena St.	Butte	MT	59701							
32	Green	C.W.	1919 S. Washington	Butte	MT	59701	S	S	0	0	S	S	S
33	Gwynne	G.	155 Shirley Way	Anaconda	MT	59711	S	S	?	0	0	S	S
34	Heath	Leo A.	13 Redwood	Butte	MT	59701	S	S	0	0	S	S	S
35	Hildreth	Ed or Eathal	122 Renz	Butte	MT	59701	S	S	0	0	S	S	S
36	Hollingsworth	Helen	2608 Hancock	Butte	MT	59701	S	S	0	0	S	S	S
37	Honer	Jeffery J.	243 Meadow View Drive	Butte	MT	59701	S	S	0	0	S	S	S
38	Janssen	Dorothy	2825 Farragut	Butte	MT	59701	S	S	0	0	S	S	S
39	Johns	David C.	3017 Harvard Ave.	Butte	MT	59701	S	S	0	0	S	S	S
40	Johnson	Keith P.	One First Nat'l Bank Bldg	Butte	MT	59701	S	S	0	0	S	S	S
41	Kehler	William	1331 Baxter Lane	Bozeman	MT	59715	S		0	0			S
42	Krause	Rebecka	2115 Grand	Butte	MT	59701	S	S	0	0	S	S	S
43	Lewis	John T	2108 S. Wyoming	Butte	MT	59701	S	S	0	0	S	S	S
44	Lovshin	Betty Jo	1834 Thornton	Butte	MT	59701	S	S	0	0	S	S	S
45	Lovshin	Gary	1834 Thornton	Butte	MT	59701	S	S	0	0	S	S	S
46	Lovshin	Gary	P.O. Box 786	Colstrip	MT	59323	S	S	0	0	S	S	S
47	Lovshin	Josh	1834 Thornton	Butte	MT	59701	S	S	0	0	S	S	S
48	Lovshin	Teresa	P.O. Box 786	Colstrip	MT	59323	S	S	0	0	S	S	S
49	Lovshin	Todd T.	1834 Thornton	Butte	MT	59701	S	S	0	0	S	S	S
50	Maesar	Dennis	119043 Silver Bow Road	Silver Bow	MT	59750	S	S	0	0	S	S	S
51	Maesar	Donna	119042 Silver Bow Road	Silver Bow	MT	59750	S	S	0	0	S	S	S
52	Maesar	Howard	119042 Silver Bow Road	Silver Bow	MT	59750	S	S	0	0	S	S	S
53	Maney	Richard L.	842 Lexington	Butte	MT	59701	S	S	0	0	S	S	S
54	Markovich	Sidni	8 Redwood Dr.	Butte	MT	59701	S	S	0	0	S	S	S

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MERDI 3 - Transportation of 1.8 mcy of wastes to either Opportunity Ponds or Browns Gulch. MERDI 4 - Possible contamination of a previously unaffected site.
MERDI 5 - Relocation of tailings to a safe area near the already affected site. MERDI 6 - Use of innovative technology and effective ICs.
MERDI 7 - Coordination with other Superfund operable units in a manner that expedites cleanup and solves other environmental concerns.

SUMMARY OF MERDI POSTCARD MAILING COMMENTS - CATEGORY III
APPENDIX D-1d - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	MERDI 1	MERDI 2	MERDI 3	MERDI 4	MERDI 5	MERDI 6	MERDI 7
55	Martinez	Denise	812 S. Dakota	Butte	MT	59701	S	S	O	O	O	S	S
56	Maxson	William	305 W. Granite	Butte	MT	59701	S	S	O	O	S	S	S
57	McDermitt	Pat	Box 21	Ramsay	MT	59748	S	S	S	O	S	O	S
58	Mohan	Pat	1809 Howard	Butte	MT	59701	S	S	O	O	S	S	S
59	North-Abbott	Mary	3425 Parkway	Butte	MT	59701	S	S	O	O	S	S	S
60	Nuthah?	Scott	1075 Blacktail Loop	Butte	MT	59701	S	S	O	O	S	S	S
61	O'Donnell	John	40 E. Broadway	Butte	MT	59701	S	S	O	O	S	S	S
62	O'Donnell	Kathy	1100 W. 5th St.	Anaconda	MT	59711	S	S	S	O	S	S	S
63	Obenhoff	Howard	200 West Park	Butte	MT	59701	S	S	O	S	S	S	S
64	Paige	Gina	500 W. Broadway	Butte	MT	59701	S	S	O	O	S	S	S
65	Parker	Bruce	1800 Fairmont Road	Anaconda	MT	59711	S	S	O	O	S	S	S
66	Patrick	Mary	2814 Locust	Butte	MT	59701	S	S	O	O	S	S	S
67	Periman	Nita	P.O. Box 104	Butte	MT	59701	S	S	O	O	S	S	S
68	Reardon	Pat	117 Rocky Mtn Lane	Butte	MT	59701	S	S	O	O	O	S	S
69	Reynolds	B.	1700 Shirley Way	Anaconda	MT	59711	S	S	U		U	U	U
70	Richardson	J.	1303 California	Butte	MT	59701	S	S	O	O	S	S	S
71	Rowe	Gary	3020 Princeton	Butte	MT	59701	S	S	O	O	S	S	S
72	Rowe	Sara	3020 Princeton	Butte	MT	59701	S	S	O	O	S	S	S
73	Sanz	Jeffery J.	P.O. Box 4881	Butte	MT	59701	S	S	O	O	S	S	S
74	Scott		15 West Copper	Butte	MT	59701	S	S	S	S	O	S	S
75	Scown	Jim	1815 Monroe Ave	Butte	MT	59701	S	S	O	O	O	S	S
76	Sletten	Jennifer	1816 Farragut	Butte	MT	59701							
77	Sletten	Kevin	2718 Bayard	Butte	MT	59701	S	S	O	O	S	S	S
78	Sletten	Mary Ann	2718 Bayard	Butte	MT	59701	S	S	O	O	S	S	S
79	Sletten, Jr.	Ron	1816 Farragut	Butte	MT	59701	S	S	O	O	S	S	S
80	Sletten, Sr.	Ron	2718 Bayard	Butte	MT	59701	S	S	O	O	S	S	S
81	Sorich	Patricia	1820 Wilson	Butte	MT	59701	S	S	O	O	O	S	S

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MERDI 7 - Coordination with other Superfund operable units in a manner that expedites cleanup and solves other environmental concerns.

APPENDIX D-1d - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	MERDI 1	MERDI 2	MERDI 3	MERDI 4	MERDI 5	MERDI 6	MERDI 7
82	Sorich	Steve	1820 Wilson	Butte	MT	59701	S	S	O	O	S	S	S
83	Stepam	Ed	101 Grandview Dr.	Butte	MT	59701	S	S	O	O	S	S	S
84	Stosich	Steve	60 Oro Fino Gulch	Butte	MT	59701	S	S	O	O	S	S	S
85	Tash	Carol	816 Waukesha	Butte	MT	59701	S	S	O	O	S	S	S
86	Tash	Paul	816 Waukesha	Butte	MT	59701	S	S	O	O	S	S	S
87	Tatarka	J.E.	426 18th St. W	Billings	MT	59102	S	S	O	O	S	S	S
88	Tatarka	Marjorie	426 18th St. W	Billings	MT	59102	S	S	O	O	S	S	S
89	Thomas, P.C.	Dr. Fred G.	2410 Amherst Ave.	Butte	MT	59701	S	S	O	O	S	S	S
90	Thompson	Jim & Margie	3505 Quincy	Butte	MT	59701	S	S	O	O	O	S	S
91	Ulrich	Don	Box 3928	Butte	MT	59701	S	S	O	O	S	S	S
92	Verstraete	Richard	680 Wildlife Ln	Anaconda	MT	59711	S	S	O	O	O	S	S
93	Vogelsang	Jay	18 Bittersweet Dr.	Butte	MT	59701	S	S	O	O	S	S	S
94	Williams	Brian E.	918 W. Granite	Butte	MT	59701	S	S	O	O	S	S	S
95	Winter	Steve	1100 Legion Lane	Butte	MT	59701	S	S	O	O	S	S	S
96	Yeagle	Dr. Bill	Montana Tech	Butte	MT	59701	S	S	O	O	S	S	S
97	Zulir	Jo Ellen	1140 Waterline Rd.	Butte	MT	59701	S	S	O	O	S	S	S

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MERDI 5 - Relocation of tailings to a safe area near the already affected site.
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MERDI 7 - Coordination with other Superfund operable units in a manner that expedites cleanup and solves other environmental concerns.

APPENDIX D-1e
Summary of CTEC Mailing Comments - Category IV

APPENDIX D-1e - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
1	?	Arnold	1080 Hobson	Butte	MT	59701			NotImp	Active	Either
2	?	James	807 Stewart	Anaconda	MT	59711					
3	?	Ronald	1209 East 4th	Anaconda	MT	59711	Oppose	?	?	Active	
4	Aguiler ?	Dan J.	435 E. Platunim	Butte	MT	59701	Oppose	Region	None	Opp/Act	
5	Allick	John	1009 Smith St.	Anaconda	MT	59711	Favor		None	Active	Truck
6	Andersen	Joe	1915 Whitman	Butte	MT	59701	Unsure			Active	Rail
7	Anonymous			Anaconda	MT	59711	Oppose	Region	Import	Opport	Rail
8	Antenioli	Tim	524 S. Washington	Butte	MT	59701	Favor		None	Active	Rail
9	Antonioli	Calvin	821 W. Mercury	Butte	MT	59701	Favor	Local	Import	Any	Truck
10	Arnold	David	422 Sacramento	Butte	MT	59701	Oppose	?	Import	Active	Truck
11	Bahr	Greg	202 Warren	Anaconda	MT	59711				Active	
12	Barscock	Dennis	66 Kountz Road	Whitehall	MT	57594	Oppose	Region	Some	Active	
13	Beierle	Fred	670 Olson Gulch Rd.	Anaconda	MT	59711	Oppose	Region	Import	Active	Rail
14	Bennett	John T.	1615 N Main	Butte	MT	59701	Oppose	Region	None	Active	Depends
15	Berube	Louise	133 Shirley Way	Anaconda	MT	59711	Favor	Local	Import	?	Neither
16	Birkenbael?	Travis	2623 Oregon	Butte	MT	59701	Oppose	Local	Import		Depends
17	Black	Dan	P.O. Box 23	Ramsey	MT	59748		Region		Active	Truck
18	Blom	Michael S.	445 Terra Verde Dr.	Butte	MT	59701	Oppose	Region		Active	
19	Blow	Donna	P.O. Box 4794	Butte	MT	59702	Oppose	Region	None	Active	Depends
20	Both	Dennis	2401 Yale	Butte	MT	59701				Active	Truck
21	Boucher	Victor	802 W. 3rd	Anaconda	MT	59711	Favor		NotImp	Active	Rail
22	Boulter?	Paul	2506 Nettie	Butte	MT	59701	Oppose			Active	Rail
23	Bowen	Elmer	120 N. Locust	Anaconda	MT	59711	Oppose	Region	None	Active	Rail
24	Bower	Jack	430 Terra Verder	Butte	MT	59701	Oppose	Region	None	Active	Truck
25	Bower	William	135 Whitetail Road	Whitehall	MT	59759				Active	Truck
26	Bozlee?	Debbie	640 Olson Gulch	Anaconda	MT	59711	Oppose	Region	None	Active	Either
27	Bradshaw	Stan	824 9th	Helena	MT	59601	Oppose	Region			
28	Breez?	Tom	Rt 3 Box 242	Rocker	MT	59701	Oppose	Region		Active	Depends

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CTEC 1 - How do you feel about using STARS as a permanent cleanup, despite the lack of much of a historical record as to its durability?
CTEC 2 - Which is prefered, many near stream repositories or one/two regional repositories? CTEC 3 - How important are land use restrictions on Silver Bow Ck?
CTEC 4 - How do you feel about using the following sites as regional repository locations? CTEC 5 - Would you prefer truck or rail haul to regional repository?

APPENDIX D-1e - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
29	Brulla	Ed	1910 Monroe	Butte	MT	59701				Active	
30	Buck	Bob	2045 Gaylord	Butte	MT	59701	Oppose	Region	Import	Active	Truck
31	Buger	Bryan	5985 Albony	Butte	MT	59701		?		Active	Truck
32	Burk	John	1222 W. Platinum	Butte	MT	59701	Oppose	Region	None	Active	Depends
33	Burke	William S.	1204 Kentucky	Deer Lodge	MT	59722	Favor			Active	
34	Burns	George	1818 Thomas	Butte	MT	59701	Oppose	Region	Import	Active	Rail
35	Carr	Ray	13 Earth Lane	Butte	MT	59701	Oppose	Region		Active	Depends
36	Case	Mel	2730 Yale	Butte	MT	59701		Region	Import	Active	
37	Casey	John	1911 Oregon Ave.	Butte	MT	59701	Oppose	Local	Import	Active	Depends
38	Cashell	Jennifer	2300 N. Drive	Butte	MT	59701	Oppose	Region	Some	Active	
39	Celli	Bruno	2335 S. Dakota	Butte	MT	59701			Some	Active	Depends
40	Cerise	Ted	1809 Carolina	Butte	MT	59701	Oppose	?		Active	Truck
41	Ch?	Clifford	821 W. Granite	Butte	MT	59701				Active	Rail
42	Childs	Art	2228 Colorado	Butte	MT	59701	Oppose	?	NotImp	Active	Truck
43	Colvin	William	990 Hwy 2 West	Whitehall	MT	59759	Oppose	Region	Import	Active	Truck
44	Colwell	Duane N.	700 Richard	Anaconda	MT	59711		Region		Active	Truck
45	Compton	Don E.	2835 Edwards	Butte	MT	59701	Oppose			Active	Either
46	Costello	Brian	935 W. copper	Butte	MT	59701	Oppose	?		?	
47	Coster ?	John	133 E Dahl ?	?	MT	59781				Active	
48	Cote	Jim	23 Pintlar Peaks Plaza	Butte	MT	59701	Oppose	Region	Import	Active	Rail
49	Crenshaw	Bill	Box 625	Boulder	MT	59632	Oppose	Region	None	Active	Depends
50	Crosby	Lawrence	416 W. Broadway	Butte	MT	59701	Oppose		Import	Active	Truck
51	Cullen	Robert A.	3350 Keokuk	Butte	MT	59701	Oppose	Region	None	Active	Depends
52	Cunningham	Stan	RT 2 Willamsburg	Butte	MT	59701	Oppose	Region		Active	Depends
53	Cutting	James	1132 Farragut	Butte	MT	59701	Oppose	Region	NotImp	Active	Truck
54	Daly	Nick	1806 Adams	Butte	MT	59701	Oppose	Region	None	Opp/Act	Rail
55	Denny	Mike	1344 Sunrise	Butte	MT	59701	Oppose	?		Active	Either
56	Digales?	Carole	19 Fairview North	Anaconda	MT	59711	Oppose	Region		Active	Truck

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CTEC 4 - How do you feel about using the following sites as regional repository locations? CTEC 5 - Would you prefer truck or rail haul to regional repository?

APPENDIX D-1e - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
57	Dombroski	John	2120 Thomas	Butte	MT	59701				Active	
58	Dorvall	Dennis	2906 Edwards	Butte	MT	59701	Oppose		None	Active	Either
59	Downey	John	805 Lexington	Butte	MT	59701		Region	Import	Active	Truck
60	Driscoll	Ralph	1325 Quartz	Butte	MT	59701	Oppose	Region		Active	Rail
61	Dummir?	Dave	919 W. Woolmen	Butte	MT	59701	Oppose			Active	Truck
62	Dunks	Bill	2400 Yale	Butte	MT	59701				Active	Truck
63	Dunmire	Dan	3240 Amherst	Butte	MT	59701				Active	Truck
64	Edsall	Kenneth	P.O. Box 176	Whitehall	MT	59759		Region		Active	
65	Evans	Morris	1028 Missoula	Butte	MT	59701	Oppose	Region		Active	
66	Faulkner	Al	829 Zareloa St.?	Butte	MT	59701	Oppose	Region	None	Active	Truck
67	Faulkner	Gary M.	1411 Iowa	Butte	MT	59701	Oppose	Region	Import	Active	Truck
68	Fellows	Don	Box 411	Whitehall	MT	59759				Active	
69	Fellows	Tim	3001 Carter	Butte	MT	59701	Oppose	Region		Active	Truck
70	Fitzpatrick	R.M.	1928 Powell Ave.	Butte	MT	59701	Oppose		None	Active	Truck
71	Foreman	Don	1512 Sage	Butte	MT	59701				Active	Truck
72	Friesz	Gale	1401	Butte	MT	59701					
73	Galb?	Cliff	302 Lost Creek Road	Anaconda	MT	59711		Region		Active	
74	Garcia	John	734 W. Park	Butte	MT	59701		Region		Active	Either
75	Garcia	P.	518 N. Emmett	Butte	MT	59701	Oppose	Region	None	Active	Either
76	Gates	Donald	3217 Hwy 1 West	Anaconda	MT	59711	Oppose	Region	Import	Active	Either
77	Gelle?	Tyke	710 Lost Creek Road	Anaconda	MT	59711				Active	Truck
78	Getz	Gerald	1806 Schlex	Butte	MT	59701		Region			Rail
79	Giacomino	Brad	927 W. Quartz	Butte	MT	59701	Favor	Region		Active	
80	Gilmen	Vern L.	417 Terra Verde Dr.	Butte	MT	59701	Oppose	Region	Import	Active	Truck
81	Gissele?	Edwin C.	11 North Preston	Anaconda	MT	59711	Oppose		?	Active	Rail
82	Gleverly	Jesse	601 St. Paul	Butte	MT	59701				Active	Truck
83	Goodwin	Charles W.	P.O. Box 33	Basin	MT	59631					
84	Graham	Dwight	2030 Porter	Butte	MT	59701	Oppose	Region		Active	Either

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CTEC 2 - Which is prefered, many near stream repositories or one/two regional repositories? CTEC 3 - How important are land use restrictions on Silver Bow Ck?

CTEC 4 - How do you feel about using the following sites as regional repository locations? CTEC 5 - Would you prefer truck or rail haul to regional repository?

APPENDIX D-1e - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
85	Graham	Keith	2725 Edwards	Butte	MT	59701	Oppose	Region		Active	Truck
86	Gransbery	Ron	826 Evans	Butte	MT	59701	Oppose				Truck
87	Greenlief	Dennis	2904 Walnut	Butte	MT	59701	Oppose	Region	NotImp	Active	Truck
88	Groves	Larry	2860 St. Ann	Butte	MT	59701		Region		Active	Truck
89	Gustafson	Harold E.	922 E. First Street	Butte	MT	59701	Oppose	?	Import		Truck
90	Hall	Robert J.	2717 Bayard	Butte	MT	59701	Oppose		Import	Opp/Act	Rail
91	Halloway	Jim	1815 Texas Ave.	Butte	MT	59701				Active	
92	Hame	Gary H.	46 Mt View	Anaconda	MT	59711				Active	Truck
93	Harrington	Brian	1755 Florence	Butte	MT	59701	Oppose	?	None	Active	Truck
94	Havens	Bill	1832 Elm St	Butte	MT	59701	Oppose	Region	NotImp	Active	Truck
95	Heikkinen	Leonard	4011 Lost Creek	Anaconda	MT	59711	Oppose	Region		Active	
96	Hess	Al	3200 S. Colorado St.	Butte	MT	59701	Oppose	Region	Import	Active	Depends
97	Hill	Bob	400 Green Acres Dr.	Butte	MT	59701	Oppose	Region	None	Active	Truck
98	Holland		314 W. Daly	Walkerville	MT	59701	Oppose	Region		Active	Truck
99	Hoppe	L.	116 Star Lane	Butte	MT	59701					Either
100	Hunter	Dan L.	9101 4th	Deer Lodge	MT	59722				Active	
101	Ingram	Ron	15 E. Woolman	Butte	MT	59701	Oppose	Region		Active	
102	Jackson	Bill	915 Missouri	Deer Lodge	MT	59722				Opp/Act	
103	Jette	Joe	1220 Quinlan Rd.	Deer Lodge	MT	59722				Active	
104	Johnson	Darryl G.	3310 Koekuk	Butte	MT	59701	Oppose	Region		Active	
105	Johnson	Gary	3131 Busch	Butte	MT	59701		Region		Active	Truck
106	Johnson	Jim L.	2401 Grand	Butte	MT	59701		Region		Active	Truck
107	Johnson	Larry	P.O. Bos 953	Anaconda	MT	59711				Active	Truck
108	Johnson	Ronald G.	1223 Steel Street	Butte	MT	59701	Oppose	Region	Some	Active	Either
109	Johnston	Bob	1516 Clayton	Butte	MT	59701			Import	Active	Truck
110	Jones, Jr.	John E.	202 Evergreen	Anaconda	MT	59711		Local		Active	Truck
111	Jorensen	Joey A.	607 California	Deer Lodge	MT	59722	Oppose	Region	Import	Active	
112	Kachtyn	Duane	1935 Harvard	Butte	MT	59701				Active	

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CTEC 4 - How do you feel about using the following sites as regional repository locations? CTEC 5 - Would you prefer truck or rail haul to regional repository?

APPENDIX D-1e - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
113	Kinghorn	Thomas E.	1115 Oregon	Butte	MT	59701			Import	Active	
114	Kirk	Jim	2025 ?	Butte	MT	59701		Region	Import	Active	Truck
115	Kito	Jim	253 Meadow View	Butte	MT	59701				Active	Rail
116	Kloher	Tom	710 Cherry	Anaconda	MT	59711		Region	NotImp	Active	Truck
117	Kohn	Timothy J.	3106 Richardson	Butte	MT	59701	Oppose	Region	Import	Active	Rail
118	Konerny, M.D.	A.M.	3215 Ottawa St.	Butte	MT	59701	Favor	None	?	None	Neither
119	Korang	Justin	111 Oregon St.	Deer Lodge	MT	59722	Oppose	Region	None	Active	Depends
120	Kramer	Raymond	1001 Utah	Butte	MT	59701				Active	
121	Kriskovica	Ron	1902 Ogden	Anaconda	MT	59711	Oppose	Region	Some	Active	Depends
122	Laoma	Lyndon	412 Milw Ave.	Deer Lodge	MT	59722	Oppose	Region	NotImp	Active	Truck
123	Larkin	D.J.	3027 Phillips	Butte	MT	59701	Oppose	Region	?	Active	Truck
124	Lawrence	Henry	1025 Nevada	Butte	MT	59701	Oppose	Local	Import	Active	Either
125	Le Prowse	Joe	2802 Walnut	Butte	MT	59701	?	?	None	Active	Truck
126	Leary	Jim	2300 George St.	Butte	MT	59701	Oppose	Region	None	Active	Rail
127	Leathers	L.R.	517 W. Daly	Butte	MT	59701	Oppose	Region	?	Active	Truck
128	Lester	Jim	848 Hornet	Butte	MT	59701	Oppose	Region		Active	Truck
129	Leubert?	Marty	200 Main	Deer Lodge	MT	59722		Region	Import	Active	Rail
130	Lewis	Jim	30 W Josephine	Butte	MT	59701				Active	Truck
131	Lewis	John	66 Apple Orchard Rd.	Butte	MT	59701			None	Active	Truck
132	Little	Tim	3403 Neighborly	Butte	MT	59701				Active	
133	Lubick	Thomas	1805 Carolina	Butte	MT	59701				Active	Truck
134	Luome	Sam	4041 E. Lake	Butte	MT	59701	Oppose	Region		Active	
135	Lutey	Randy	216 Barker Creek	Anaconda	MT	59711	Oppose	Region	None	Opp/Act	Rail
136	Lutz	John	212 4 1/2 Aberdeen	Butte	MT	59701	Oppose			Active	Truck
137	Lyons	Dick	P.O. Box 724	Butte	MT	59701	Oppose	Region		Active	Truck
138	Maloney	Kelly	101 Greenwood	Butte	MT	59701	Oppose	Region	None	Active	Either
139	Maloughery?	Mike	323 W. Daly	Butte	MT	59701				Active	Truck
140	Malyeroe?	Wade	1347 Hwy 2 WEst	Whitehall	MT	59759		Region		Active	Truck

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APPENDIX D-1e - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
141	Malyevac	Dale	1509 Harrison Ave.	Butte	MT	59701	Oppose	Region	None		Truck
142	Martinez	Fred	3645 Banks	Butte	MT	59701				Active	
143	Mc Leod	?	2127 Wall	Butte	MT	59701		Region		Opp/Act	Truck
144	Mc?	Stanley	2220 Pine	Butte	MT	59701				Active	Truck
145	McBride	Jon P.	1808 Howard	Butte	MT	59701	Oppose	Region	Import	Active	Truck
146	McCaffery	Joe	2413 Farrogut Ave.	Butte	MT	59701		Region		Active	Truck
147	McCarthy	James L.	3320 Keokuk	Butte	MT	59701	Oppose	?	Import	Active	Truck
148	McClernan	John	820 Lexington	Butte	MT	59701	Oppose	Region	None	?	Truck
149	McGinnis	Doug	5101 S. Warren	Butte	MT	59701	Favor	Region		Active	Truck
150	McGinnis	Matthew	2158 S. Montana	Butte	MT	59701				Active	
151	McGowan	Ed	3537 Whiteway	Butte	MT	59701	Oppose	?		Active	Rail
152	McHugh	Paul	2310 Continental Drive	Butte	MT	59701				Active	Truck
153	McKenzie	John	R.R. #3 116120	Silver Bow	MT	59750	Oppose			Active	Truck
154	McLean ?	Jim ?	1745 Long Fellow	Butte	MT	59701	Favor	Region	NotImp	Active	Truck
155	Merrick	Mike	2232 Wall	Butte	MT	59701	?	Local	Import	Active	Depends
156	Miller	Bill	1825 Garfiled Ave.	Butte	MT	59701	Favor		Some	Active	Rail
157	Motland	Norman	1020 W 3rd St.	Anaconda	MT	59711				Active	
158	Mullony	Tom	2422 Princeton	Butte	MT	59701	Oppose	?		Active	Truck
159	Murphy	Joe D.	1126 W. Silver	Butte	MT	59701				Active	Depends
160	Myers	Serge	6 S. Hauser Ave.	Opportunity	MT	59711	Oppose	?		?	Rail
161	Nat?	Ray	3127 Cartr	Butte	MT	59701				Active	
162	Niland	George	600 Rickard	Opportunity	MT	59711	Oppose	Region		Active	
163	Nugent	Dan	1919 Harrison Ave.	Butte	MT	59701	Oppose	Region	Import	Active	Either
164	O'Connell	Daniel M.	410 Holmes Ave.	Butte	MT	59701	Oppose	Region	None	Active	
165	O'Connell	Tim	2312 S. Colorado	Butte	MT	59701	Oppose	Region	Import	Active	Rail
166	O'Melbey ?	Kurt	2003 Porter	Butte	MT	59701				Active	
167	O'Neill	Pat	644 S. Montana	Butte	MT	59701	Oppose	Region	None	Active	Depends
168	O'Redli	Steve	25 Nickle Annie	Butte	MT	59701				Active	

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APPENDIX D-1e - RESPONSIVENESS SUMMARY

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169	Palagi	Charles	3468 Hannibal	Butte	MT	59701	Oppose	Region	NotImp	Active	Truck
170	Parrow	Burnie	1819 Ogden	Anaconda	MT	59711	Oppose	Region	None	Active	Truck
171	Peaslee	Art	3105 State	Butte	MT	59701		Region		Active	Rail
172	Pelter	Gabe	129 Upston St.	Butte	MT	59701	Oppose	?		Active	Truck
173	Perise	Mike	1901 Thomas	Butte	MT	59701		Region		Active	Rail
174	Peterson	Richard	14403 East Side Rd	Anaconda	MT	59711				Active	Rail
175	Piazzola	Frank	1350 Phyllis Lane	Butte	MT	59701	Oppose	?		Active	
176	Piercy	Mark	P.O. Box 84	Wise River	MT	59762		Region		Active	Rail
177	Pousers?	Dan	732 North St	Walkerville	MT	59701	Oppose	Region	None	Active	Either
178	Puccinelli	Larry	910 E 3rd	Anaconda	MT	59711	Favor	Region		Active	Truck
179	Radcliffe	T	2901 Harvard	Butte	MT	59701	Oppose	Region	None	Active	?
180	Rask	Ted	3040 Bavard St.	Butte	MT	59701	Oppose	Region		Active	Depends
181	Rawson	Harry	119110 Lone Pine Gulch	Silver Bow	MT	59750	Oppose		Import	?	Rail
182	Reed	Harold	1411 Sonneson St.?	Butte	MT	59701			Import	Active	Either
183	Reilly	Gerald	2945 St. Ann	Butte	MT	59701	Oppose	Region	Some		Truck
184	Richards	J.	3333 Paxson	Butte	MT	59701	Oppose	Region		Active	Depends
185	Robbins	Doug	178 Yellowstone Trail	Whitehall	MT	59759	Oppose	Region		Active	Truck
186	Robbins	Ron	2031 Utah	Butte	MT	59701	Oppose	Region		Active	
187	Robinson	Neil	P.O. Box 288	Whitehall	MT	59759				Active	
188	Saleid?	Eugene	2900 Carter	Butte	MT	59701	Oppose	Region	Import	Active	Truck
189	Salmonsen	Doug	1628 Hobson	Butte	MT	59701				Active	Either
190	Sample	James	1850 Grand	Butte	MT	59701				Active	
191	Scheth	Larry		Butte	MT	59701		Region	NotImp	Active	Truck
192	Schnell	Larry	1010 Diamond	Butte	MT	59701	Oppose	Region	Import	Active	Either
193	Seitz	Mark	1810 Whitman	Butte	MT	59701	Oppose	Region		Active	Either
194	Shaw	Gerald	1926 Florida	Butte	MT	59701	Oppose	Region	None	Active	Either
195	Shea	Jimmy	604 W Daly St.	Walkervill	MT	59701	Oppose	Local	?	?	Depends
196	Shepard	Nick	1104 W. $th	Anaconda	MT	59711	Oppose	Region	NotImp	Active	Rail

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APPENDIX D-1e - RESPONSIVENESS SUMMARY
STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
197	Sletten	Ron		Butte	MT	59701				Active	
198	Smith	Charles E.	305 W. Copper	Butte	MT	59701	Oppose	?	Import	?	Truck
199	Solari	R.M.	3145 S. Hillcrest	Butte	MT	59701	Oppose	Region	NotImp	Active	Truck
200	Solmonsen	Walt	7624 Ottawa St.	Butte	MT	59701		Region		Active	Either
201	Sparks	Jerry	1904 Howard	Butte	MT	59701	Oppose	?	Import	Active	Truck
202	Spear	Brad	2019 Johns	Butte	MT	59701				Active	Truck
203	Sprunger	Dan	3029 Edwards	Butte	MT	59701	Oppose	Region	NotImp	Active	
204	Sprunger	Jim	2615 Princeton	Butte	MT	59701				Active	
205	St ?	Walt	1817 Farreset ?	Butte	MT	59701	Oppose		None	Active	Truck
206	Stanley	Cal	314 Stewart St.	Anaconda	MT	59711	Oppose	Local	Import	Active	Truck
207	Starcevich	Sheri	2017 Gaylord	Butte	MT	59701	Oppose	Region	Import	Active	Depends
208	Stefalo	Ed	1119 4th Street	Deer Lodge	MT	59722				?	Rail
209	Steilman	Lance L.	2523 Pine	Butte	MT	59701	Favor	Region		Active	Rail
210	Steilman	Pete	2523 Pine	Butte	MT	59701		Region	Import	Active	Truck
211	Stepper	David	1717 Yale	Butte	MT	59701				Active	
212	Stiles	John	2727 Aberdeen	Butte	MT	59701					
213	Sullivan	Pierce	1910 Sampson St.	Butte	MT	59701		Region	Import	Opp/Act	Rail
214	Sundberg	Steve	2285 West Drive	Butte	MT	59701	Oppose	Region		Active	Rail
215	Sweet	Jim	2125 S. Arizona	Butte	MT	59701	Oppose	Region		Active	Depends
216	Tangmo	Raymond E.	2 West Front	Butte	MT	59701	Oppose	Region	None	?	Rail
217	Taylor	Darrell	2700 Phillips St.	Butte	MT	59701				Opport	
218	Taylor	Don	Rt 2 South Rocker	Butte	MT	59750				Active	Truck
219	Tiovanen	John	3210 Richardson	Butte	MT	59701		?		Active	Truck
220	Truzzolino	Rick	1449 Dewey Blvd	Butte	MT	59701	Oppose	Region			Rail
221	Valentini	Rick	1415 W 4th	Anaconda	MT	59711				Active	Truck
222	Varelty?	J.	818 E. 5th	Anaconda	MT	59711			None	Active	Truck
223	Vercella	Jim	1924 Georgia	Butte	MT	59701	Oppose	Region	None	Active	Truck
224	Vidic	Tom	1339 Sampson	Butte	MT	59701			Import	Active	

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APPENDIX D-1e - RESPONSIVENESS SUMMARY

STREAMSIDE TAILINGS OPERABLE UNIT

NO	LAST NAME	FIRST NAME	STREET	CITY	ST	ZIP	CTEC 1	CTEC 2	CTEC 3	CTEC 4	CTEC 5
225	Voss	Glen E.	3002 Carter St	Butte	MT	59701	Oppose	Region	NotImp	Active	Depends
226	Walker	Larry	8145 Dakota St.	Butte	MT	59701	Favor	Region	Import	Active	Truck
227	Watts	Don	2201 Princeton	Butte	MT	59701	Oppose	?		Active	Truck
228	Weber	Jim	4034 Wynne	Butte	MT	59701				Active	
229	Whitaker	Ray	1812 Mass. Ave.	Butte	MT	59701		Region		Active	Rail
230	White	Russell A.	1118 Rickards	Anaconda	MT	59711	Oppose	Region	Import	Active	Rail
231	Wright	Jeffrey C.	3211 Phillips St.	Butte	MT	59701	Oppose			Active	Rail
232	Zen?	Scott D.	2111 N. Walnut	Butte	MT	59701	Favor	Region		Active	Either

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APPENDIX D-1f

Written Comments

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	1	Munday, Assoc. Prof.	Dr. Pat	"As a former engineer who now teaches courses such as 'Technology & Society' and 'Politics of Technical Decisions,' please consider my comments on the MDHES/EPA Preferred Alternative for the cleanup of streamside tailings in Silver Bow Creek basin. /// Trout are a fair indicator species of ecosystem health, ... /// To accomplish this goal removal of in-stream sediments is imperative. ... /// Not all tailings must be removed. ... Depending on actual contaminant levels, perhaps not all tailings within the floodplain need to be removed or treated. ... /// There is an important long-term consideration: all STARS treated tailings must be monitored and maintained far beyond the 30 year period normally considered by EPA. Some endowment or annuity, as used by the Canadian version of the EPA, should be instituted to insure that STARS treated tailings do not become a problem for the next generation. /// Treating streamside tailings will, in itself, not make 'a self-reproducing fishery for trout species' out of Silver Bow Creek. Implementation of the streamside tailings plan must go hand-in-hand with stopping metals pollution from Butte's storm sewer system and nutrient pollution from Butte Metro Sewage. Creating an artificial wetlands might benefit both ARCO and Butte. An ideal wetlands site might be the Ramsay Flats/Silver Bow area, which was historically a marsh. /// As Silver Bow Creek is restored, some attention must be paid to constructing a meandering channel, planting bank cover such as willows, fencing cattle from the riparian zone, and introducing beneficial species such as beaver. Trout do not live in drainage ditches. /// The bottom line here is that Silver Bow Creek is not a broken machine that can be fixed by inserting a single new component. Silver Bow Creek is a complex and unpredictable living ecosystem. A flexible and biological solution is preferable to a rigid and linear one."
I	2	Scown	Pat	"1. Ok, if not harmful to humans & animals or water. /// 2. Can't it be treated on the spot? If not - 2. /// 3. I hate to see more land become bad. /// 4. No ideas. /// 5. No! We just cleaned up Opportunity Ponds & Brown's Gulch is a beautiful area! /// 6. Best of the 3, but still not unless needed. /// 7. Be careful! /// 8. Truck /// 9. No ideas. /// 10. I agree. I also liked the Greenway project!"
I	3	Van Sice	R.B.	"I, as an uninvolved "observer", or reader/listener, would like to ask a few questions regarding your proposed "cleanup" of the Silver Bow Creek/surroundings.///(1) Can you clarify for me what the hazards are, from the creek. I understand, we have heavy metals, etc..in the creek itself, and in the soil through which the creek runs. I would assume they have been there for many, many, years??///What impacts have occurred downstream to date? Have humans become ill? When? Where? How many??///Have farm animals been affected? Again, where? When? How many?///(2) You propose removing + 2 Million

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	3	Van Sice	R.B.	yards of tailings from the flood plain (at Ramsey?) and dumping it in Browns Gulch or at Opportunity.///What can be done in Browns Gulch, or at Opportunity, that can't be done (as ARCO suggests), essentially on site" Doesn't cost influence your decisions at all?///Who will determine whether 2 Million yards is enough? Or will it become 4 Million or 6 Million?? - as I suspect!///(3) Remove all fine grain sediment in the stream. How do you propose to do this without just spreading the contaminants down stream? I think this particular idea is not too bad- if it can be done! Maybe a new creek bed would be a reasonable idea!///Again, I presume this stuff gets dumped someplace, and treated somehow? Again, I would ask, who will decide when enough is enough?? The treatment, etc.?///(4) Remove, cover, or treat railroad bed materials that affect human health or the environment.///What affect does this material have on humans, the environment? What has happened to affect human health/environment to date? Do you have records regarding these happenings?? What are they?///Frankly, Mr. Ford, I have little faith in the "Environmental" establishment, or whether their decisions are realistic or whether they are necessary or if they are based on scientific data, or are on speculation and assumptions.///Such things as this clean up should be based on reasonable thinking - and should not merely punish and bleed existing present owners out of business.///It's an unfortunate fact Mr. Ford, that people still have to make a living, and usually that requires some kind of industry, and that usually means some kind of "impact" on the environment.///I guess we in Montana can call "cleanup" of past practice - to pre-Indian days standards - our industry? That's about all we'll have left to do -- "
I	4	Colaiuta	Ms. Vickie	"I do think that the area involved should be cleaned up first- /// Putting greenery or {?} on top of that mess is like a woman putting powder on a dirty neck because she hates to wash it. Eventually the filth will work its way up and no powder will be able to conceal what's underneath. So. Clean up first -Greenery after."
I	5	Baker	Forrest	"Why should ARCO get stuck with the expense of cleaning up a mess they did not make? Mining and smelting and the residents of Butte for over 100 years have made this mess and though a lot of them are gone those left are just as responsible and more so than ARCO. /// Why stir up old polutants that nature is taking care of much better than man and shifting it to some other location where it will no doubt be a problem at some future date. Nature is far better able to take care of this and it doesnt cost the taxpayers or ARCO's stockholders a dime. /// The big thing for Butte, Anaconda and all their wonderfull people is they think they will be getting a wonderfull play ground for nothing. /// MERDI Greenway is somebodys pipe dream to make a job for themselves and friends at someone elses expense. /// P.S. Your

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	5	Baker	Forrest	superfund pays more money to lawyers and does less to clean up the environment because it is a political boondogle and another way to create jobs for political friends at taxpayers expense."
I	6	Helding	Linda	"Thank you for the opportunity to comment on the proposed plan: streamside tailings operable unit. I would also like to comment on the good pamphlet presentation I received in the mail which prompted me to comment. I was one of the members of the Milltown Citizens Committee with Phil Tourangeau for several years and think that your pamphlet is excellent.///I will respond to Page 21 and the 10 points.///I don't think a floodplain is a good repository, just as I don't think a floodplain is a good place for housing. Contaminants in a floodplain should be stabilized with STARS if removal is impossible or impracticable. The creation of sloughs and small ponds in floodplains aids in contaminant stabilization and creates habitat for plants and critters.///I don't think I'm qualified to comment on this. I would "imagine" that larger repositories would be easier to monitor and that many small repositories would have a tendency to pose more of a cleanup dilema 50 years from now or maybe people won't care if it's stabilized.///I always feel uncontaminated or undeveloped real estate in Montana could possibly be used in some way other than industrial use. I grew up in Missoula and have lived with air pollution and continued human development problems. I see that our future here in Missoula is going to include the battle to save islands of natural habitat with connecting corridors. To the east of us, outside of the Butte area, the critical stages of development have not hit as hard. I think it is forsightful to protect uncontaminated areas and to save or recreate wetlands wherever possible.///I don't think it's possible to keep Montanans out of the outdoors. We've all lived with pollution from the Clark Fork and there's no green ooze coming out of our ears yet. I think trying to keep people off sites is a waste of money. Witness the bruhaha over the upland disposal site at Milltown.///I think the Opportunity Ponds is a good repository site. I believe I've been told that the increase in pollution to that site would be an increase of less than 1%. Also, I always liked the idea of building another pond at Warm Springs.///Ramsay flats is next to a town and that is unfair to them.///I think drivers can haul carefully if they obey stop signs and don't drive drunk or stoned.///Only on Highway 93 is it critical to keep more trucks off the road.///There is a lot of pollution that is less than 1MM but the questions is: how do you clean it up? I suppose stabilization is critical at that size.///Fish are good."
I	7	Stokke	Melvin A.	"First, let me identify myself. I worked for the Anaconda Company and ARCO for a total of 34 years at the Anaconda Smelter; the last 8 years as General Manager.///I have to agree with ARCO which includes moving the waste to higher ground along the site, where it would be treated. I feel very strongly that

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I	7	Stokke	Melvin A.	the waste removed from Silver Bow Creek in Silver Bow County should be taken care of in Silver Bow County. That portion in Deer Lodge County would be handled by Deer Lodge County.///Why, you ask?///1. In the early days of mining, Butte allowed the tailings to be transported down the creek.///2. The first ores shipped to the Anaconda Smelter were from underground mines, and these ores were high in metal value and arsenic.///3. In 1955, the Berkeley Pit went into operation as an open pit venture. Some portions of the pit were high in arsenic and some fairly low.///4. In 1962, the Weed Concentration started operation in Butte, Montana. Instead of receiving 700 plus cars of ore per day, we received 15 to 20 cars of concentrates. These concentrates average 1 to 2% arsenic.///5. The officers of the Company Headquarters located in Butte all came up from the ranks of mining. The operation then included mining and finally concentrating in Butte. Smelting was done in Anaconda and the refining was accomplished in Great Falls. The cost of a pound of copper was inclusive of all 3 operations.///Each operation should have been a profit center, allowed to stand on its own. A commercial smelter charges a penalty for the arsenic in the material handled; zinc in the ore also was a waste product with no penalty. Also, silver and gold have a smelting charge and a deduction from the quantity of silver and gold assayed.///(a) This was not allowed by Headquarters in Butte, and the Smelter had to accept these materials.///(b) The silver and gold values were all credited back to the Mines to make their operation look better.///6. We received concentrations from British Columbia, Lornex in Canada, Anamax in Arizona, Yerington (concentrates and precipitates) from Nevada and other sources.///(a) These concentrates were low or had no arsenic, so we tried to blend them with the Butte concentrates in order to make an acceptable anode for Great Falls.///Enough is enough:///For over a center (100 years plus) Butte has sent us the material that was highly contaminated with arsenic. Do we in Deer Lodge County have to continue to accept these materials? I say "NO", let Butte and Silver Bow County take care of their portion of clean-up in their county.///Now let us look at another aspect of this situation.///1. The people of MDHES and EPA are supposed to be professional with Bachelor's, Master's and probably PHD degrees in various fields. Then you make an estimate of $39 million to $68 million.///2. Articles that I have read said that this has been studied for 10 years.///3. At the Smelter, we made a definitive estimtate for 2 stages of Smelter expansion and environmental control.///4. One was for $33 million and the other for $30 million, and each project was completed within 0.5% of the money allocated or approximately $150,000 out of a budget figure of $30 million.///5. I can't imagine going back to Corporate Headquarters in New York and saying I needed $33 million or possibly $58 million.///(a) I would be going down the road talking to myself!///6. Now the figure of 1.5 million cubix yards is the one the State has arrived at in this study.///(a) Contractors can supply the numbers for removal, loading, hauling and dumping at the disposal point. This figure would be in dollars per cubic yard.///(b) ARCO has acquired the numbers for depositing materials, covering with lime, and soil. Also,

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	7	Stokke	Melvin A.	the revegetation of the area.///(c) Then a percentage (approx. 10%) can be added for overhead and incidentals.//In conclusion, I feel the State has been way too lax in throwing around numbers in terms of dollars. You should go back and review all the studies and then say this is the one figure we can stand by. Nobody can build a budget on the basis you present. I think it is time to be realistic..I wouldn't want to be in Sandy Stash's position and present these numbers to ARCO corporate officers.
I	8	Richards	Paul	"Please remove the toxic wastes from the floodplain. Toxic wastes, water, and fish do not go very well together.///Thank you for your consideration."
I	9	O'Brien	Edna	"Keep up the good work!///I fully support your plan for cleanup of Silver Bow Creek. Your technical expertise and extensive research are apparent in your conclusions."
I	10	Beer	Mrs. Mary S.	"I am writing to commend you on your plan for restoring Silver Bow Creek. It is refreshing and encouraging to hear Montana State officials backing a plan which embodies the best possible cleanup methods for Montana's mining sites. Of course ARCO wants to do something cheaper and easier with Silver Bow Creek. But please stay with the plan to remove tailings and contaminated sediments from the creek and its banks. This will give the creek a change to once again become a clean, trout filled stream such as all Montana streams should be."
I	11	Everhart	Nancy M.	"I would like to state my view on the remedy you recently proposed for the Streamside Tailings Operable Unit.///What your agency is proposing is unrealistic, unnecessary and not in the best interest of those of us who live here in Butte/Silver Bow County. I believe the remedy you have recommended was biased and decided on without proper consideration of:///- The disruption and risk involved to our community./// - The use we could get from the land without the removal./// -The facts in feasibility studies showing removal is not environmentally any better than STARS-type treatment.///I support the ARCO-proposed remedy, or something close to it, which is much more reasonable. Their methods of treating the material in-place or near-place:///-Are totally adequate to meet criteria for protecting human health.///-Considers use of the land for the long term benefit of the community, such as a Greenway, a concept similar to their Golf Course in Anaconda.///-Is less dangerous and disruptive to our community.///My husband and I have four children (ages 9 through 15) and firmly believe that their futures here are much

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	11	Everhart	Nancy M.	better served by the proposals put forth by ARCO and local community groups. You need to seriously modify your cleanup plan."
I	12	Heaphy	Larry and Shirley	"We are writing to express our view concerning the State's proposed cleanup of the Streamside Tailing Superfund Site.///We believe everyone in the State wants a clean and livable environment. At the same time, we believe economic development and recreational land uses are also of great importance.///The State's proposed cleanup remedy is too costly, will take too long to achieve and is very disruptive to the communities involved.///ARCO's remedy to use the STARS treatment without moving the tailings long distances seems to be logical and more cost effective, while still protecting human health and environment and giving some hope to future recreational land use.///We feel the State of Montana needs to reconsider its remedy to meet the wishes of the communities involved.///Thank you for your time and consideration."
I	13	Waring	Thomas	"The following comments address the MDHES/EPA Preferred Alternatives for the cleanup of Silver Bow Creek tailing deposits. I first address some personal opinions and then specifically address the concerns listed for public input:///I feel that wetlands should be an integral part of the cleanup plan. Historic maps show areas of wetlands in the Butte area and downstream. As tailings are moved, low lying areas should be created that would be periodically or permanently flooded. Such wetlands would provide valuable wildlife food and cover. They would also provide a buffer against flooding by providing water storage capacity during periods of high runoff.///Since wetlands have also been shown to be effective for removing sediment, dissolved metals and nutrients from runoff and discharge streams, the strategic placement and use of engineered wetlands should be a part of the total drainage plan.///Areas where comments were solicited:///TAILINGS IN THE FLOODPLAIN AND STARS TECHNOLOGY: It seems financially prudent to use public and private resources to stabilize and revegetate tailings without moving them long distances. Certainly, the banks of the creek should be cleaned and then planted with trees and willows or other shrubby vegetation. That action should assure a stable channel. With a stable channel and vegetative cover the floodplain should not experience erosive velocities. Tailings could even be placed in the floodplain if protected by low levees and revegetated.///I think that if tailings were piled, contoured, protected by levees, and revegetated then they could be aesthetically pleasing and not pose an environmental hazard. I think that it makes sense to make many small repositories because the transportation risks are reduced as are the costs.///LOCAL OR REGIONAL REPOSITORIES:Local repositories make the most sense to me. If located in areas of local topographic relief, local repositories would

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	13	Waring	Thomas	likely be mostly unnoticed.///UNCONTAMINATED AREAS FOR REPOSITORIES: Small controlled areas not now used would be fine. However, creating larger (10+ acre) repositories would make existing areas less productive which should not happen unless the new area is already disturbed.///LAND RESTRICTIONS: Restrictions which prevent future digging or exposure of tailings would be fine. There should be only limited restrictions on unobtrusive recreation activities such as hiking, bicycling, fishing, etc. Fencing should be only temporary or as a last resort. Agricultural or commercial uses of the reclaimed areas and repositories should be encouraged.///OPPORTUNITY PONDS/BROWNS GULCH: Tailings should not be moved into a branch watershed such as Browns Gulch or to take productive land out of use. I've not seen the proposed remedy for the Opportunity Ponds so I find this questions impossible to answer. Certainly it would make no sense to move the tailings twice - ie to the Opportunity Ponds and then to somewhere else in a future remedy for that area. In this regard, I feel that the streamside tailings remedy is incomplete because it addresses only one issue for the entire Silver Bow Creek ecosystem. There needs to be a master plan and not isolated and non-interactive clean-up components.///RAMSAY FLATS: Ramsay Flats could become either a local or regional repository. As stated above, I prefer the local option because it creates more diversity and may even require less land area. Environmental control of runoff and airborne dusts would also be less obtrusive and probably more effective with local repositories. Small wetlands could be created to accept the runoff from local repositories.///EXCAVATING AND HAULING RISK VS CREEK CONTAMINATION RISK?: Excavating and hauling to local repositories clearly has less risk than hauling to regional repositories simply due to less miles traveled, less crossings, etc. The significance of comparable risk seems to be unanswerable because you are asking to compare transportation and airborne dust risks to people to metal level risks to fish in the creek. How does one do that? Some common yardsticks needed. For example, what are the calculated risks - ie estimates of deaths per million people per year or decreased life expectancy if the tailings were moved or not moved? It is simply not possible to quantitatively compare environmental exposure risk to people against risk to fish.///SEDIMENT SIZE: To me this is an unnecessary criteria because a stream would always be expected to have a gradation of sediment from clay sizes upwards. The key it seems will be to prevent additional tailings from entering the stream or becoming acidic and thereby releasing metals. If there are areas with substantial "in-stream" tailings deposits then these should be removed.///I have heard that the Silver Bow Creek stream bed may be "cemented" thereby reducing habitat for aquatic insects. In that case some ripping or rerouting of the streambed may be in order.///TROUT FISHERY: If the tailings and tailings runoff are removed from the creek and creeksides and the banks are stabilized, a trout fishery will develop without further effort.///In summary, I support local repositories, short haul distances, maximum use of wetlands, and final productive land and stream usage all done at the lowest possible cost. In regard to the cost, it seems that ARCO should have the most say in type of

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I	13	Waring	Thomas	transportation because they are paying. Other than risk analysis, why should I or the State of Montana care about how ARCO does this cleanup? They will always be responsible. It clearly is in their best interests to do it right.///Thanks for the opportunity to comment."
I	14	Kraus	Susan L.	"As a 12-year resident of Deer Lodge and a 33-year resident of the Clark Fork valley, I read with interest the "Proposed Plan: Streamside Tailings Operable Unit." I strongly support Alternative 6, the Preferred Alternative, presented in this information. Removal of contaminants, rather than in-situ treatment or utilizing STARS for the majority of these sites, is the most logical plan to permanently address the problem. Alternatives 1 through 5 seem to prolong the inevitable decision to remove much of the containated material which is needed in a permanent solution. Covering up a problem doesn't make it disappear. Allowing most contaminants to remain within the floodplain or creek is an irresponsible long-term alternative that does not fully address human health and the environment.///Leaving tailings treated with the STARS technology in the floodplain or in railroad impacted soils is not something I generally prefer to see used. It should be used minimally. STARS would be acceptable to me only in areas where it can be used effectively and protected from erosion.///One or two regional repositories are preferable to many near-stream relocation repositories. There would be many fewer places to monitor and into which access must be restricted. Also, if there comes a time in the future when these contaminants can be further treated, it will be easier to do this in only one or two locations.///Land restrictions on relocation repositories are a critical part of protecting the health of the public and wildlife. Access to these areas should be restricted to persons who may be monitoring or working briefly in such areas. This is another reason I favor one or two regional repositories which would also allow more public access to the creek's floodplain. Although Browns Gulch is presently uncontaminated, I do favor its use as a regional repository if the Opportunity Ponds location, my first choice is unable to be utilized for the entire amount of contaminants removed.///The short-term risk of excavating and transporting the contaminated materials to regional repositories is extremely preferable to the long-term risks of creek contamination. The long-term risks put all of us and our environment in danger for many, many years to come. The short-term risks can be managed and will end realtively soon. Transportation by rail, if possible, is preferable to the use of trucks. The potential for accidents is less, and rail transport may be more efficient.///After reading the information, I feel comfortable with the use of less than 1mm as the remedial criteria for in-stream sediment as that is the size of most contaminants in the stream. The objective of improving Silver Bow Creek to support a self-reproducing trout fishery is a very worthy one which I fully support. Such a stream would truly be a healthy base for all of the organisms, including people, in the area.///In conclusion, I support Alternative 6 and

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	14	Kraus	Susan L.	urge you to maintain it as the Preferred Alternative as the most responsible alternative that provides an acceptable permanent solution to the contaminated tailings/impacted soils of the SST OU Silver Bow Creek/Butte Area Superfund site. Through the Montana media I have learned of ARCO's opposition to this plan. I believe that this state supported remedy, Alternative 6, is far superior to anything proposed by ARCO. You and your department have my full support in your efforts to continue to maintain Alternative 6 as the Preferred Alternative. Thank you for being so responsible in your efforts to provide Montanans a healthy place in which to live."
I	15	Smith	Larry N.	"I fully support the plan the state presented to remediate the streamside tailings unit of the Butte Superfund Site. I think that relying on the STARS technology for the majority of the site is ill-conceived for a number of reasons, including the Liklihood of cut bank erosion.///Specifically, I have questions about (1) the mass-balance of carbonate species and acid-producing species over the long term (2) the possiblity of increasing the water-table elevation in areas, through sedimentation events or artifically filling an area, and/or irrigation, which may lead to acid production (3) the long-term viability of using soluable buffering material above the depth of leaching or carbonates in soils, and (4) the adequacy of monitoring in the test plots...The spatial distribution and depth of observation wells are extremely limited.///I conclude that STARS is in no way a "Proven" Technology as promotors have said, although it does have a use in SST.///Please note that anyone that uses the terms PROVEN or DISPROVEN in field-based sciences lacks critical understanding of the scientific method and inherent limitations in observations."
I	16	Berube	Daniel T.	"On behalf of the Montana Power Company, I want you to know of our support for (1) safe, long-term remediation of Butte's Silver Bow Creek, (2) in an economically beneficial way other than the maximum possible expenditure of dollars, (3) minimizing the distance mine-waste tailings must be moved, and (4) providing the opportunity for a greenway such as Project Green, which has been submitted to your agency.///Butte residents have a strong desire to see Silver Bow Creek revitalized and used as both an economic and recreational resource for our community.///Many of us strongly believe this can be accomplished without resorting to the massive, most costly, time-consuming multi-year removal of tailings as far away as is proposed -- which will require further treatment at receiving locations, as well as provision of topsoil where wastes were removed.///In considering a course of action for Silver Bow Creek, you are supposed to consider the acceptability of the actions to our community as well as reasonably anticipated future uses.///Some would argue that there is a need for the widest possible

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	16	Berube	Daniel T.	number of uses. Given the fact of a flood plain, which limits possibilities, it seems prudent to invoke cost considerations for what obviously is less than a full spectrum of possible uses.///The city of Spokane, Washington provides one example of riverfront revitalization from heavy industrialization to a highly useful, aesthetically pleasing, citizen-accessible greenway. That type of reclamation, which is more in the nature of stabilization rather than removal, would serve well the interest of the Butte community.///I do believe it is important to consider economic aspects and the logistics of a massive removal to great distances, as well as the aesthetic possibilities related to a greenway."
I	17	Ray	John W.	"Enclosed are my written comments on the Proposed Plan: Streamside Tailings Operable Unit.///The purpose of Superfund is to clean up hazardous waste sites which are a threat to human health and the environment. Remedies under Superfund should provide a permanent cleanup remedy not temporary containment or simply removal to another untreated site. Cleanup is the "act of cleaning up" and the term clean means "pure, free from dirt, contamination, impurities." According to the EPA publication entitled Superfund: Enviromental Progress, the purpose of Superfund is to achieve "long term cleanup goals for sites: and to remove "contamination from the environment." (p.1) The document further states that "the law directs EPA to protect public health by meeting strict cleanup standards at each site. and "Reduced to its environmental essence, the New Superfund mission is make sites safe, make sites clean, and bring new technology to bear on the problem." (p. 3) According to the Superfund law, any remedy for Streamside Tailings should be real cleanup remedy.///If one examines the major Superfund laws and regulations, CERCLA, SARA, and the NCP, one finds that they ALL emphasize: ...1. CLEANUP to protect human health and the environment.///2. The REDUCTION of TOXICITY, VOLUME, AND MOBILITY of hazardous substances, pollutants, and contaminants at a site.///3. PERMANENT cleanup remedies. Former U.S. Senator George Mitchell (D-Maine) argued that permanent treatment means that Superfund cleanup plans must result in a permanent and major reduction in the toxicity, volume, and mobility of hazardous substances, pollutants, and contaminants at a site and that this reduction must be to the "lowest levels achieveable." He stated: "In addition to the quantitative reduction implied, significant reduction in this context means the minimization of volume, toxicity and mobility of such substances to the lowest levels achievable with available technologies." 132 Cong. Rec. S. 14914 (daily ed. Oct. 3, 1986)///4. COST is NOT the MAJOR FACTOR. Cost is secondary to protecting human health and the environment. Under Superfund, human health must be protected from potential threats regardless of cost.///ANY SOLUTION TO THE PROBLEM OF STREAMSIDE TAILINGS MUST EMPHASIZE THE ABOVE CRITERIA. IT IS IN LIGHT OF THE ABOVE CRITERIA THAT THE SOLUTION TO THE PROBLEM OF THE STREAMSIDE TAILINGS MUST BE JUDGED.///Unfortunately, past Superfund efforts have not met these goals of permanent cleanup. The Office of Technology

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	17	Ray	John W.	Assessment (OTA) has concluded that Superfund "Remains largely ineffective and inefficient: and "is not working environmentally." OTA has concluded that the Superfund program has too often settled for remedy technologies which would not reduce the "toxicity, mobility, or volume" of the the hazardous waste. All too often Superfund has settled for remedies short of cleanup. Given the serious nature of the contaminants in the Streamside Tailings Operable Unit we cannot allow any remedy short of real cleanup. We must clean up the problem so that future generations don't have to deal with it.///ADVANTAGES OF PREFERRED ALTERNATIVE (ALTERNATIVE 6)///1. Provides more protection of human health and the environment than Alternatives 1-5 because Alternative 6 calls for the removal of tailings which pose a serious threat to human health and the environment from the flood plane. Therefore, Alternative 6 provides a more permanent and a more effective long term solution to the Streamside Tailings contamination problem than do alternatives 1-5 or the ARCO hybrid plan.///2. The preferred alterantive does not mandate the creation of numerous mini-waste dumps along the stream which dumps would threaten the stream in perpetuity and lessen productive land use along the stream.///3. The preferred alternative provides the greatest possibility for the development of a self-sustaining greenway or other types of productive land uses.///4. Because the preferred alternative removes dangerous tailings from the flood plane, the preferred alternative provides the greatest possibility for multiple land uses such as agricultural or recreational uses along the site. By making the site significantly cleaner, there would have to be less reliance on institutional controls which would greatly limit land uses.///5. Because the preferred alternative is a real cleanup alternative which would remove a substantial amount of contamination from the Streamside Operable Unit, it would be more protective of property rights. Property owners would be freer to use their property as they determine.///6. The preferred plan is cost effective given the parameters of Superfund law. (See section of my comments entitled Cost in Superfund Decision Making).///7. The preferred alternative correctly relies on STARS technology only where STARS technology is appropriate, i.e. areas where tailings are not saturated and where erosion back into the creek is not possible.///8. The preferred alternative clearly meets the cleanup objectives on page seven of the proposed plan.///DISADVANTAGES OF ALTERANTIVES 1-5 AND ARCO PLAN///1. Because of an inappropriate reliance on STARS technology these approaches would be significantly less protective of human health and the environment and would not offer a long term effective nor permanent remedy for the problem of Streamside Tailings.///PROBLEMS WITH STARS TECHNOLOGY.///A. The STARS approach does nothing to reduce the toxicity or volume of contaminants at a site.///B. Because of erosion problems and problems of stream meandering, STARS does not permanently reduce the mobility of contaminants.///C. In many areas along the stream, the depth of tailings is too great to allow STARS to be effective.///D. STARS technology would not adequately deal with the specific contamination problems caused by the presence of mercury and cadmium.///E. STARS technology would mandate the extensive use of institutional controls for

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	17	Ray	John W.	protective purposes. Such institutional controls would seriously limit productive land uses and the property rights of owners to use their lands as they determine.///F. There is a disparity in STARS technology between the pH level necessary to prevent the leaching of heavy metals and the pH level necessary for native vegetation to flourish.///The STARS technology is a relatively new approach which has not been adequately tested. We must not mortage the protection of human health and the environment to an untried and untested technology.///H. Far too much of the support for STARS is provided only by computer modeling without real world evaluations. Computer models have often been inadequate when applied in the real world.///I. It makes no environmental or public policy sense to spend millions of dollars to clean up the areas above and below the Streamside Tailings site and leave a contaminated mess in the middle.///2. Because the Alterantives 1-5 and ARCO's hybrid plan leave so much contamination near the stream and would rely so heavily on institutional controls, there would be severe restrictions on future productive land uses of the site.///COST AND SUPERFUND DECISION MAKING///Cost is not the major determining factor in Superfund decision making. Cost is secondary to protecting human health and the environment. Under superfund, human health and the environment must be protected from potential threats regardless of cost. The cost factor needs careful consideration. There are two ways of calculating cost: (1) What is the cheapest plan of action or (2) What are the goals we are trying to achieve and, after the goals have been established, what is the most cost effective way of achieving those goals.///According to Superfund, we are not looking for the cheapest remedy but, once we have decided on the plan we want to implement to protect human health and the environment in a permanent way by reducing the toxicity, mobility, and volume of hazardous contamination, WHAT IS THE MOST COST EFFECTIVE WAY TO ACCOMPLISH THAT PLAN. Under Superfund, cost does not determine which plan is accepted or the end result desired of a cleanup plan, the cleanup plan and its end result, which should be protecting health, determines cost. Senator John Chafee (R-RI) has commented on Superfund's consideration of cost: "The extent to which a particular technology or solution is feasible or practicable is not a function of cost. A determination that a particular solution is not practicable because it is too expensive would be unlawful." 132 Cong. Rec. S. 14925 (daily ed. Oct. 3, 1986) In devising a remedy for Streamside Tailings, we must not select the cheapest solution but the solution which will maximize the protection of human health and the environment. We must select a cleanup solution.///CONCERNS ABOUT THE GREENWAY PROPOSAL AND CLEANUP OF STREAMSIDE TAILINGS.///1. The Greenway proposal cannot be a substitute for a real cleanup effort in the sense of cleanup defined as making the Streamside Tailings site as free of contamination as possible in order to protect human health and the environment.///2. The Greenway proposal must be given serious consideration as a potential land use plan only after cleanup has been completed. The Greenway proposal must not be considered as a substitute for cleanup. In and of itself the Greenway proposal is not a cleanup remedy as mandated by Superfund law.///3. Proposed land use under

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	17	Ray	John W.	the Greenway proposal must be compatible with the cleanup remedy, i.e. it must be made clear that the Greenway program must not interfere with, diminish, or subvert the cleanup remedy. Land use does not drive Superfund cleanup activities, protection of human health and the environment drives Superfund activities.///Submitted by: John W. Ray///PLEASE REFER THESE COMMENTS TO THE DISCUSSION OF THE MERDI GREENWAY PROPOSAL" ON PAGE 22 OF "PROPOSED PLAN: STREAMSIDE TAILINGS OPERABLE UNIT.""
I	18	Fischer	Susan	"Please consider these statistics in your evaluation of this meeting:///The comments favoring Project Green out numbered the Gato plan by over two to one of those persons supporting the state plan, a majority of them are state employees (i.e. agencies or departments headquarters in Helena, professionals at state schools, and graduate students working on projects at state schools).///Please consider the demographic makeup of the persons making comments here tonight. It is ??? to others!"
I	19	Smith	Geoff	"Thank you. For the record, my name is Geoff Smith and I'm here to testify tonight on behalf of the Clark Fork-Pend Oreille Coalition. /// We're a membership organization working to protect and restore water quality throughout the Clark Fork River Basin. For the last several years we've advocated permanent and effective cleanups of the Superfund sites in the Upper Clark Fork River and we will continue to do that today. /// I want to begin by saying that we applaud the State's commitment to cleaning up Silver Bow Creek. I think that's what everybody here in the room wants is to have a clean creek. We support the State's selection of Alternative 6 as a preferred cleanup alternative with one exception; that is, we believe that the State should remove all the contaminated mine wastes in the 100-year flood plain as outlined in Alternative 7. /// I think it's important for all of us to take a second and think about Silver Bow Creek. Silver Bow Creek is essentially a dead stream. It's so contaminated with arsenic and toxic metals that its waters do not support fish and its flood plain is nearly devoid of vegetation. Removing these wastes will eliminate the major sources of contamination to the creek. Removal will prevent further erosion of contaminants into the creek and will drastically reduce the threats to aquatic life in the creek. It will eliminate the leaching of metals and arsenic to groundwater, and it will end the need to perpetually treat the Silver Bow Creek stream water in the Warm Springs Ponds. /// In short, we believe that removing the majority of wastes from the flood plain will allow Silver Bow Creek to heal once for all and to open it for future land uses. /// Now, in addition to restoring the biological health of the stream, removing the wastes is the only way to ensure that fish will one day live in that stream again, one of the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	19	Smith	Geoff	initial goals of this Superfund cleanup. It's also the only way to guaranty that the Silver Bow Creek corridor will be open to all future land uses, including residential, agricultural, and recreational, including the greenway proposal. /// Now, as you've all heard tonight an issue related to the removal of the contaminated waste is where we're going to put them. For the record, the coalition supports the use of the Opportunity Ponds for the repository for these materials. These ponds already contain between 300 and 400 million cubic yards of contaminated wastes. That means that the amount that would actually be put in there so that we can clean up 25 miles of Silver Bow Creek would be about one-half of one percent. /// Now, it's obvious that some aren't too happy about the idea of putting these wastes in the Opportunity Ponds and that's understandable. However, if the State and those communities should decide that Opportunity Ponds or Brown's Gulch is not an appropriate place for the repository of these wastes, we suggest the State go back to the repository siting and find another site that is appropriate. Under no circumstances should the failure to reach agreement on the repository site lead to a lesser cleanup of the Silver Bow Creek system. /// Another important issue that's come up is the issue of the STARS treatment. As I've said, we believe that removal of the wastes is the most permanent and effective way to treat these wastes. ARCO continues to promote the use of STARS as the cleanup alternative for the site. /// Now, we don't believe that STARS is an appropriate use or an appropriate cleanup alternative for the site because of the many limitations it has. We certainly agree that it has shown some short-term success in reducing overland flow and the washing of metal salts into the creek. But at the same time, it has numerous limitations. The biggest one is it does nothing to reduce the volume or concentration of wastes in the creek. In addition, it does nothing to immobilize metals where groundwater is in contact with the stream. It's unable to withstand the erosive flows that occur routinely on Silver Bow Creek like the ones we've seen this Spring. And finally, it actually increases the mobility of arsenic, one of the biggest human health concerns on the site. /// In addition to these technical shortcomings, STARS also requires long-term maintenance, which with it carries costs and also limits the development and future use of the Silver Bow Creek corridor. Finally, STARS does not take into account the simple fact that stream systems are dynamic and streams will meander. Just because a stream is one place today doesn't mean it will be there in 10 years or in 15 years. That's why we think it's critical to get these wastes out of the flood plain and into a dryer location where they may be treated or capped in a repository. /// In short, we believe that removing the wastes is the only way to clean up Silver Bow Creek, to ensure that groundwater will be restored to drinking water standards, and to assure the land will support any future land use that anybody wants, including the greenway proposal. I thank you for the opportunity to speak tonight."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	19	Smith	Geoff	
I	20	Haeffner, R.PH	Charles	"Our organization and the people that we have talked to in Anaconda Deer Lodge have come to a conclusion that your method of clean-up in our county is very much of a over kill. We are interested in some other means of remediation along the Silver Bow Creek. Your Dept. ideas are only as scientific that someone has placed them on paper. None of these ideas have been tested for 20-30 years or longer. With that in mind all of the proposals are only estimates on the cure. We don't want any more studies and waiting.///We would like to see some what of a lesser removal and more money spent after the clean-up has taken place. This would give us a much better area when finished. Such as the Golf Course that is being built in Anaconda. It will bring money into our community instead of having a sterile area that has little or no value. By capping more of the product closer to the area and not spending extra money hauling it around the country in trucks or trains, which is not very safe for the people moving it or the people that live in the area where it is moving to. We should be able to push for more money spent on making the area more usable. Time is a very big factor that is a concern of ours also. We don't want a unhealthy area, but we do want something done in a workable time frame.///If you put too much of a strain on ARCO they might push back and the time will get stretched out even more. Most Corporations would not have gone as far as ARCO has now. They have shown us very good faith in Anaconda and I don't think they will let us down now. This is a very visible task that ARCO has taken on as the whole country is watching on how they handle the situation. I am sure they are always going to explore land else where in the country and people are looking on them as how they handle us and the remedial area."
I	21	Fladagen	Brian	"My name is Brian Fladagen - landowner on Silver Bow Creek. I support the Project Green Program and the use of the Opportunity Ponds as needed to remove tailings. I don't support the deposit of tailings in Browns Gulch. I further believe STARS will work in various portions of tailings to revegetate areas along the creek.///Whatever your decision please do NOT go the law suit route if it can at all be avoided. We need to do something "NOW" - Let's find a workable solution in 1995 to start a cleanup work program before the year 2,000. Make the Silver Bow Creek a reusable creek in a timely fashion."
I	22	Mullen	Gregory	"My name is Gregory Mullen. I'm a staff scientist with the State's Natural Resource Damage Litigation Program. The state of Montana filed suit against the Atlantic Richfield Company for damages to natural resources pursuant to the Superfund law. The lawsuit was filed to protect the interests of the public by recoverying monetary damages for the economic losses associated with the natural resource injuries and

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	22	Mullen	Gregory	for the costs necessary to restore the injured resources to the condition of a healthy functioning ecosystem.///The Proposed Plan for the Silver Bow Creek Operable Unit is an excellent proposal for remediation and addressing public health and the environment. The Proposed Plan (on page 22) explains the differences between this plan and the State's restoration plan for Silver Bow Creek. Restoration strives to return the injured resources to baseline conditions, which are the conditions that would exist absent the release of hazardous substances, in this case metals. Remediation does not attempt to restore the area to its baseline condition but strives to protect human health and the environment by complying with standards set in federal and state environmental laws.///Presently surface water and stream bed and bank sediments are contaminated with hazardous substances (primarily copper and zinc) throughout the length of Silver Bow Creek. The contaminated sediments act as a critical exposure pathway to injured surface water and aquatic insects which in turn injure fish. Due to the extremely elevated concentrations of hazardous substances in Silver Bow Creek, trout populations have been eliminated entirely. Restoration of fish populations to baseline conditions requires restoration of surface water, sedimients, and aquatic insects; all of which servce as exposure pathways to fish. Also, riparian wildlife habitat has been injured throughout the length of Silver Bow Creek. These injured areas no longer provide sufficient habitat to support viable populations of wildlife species typical of riparian habitat in Western Montana.///Due to these injuries to the State's natural resources the citizens of Montana have lost opportunities for fishing, hunting, and other recreational activities along this important corridor. We are seeking compensable damages for these lost opportunities which can be used for exhancing recreational activities along SBC. Such damages could even be used for components of "Project Green."///A major common goal of most of us here is to improve surface water quality to support fish and wildlife. This common goal will take significant efforts and notable source removal to achieve. While the DEQ/EPA Proposed Plan may not restore the injured area to baseline conditions, it is a step in the right direction by removing a substantial volume of floodplain tailings and a portion of the contaminated bed sediments. Additional efforts to restore the fishery and to repair the lost wildlife habitat are necessary to fully restore the creek. The funds obtaned in the lawsuit against ARCO will be used for these efforts. The State's restoration plan goes beyond remediation by:///1) Removing all tailings in natural 100 year flood plain;///2) Removing all toxic sediments in SBC channel;///3) Additng substantially more top soil and or soil amendments to support revegetaion efforts;///4) Revegetating riparian zone with diversity of species, including trees;///5) Reconstructing stream banks and bed.///Finally, implementing a lesser remedy, i.e., one that is largely reliant on STARS as advocated by ARCO, and which our experts have grave concerns about, would result in waiting many centuries for recovery of resources due to the toxic nature of these contaminants. If considerable amounts of contaminants are allowed to remain in the floodplain the ability of the area to remain green and for

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	22	Mullen	Gregory	trees to grow for any length of time is very doubtful. In addition, unreasonable long-term maintenance would be required. The natural Resource Damage Litigation Program supports implementation of the State's Proposed Plan which in conjunction with its Restoration Plan for Silver Bow Creek, would ensure a healthy ecosystem in a short period of time. Thank you."
I	23	Haffey	J. Ray	"My name is Ray Haffey, and I wish to testify in support of a compromise plan for reclamation of the Silver Bow Creek drainage. If a compromise effort is not promoted, this important project may be lost in further expensive studies, delayed by court litigation, or affected by future changes in legislation. It is time to start the job that needs to be done.///There have been many excellent suggestions over the past year that could be considered. The Project Green concept plan has gathered community input aimed at promoting both short and long-term solutions. Safe, long-term protection of human health and environment have been suggested rather than a "fenced off" unusable resource. Historic preservation and economic development have also been reviewed and promoted in the Greenway Concept Plan.///Other interesting concepts have been suggested such as a wetland area west of Butte. Such a proposal would provide a multiple use situation as well as a holding/monitoring station. Both the proposed wetland and the Warm Springs Pond could be valuable checkpoints for waterway drainage.///It is time for compromise and implementation. ARCO's proposal to utilize the STARS technology appears to be a workable solution for much of the corridor. In identified "hot spot" areas such as the Colorado Tailings, removal of contaminants to drier, safer areas would be necessary. Other pockets of high contaminants could be carefully removed away from the flood plain. Less contaminated areas could be treated using STARS technology. Massive large-scale hauling by trucks may increase health risks and or death. Therefore, careful removal using limited trucks and rail hauling wherever possible may be a more reasonable option.///A blended compromise of the Montana State recommendation and ARCO's proposal utlizing STARS technology appear to be a workable solution. Other proposals complement the clean-up concept. It is important to do the job and not let it be lost or diverted in legislation, litigation, or extended studies."
I	24	Ginn, Ph.D	Thomas C.	"Good evening. My name's Thomas Ginn and I'm a principal with the firm of PTI Environmental Services. I'm speaking this evening as a toxicologist and an ecologist who's been studying the situation in Silver Bow Creek for the last four years. I'm a sediment scientist and my specialty is evaluation of the ecological risks of metals and organic chemicals in sediments and soils. In addition to my work in Silver Bow Creek, I have been doing studies of this kind since 1983 at Superfund sites throughout the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	24	Ginn, Ph.D	Thomas C.	country. /// My comments tonight, I'd like to discuss some very important technical problems associated with the proposed plan. First I'm going to comment on the ecological risk assessment itself that would presumably form the basis for the decisions made in the proposed plan; and second, I'm going to comment on the appropriate remedial actions that should be undertaken for Silver Bow Creek. /// Now, from a risk assessment standpoint, there are two distinct environments that should be addressed for Silver Bow Creek. The first is bed sediments in the creek itself, and the next is the historically deposited tailings on the flood plain. First I'd like to start with a positive comment. With regard to the historically deposited flood plain tailings, I fully agree with the State's position that the risks are minimal to terrestrial animals. I've conducted extensive studies in Silver Bow Creek on plant and animal communities and I have found insignificant risks to deer, birds or small mammals that use those habitats. /// With regard to the stream bed sediments themselves, the sediments in the stream, I have significant disagreement with the State's proposed plan, however. The State has conducted a simplistic and overly conservative risk assessment that is based on theoretical numbers supposedly relating concentrations of metals to adverse effects. These values are derived from the general literature and are not valid from a scientific standpoint for estimating risks in Silver Bow Creek. /// Why is this important? It's important because the use of these numbers by the State has resulted in a gross over-estimate of the risks of sediment metals to aquatic biota and results in a biased perspective concerning the need for any remedial action in the creek. /// In the proposed plan, the State has suggested that all sediments less than one millimeter in size, and that's up to sand grain size particles, be removed from the creek. I strongly disagree with this position regarding the need for removal of these so-called fine grain sediments. Any removal, and I stress "any removal" of stream bed sediments in the near term is unwarranted, it cannot be substantiated by scientific information, and it's inconsistent with national EPA policy. /// First, as I stated before, the State has over-estimated this risk of sediments. The State has also ignored the recovery of some biotic communities, insects living in the bottom sediments in Silver Bow Creek. And second, laboratory experiments and field data have shown that these sediment-bound metals in Silver Bow Creek will not be a significant long-term source of metals to the creek, and that is dissolved metals. This concept of dissolved metals is important. It's supported by EPA. If there is a potential toxicity, it's dissolved metals; it is not the metals that are bound up in particles. Now, although isolated removal of truly fine sediments, and those are the silts and clay-size particles, from pool areas may have some beneficial and limited effects at some point after all other response actions are implemented, there will never be a need for large-scale removal of bed sediments that are in the one millimeter or smaller size range. /// The truly fine grain particles have the higher concentrations of metals and these are the particles that are very easily flushed from the system by natural processes. High flows like we had

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	24	Ginn, Ph.D	Thomas C.	this spring, flush them and we have an excellent system in Warm Springs ponds to trap those metals once they are flushed. /// So what should be done concerning sediments in Silver Bow Creek? The answer is: Right now, nothing. Any active removal of stream bed sediments should be deferred until the planned source control actions are completed. These actions near Butte will control the sources of metals to the creek and it would channel stabilization and implementation of STARS. The input of any new metals will cease and the sediments can clean themselves up naturally. The natural flushing action of the stream will remove these fine grain sediments, promoting the natural recovery process. /// Now, for an example of how this will work, we only have to look down to the Upper Clark Fork River. Once the sources of metals were controlled in the 1960s and '70s, there's been dramatic improvement in the water quality below Warm Springs Ponds. There is abundant fish, abundant fish food organisms that are healthy. This is in an area where the sediment metals are the highest in the Upper Clark Fork River, and yet we have the highest numbers of fish in that area. /// Now, there's several merits for deferring any of these sediment removal actions. The first is time is needed, at least five years for these upstream sources of metals to be controlled. Any sediment actions during this period would be unwarranted. /// Once again, the bottom line is defer these sediment actions until all other cleanup alternatives are implemented. Thank you very much."
I	25	Fitzpatrick	John S.	"As a person who was born and raised in Anaconda, I sincerely appreciate the opportunity to comment on the State's proposed remediation plan for the Streamside Tailings Operable Unit.///Overall, the State's proposed plan lacks two things: foresight and logic. The idea of moving such massive amounts of material by either truck or rail is not a reasonable one. Also, while the plan does not seem to rule out future, productive land uses like those put forth in MERDI's Project Green, it does little to cultivate such uses. Further, I question the State's weighing of long-term risks versus short-term risk. Regardless of whether the material were transported by truck or rail, the state would be sanctioning substantial risks to area residents and visitors. The plan's risk and cost assumptions regarding rail transport seem particularly under estimated.///Another point which quickly arises is the adage of, How Clean Is Clean? The science-based approach ARCO has taken with STARS and the other aspects of its plan takes a more reasonable approach, and one which effectively and substantially reduces realistic risks from metals which would remain.///I will briefly address some of the questions attached to the state plan.///*WHAT ARE YOUR VIEWS ON LEAVING TAILINGS IN THE FLOODPLAIN IF SUCH TAILINGS ARE TREATED WITH THE STARS TECHNOLOGY?///Over the vast majority of the area, with perhaps a few select places, STARS is an excellent, reasonable treatment and is substantially preferable to hauling the material

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	25	Fitzpatrick	John S.	elsewhere.///*WHICH IS PREFERABLE, MANY (15-30) LOCAL NEAR-STREAM RELOCATION REPOSITORIES OR ONE OR TWO REGIONAL REPOSITORIES?///Perhaps in other cleanup situations, one or two regional repositories would be preferable. In this case, every reasonable effort should be made to keep the material in place or as nearby as possible.///*HOW DO YOU FEEL ABOUT THE USE OF PRESENTLY UNCONTAMINATED AREAS FOR WASTE REPOSITORIES?///In terms of areas such as Brown's Gulch, the concept is a poor one.///*HOW IMPORTANT ARE LAND RESTRICTIONS ON RELOCATIONS REPOSITORIES?///Land use restrictions should enhance protection of human health and the environment, along with community preferences for productive uses. Those conceptually proposed by proponents of Project Green seem quite appropriate.///*HOW WOULD YOU FEEL ABOUT USING OPPORTUNITY PONDS AND/OR A LOCATION UP BROWN'S GULCH FOR REGIONAL REPOSITORIES?///Unequivocally opposed.///*WHAT ARE YOUR FEELINGS ON THE USE OF RAMSAY FLATS AS A RELOCATION OR REGIONAL REPOSITORY?///Ramsay Flats is an appropriate location for the materials which would be removed from a reasonable section of the operable unit. Again, however, the State's plan is unreasonable in its determination of how much of the material should be removed.///*HOW SIGNIFICANT IS THE SHORT-TERM RISK OF EXCAVATING AND HAULING WASTE MATERIALS TO DISPOSAL SITES IN COMPARISON WITH THE LONG-TERM RISKS OF CREEK CONTAMINATION?///Extremely significant, particularly in light of the fact the State's risk calculations seem to underestimate short-term risks and overestimate long-term risks.///*WHAT WOULD BE PREFERABLE, TRUCK OR RAIL HAUL TO REGIONAL REPOSITORIES?///Neither. As much material as possible should be left in place. The lengthy time tables and associated risks are unreasonable and unnecessary.///*HOW WOULD YOU FEEL ABOUT THE USE OF SIZE (LESS THAN 1MM) AS THE REMEDIAL CRITERIA FOR INSTREAM SEDIMENT?///This seems to be a rather arbitrary selection of sediment size. Further, the plan doesn't explain how this would be done. Also, it underestimates the harm which will be caused by excavating the instream sediments.///*WHAT ARE YOUR VIEWS OF THE REMEDIAL ACTION OBJECTIVE OF IMPROVING SILVER BOW CREEK TO SUPPORT A SELF-REPRODUCING FISHERY?///Certainly everyone wants as many good fisheries as possible. But again, the State's plan underestimates the ability of techniques such as STARS toward reaching the goal, and overestimates the effectiveness of such things as massive removal.///In addition, the State's plan fails to adequately recognize the downside of such things as removing massive amounts of topsoil from other locations to replace the material which the plan proposed to be moved. Has the State determined where this topsoil would be found.///Finally, I would like to remind the Department that the 1995 Montana Legislature passed Senate Bill 382. The plan does not properly consider the letter or the spirit of the CECRA law, particularly in the areas of anticipated future land uses, community acceptance and cost effectivness. I thank you for your time and consideration of my comments."
I	26	Fredrickson	Dorothy K.	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	26	Fredrickson	Dorothy K.	"I have been a resident and taxpayer in Butte Silver Bow County for the past 35 years.///I am in FAVOR of the removal of 15% to 20% of the contaminated soil along Silver Bow Creek and the treatment of the remainder in place with lime."
I	29	McCarthy	Bea	"The PROPOSED PLAN: STREAMSIDE TAILINGS OPERABLE UNIT is a thorough well thought out academic review of the Silver Bow Creek Superfund site.///Throughout the paper, with all of the alternatives, it abounds in facts and figures regarding the possible remedies and the justification for these proposals. None of us dispute any of the scientific facts or information that is given, we all have the right to disagree, either totally or partially, with the conclusions that have been drawn.///To many of us living in the area it is sadly lacking in a timely solution. It is understood that the clean-up of over 100 years of mining activity is not going to occur in a day, but it would be nice to see an end to the tunnel at least within a reasonable time-frame or a lifetime.///Alternative 6, which is the preferred choice, calls for removal of almost all of the streamside tailings. This is estimated to be about 2.3 million cy. During the 93 and 94 hauling season, ARCO hauled approximately 208,000 cy of tailings from the Colorado Mine site to the Opportunity Ponds. Projecting that figure into the amount of residue that is to be removed under this proposal could conceivably require about 11 years to complete. If the EPA would permit longer trains than the 17 cars or more than the two trains per day, this could be finished of course in less time.///I deliberately did not calculate the hauling by truck because personally I do not feel this is a safe or viable alterantive to the problem.///Every recognizes that recovery must be done as well as removal of the waste, this would entail additional time and money beyond the 11 years needed for the projected removal.///In finding a solution to the present project it would seem that a compromise between proposal 6 and the Greenway proposal, which is a result of community hearings and input, would be both reasonable and workable.///The proposal by the Department lacks any community input and has little support. This is needed if the people involved are to feel safe with the work and it isn't another case of bureaucrats from the capital telling the community what is good for them.///On the ground around Ramsey are two test plots that were constructed under the supervision of EPA by ARCO. Both of these are in their third and fourth season of growth. From all appearances and reports they are doing excellent. The health considerations that are paramount to all of us have been addressed and the growth of the natural grasses lend credibility to this as a possible alternative to be considered.///The communities have been going through turmoil since the shutdown in 1980. We have had demolition, hearings and more hearings. It took two and one half years of hearings before the final decision was made to haul the materials from the Colorado tailings. That work has barely begun and is now on hold. The streamside tailings, as they are proposed, will be a more disruptive process, but if the outcome is an area of park

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	29	McCarthy	Bea	or walking trails, natural animal habitat and a stream that is returned to a healthy fish environment, it will be worthwhile.///We do not need fenced off no trespassing areas that no one can use. We do need faster and healthy solutions to the cleanup problem."
I	30	Minich	Linda M.	"I would like to make some comments on the "Proposed Plan: Streamside Tailings Operable Unit" plan that I received recently in the mail.///Tailings in the floodplain///I do not believe that leaving talings in the floodplain is a good idea. I do not believe that "the STARS technology would attain a standard of performance equivalent to that required by floodplain and solid waste disposal ARARs."///Many repositories or a few///I think that many repositories near the site, but out of the floodplain would be acceptable. This would save on hauling time and costs. And perhaps it would save the cost of building a railbed for the railcars to haul the tailings.///Uncontaminated sites for repositories///I believe that there is already enough contaminated ground. Find a site that is already contaminated to put the contaminated tailings.///Land restrictions on relocation repositories///The restrictions should be so that using the area would present no more risk than using the streamside area that is being cleaned up.///Using Opportunity Ponds, or an area up Browns Gulch.///Are these areas already contaminated? If they already are, they could be used. If they are not contaminated, then don't use them.///Ramsay Flats as a repository?///Please see above answer///Short term Vs Long term risks///I believe that the short terms risks of hauling the material are minimal compared to for example leaving the tailings in the floodplain.///Truck or rail to regional repositories///Use regional repositories only if they are already contaminated. Haul the material by truck.///Have the truck drivers obey the speed limits and traffic laws of the area.///Size of remedial criteria///I have no way of knowing what is an acceptable size to leave in the stream. Preferably no contamination, but we have to be realistic.///Silver Bow Creek to support a self-reproducing trout fishery?///Excellent plan. Isn't that what it was before it got contaminated? I believe that many people think that is the job of the EPA, but if I read this material correctly that is not in the scope of the cleanup.///Thank you for all you hard work and taking the time to read this letter."
I	31	McGowan	O.	"I believe that ARCO should be held responsible to the highest most degree.///I was raised in Butte in the 50's and what I have seen that ARCO has destroyed is a sin against nature. How they get away with this destruction is hard to imagine.///Butte was a mining town of course, but all the mountains around it were green and full of vegetation - now it is an embarrasement.///I believe that State should take ARCO to "the cleaners". We live in the most beautiful area in the state. Why shouldn't everything be

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	31	McGowan	O.	restored at ARCO's full cost, to beauty, safety, health."
I	32	Tuchscherer, M.D.	Mabel E.	"The Streamside Tailings Public Hearing on Monday, July 10, 1995 at Fairmont Hot springs from 7 P.M. to after 11 P.M. was extremely valuable to me. Anaconda has always been home to me since I was born there in 1922 and was educated there through high school years until 1940. I have been living in Helena for the last three years but returned home to live on June 1, 1995. In 1940 I also began to pursue premedicine, medical school, and post graduate medical studies. I returned to practice Internal Medicine in Butte, Montana December 8, 1953 and practiced there until early 1957, when I moved to Anaconda because of the deteriorating health of my father, who died February 28, 1960.///During my years in Butte the Mary Swift Tumor Clinic was established and I attended it regularly while in Butte and frequently from Anaconda. We could present patients for discussion with known or questionable diagnosis of tumor or cancer. At no time was there mention of arsenic that I can recall. At that time the main interest was being drawn to the newly introduced pap smear to become of use to all physicians in our area in relationship to uterine cancer in women. Of course other cancers were also discussed and new information gradually became more available.///Some time in 1977 Dr. Jack Newman, M.D. a Butte Pathologist, gave me a printed copy of a paper he had given in 1976 at the New York Academy of Science regarding lung cancer in Silver Bow and Deer Lodge Counties. In this paper arsenic, which was involved in the smelting process at the Anaconda Smelter, was assigned as the cause of a particular type of lung cancer. In 1976 no tumor registry existed for evaluation of the entire state for cancer other than vital statistics, a completely separate kind of registry; therefore there were no proper controls for any specific type of cancer, including that for the lung, within the State of Monana for Dr. Newman's study.///In 1979 the Montana State Central Tumor Registry was started in Helena. The Anaconda Smelter was closed in 1980.///In late 1979 for reasons completely unrelated to this problem, I made the decision to retire from the active practice of medicine and move to Great Falls for a period of three years. I then moved to Milwaukee, WI, where I received most of my medical education, also for three years. I returned to Anaconda in mid 1985 because of a persistent serious back problem. I gradually became aware of the serious Superfund legal problem with the EPA and State against ARCO regarding Anaconda and Butte and the implication that people would be dying from cancer and particularly lung cancer until the end of the world if all arsenic was not removed (? to the moon) that existed between Butte and Missoula. This latter was particularly stressed at a public meeting that I attended at Hardee's Restaurant in Anaconda in October 1989. Until that time no major cleanup had begun. This type of information was completely foreign to me and did not ring truth since arsenic is one of the elements of the earth that I believed God created. Compounds of arsenic had been used to treat certain disease like syphilis and as a pesticide. Immediately I sought

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	32	Tuchscherer, M.D.	Mabel E.	information through the Hearst Free Library's inter-library loan service and became aware of the State Turmor Registry who were wonderfully cooperative. Ten years of information covering the entire state could be made available. We discovered from those who ran the registry that no one had taken the initiative to create a study from it. This we did over several months. We also obtained information from the National Cancer Institute. A study from them regarding arsenic with animals exposed to it and a specific microscopic cell study to determine the carcinogenic aspect of substances had never shown arsenic to be an offender.///Our study from the State Tumor Registry indicated that the kind of lung cancer that had been assigned to arsenic existed in almost every county that had population and it varied from year to year from one county to another like one might find in an infectious process. In early 1990 we sent our findings with copies of the material to a Dr. Smart, Director of the National Cancer Institute, the Montana State health Dept., as well as ARCO. We asked the national head of the EPA and Senator Conrad Burns to check with the National Cancer Institute about their evaluation of our information. In February 1990 an article appeared in Popular Science Magazine indicating that an 800,000,000 dollar Superfund Study was being done without controls. This was being expressed by the scientist at Stanford University who had developed the microscopic cell test for carcinogenicity. When I moved to Helena in 1992 I sent my original copies of this work to the Mansfield Library in Missoula. I have asked Sandy Stash of ARCO to send you a copy of that work I gave to them in 1990. This should also exist somewhere in the records of the State Department of Health. This information I am told allowed the Anaconda cleanup to begin in 1990.///At the recent meeting on July 10, 1995, I again heard scattered individual concerns expressed that arsenic causes cancer - a group from Missoula also expressed this - and stated that no study had been done regarding this problem.///I would suggest to you that there can be 5 more years of information i.e. 1990 - 1995 available at the State Tumor Registry, which I certainly presume is still in operation. Any new study should include all information at least in the same manner we provided in 1990. If done this followup information should be submitted to the present Director of the National Cancer Institute referring them to our 1990 information sent to them. If done I also request a personal copy and of course ask you to submit one to ARCO. My own present health does not permit me to carry out this study myself. The EPA and STATE should have competent help to gather this material.///In the meantime it would be foolhardy to delay the Silver Bow Creek cleanup in the manner which ARCO has recommended. Only God can made a perfect world and He will do it when He is ready!///Thank you for your gracious response to me at the meeting."
I	33	Leiss	Nicki	"It is my opinion that Alternative #3 should be used in treatment of Silver Bow Creek. This way no further land will be contaminated.///Also I wish to tell you again that I do not want any more waste to

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	33	Leiss	Nicki	enter Deerlodge County. (Remember the day that we met in Hardees at a meeting of ADRA)."
I	34	Groff, Ph.D.	S.L.	"As the former (now retired) State Geologist and Director, MT Bureau of Mines and Geology, I have many years of experinece in dealing with ground water, surface water, minerals, mining and Geology. Therefore I did make remarks related to the MHDES Silver Bow Creek Proposal Hearing (July 10 at Fairmont). I appreciate the fact that you and your personnel have worked hard on this proposal, but I cannot agree with the tearing up of the creek channel and the lack of real alternatives options. I am sending a summary listing of what I (and others) believe to be alternative procedures worthy of your study and attention. I am willing to discuss any of these concepts with you should you so desire.//(1) Possible and potential discharge of hazardous materials from the City of Butte area (to include the pit) should be secured before extensive measures of cleanup or reclamation are underway on the Silver Bow Creek project. First things first!///(2) I get the idea (from reading the proposal) that your principal reason for the cleanup relate to the EPA concept that arsenic "may" cause cancer in one person out of 10 thousand. EPA has indicated that this range could be one of ten thousand to one million. You have chosen the lower number. In my opinion, this is a specious argument. It certainly doesn't provide a reasonable basis for tearing up a creek channel. In fact, I have never heard of cancer as being caused by arsenic. As compared to high background of Alpha and Beta radiation in the vicinity of Butte, it can hardly be a valid consideration. This is not to say that arsenic is not a poison, but it has to be ingested or enhaled.///(3) I am certain that the excavation and removal of the stream bed is uncessary and will cause more problems that it will solve. Tearing up the stream bed will remove the present impervious layers of clay-silt-sand-tailings which have "hardened" the stream bed and channel in many places. An extensive erosion problem could well be the result. Also, the rechanneling, removal, hauling away and hauling fill back, refilling and closing the diversion channel, etc. and etc. may very well far exceed the present cost estimates. Why not work with nature to neutralize metallic pollutants in the present stream, thus establishing a "natural" semi or very useful cleaning? What remains can be taken care of in the Warm Springs ponds. I suggest the use of crushed limestone periodically added in several in-stream sites along Silver Bow Creek. The concept involves raising the Ph to 8# which should begin to neutralize sulfites and sulfides and possibly other sulfur acid radicals by tying them up in calcium compounds. A high level of oxygen in the creek water is a valuable ingredient to nature's work and input or disposal of sewage or other substances or pollutants from the city that tend to use up oxygen should be halted. In fact the product of sewage treatment might possibly be dried and utlized as on land and stream side fertilizer (for the Greenway no less).///There is a great deal of complex chemistry to consider in this section. Geochmists should be consuted for expert opinions. One thing for sure, the oxidation of iron-

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	34	Groff, Ph.D.	S.L.	sulfide (pyrite) will stain rocks red to brown. Other metallic sulfur compounds will, however become much more stable and virtually insoluble in water when oxidized. Note: Crushed limestone is not the same as commercial lime as particle size should be equivalent to medium or large sand grains with some larger fractions. To be successful in helping nature, however, pollutants from upstream Butte area, Pit, etc. must be eliminated.///(4) Relative to those streamside tailings areas that need cleanup. Instead of digging up everything for hauling away, why not try to mix the tailings with cement to immobilize the hazardous metallic pollutants and cast useful bricks, blocks, or whatever can be utilized in assisting in the project or elsewhere. This can and will work and is almost certainly more efficient and less costly than removing, hauling, burying, and replacing with fill brought in from somewhere else. Some fill, however, will be necessary. Experts in the use of cement would advise on the type to use in this case. Considering the acid radicals probably present in the streamside tailings there may have to be specific additivites in the mix. Making ceramic cylinders from radioactive waste was studied by ERDA and DOE several years ago for a radiation waste disposal system. The study showed it would work. The idea of cement-tailings concrete would be cheap and practical would lock up any deliterious effects of the "so-called" hazardous metals.///(5) From what I'm hearing, no one wants any hazardous waste disposal site in Brown's Gulch.///As one individual citizen, I strongly favor the Green way. I believe that some initial effort on this could be initiated by the citizens of the area. I am fully cognizant that the proposed cleanup does not include the Greenway and understand your reasoning in this. Nevertheless, this locality needs more trees and more recreational sites. Butte has come a long way from it's historical fame as a smokey, grimey, and famous old mining city. It is my hope that you well give the ideas expressed in this letter your keen consideration."
I	35	Smitham	Jim	"I am taking this opportunity to comment on the Proposed Plan: Streamside Tailings Operable Unit of the Silver Bow Creek/Butte Area Superfund site. I have attended both the Butte public information meeting and the Fairmont Hot Springs public meeting/hearing. In addition, I have read several documents published by MDHES, EPA and Arco on the project. I realize this by no means makes me an expert on the subject nor do I profess to be. I have lived in the Butte area most of my life, received an engineering degree from Montana Tech and have become very active in a great variety of community activities. Therefore, my comments are based on my perception of a workable solution which will benefit the citizenry of all communities along the creek corridor.///The very first project which should be undertaken is the Priority Soils on the Butte hill. Several times this spring, strong storms have hit the Butte area causing heavy rainfall. The color of the runoff is a strong indicator the soils on the hill need to be stabilized. Actual mud flows can be seen on East park street and several other sites

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	35	Smitham	Jim	around town. Since the entire Butte hill, including the stormwater drainage system, drains into the Silver Bow Creek, The Butte area Priority Soils act as a continual source of contaminted sediments for Silver Bow Creek. Until this problem is solved, clean-up of in-stream sediment would be fruitless.///The Butte Metro Sewer plant is currently facing increased demands to meet regulations governing nitrate and phosphate loading on Silver Bow Creek. In order to comply with the regulations, the plant would have to expend an estimated $25 - $35 million dollars. Studies have indicated the use of wetlands can accomplish a high degree of treatment with little operations and maintenance cost to taxpayers as compared to an advanced wastewater treatment plant. If this could be incorporated in the subarea #1 remediation design, Butte citizens would receive a great benefit along with Metro sewer meeting their discharge requirements. This is a win-win situation.///STARS technology developed by Montana State University has been used in various field applications for approximately 5 years now. As in any developing technology, application techniques have been varied in order to test results. I propose no technology is totally fool-proof and what a better opportunity to utilize long term field testing for STARS than in this application. By using the Silver Bow Creek corridor as a laboratory to further enhance the STARS technology, Montana could develop a means to clean up the many other mine waste sites scattered throughout the state. This too could be a win-win situation.///On the subject of the streamside tailings and sediments, I would ask the State to reconsider their choice of alternative #6 as the preferred alternative. I believe using STARS to treat tailings in place where the hydrology allows for slower stream flows makes sense. Flooding events, do not equate to erosion of all stream banks. Those stream banks which have good vegetation cover show significant stability. Those stream banks which have good vegetation cover show significant stability. In restricted areas flows increase rapidly during high water events. The streamside tailings in these areas should be relocated to a nearby area outside the flood plain. Alternative #6 calls for the relocation of approximately 1.8 million cu.yds. of tailings/impacted soils to one or two regional dry repositories. To relocate the tailings/impacted soils to a clean area (Browns Gulch) or add to a problem area which has no defined solution (Opportunity ponds) is not logical. Technically a better strategy is near place relocation and STARS treatment of the tailings/impacted soils. Once the soils are relocated and treated, include them in a bounded area such as a Greenway where the future land use will be predetermined. The argument that this solution will be too restrictive on future land use does not hold water. Arco currently owns or has pending ownership of approximately 60% of the land bordering the creek. They are working on additional land purchase. If Arco owns the land adjacent to the creek what a better place to relocate the tailings/impacted soils. I am sure Arco will not allow development to occur in areas which will adversely impact the STARS treated soils. Therefore, the best end-use of this land is a greenway. Once again this creates a win-win situation.///In conclusion, I hope the Montana Department of Health and Environmental Sciences will

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	35	Smitham	Jim	seriously consider the technical information received by experts, the heartfelt testimony of a majority of the local citizenry and the estimated time frames associatd with each alternative in making its final decision. Many feel the higher the price tag the better the quality. I feel this situation definitely proves that theory wrong. Also "the size of Arco's checkbooks" should not even be considered. A technically sound, common sense solution which will result in Silver Bow creek being cleaned to acceptable standards within a reasonable time frame is a win-win for all involved. I appreciate the opportunity to express my views on this matter and wish you the best in your deliberations."
I	36	McMaster	Kemper M.	"In response to your 26 June request, I am providing the following comments on the suject Proposed Plan.///The U.S. Fish and Wildlife Service (Service) supports the selection of a cleanup alternative that provides effective long-term protection of human health and the environment. This protection requires eliminating exposure to deleterious concentrations of hazardous substances. Alternative 7 (total removal of tailing/impacted soils, total removal of in-stream sediments, limited removal of railroad materials, consolidation in a regional dry repository and source control for ground water) would eliminate such exposure and thus provide the most effective long-term protection of the Silver Bow Creek riparian and aquatic ecosystems.///The State's preferred alternative (Alternative 6) would not remove all contaminated material, but rather relies on the Streambank Tailings and Revegetation Study Technology (STARS) treatment to immobilize the contaminants along certain reaches of Silver Bow Creek. Although the STARS demonstration areas along the Clark Fork River appear to be successfully revegetated and are being recolonized by riparian/wetland species, the natural meandering of Silver Bow Creek may cause erosion of the contaminated materials into the Creek. The metals associated with these materials would then be available for uptake by both benthic and water column organisms. If it can be demonstrated that all the tailings/affected soils that are to be left in place and treated by STARS will not be eroded into Silver Bow Creek, then I would agree that Alternative 6 would provide environmental protection equivalent to Alternative 7.///The Service agrees with, and fully supports, the remedial action objective of improving Silver Bow Creek to support a self-reproducing trout fishery. Fulfilling this objective will require not only the elimination of exposure to deleterious concentrations of hazardous substances, but also reducing non-chemical stressors, as discussed in the Baseline Risk Assessment. That is, riparian and aquatic habitat must be restored as an integral part of the remediation.///In summary, Alterantive 7 provides the most effective environmentally protective remedy. However, if it can be shown that the tailings/affected soils to be STARS-treated will not enter Silver Bow Creek, Alternative 6 may be equally protective. Riparian, aquatic and upland habitat restoration alternatives were not discussed in the Feasibility Study. For the remedy to be protective of the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	36	McMaster	Kemper M.	environment and to comply with the applicable or relevant and appropriate requirements, these habitats need to be restored. Habitat restoration alternatives should be fully evaluated during the remedial design phase."
I	38	Prodgers	Richard A.	"Thanks for this opportunity to comment on the MDHES/EPA proposal to redress problems associated with streamside tailings between the Colorado tailings and Warm Springs Ponds. Like most people, we have had time only to review your 23 page document, which no doubt simplifies both issues and data summaries.///The scope and severity of the problem are beyond dispute. We likewise doubt that anyone questions that remedial action is necessary. Alternative six looks like a reasonable solution to me, although we have a few reservations.///The objectives outlined on p. 7 look good, but in a broader sense we believe that one goal should be to make the affected streamside areas part of health functioning ecosystems, and for this the soil/plant complex must be a final focus of remediation. We are pursuaded that soils and plants have not been given adequate consideration because you failed to outline the measures that are planned to establish healthy plant communities on sites where streamside tailings have been removed. Moreover, we are not so sure that the exposed antediluvian substrate will provide the basis of a healthy terrestrial vegetation. No doubt it will be one helluva improvement, but it may need amendment.///With limiting knowledge, we suspect that creating a new stream channel in a clean area, followed by reclaiming the old channel area, is preferable in most portions to trying to clean an active channel.///You specifically asked for comments on several topics. These follow.///We believe STARS is inappropriate within the floodplain, as lime incorporation will not survive a flood.///As for repositories, there is only one GOOD solution: the Opportunity Ponds with tailings transported via rail to the extent possible. There is one other ACCEPTABLE solution: transporting tailings via truck to the Pit/Yankee Doodle Tailings area. We definitely oppose repositories in uncontaminated areas. Trucking is vastly inferior to rail transport. Fuel consumption and air pollution should be a factor in evaluating transportation, along with safety.///"How important are land restrictions on repositories?" Are you serious? Look around Butte: every accessible area has been trashed, including reclamation on MRI's land. Repositories will be degraded with off-road vehicles; caps and vegetation will be destroyed; and vectors of pollution will be opened. THIS IS NOT A POSSIBILITY; IT IS A CERTAINTY. Restrictions are a beginning in protecting repositories, but law enforcement probably will be necessary if ultimately unsuccessful. Frankly, it will take a moat filled with alligators to keep the destructive element in Butte from overrunning repositores.///How could Ramsay Flats, situated as it is in the immediate floodplain, be considered as a repository?///We believe that the risks and undeniable impacts associated with trucking are significant indeed, and that rail is a far better approach.///The trout fishery idea is fine but

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	38	Prodgers	Richard A.	limited to only a portion of the floodplain. The entire floodplain should be the focus. Without sounding pedantic, may we suggest that you look at a short document Richard wrote for the Butte/Silver Bow Planning Department about goals of reclamation? Some of those goals are appropriate for your project.///Thanks again for this chance to influence your selection of a plan for the Silver Bow area. We hope you find the support you deserve. Butte is corrupt and sometimes it seems many people have suffered from heavy metal concentrations in the brain.///Mark Twain said, "Do right. That will gratify some people and astonish the rest." We hope to be gratified."
I	40	Schetzsle	Anthony J.	"The National Park Service supports the preferred remedy, Alterantive 6, as proposed by the Montana Department of Environemtnal Sciences (MDHES) and the U.S. Environmental Protection Agency (EPA) for the Streamside Tailing Operable Unit (SST OU).///Grant-Kohrs Ranch National Historic Site, administered by the National Park Service, is located adjacent to the City of Deer Lodge on the Clark Fork River within the Milltown Reservoir/Clark Fork River Operable Unit. The Ranch has historically been the recipient of upstream hazardous tailings and contaminants that have been and continue to be released to the Clark Fork River. The primary vector of contaminant release affecting Grant-Kohrs include Silver Bow Creek in the SST OU, as well as the Warm Springs Ponds area and the Upper Clark Fork River and floodplain. In order for removal and remediation actions to occur and be effective at Grant-Kohrs Ranch, a permanent and resilient remedy must first be implemented in the SST OU.///Grant-Kohrs Ranch and the Clark Fork River must be protected from recontamination. The short-term risks associated with implementing the proposed plan, i.e., REMOVING the majority of tailings from the floodplain, are justified relative to the long-term risks and continued exposure associated with leaving the tailings in the floodplain even with Streamside Treatment and Revegetation Study (STARS) treatment. Any alternative to merely relocate and treat contaminants in the floodplain poses unacceptable risk to resources and human health downstream at Grant-Kohrs Ranch. The dynamic flows of Silver Bow Creek and the Upper Clark Fork River provide empirical evidence that any contaminants left in the floodplain will be re-entrained and redeposited downstream. STARS treatment will not adequately protect against recontamination from erosion associated with overbank flows and natural stream meandering, and staturation of soils and tailings from fluctuating ground water levels and flows.///A component of the proposed plan calls for approximately 540,000 cubic yards of tailings to remain in place and treated with STARS in Subunit 4 if equivalent performance can be demonstrated to comply with applicable or relevant and appropriate requirements (ARARs). If the ARAR standard cannot be satisfied nor a waiver granted, the tailings should be removed as called for in Alternative 7.///Grant-Kohrs Ranch national Historic Site is a unit of the National Park System and is the only unit to appear on the National Priority List for Superfund cleanup. It

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	40	Schetzsle	Anthony J.	serves as the institutitonal memory of this Nation as it commemorates the frontier cattle era and its role in American history. Grant-Kohrs Ranch also bears testimony to the mining legacy of the region as evidenced by elevated levels of soil contaminants and hazardous substances and associated areas of denuded vegetation. The National Park Service is tasked by the United States Congress with preserving the Ranch. In order for the Service to remediate, protect and restore Grant-Korhs Ranch, the same must occur at all potentital release sites upgradient in the SST OU and beyond.///The National Park Service agrees with the cleanup objectives for the SST OU and the criteria invoked for selecting the proposed remedy. It would appear that successful implementation of the proposed remedy will negate the need for Warm Springs Ponds and provide the National Park Service with the best opportunity to restore Grant-Kohrs Ranch and fulfill its public trust responsibilities. The proposed plan is not perfect but it does offer a remedy that is permanent and resilient.///Thank you for considering these comments."
I	41	Stickney	Michael C.	"I have followed with interest the debate surrounding cleanup alternatives proposed for Silver Bow Creek. After reading Sandy Stash's presentation of ARCO's position in the July 4 Montana Standard, I am compelled to comment. Over the past 15 years, I have used the Silver Bow Creek corridor between Butte and the lower end of Durant Canyon as a recreation area, having hiked and bicycled along Silver Bow Creek on many occasions through all of its length. Employed as a geologist and having experience mapping the sedimentary deposits of modern and ancient stream systems in western Montana, I have some concerns about ARCO's proposed remediation of the Silver Bow Creek corridor.///My concerns focus on the behavior of Silver Bow Creek and its impact on proposed cleanup solutions. Little attention seems to have been given to how the tailings came to be distributed along the length of Silver Bow Creek and the upper Clark Fork River in the first place. In the spring of 1908, a flood inundated the Colorado Mill tailings --which unfortunately were placed on the flood plain of Silver Bow Creek--eroding them, carrying them miles down stream in a matter of hours to days, and depositing much of them on the flood plain terrace. The flood plain terrace is an integral part of every stream system in the Northern Rocky Mountains. Although almost always dry and unused, the flood plain is formed, and evoloves, with each successive flood of the stream. Most people, and apparently ARCO, think of Silver Bow Creek as only the narrow channel which incises the flood plain and flows water most of the time. However, viewed from a geologic perspective, the flood plain is every bit as much a part of Silver Bow Creek as is the narrow channel.///As surely as the sun will rise tomorrow, there will be future floods on Silver Bow Creek. Whether they will occur next year or 100 years from now, nobody can foretell but be assured, they will occur. Anybody who believes otherwise is ignorant of the historic and geologic record of this region. When these floods occur, the flood plain will take the next step in its evolution. Sediments will be

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I	41	Stickney	Michael C.	moved, some from the creek channel onto the flood plain, in other places from the flood plain into the creek channel. New channels may be cut into the flood plain and the existing channel of Silver Bow Creek will be modified through stream bank erosion, channel meandering, and sediment redeposition. Materials from the flood plain, including tailings left there, will make their way back into the stream channel. Vegetative cover on the flood plain surface may prevent some sediment transport during minor flooding however, processes that occur during flood events of the magnitude that initially deposited the tailings will be largely unaffected by vegetation. I also have little confidence in engineered efforts to keep the stream channel in its present course. The fact that Silver Bow Creek has cut Durant Canyon a thousand vertical feet into solid bedrock demonstrates that riprap or channelization are at best, temporary measures to keep the stream channel in its present course. Eventually, despite the best efforts of mankind, Silver Bow Creek will continue to modify its channel and rework its flood plain in the endless evolution of this fluvial system, and in so doing, rework any tailings remaining within the flood plain.///With this knowledge in mind, it is clear that any remediation short of complete removal of the tailings from the creek channel/flood plain system is destined to eventual failure. The Streamside Tailings and Revegetation Study (STARS) proposed by ARCO is not a permanent solution to the tailings problem. It is a temporary fix that may look nice and green in a few years but is destined to fail in the long run. ARCO may not be around to "go back and fix it" if the next major flooding event occurs decades from now. The State plan to remove most of the talings from the flood plain is clearly the better option. The streamside tailings should be placed in permanent storage at the Opportunity ponds right next to the Colorado Mill tailings from which they were derived. The rail system used to haul the Colorado Mill tailings to the Opportunity ponds runs nearly the entire length of the streamside tailings area and is well suited to haul these tailings to the repository. ARCO's claim of 100,000 truck loads on public roadways is a scare tactic. I trust that scientific insight will previal over politics in the decison on how best to clean up Silver Bow Creek."
I	42	Karvinen	Ronald D.	"As a supplement ts S.K. Groff's article of July 16, let me add the following thoughts. As far as the water in the Berkley Pit is concerned, it should be noted that less than a cupful of man-made solution is contained therein. Since the introduction of the mineralization into the "Butte Hill" some 70 million years ago, waters with the same chemical characteristics have exuded from the hill. Meteoric waters (rainfall, etc.) with inevitable dissolved atmospheric gasses have percolated through and around ore bearing sulfide veins and veinlets. Shrinkage after emplacement of the mineralization provided the "plumbing" system. A myriad of chemical reactions occur with the advent of meteoric waters, especially in the oxidation/reduction zone. When the host rocks and mineralized zones become saturated, springs

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	42	Karvinen	Ronald D.	occur. Let it be known, many of Butte's underground mines were "wet", with dewatering pumps working constantly. Note again, the affluent from these mines did NOT contain man-made chemicals. Waters in the Berkley are not different than those of millions of years past. Unless commercially viable extraction of the dissolved salts is effected, leave the waters alone. The earth's recuperative powers will negate hazards fear-mongered by pseudo-scientists.///As for the tailings, as Mr. Groff states, they have reached a natural state of physical/chemical equilibrium, that if left untouched will harm no one. Reclamation and/or relocation would be hocus-pocus endeavor.///I think the "moneychangers" in the Temple of the Superfund have motives other than the welfare of humanity in mind.///Out of curiosity, I visited several sites down-stream from the tailings. Not a CORPUS DELICTI of any species was evident and the natural vegetation was lush and green. Where's what hazard? If recollections are correct, the only man-made chemical that could be in these tailings is ethyl xanthate (a sulfide mineral flotation reagent, foul of odor but non-toxic).///To some, these works are not a thing of beauty, but to me they are monuments of man's mastery over nature. (As mandanted by God in the very first chapter of the very first Book of the Old Testament, namely Genesis 1, Verse 26. If you have any doubt of the meaning of the word "dominion", look it up.) This concenpt applies to the Berkley Pit, MRI's operations, and the numerous prospect pits that color our landscape, i.e., monuments to dreams of wealth and independence. Has anyone contemplated that archeological protection these pits would have, had they been dug by the "noble redman", rather than by the "greedy, evil white man"?///Should treating the tailings mistakenly prevail, in situ soil cementation could be the optimum means. Doing so would allow utilitarian configuration of an infinite variety to be formed before the cement sets. Within my acquaintances are people with hands-on knowledge of this art form.///In a magazine article published some time ago, the "ugliness" of the Butte was extolled. One picture as printed was of a dilapidated house in Centerville. Had the photographer faced 10 degrees about, and had he a "wide-angle lens", his photo would have captured the majesty of the East Ridge, the Highlands, Timber Butte, Mt. Fleecer, the Pintlars, and Big Butte.///In traversing the Rocky Mountains from Southern Canada to Northern Mexico, I have visited every major city therein (unimportant) and hundreds of the smaller towns and hamlets (very important); none have all the characteristics that make up Butte. Some have a few, a lot have none.///Though the real flavor of Butte vanished with the last underground miner, its soul and spirit still persisit. Age and abandonment of some of the structures above the "flats" are not the pride of our Chamber of Commerce and are looked on askance by most tourists.///It takes a person who knows and loves the soul of Butte to be able to see its beauty and to be able with benevolent indulgence to graciously say, "If you don't like our ugly, stay out of Butte."

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I	44	Waring	George H.	"At their regular monthly meeting on Wednesday, July 12th, the membership of Butte's Citizen for Labor and Environmental Justice voted unanimously to support the thorough cleanup of Silver Bow Creek as contained in your agency's proposed remedy, "Alternative Number Six," on page 15 of the June 1995 publication: PROPOSED PLAN: STREAMSIDE TAILINGS OPERABLE UNIT.///The vote of our membership was taken following an extensive question and discussion period. Mr. Neil Marsh of the Montana Department of Health and Environmental Sciences was kind enough to attend our meeting and provide answers to the many questions posed by our members.///On the basis of my notes, I wish to share with you the reasons that our members provided for supporting the Department of Health's preferred alternative:///1) Our members expressed great concern that the MERDI "Greenway" proposal has introduced an element of major confusion to the people of Butte. Our members believe that the Greenway plan should be considered for use only after the tailings in the floodplain have been removed. They do not want a specific, limited land end-use to be the driving factor in determining which alternative is selected to cleanup Silver Bow Creek. Their fear is that any cleanup which leaves toxic materials in a position to be reentrained to the creek and floodplain via water contact is insufficient. Given the creek's history of meandering and the danger to human health posed by mine waste, the group is concerned that any cleanup less than Alternative Number Six will result in the need to redo a remedy at the site at some future time.///2) Our members also voiced the concern that the Butte-Silver Bow and Anaconda local governments appeared to be basing their nonacceptance of the State's proposed cleanup mainly on the political activity and all-out public relations campaign undertaken by MERDI and ARCO. Our members believe that the economic results of a thorough cleanup of Silver Bow Creek will be more beneficial to Southwest Montana than the benefits promised via a MERDI "Greenway" that may never come into existence. Our members believe that a toxic-free Creek which is able to sustain a spawning trout population will be of far greater benefit to future generations than the results of the minimum cleanup and maximum coverup of materials ARCO favors. They voiced their belief that any remedy short of Alternative Number Six will require management in perpetuity and the imposition of severe institutional controls. The question was raised as to which entity would be charged with the constant management, revegetation and repair of decaying STARS treated soils required in any ARCO-like solution. Our members do not trust ARCO to do this crucial work. Nor do they feel confident that MERDI would be appropriate---as MERDI seems a chameleon-like entity in which non-profit and for-profit enterprises come and go, an entity which has at least one subsidiary with economic ties to ARCO. And the members also have real worries about county government managing any STARS -treated toxic waste materials. There are historic examples where institutional memory has been lost at the local level. What may seem logical and necessary to the county at the outset of managing a project may seem illogical and unnecessary after a few election cycles. Because this site involves two counties, the public's health along Silver Bow Creek should be entrusted to a state entity guided by the best

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I	44	Waring	George H.	science. However, the group appreciates the kind of cleanup discussed in Alterantive Number Six would not require a great deal of future management.///3) Our members have heard testimony from folks involved in assessing the efficacy of the STARS treatment of the tailings, staff of the Department of Health and people trained in environmental science. Quite simply, the adjectives that the main ARCO spokesperson uses in describing the "success" of stars ring hollow in the light of the scientific evidence we've listened to. For this reason, our members oppose acceptance of the STARS technology for use on tailings near the Creek. It worries our members that staff people working for the Butte-Silver Bow County Government, while stating the tailings should be kept from water's way, appear to desire greater use of the STARS technology than that called for in Alternative Number Six in the Montana Department of health and U.S. Environmental Protection Agency's PROPOSED PLAN of June 1995.///4) Our members are concerned that the spokespeople for the Butte and Aanconda Local Development Corporations and the local Chambers of Commerce have ignored the economic benefits to be gained from the thorough cleanup called for in Alternative Number Six. They have testified glowingly about the magical results to be derived from the MERDI "Greenway" project, but have dismissed the longterm attractiveness for new tourist-based industries and non-polluting businesses of a clean and recreation-ready Silver Bow Creek. Our members, therefore, voiced their support for a thorough cleanup on the basis of long-term and short-term job creation in this area. Specifically, the kinds and number of good-paying jobs to be created by transporting waste materials must be mentioned: truck drivers, backhoe and loader operators, general laborers, railway employees, people with hazardous waste training, etc. ARCO estimates that the State's Alternative Number Six would require the moving of over 86,000 truckloads of soil for almost three and a half years up to 172,000 truckloads for almost nine years. For folks concerned about the immediate economic health of the Butte-Anaconda area, these truckloads mean paychecks. Our members believe the creation of good blue-collar jobs in this area should be given a higher priority than the maintenance of lifetime employment for MERDI executives. In an area where open-pit mining has occurred for nearly fifty years, the recently-raised concern about workers' safety by ARCO spokespeople leaves our members bewildered. Our members believe that the workers engaged in the soil removal work would face no greater safety risks than normally found in the mining industry. However, they fully expect that all OSHA regulations would be enforced during soil removal. Our members also noted that the trucks removing contaminated soils would be travelling on back roads.///These remarks, to the best of my ability, provide an accurate summarization of the spirited discussion which occurred on the evening of July 12th. I hope they convey the high level of support which the State's Alternative Number Six enjoyed among the members of our Citizens for Labor and Environmental Justice group in Butte.///On behalf of the membership,"

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	45	Evans, Chairman	Barbara	"After review of the Streamside Tailings Operating Unit alternatives, we believe that alternative No. 7 best serves the public interest.///We would recommend alternative 6 except for one important difference. We feel that when evaluation criteria 3 and 4 are applied ojectively, the STARS treatment and partial removal of some contaminated material are simply not long-term solutions. However, we would support alternative No. 6 should No. 7 not be selected.///Missoula County has a strong interest in the project and applaud the efforts of the State to resolve this monumental problem."
I	46	Micheletti	Joe	"I am writing this letter urging your support of Project Green, which is the most viable option for cleanup of the Silver Bow Creek corridor. I am a lifetime resident of Anaconda, and feel the concerns and input of local residents should be heavily weighted, when making a decision on this very important issue.///It just makes good common sense to encapsulate the contaminated material adjacent to the corridor and spend the monies on reclaiming the corridor for future development; rather than, spending the monies to haul the contaminted material a long distance to a repository, and devote minimal funds and effort to reclaiming the corridor.///Once Again, I urge your support of Project Green, and thank you for considering my opinion."
I	47	Beaudette	Edward G.	"I am writing to formally express my opposition to the remediation alternative chosen by the MDHES for remediation of the streamside tailings operable unit of the Silver Bow Creek Superfund site.///As I stated in my testimony at the hearing I have had extensive experience in working with Superfund issues before and during my tenure as County Attorney for Anaconda-Deer Lodge County. In those endeavors, I have gained much insight into the Superfund process and worked closely with representatives of all sides of this most complicated issue.///Using this experience as a basis for my position I oppose the State Proposed Plan on the following grounds:///1. Economics. The alternative proposed by the State is estimated to be the second most expensive option considered. In looking at the scope of work included in the proposal and comparing it with the cost of the work which has been completed in Anaconda-Deer Lodge County it is clear to me that the cost as predicted is both outrageously high and probably grossly underestimated for the work proposed.///This, coupled with the fact that if ARCO is required to complete this alternative, the remediated property will be fenced off from public use makes this plan absolutely unacceptable as a plan for successful remediation.///2. Practicality. As was discussed at the Public Hearing held at Fairmont, the State's proposal of removing particles larger than 1 cm. from the streambed of Silver Bow Creek is totally impractical and probably virtually impossible.///Similarly, the concept of trucking or hauling by rail the tons of material as proposed to an unknown site is a concept

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I	47	Beaudette	Edward G.	that is fraught with difficulty, hidden expenses and delays.///Finally, one need only look further upstream to the Colorado Trailings site and see the problems that removal has caused there as the work impacted the previously remediated Montana Post and Pole Site. I can hardly believe that your department is unaware of the problems caused by that removal and yet maintains that the same concept will work further downstream.///3. Productivity. The plan as proposed by the State is the least productive and beneficial for the residents of the affected counties and the State of Montana.///Requiring ARCO to comply with the State plan as proposed will result in the closure of all of the land owned by ARCO to public access and productive use. It is my understanding that ARCO has present ownership of more than 2/3 of the land to be remediated and is in the process of obtaining more. ARCO has clearly stated as would any responsible party forced to such an expense that upon completion of the work in the State's plan, the land would be fenced off and public access prohibited. This is clearly not in the best interests of the residents of Butte-Silver Bow and Anaconda-Deer Lodge County nor is it in the best interests of the rest of the population of the State of Montana.///Similarly, the goal as stated in the public report of the State's proposed plan to meet a level of a 1 in 1,000,000 excess lifetime risk of cancer (report p.9) is totally ludicrous given the impossibility of that standard. No one has or will be exposed to the existing contamination on a lifetime basis and there are to my knowledge no actual reportable cases of cancer arising from this exposure. Given a total population in the entire state of less than 800,000 people it is ridiculous to set a goal that no one will ever suffer the effects of cancer from this source in Montana.///Finally, I would state that I support the Greenway Concept as proposed by MERDI. While it is not perfect and is far from being complete it is a concept which will result in something beneficial and useful arising from the clean-up.///Given the fact that ARCO is the responsible party in perpetuity, it is worth the effort to see if the STARS technology will work and allow for a cohesive development of the area with sufficient controls to protect both human, fish and wildlife populations. If the plan ultimately does not work, ARCO will have to return to remedy the situation.///Insistence upon the State's Proposed Alternative in light of the public sentiment against it, the inherent deficiencies of the plan and the economics of the plan would be a bastardization of the public process which you are responsible to."
I	49	Luebeck	Al	"I support your agency's proposed alterantive number six for the cleanup of Silver Bow Creek. I am in favor of a thorough cleanup of Silver Bow Creek and I believe alternative six will accomplish this. I believe that the objective of improving Silver Bow Creek to support a self reproducing fishery is very appropriate and ARCO should be required to accomplish this goal. I believe strongly that all tailings within the floodplain should be removed. If they aren't removed, then it is psosible that some future

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I	49	Luebeck	Al	flood will carry the remaining tailings into the stream, recontaminating it and creating considerable havoc to the biological life in the stream.///I think that the "Greenway" proposal is creating considerable confusion among people living in Butte and Anaconda. The Greenway is not a cleanup proposal. It is a proposal for management and uses of the land after the cleanup has occured. There sohuld be no real conflict between alternative six and the Greenway proposal. Yet supporters of the Greenway want only a minimal cleanup of Silver Bow Creek and it appears that supporters of the Greenway have an agenda which goes beyond the thorough cleanup of Silver Bow Creek.///I hope that you and your agency will not be swayed by the discussion and confusion over the Greenway. Stick to your principals, choose alternative six and let's have a thorough cleanup of Silver Bow Creek."
I	50	Cote	John S. "Harp"	"I appreciate the opportunity to comment on the state's proposed cleanup of Silver Bow Creek. I am a life-long resident of Butte and the cleanup of Silver Bow Creek and its long-term community benefits are of great interest to me. I am in complete support of Project Green and any safe long-term remediation that includes future beneficial land uses.///Your plan requests comment on the following matters:///(1)TRANSPORTATION OF TAILINGS TO OPPORTUNITY OR BROWN'S GULCH: I do not think that truck or rail haul to either site is the safest practical remedy. Rather I think the tailings should be appropriately handled at or near the site through relocation or use of the STARS technology. If this results in many smaller repositories for tailings I still favor this approach. The benefits gained by consolidation are unacceptable when taking into account the risk of harm to area travelers during the 7 to 10 year hauling. Any land use restrictions, resulting from near site relocation, can be successfully handled through institutional controls, and by incorporating Project Green as part of the final remedy.///(2)BROWN'S GULCH: In short, I could not think of a worse place to put tailings than in Brown's Gulch. Placing tailings in a site completely unaffected by mine wastes or Superfund makes little if any sense.///(3) STARS TECHNOLOGY: As indicated, I favor use of the STARS technology. Its application is a credit to those who developed it at Montana State University. If ARCO is willing to bear the risk in perpetuity of its failure, I think we should maximize usage of the technology.///I would also like to see the State address:///(1) PROJECT GREEN: The community vision for Silver Bow Creek should be incorporated into the final remedy. I realize you are unable to force ARCO's participiation in such a project, but I think you can successfully negotiate a fair remedy that includes a greenway concept. ARCO has expressed a willingness to go along with a greenway. This builds a long-term community asset similar to the Anaconda golf course. We should take advantage of any opportunities presented as long as they meet the objectives for a safe long-term remediation.///(2)OTHER COMMUNITY CONCERNS: Butte is faced with some expensive problems regarding its Metro Sewer Treatment Plant. The state Water Quality Bureau is

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I	50	Cote	John S. "Harp"	addressing this issue. I think it would be beneficial for everyone involved if efforts were coordinated in a manner that could alleviate some of these costs. In addition to Metro, I think the state should also look for ways to coordinate efforts with other Superfund projects in the area.///Butte and Anaconda need a safe long-term remediation that also takes advantage of recreational and economic opportunities. Thank you for the opportunity to comment and for your consideration of my concerns. Sincerely,"
I	51	Gooding	Diana H.	"I support strongly Montana's plan for clean-up at the headwaters of the Clark Fork River - I endorse alternative 6 and would rather see the implentation of alternative 7 and the complete removal of all tailings, impacted soils and instream sediments.///It would be a grave error to allow further precedents be set through ARCO being relieved of its responsibility in clean up of the Silver Bow Creek site.///Thank you for listening."
I	52	Rowik	Pete	"I would like to express my SUPPORT FOR the states plan (Alternative 6) for the cleanup of Silver Bow Creek."
I	53	Roberts	Richard E.	"Regarding Montana's plan to cleanup the toxic seiments and tailings at the headwaters of the Clark Fork, I want you to know that I am in favor of and support alternatives # 6 and # 7 above all of others."
I	54	Nobles	E. Terrill	"Please choose Alterantive 6 for the cleanup of Silver Bow Creek, in the Butte area and downstream.///ARCO assumed this responsiblity when they bought their Butte property--make them honor it.///The upper Clark Fork should be a GREAT fishing stream, and this is an opportunity for your office to make it so!"
I	55	Dolese	Thomas	"I'm writing to express by support for Alternative 7 regarding the cleanup of Silver Bow Creek. I believe that when mining companies pollute and kill our streams and lands, the responsible party should bear the cost of a complete and comprehensive cleanup."

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I	56	Hennessy M.D., M.P.H	P.J.	"I strongly support your plan for this severely degraded stream and flood plain; and encourage you to proceed with the Most protective approach. I am a family practitioner with special training in public health and toxic containment of the environment. I have practiced in Montana for the last 17 years and, with increasing concern, have noted a disproportionate number of individuals from Anaconda area with birth defects, cancers, and chronic disease. Because Montana lacks a central tumor registry, and until very recently had no epidemiologic support for cancer closer surveillance, my observations will remain anecdotal. Even a person without scientific training in toxicant contamination understands the deadly nature of arsenic in even minute quantities. Because of the current Federal congressional mood, it appears that SuperFund Cleanups Law may be dismantled. It is imperative that we move promptly and seek a permanent remedy. /// Please register my endrosement of Alternative 7 of the State Plan for Silverbow Creek."
I	57	Gilels	Dori	"I would like to express my support for the state's proposed plan to clean up Silver Bow Creek. Alterantive 6, and especially, Alterantive 7 are the only effective means of eliminating the problems and risks associated with the toxic sediments and tailings found at this site. I am impressed with this plan since it is the first I have seen to directly attack the source of the problem. Too often, in our society, we deal with environmental problems by using a "band-aid" method to temporarily avoid the real issue. The STAR technique is completely inappropriate for restoring the biological health of this stream and protecting humans from serious health threats (it is only a band-aid). I hope the state's plan becomes a reality and that it will serve as an example for future environmental cleanups. /// Thank you."
I	58	Vaneler	Mike	"I'm writing at the Clark Ford Pend Oreille Coalitions request to show my support for your 'Alterantive six' proposed plan concerning the cleanup of the Clark Fork Headwaters. It sounds good."
I	59	Magnuson	Leaf	"The only way to protect public health and water quality is the complete removal of the toxic waste from Silver Bow Creek. ARCO is liable for what they did there in the name of profit. I support alternative 6 or 7 for these reasons. Don't let ARCO weasel out of their responsibility to this state. If there is not enuf room for the material in the backyards of the corporate officers, put it in their front yards too."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	59	Magnuson	Leaf	
I	60	Johnson	Michael	"Let's get Silver Bow Creek cleaned up once and for all time. Even the asthetics of the area is sickening. Support Alternative #7, please!"
I	61	Schombel	L.F.	"I agree with the State that Silver Bow Creek tailings should be removed. I support alterantive 6 or alterantive 7 for the clean up."
I	62	Smith	Jeffrey J.	"As a Montanan familiar both with the history and the present biological crisis of Silver Bow Creek, I support Alternative 6 and Alternative 7 of the state's plan.///Placer miners first found gold in Silver Bow Creek in 1864. The first open-air smelter for silver and copper ore was built in the creek bottom in 1870. These smelters were primitive affairs. Miners would stack a layer of lumber, a layer of raw ore, another layer of lumber and so on. Then they would set the whole thing ablaze to smoulder for days, sometimes weeks. The result was massive heavy metal pollution the entire length of the creek.///Butte's urban and domestic waste began entering the stream by 1890. The Anaconda Company's Washoe Smelter came on line in 1903. We know that this "tall stack" spread heavy metal pollution throughout the lower stretches of Silver Bow Creek. By 1917 there were 150 mines operating in or near Butte.///We know that there was a manganese refining plant on the creek from 1920 to 1963 and a post-and-pole plant within a quarter mile of the creek from 1946 to 1983. The Weed concentrator discharged untreated heavy metal waste into the creek beginning in 1963.///Last year in the late spring I spent a morning walking upstream on Silver Bow Creek from the Fairmont Hot Springs bridge. I've been walking Montana streams and rivers since the summer of 1974. I know what a healthy stream looks like. It is full of diverse streamside vegetation. It supports a wide diversity of insects as well as the birds and the fish that feed on them.///My morning's walk I could see cutbanks that glistened green with copper wastes. No vegetation grew within 25 yards of the stream. No insects rose or lighted on the water. There were no fish holding in the eddies or rising anywhere in the two miles I covered. I didn't see any great blue herons, no red winged black birds, and no water fowl.///As the main tributary to the Clark Fork River, Silver Bow Creek is a "high prioirty" Superfund cleanup site.///There should be no compromise here. After 100 years of mining, this stream needs to be cleaned up completely. I urge you to put into action Alternative 6 or Alternative 7.///The STARS technique proposed by ARCO is inacceptable. Silver Bow Creek will meander and will eventually come into contact with the tailings throughout the riparian area. STARS does not reduce the amount of metal in the tailings and only temporarily holds them in place. They will

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I	62	Smith	Jeffrey J.	eventually recontaminate the stream.///Furthermore, STARS cannot immobolize arsenic. STARS may even increase the mobility of arsenic, which has been found in the tailings througout the site and is the contaminant of greatest concern to human health, not to mention the health of our fellow creatures."
I	63	Hoon	Kirby L.	"I am writing to urge that Alternative 7 be adopted for clean up of the toxic sediments and tailings at the headwaters of the Clark Fork. As a minimum Alternative 6 should be adopted. Under no circumstances should ARCO be allowed to leave toxic material in place. The material is residually permanently inert and admittedly toxic. It flys in the face of common sense to leave it and hope for the best.///Thank you for your help."
I	64	Coddington	Lane	"I support Alternative 6 or 7 of the state's proposed plan for cleaning the toxic sediment and tailings at the headwaters of the Clark Fork River at Silver Bow Creek. It is obvious that the best way to provide for permanent water quality protection is the removal of contaminated tailings from the site.///This is a fantastic proposal on your part and you must not let ARCO leave these tailings in the floodplain.///Thank you for your diligence in protecting our health and water quality. All Montanans benefit from your alternatives."
I	65	Benson	Robert E.	"I would like to thank and commend MDHES for selecting the option to remove most of the impacted soils from the Streamside Tailings unit.///I recently visited the Warm springs ponds area and was very much impressed by how much erosion had occurred along the east side of the pond area, even washing out the road in several places. This from nothing more than some heavy early summer storms. It convinces me that the highly erodible soils along Silver Bow Creek would almost certainly erode in any really big flood or rain event. This springs rains while being above average are certainly not rare; I recall several such springs in the thirty plus years I've lived in the area.///In addition, the damage done to the reconstructed by-pass channel at the ponds is further evidence of what can happen in a wet, but by no means major flood event. I think placing the tailings in Opportunity ponds is the best solution to cleanup."
I	66	Benson	Erik	"I am writing to encourage you to support the Alterantive Six plan for cleaning up toxic sediments in Silver Bow Creek. Compared with liming and seeding, Alternative Six fixes the problem by removing it,

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I	66	Benson	Erik	not just hiding it.///Please don't let ARCO use their STARS technique in this area. The creek will surely carve new channels in its floodplain over time. If large deposits of toxic sediments are allowed to stay in place they will be swept back into the stream to poison wildlife and threaten public health over and over again.///Silver Bow Creek should get the Alternative Six treatment now while the money is available through Superfund."
I	67	Pence	Dennis	"I am writing to you today to strongly recommend Alternative 6 as a means of restoring the biological health of the Silver Bow Creek.///Permanent removal of contaminated tailings and impacted soils is important and should not, by any means, be overlooked or ignored. There may be serious risks if the STARS technique is employed, with downstream effects on the health of humans and wildlife in Montana and Idaho. One main concern is the lack of ability to absorb the arsenic, which makes Alternative 6 the state of Montana's best course of action.///I appreciate your time and attention to this matter."
I	68	Thomas	William R.	"This letter is to state my preference for Alternative 6 or 7, preferably #7 for cleanup of Silver Bow Creek. ARCO should be held accountable for a permanent solution and cleanup should begin soon."
I	69	Pally	Barbara Archer & Tom	"We are writing to express our support of the Department's proposed remedy, Preferred Alternative 6, for the cleanup of Silver Bow Creek. Some specific concerns are as follows:///1) It is our understanding and belief that the STARS technology, while appropriate in some specific areas, should not be the primary method of remediation, especially in the floodplain, where such treatment would be vulnerable in high water years well into the future. As much of the streamside tailings currently existing in and out of the floodplain should be removed as technically feasible.///2 Regarding the issue of repositories, we believe that the existing regional repository at Opportunity Ponds should be the sole tailings repository. To use land that is presently uncontaminated for relocation of tailings, or to relocate tailings to many repositories, would, we believe, be an unnecessary burden on future generations, as well as the probable cause of future adverse environmental impacts.///3) With regard to transportation of tailings, if the Opportunity Ponds repository were used, it would seem that the most logical method of transportation would be by rail, as a railroad(s) runs along Silver Bow Creek for a good share of the distance, and runs to or near Opportunity Ponds.///4) Strict land use restrictions should be placed on repositories; conversely, if tailings are removed to the greatest extent feasible, there should be far fewer, if any, restrictions on future land use of remeidated areas.///5) We believe that the objective

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I	69	Pally	Barbara Archer & Tom	of restoring Silver Bow Creek to a permanent, self sustaining trout fishery should be the ultimate goal of remeidation. If this goal was achieved, that in itself would indicate that the Upper Clark Fork watershed as a whole were well on its ways to being healthy again, both environmentally and econmically.///We blieve that it is important to consider the issue of Streamside Tailings in the context of the Clark Fork Basin. It is not only the desires of the citizens of Butte Silver Bow and Anaconda Deer Lodge, but those of the entire watershed, that should be considered when making the final decision as the to level of cleanup.///Thank you for the opportunity to comment on this proposal."
I	70	Kern	Donald	"The Montana River Action Network (MRAN) is a grassroots river advocacy organizaiton dedicated to the protection and improvement of Montana's stream flows, water quality and fisheries. In that capacity, we are very much concerned with the effort to clean up Silver Bow Creek and other superfund sites in the upper Clark Fork River basin.///Silver Bow Creek has become a prime example of the toxic legacy which has been left to Montanans by the mining industry. The creek and surrounding waters are so contaminated by heavy metals and other pollutants that it supports no aquatic life whatsoever and the adjoining riparian areas are barren and sterile.///MRAN basically is in approval of the State's plan as outlined in alternative 6. However, it is the firm conviction of this organization and my professional opinion as a hydrologist that the State should remove all of the contaminated mine wastes from the floodplain and make the most concerted effort possible to remove as much of the in-stream contaminted sediments as is technologically feasible. Only in this manner can the State guarantee the prevention of further contaminants leaching into the stream.///Removing these contaminated wastes completely is the only way to ensure that Silver Bow Creek will one day be returned to it's natural state of biological diversity, supporting fisheries, wildlife and other beneficial uses.///ARCO's continued promotion of STARS-Streamside Tailings and Revegetation Study-is irresponsible and without scientific prudence. This is an unproven technology which proposes to leave the majority of the contaminated materials both in-stream and in the floodplain. This plan does nothing to reduce the concentration of heavy metals in the stream and the surrounding riparian areas and increases the likelihood that arsenic and other toxic heavy metals will eventually interact with groundwater in the area of contamination. The implementation of STARS procedures would result in a direct increase in human exposure to these carcinogenic substances.///ARCO's proposal also does not take into consideration the fact that Silver Bow Creek is a dynamic, functioning stream. ARCO expects that stream to remain in it's current channel and to stay there in perpetuity. This assumption is preposterous. A flood event, such as that which occurred earlier this year at the Opportunity Ponds, could easily push the stream out of its bank and contaminate additional reach segments and floodplains downstream.///For these reasons, it is our strong

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I	70	Kern	Donald	recommendation that you consider adopting Alternative 7, which would remove all contaminated wastes from the Silver Bow Creek floodplain. We also strongly encourage you to further investigate plans which allow for the removal of the vast majority of instream contaminated sediments.///Please enter our comments into the official record and place our name on your mailing list to receive any further information regarding this project."
I	72	Onishuk	Martin	"Regarding the cleanup of Silverbow Creek, I favor Alternative 7--removal of all contaminated soil--but I will settle for Alternative 6--removal of about 80 percent.///Anything less than Alternative 6 has no hope of long-term mitigation of these mining wastes and we all understand that. Streambank cutting and surface runoff, which are a natural part of our riparian ecosystems, will quickly expose and transport into the stream contaminated soils allowed to remain under plans like Stars."
I	73	Maloney	Joe F.	"There is only one way to clean it up and that is completely. Let's use the "States Proposed Plan" alternative "7".///If you wanted to save your life by cutting off your gangerenous leg, you wouldn't cut off 80%. Let's clean the CREEK 100%. ARCO NO"
I	74	Kinyon	Mr. & Mrs. W.R.	"I urge you to Support Alternative 6 or 7 to clean up Silver Bow Creek.///I own property on Pend Orville Lake near the mouth of the Clark Fork River. I hope you will be able to protect the Clark Fork River basin in its entirety."
I	75	Parodi	John A.	"With regard to the clean up of toxic sediments and tailings at the headwaters of the Clark Fork River, I support the state's alternative 6 plan, although I believe that alternative 7 would be better. It is very important that contaminated tailings and soil be as completely removed as possible in order to ensure the permanent protection of water quality and human health."
I	76	Turman	Kathleen & George	"Regarding the Streamside Tailings site of the Clark Fork River we strongly support the Alternatives 6 and 7 of the State's Proposed Plan, with 7 being preferable.///We are persuaded that the likelihood of Silver Bow Creek's meandering makes the removal of contaminated soil necessary. Nothing short of soil removal can assure useful reclamation."

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I	76	Turman	Kathleen & George	
I	77	Herbert	John M.	"I am writing to express my support for the States plan to "fix" Silver Bow Creek. I strongly support Alternative 6 as the preferred relcamation choice for rehabilitating this drainage.///I hope you stick to your gun and get ARCO to do the job right to prevent future "re" contamination, should an incomplete restoration happen."
I	78	Childers	Robin L.	"I wish to take this opportunity to tell you that I support that State's commitment to cleaning up Silver Bow Creek through the implementaiton of either Alternative 6 or Alternative 7.///My only concern regarding Alternative 6 is that it does not go far enough with regard to removal of the tailings and impacted soils from the 100 year floodplain. I think that failure to remove all of tailings and impacted soils puts future water quality unnecessarily at risk.///The only way to ensure that metals do not eventually enter the stream is to remove them. ARCO may be willing to gamble that high water and normal meandering of Silver Bow Creek will not have devastating effects in the company's lifetime, but as a Montana resident, I am not willing to take this risk now or ever. Silver Bow Creek will meander and someday it will overflow into the floodplain. The lingering question regarding these changes to the stream doesn't begin with "If." The questions begins with "When."///It's time to restore Silver Bow Creek to biological health and it's important that we do it right while we can.///I'm pleased with the state's efforts to put forth a reasonable and considerate plan of aciton and I support Alternative 6 or 7."
I	79	Zimet	Andrew	"I am writing to register my support for Alternative 7, the plan which would remove all contaminated mine wastes from the Silver Bow Creek flood plain. This is the best way to ensure permanent protection of water quality and human health."
I	80	Kemmis	Daniel	"I wish to comment the Montana Department of Environmental Sciences and the U.S. Environmental Protection Agency for the professional work the agencies have performed in developing the proposed plan for the Streamside Tailings Operable Unit. I am pleased that your agencies have recognized the important principles of achieving a permanent and effective remedy for this site, and that you have recommended the removal of the majority of tailings and contaminated soils and streambed sediments from the site. At the same time, I have significant reservations regarding your preferred alternative number 6, and

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I	80	Kemmis	Daniel	strongly urge you to implement Alternative 7, which includes plans for the complete removal of tailings impacted soils along Silver Bow Creek.///Missoula local government has consistently commented to your agency and the U.S. Environmental Protection Agency on matters concerning the cleanup of the Clark Fork Superfund sites. We have requested that your agencies proceed with cleanup measures that will effectively and PERMANENTLY remediate contaminated areas in the upper Clark Fork watershed. Such measures are necessary to protect the health and welfare of the residents of Missoula, which lies at the downstream end of the upper Clark Fork watershed.///I do not support the agencies' preferred alternative 6 because of its reliance on revegetation techniques in place of tailings removal. The agencies' proposed plan suggests revegetation of the farthest downstream portion of the site, which lies in closest proximity to the Clark Fork River and Missoula County.///I oppose the use of revegetation techniques because they will not effectively immobolize metals over the long term. Revegetaiton may succeed in temporarily beautifying the area. But in the long-term, floods will occur, the stream channel will meander, and tailings will once again be distributed downstream, accompanied by a release of metal contaminants into the headwaters of our watershed. In fact, the revegetation techniques may lead to increased mobility of contaminants such as arsenic and possible cadmium and zinc. This concerns us, because arsenic contamination has already occurred in the Milltown and Missoula Aquifers.///The release of contaminants in the upper Clark Fork watershed has resulted in groundwater contamination and damages to aquatic resources in Missoula County. If the contaminants along Silver Bow Creek are not removed from the floodplain, we anticipate continued re-contamination of the Milltown Reservoir, Clark Fork River, and Missoula Aquifer, despite any measures which may be taken to clean up current contamination at those sites.///I certainly do not oppose the concept of a greenway along Silver Bow Creek, but suggest that it be constructed FOLLOWING tailings removal, not INSTEAD OF tailings removal.///Please carefully consider my support for Alternative 7."
I	81	Smith, PT	Richard L.	"I am writing you in regards to the Silver Bow Creek Superfund clean up. PLEASE SUPPORT ALTERNATIVE 6 OR 7 because removal of these contaminated tailings and soils is the best way to ensure permanent protection of the Clark Fork river basin.///Thank you very much for your consideration."
I	82	O'Connor	Roy	"I wish to give full support to the states plan, called Alternative 6, to clean-up the toxic sediments and tailings at the headwaters of the Clark Fork river. I understand that the state is close to an agreement with ARCO, and hope this is completed in a short time.///I have seen some information on the alternatives, being 6 and 7. I would prefer to see Alternative 7, which would include removal of all the

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I	82	O'Connor	Roy	tailings and impacted soils, as well as in-stream sediments. I understand however, that you must reach an agreement, and if necessary to go with Alternative 6, I fully support this as well.///Like many residents of Montana, I use the Clark Fork river for fishing and floating. I would look forward to seeing this river come back to its previous good health. I congratulate the state on their efforts to make this possible."
I	84	Koons	Richard A.	"I strongly support Propositions 6 and 7. It is extremely important that tailings/impacted soils be removed as much as possible and lime tilled into the soil to reduce the mobility of some of the metals remaining. All fine-grained sediments should be removed. Contaminated Railroad Materials should be removed or covered where they threaten water quality.///The safety and quality of our public water supply depends on the proper clean-up of all toxic sediments and tailings at the headwaters of the streams that furnish water to our cities, towns, and homes."
I	85	Griffin	Jim	"Please put me on record supporting Alternative 6 cleanup of Silver Bow Creek. Anything less is simply passing the cleanup on to the taxpayer of the future because it must be done now by ARCO or then by the government.///I recently flew over the section in question and was impressed by the lack of any vegetation over wide areas along the creek. Hydro action will eventually move these contaminants to water systems, private or public, downstream affecting public health into the next millinnium.///I really believe that Alternative 7 would save lives and health but I recognize that even Alternative 6 will be very expensive and difficult to accomplish. I am willing to compromise to this level.///Thank you for enforcing the environmental laws and being willing to bring this stream back to life."
I	86	Hammer	William & Audrey	"Because our home is located a quarter of a mile downstream from the confluence of the St. Regis River with the Clark Fork River, we are vitally concerned about the health of the Clark Fork River at our homeiste and more particularly about the Clark Fork headwaters and its stream tributaries. /// Therefore, we applaud the State's proposed plan Alternative #6 and while we feel that Alternative #7 is the preferred choice, we accept the political realities and totally endorse Alternative #6. /// We bought our property on the banks of the Clark Fork River in 1971 and subsequently built our retirement home and as natural born citizens, we decry the few hundred million of ore taken out and proposed cleanup costs which far exceed the value of the minerals extracted - irresponsibly. It's too bad that we can't go back in time and file liens against the copper barons who exploited our resources."

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I	86	Hammer	William & Audrey	
I	87	Weight	Willis D.	"I haven't been able to attend very many meetings, but since the public comment period is nearing an end, I did want to respond. /// 1. STARS - stars technology looks promising; however, the long terms effectiveness seem doubtful to me. Once the lime or crushed limestone have been coated with ferric hydroxide precipitate, it will loose its effectivenes. The technology works. The test plots look great, but will the various mixtures persist over tem or more years. This is a tough one to prove. Certainly, its technology should be used, but not as a soul source answer. It seems that, where large areas of easily removable tailings exist (greater than two-three feet thick?), they should be excavated. In areas where the tailings deposits are thin or otherwise difficult to excavate, STARS technology may prove to be a best second choice. /// 2. Many or few repositories? - What are the costs involved? How will each repository site me controlled or maintained?. Having 15-30 sites would reduce the overall size and haul distance; however, what kind of personnel and equipment would it take for maintenance? To me it does not matter, but the preference would be to have one or two larger repositories. /// 3. Land use restrictions along SBC - Does anyone really know what the land uses along Silver Bow Creek were before mining took place? Who will own and maintain the properties? If there are to be public walking and biking trails, soccer fields, or Frisbee courses, these should be open to the public. Other areas that will be used for grazing and agricultural uses could be restricted by the property owners. There should be some public "park-like" uses. /// 4. Regional repositories - Since the Opportunity ponds and Berkeley Pit areas are already regionally impacted tailings areas, why not use these. The potential for better land use (commercail or residential) exists at the Brown's Gulch and Ramsay Flats areas. /// 5. Both of the regional sites mentioned in No. 4 could be easily accessed by rail. This is preferable."
I	88	Capps	Paul	"When making the final decision regarding the Streamside Tailings Operable Unit, I would ask that you ignore this letter. Ignore this and all the other letters and opinions you will receive from: /// heads of Local Development Corporations; members of local and state Chambers of Commerce; Chief Executives, Planning Directors, County Attorneys, Commissioners and other local government officials; politicians; so called "Reclamation Advocates"; Golf Course Promoters and Pimps; corporations - (MERDI) seeking cheap sewage treatment solutions for Butte/Silver Bow and pushing private economic development opportunities in the guise of a "Greenway"; any current/former employees of MT Tech and the Cow College (MSU) or any other bastion of "higher/hired education that receives grants or funding from the PRP; former ACM plant superintendents; editors/publishers of the Montana subStandard; ... /// ... and all the other spin

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I	88	Capps	Paul	doctors and ARCO apologists whose names litter all of the public hearing transcripts and ROD's that the EPA has issued on the Clark Fork Superfund Operable Unit. /// The truth of the matter is that public participation in the remedy selection process is, in fact, a fallacy - a distortion - an out and out lie. To prove this contention one need only attend a public information meeting. Is an average attendance of 25-35 people really indicative of "public" participation? And look at the Public Responsiveness/Comments section of any ROD. If you consider the affiliations of most of these people, there is a further decline in "public" participation marked by the increased participation of individual members of special interest groups. The special interest groups represented there and at the public hearings have obvious agendas. They only crawl out from under their rocks when there is potential personal economic gain at stake. So, when their benefactor (the PRP) faces the higher costs associated with true restoration, (as in SST/OU) their participation and chicanery increases comensurate with their perceived loss/gain. If the opinions of these groups and the individuals that they hide behind are given as much consideration in remedy selection as the EPA claims is due the public, then the process has not only been subverted, it is perverted. /// The very nature of this process, (with the overwhelming amount of information necessary to fully understand the issues plus seemingly conflicting "scientific" opinions/conclusions etc.) participate in Superfund. /// If the Superfund process wasn't complicated enough in and of itself, the Montana subStandard has chosen to return to its old "company paper" (ACM) ways in an effort to sway public opinion. By artful editing of articles from other sources -3/10/95, 6/17/95, 7/7/95 etc.' distortion of facts - 6/21/95; and attacks on groups and individuals - 6/11/95 - with different views and opinions; the subStandard has succeeded in turning the SST vs Greenway proposals into the most contentious and vitriolic debate yet on restoration policy. It is one thing to have a bias, but the way they have conducted this latest campaign must rank as one of the low points in Montana journalistic history. By further complicating and compromising the remediation process, they have done a great disservice to all of the people of Montana on both sides of the issue. However, resignation in disgust should not be interpreted as apathy - and the opinions of a few should not be give precedence over a majority whose participation has been precluded. /// I question the logic and ethics of any group or individual who is playing an end game wherein any restoration plan that does not result in something "useable" that can be further expoloited for economic gain is considered "exorbitant", "short - sighted", "bookish and too scientific" and "technically unfeasible". Those making these claims are the direct descendants of the poeple whose greed turned Silver Bow Creek and the Clark Fork River into an industrial sewer in the first place. These people are not interested in returning a resource to a natural state or righting a wrong. Their only concern is the further exploitation of a natural resource. These people view all nature as a commodity - something to be used and developed. Unless they can "get" something from restoration they see no value in it. /// We must

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I	88	Capps	Paul	learn to appreciate the intrinsic value of a thing. The land and waters of Silver Bow Creek and the entire Clark Fork Basin is in and of itself something of great value to all people. The goal of any proposal regarding SST/OU should be returned to its natural state and to the purpose for which its creator intended - to create and sustain life. Those who see some other raison d'etre and have a "vision" of what could or should be - have no place in this debate. /// Therefore, in order to restore this ecosystem and prevent any future recontamination, the tailings must be removed form the floodplain. The recovery and future health of the entire Clark Fork River Basin is dependent upon a thorough and permanent cleanup of the SST/OU. The question then becomes - what to do with the contaminated soils? Answer, return to sender - Butte/Silver Bow. This may seem to be a simplistic reply to a complicated problem, but it is no more ludicrous than the asshole who suggested Browns Gulch as a repository. No area that is contaminated should be sacrificed for convenience or economic considerations. Anaconda/Deer Lodge should not be forced to accept any contaminated material that was not generated within this county. Since Subarea 4 contains more tailings and impacted soils than any other area, a more thorough cleanup should be considered for this area. If and when such a cleanup were implemented, it would then be acceptable to transport that and only that contaminated material by rail to the Opportunity Ponds. Any short term risk associated with removal and transport of waste materials is clearly offset by the benefits of reestablishing the aquatic and riparian ecosystems, and the long term protectiveness that removal guaranties. The use of any technology (STARS) that has limited potential in the kinds of vegetation it supports and whose long term stability has yet to be proven should be used with caution. Any liability for the failure of STARS in areas where it is used in place of removal rather than in conjunction with removal should be shared not only by the PRP, but by any agency; county; or landowner who allows this use. /// I could go into further detail about what approach I support or reject, but there really is no point. As with other sites in this area (specifically Warm Springs Ponds OU), the public is presented with a conceptual plan or "inital proposal" that we are asked to agree/disagree/comment on. By the time the accepted proposal goes through the design phase of the process, it often bares little resemblance to the concept that the public was asked to accept/reject. This is public participation by default, and leaves citizen and bureaucrat alike - pissing in the wind. /// In the end, those in positions of power (political but most often economic) determine what "solution" will prevail and what compromises will be made. I can only urge you to base your decision on the NCP Criteria. Ignore the emotion and rhetoric. The laws that guide your decision (NCP; CERLCA; state and federal ARARS; etc.) together with the laws of nature are the bases of a good choice. Add the good science and a little common sense and foresight and I'm semi-confident that you will make the right decision. Stand firm on the key elements of the Preferred Alternative - for the sake of the future of the entire Clark Fork. Good Luck!"

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	88	Capps	Paul	
I	89	Blackwood	Traci	"I understand you are accepting comment on the suggested plan for remediationn of Streamside Tailings. I have followed some of the coverage, and as a citizen of Butte, have some opinions I would like to share. /// I support ARCO's proposal for the following reasons: /// ■ It meets EPA's requirement to reduce the risk to human health and the environment. /// ■ It is cost effective and provides long-term protection. /// ■ It allows the community to use the land in just a few years. /// ■ It could be completed in under 5 years, with little disruption to the community. /// ■ It is a remedy. A repository just "relocates" the problem, to be dealt with at a later date. /// In addition, I have the following concerns about the States' plan: /// ■ The risk of injury to the workers involved in the removal. /// ■ The number of loads that would be necessary would be disruptive to the community. /// ■ Wear and tear on the roads used to haul the soil would be a liability to the community. /// ■ The costs associated with moving the tailings are immense. /// ■ The length of time it would take to complete the clean up is much longer (4-15 years). /// STARS should be utilized to the greatest extent possible. My biggest concern is the moving of tailings to another location. I see mving the tailings to a repository as a quick-fix, not a long-term solution. STARS is, at the very least, a proactive approach. We may learn years down the line that there are better alternatives, but only by attempting to find solutions now. If the tailings are buried, we may never know if there are better solutions. And with any luck, STARS may be the best answer. Mining will always be part of industry in Montana, and we need to find ways to control the by-products. /// I commend the efforts of the State of Montana, the EPA and ARCO in finding alternatives to the pollution created by many years of mining. However, I don't want to see this "buried". Please find a way to correct the problem; don't leave it in some hole in the ground for another generation of Montanan's to tackel. /// I hope you will take into consideration my comments and those from the rest of the citizens affected by this decision."
I	90	Farling	Bruce	"The Montana Council of Trout Unlimited (Montana TU) appreciates the opportunity to comment on proposed remediation for the Streamside Tailings Operable Unit. The Council represents 13 Trout Unlimited Chapters or affiliates in Montana. Collectively they represent nearly 1,800 individual TU members. These comments have been prepared after consulting with two of our local Clark Fork-oriented chapters, Goerge Grant and Westslope. Both may be submitting additional comments.///Trout Unlimited has long been involved in issues relating to water quality and fishery habitat in the Clark Fork basin. I've personally been involved in Clark Fork Superfund issues since the mid-1980's, and in other Clark Fork environmental matters for a number of years before that. I know many of the Superfund sites first hand,

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I	90	Farling	Bruce	including the Streamside Tailings Operable Unit. I'm confident I have a good idea of what needs to be done to permanently reduce the pollution to acceptable levels.///Montana TU believes Alternative 6 goes a long way to correcting problems along Silver Bow Creek, while also reducing the migraion of contaminants downstream to acceptable levels. Alterantive 6 also helps ensure that the Warm Springs Ponds can be retired someday, and that their contaminants will be more easily dealt with permanently. Alternative 6 allows the state to better achieve Montana TU's goal for the upper Clark Fork. That objective is to create and sustain a reproducing wild trout fishery of the size and diversity that fits the river's biological potential.///We have compared the various alternatives against the basic Superfund cleanup criteria of permanence and effectiveness. A modified Alternative 6 achieves these criteria within reasonable bounds of cost-effectiveness.///WHY A MODIFIED ALTERNATIVE 6 IS THE BEST OPTION.///It removes the majority of contaminated material from the floodplain, thereby eliminating the risk of in-situ tailings and contaminated soils from recontaminating the stream following land-use changes, floods or reduction/oxidation in the vadose zone.///It removes a good portion of the bed sediments with the highest concentrations of metals (the fine-grained fractions).///It eliminates contaminated materials from railroad crossings and other areas where there are known concentrations of tailings along the rail right-of-way.///It effectively eliminates a major source of the contaminated material that is mgrating downstream to Warm Springs Ponds and the upper Clark Fork River.///It reduces contaminants in Silver Bow Creek, thereby improving the ponds' effectiveness for removing metals before they reach the Clark Fork.///It protects the investment made in upgrading the ponds system.///It is indisputable that removal of contaminated tailings from the floodplain is a proven, effective way of eliminating a pollution source to a stream. (Unlike alternatives that recommend leaving material on-site).///It ensures a broad spectrum of post-cleanup land-uses will be feasibly without risk re-contamination.///It is consistent with, and even improves on, goals for a greenway.///It ensures Silver Bow Creek has the potential for producing wild trout for local anglers and for recruitment to the Clark Fork.///It helps create conditions for wild trout production, which is far more cost-effective and beneficial to anglers and the local economy than maintaining a fishery through hatchery supplementation.///It passes little risk on to future generations.///It helps ensure that the Silver Bow Corridor can be used for more land use activities than if tailings and contaminated soils are left in place, thereby producing larger tax benefits to local government.///It produces more jobs than alternatives that leave the materials in place.///SUGGESTED MODIFICATIONS FOR ALTERNATIVE 6///We endorse the state's removal/STARS criteria, with these modifications:///STARS should not be used on any materials left on-site with elevated levels of arsenic. If STARS is needed to immobolize other metals, but arsenic is present, the material should be removed. This will be the best source control for reducing contamination to drinking water.///No contaminated material should be left in the active

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I	90	Farling	Bruce	floodplain. This is being contemplated in Subarea 4, for example, but it ignores the basic reality that these materials were deposited by floods in the last 100 years and they are therefore likely to be entrained and deposited downstream in the future.///In addition:///the design and operational phases of removing contaminated sediments should be coordinated with cleanup activities upstream, to ensure once the stream bed is clean it stays that way.///ADDITIONAL COMMENTS///Because STARS has yet to pass scientific muster as a permanent remedy for eliminating metals sources--especially the uncertainity of its efficacy in immobilizing cadmium and zinc and its potential for mobilizing arsenic -- it should NOT be a prime element in final remediation. It also should not play a prime role in the final remedy because its effectiveness will be undermined by morphological changes in the floodplain.///All STARS applications should be subjected to rigorous monitoring and alternative plans developed for dealing with areas where it fails.///Opportunity Ponds should be the preferred repository for the materials. The amount of material that will be removed under Alterantive 6 (even with our suggested modificaitons) will amount to less than 1 percent of the total currently found at the Opportunity Ponds. Given that, the addition of this material offers little if any additional impact to local groundwater in the pond area. Using the Opportunity Ponds as a repository should make sense to local communities because:///the additional material is like adding a needle to haystack, and it is already a hazardous waste site.///Containment of the material will be engineered to minimize, if not eliminate, any risk to local water quality.///Risk to local groundwater and air quality at Opportunity already exists and will not be compounded.///Using the ponds as a repository could increase monitoring of local groundwater///any incremental risk to local groundwater presented by increasing the waste volume by less than 1 percent is far outweighed by the public health, environmental and economic benefits of a clean Silver Bow Creek not subject to risky in-situ remediation.///Opportunity Ponds will be the object of future Superfund remedation.///The existing rail system can be used to transport the material.///Rail transport should be the preferred way of moving the material. A system is in place that can be modified with minimal disruption and additional risk to locals.///Though the initial investment (the cost of removal) is more expensive than leaving the material in place with STARS treatment, its long-term economic benefits make it more cost-effective. It produces higher property values, higher property taxes, more jobs, higher quality water, less monitoring costs, lower-cost fishery management, better protection for downstream investments in cleanup and far less potential risk that future investments will have to be made to correct today's remediation mistakes, which the STARS-only approach poses."
I	91	Morgan	Cindy	"I am writing to you to inform you of my support for Alternative 7 in regards to the clean up of Silver Bow Creek. /// I am a resident of Trout Creek Montana, with my home along the Clark Fork River. My

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I	91	Morgan	Cindy	children swim in the river and fish from its bank. I am very concerned about arsenic from the tailings continuing to contaminate not only Silver Bow Creek, but also the Clark Fork River. ARCO must remove all the tailings and impacted soils from Silver Bow Creek and prevent further contamination of the Clark Fork River. The restoration of Silver Bow Creek must be thorough so the creek can heal and not continue to be detrimental to human health. /// Again I support Alternative 7 which is more protective than Alternative 6, as this may be our last chance to clean up Silver Bow Creek. /// Thank you for your attention to this critical issue."
I	92	Pearce	William B. & Olive M	"This letter is written concerning the efforts to remediate Silver Bow Creek. /// After careful study of the various proposals to do the job, we wish to recommend that ARCO's STARS - (Streamside Tailings and Revegetation Studies) be implemented. /// We find STARS to be well-thought out and well planned in engineering and technology /// STARS will avoid ruining still another piece of real estate. /// STARS is by far the most cost-effective plan offered. It will avoid the high cost of moving tailings by truck or train. /// It will get the job done in a much shorter time frame, and save a great amount of money. /// STARS treats the tailings, while the other suggested projects do not. /// Everyone involved in arriving at the solution should consider: getting an efficient job done at the lowest possible cost. It should be clear to everyone that STARS is the best plan offered."
I	93	Walker	James	"I am writing you a short note to let you know I support the state of Montana's proposed plan to clean up the toxic sediments and tailings at the headqaters of the Clark Fork River, at the Streamside Tailings site. I've read that it is one of the best cleanup plans for a Superfund site. I think the State should be commended for its commitment for the cleanup. /// The State's plan Alternative #7 seems to be a better plan than Alternative #6 because it involves removal of all tailings/impacted soils. But Alternative #6 is very acceptable, also. /// I wanted to give you my position. I appreciate your time."
I	94	Marley	Patrick	"Thank you for the opportunity to comment on the State of Montana's proposed plan to clean up the toxic sediments and tailings at the headwaters of the Clark Fork River, at the Streamside Tailings site. This office has actively participated in environmental actions and has represented numerous environmental organizations both on a national level and a state level. /// We applaud and fully support the State's proposed plan which chooses Alternative Six as the best method to remove the tailings-impacted soils as well as much of the in-stream sediments. Further, we support Alternative 7 should the State decide to

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I	94	Marley	Patrick	change Alternatives as our preferred choice. It is unfortunate that ARCO should choose short-term financial goals over the long-term concerns of the environment in this most beautiful natural resource setting. As a resource user of the Clark Fork River, I am concerned that its headwaters be protected from contaminations by arsenic and other toxic metals and that the fishery be protected and its flood plane not be destroyed forever. /// Thank you for the opportunity to comment on Montana's proposed plan to clean up the toxic sediments and tailings in headwaters of the Clark Fork River. This office remains available for further comment on the proposed project and would appreciate this communication to be considered as part of any NEPA or other environmental documentation concerning this matter."
I	95	Hutchins	Judith	"I am writing in support of Alternative 7 which would provide a quality cleanup of the upper Clark Fork. I would also like to commend you and your staff for the great work the state has done on this sadness."
I	96	Clifford	Gay & John	"We wish to include our voices and opinions with those who support Montana's commitment to clean up Silver Bow Creek. As members of the Clark Fork Coalition we support, specifically, Alternative 6 with the exception that the state should remove all contaminated mine waste from the Silver Bow Creek floodplain as outlined in Alterantive 7."
I	97	Drury	Bill	"I am concerned about ARCO's plan for the Streamside Tailings. I agree with what you have been quoted as saying (in the Montana Standard) that the changes in location of the creek channel over time will erode the banks and wash tailings into the creek. This will happen even if STARS is successful. You can see this happen in a meadow stretch of any low gradient stream - the stream channel is dynamic, it changes location over time, and the bank side material erods into the creek, even when there is good plant growth on the surface. The stream channel may not meander much in Durant Canyon, but it will in Ramsay Flats. /// Thank you for the opportunity to comment on this situation."
I	98	Cooper	Ron	"The Pacific Rivers Council is the largest river conservation and aquatic conservation organization in the pacific Northwest region with a Northern Rockies office located in Bozeman, Montana. The Pacific Rivers Council supports the State of Montana's proposed Alterantive 6 for the clean-up and restoration of Silver Bow Creek except that the removal should include removing all tailings from within the 100-year flood plain as outlined in Alternative 7 (Note; support is for Alternative 6 as modified). The only

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	98	Cooper	Ron	more protective alterantive is Alternative 7.///Alterantive 6 as modified will allow Silver Bow Creek to begin the long-term process of recovery to a healthy stream condition. It incorporates and would accommodate the reestablishment of a health naturally meandering stream, natural expected flood processes and the re-establishment of a natural riparian system. The only way for Silver Bow Creek to meet the biologic, numeric, and narrative water quality standards in order to achieve the required beneficial use is to accommodate these natural processes in the site remediation. Alternative 6 as modified will allow these natural stream restoration processes to begin.///Silver Bow Creek should be capable of supporting native bull trout, westslope cutthroat trout and the full range of aquatic species found in the region. The stream is severly degraded. Native fish and aquatic species will only become re -established if natural stream processes are considered as part of the alternative chosen. The bull trout is currently a candidate for protection under the Endangered Species Act. The westslope cutthroat trout may actually be in worst condition and is likely to be petitioned in the near future. ARARS are required to address the condition of species and specifically any state or federal listings.///Alternative 6 as modified will allow a healthy Silver Bow Creek to become incorporated into the growth and expansion of the Butte community. While a number of CERCLA sites around the nation may be so polluted that little no opportunity exists for a site to become a positive addition to an expanding urban landscape, this is not the case for Silver Bow Creek. Alterantive 6 provides a vision to allow full re-use with little or no future restrictions. ///Alternative 6 as modified will provide a level of certainity to any downstream remediation and the recovery of damages to natural resources such as native fish and aquatic species in the Clark Fork River. The preferred alternative will provide both flexibility and certainity to decisions which will need to be made concerning other down stream sites. Alternative 6 as modified will meet the ARARs requirement to protect public health. Allowing highly contaminated sediments to remain within the hypoheric zone where ground and surface water will annually or on an event basis re-mobolize arsenic violates the spirit and legal requirements of a CERCLA site clean-up.///Alternative 6 as modified will protect aquatic life as required by the Montana and federal water quality laws from chronic and acute toxicity resulting from high concentraitons of heavy metals in the stream. These metals are likely to migrate throughout the entire Clark Fork River system. Even where these metals become bound in bottom or riparian area sediment deposits future storm events may re-mobilize them. The reult would be a continuation of the existing condition where short-term toxic events threaten aquatic life and native fish along the entire River.///Allowing the use of on-site technology that ignores natural processes will not meet the requirement of CERLA to base decisions on ARARS. Even if a determination is made that a short-term ARAR is meant, the Record of Decision (R.O.D.) can not be considered final since any on-site treatment would have a high probability of causing a "release" in any given year. This would require action udner the current R.O.D. and could constitute the basis for a new

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I	98	Cooper	Ron	natural resource damage claim by either the State or the Confederated Salish and Kootenai Tribes. The high probability of a future release from on-site treatment as proposed under the State or ARCO's alternatives that rely on on-site treatment threaten other downstream restoration with releases from Silver Bow Creek. Restoration of the Clark Fork River necessitates a permanent remedy at Silver Bow Creek.///In closing the Pacific Rivers Council supports alternative 6 as modified for remediation of Silver Bow Creek and ultimately restoration of the Clark Fork River."
I	99	Gazzo	Paul	"I am writing to you in regards to the Silver Bow Creek clean up plan. I am in favor of Alternative 6 or 7. If the Silver Bow is to be cleaned up I feel it should be done correctly the first time. Leaving the majority of the tailings in place is just a time bomb waiting for a flood. Please don't back down to ARCO. Thanks for your time and good luck with the continued effort to clean up this superfund site."
I	100	Lunde	Eric	"I am writiing in regards to the cleanup effort at the Streamside Tailings site encouraging you to continue pushing for maximal removal of contaminted tailings in Silver Bow Creek. Alternative 6 which the state currently recommends is a major step to proper cleanup at the area. However I urge you to consider Alternative 7 as the best way to remove the maximal amount of contaminants in the soil. \\\ Keep up the good work of holding ARCO accountable for proper cleanup of the superfund site."
I	102	Hedges	Anne	"The Montana Environmental Information Center (MEIC) commends the Montana Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) intent to chose a long-term solution to the Streamside Tailings Operable Unit (SST OU) contamination. /// A community whose environment has been abused by over a century of pollution deserves permanent long-term solutions and not temporary quick-fixes. Because of the impact these tailings and toxic sediments have had on the community and the environment it is appropriate and just that the DEQ and EPA choose the most effective long-term solution to contamination problems at the site. MEIC therefore supports using existing railroads to move all tailings within the 100 floodplain, to Opportunity Ponds. The STARS technology is simply an inadequate, temporary solution to the contamination of Silver Bow Creek and the floodplain. /// Specfically we would like to respond to the questions posed for public comment in the "Proposed Plan," issued June 1995. /// What are your views on leaving tailings in the floodplain if such tailings are treated with the STARS technology? /// Leaving the tailings in the floodplain would be a short-sited solution and would not be protective of public health and the environment. The STARS technology is relatviely unproven and may

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I	102	Hedges	Anne	not prevent leaching of certain contaminants. Because STARS may fail to immobilze some contaminants and increase mobility of outher contaminants, such as arsenic, this method should not be utilized. /// The movement of Silver Bow Creek is unpredictable, and will meander over time. This will cause contaminants in the soils to erode in to creek waters and will result in recontamination of Silver Bow Creek. Because of this and the fact that the watertable in the area varies over the course of the year and brings the groundwater in contact with the contaminants in the soil, it is only prudent that all contaminants be removed from the floodplain. /// Furthermore, a goal of cleanup should be to eliminate the potential for Warm Springs Pond becoming a repository for contaminated runoff wastes from the Silver Bow Creek floodplain. Anything less could jeopardize cleanup efforts at the Warm Springs Pond. /// Which is preferable, many local near-stream relocation repositories or one or two regional repositories? /// Contaminated soils should be moved out of the floodplain and into one or two repositories. Permanent maintenance, monitoring, and access restrictions would be easier and more cost-effective for the public and appropriate government agencies to oversee at a smaller number of repositories. /// How do you feel about the use of presently uncontaminated areas for waste repositories? /// This would not be logical. Enough of the area has been contaminated that it would be irresponsible to pollute currently unimpacted locations. /// How would you feel about using Opportunity Ponds and/or a location up Browns Gulch for regional repositories? /// Opportunity ponds is the most logical repository for the floodplain waste. The site is already contaminated and the additional soils will have a minimal impact on the large and highly contaminated area. Furthermore, rail transport is already available to haul waste to Opportunity Ponds. /// What are your feelings on the use of Ramsay Flats as a relocation or regional repository? /// All contaminants should be removed from the floodplain and into one repository at Opportunity Ponds. During the last 100 years Ramsay Flats was contaminated by natural deposition. This fact should not be ignored regardless of whether DEQ believes that Ramsay Flats lies either wholly or partially outside the 100 year floodplain. Common sense requires that all contaminants in this area be removed in order to protect the area from future contamination by a similair natural event. It would be short-sited to use Ramsay Flats as a reporitory. /// How significant is the short-term risk of excavating and hauling waste materials to disposal sites in comparison with the long-term risks of creek contamination? /// The short-term risks, if properly minimized, are well worth the long-term solution. The proposal should have a goal of permanent cleanup the site. It would be a mistake to have to revisit this very contentious cleanup issue and it would do the residents in the area a grave disservice. Residents and wildlife in the area need, and deserve, clean water. /// What would be preferable, truck or rail haul to regional repositories? /// Rail transport would be the preferred method of transporting these contaminated materials. Rail has already been used successfully for transporting contaminated soils in the area. This would decrease the potential for accidents on the roadways and therefore

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I	102	Hedges	Anne	conflicts with the public. Most importantly it would save on energy costs, keep air pollution at a minimum and eliminate truck-route risks. /// How would you feel about the use of size as a remedial criteria for in-stream sediments? /// Since the contaminants are largely present in the smaller particles in the stream this is a reasonable choice for remediation. /// What are your views of the remedial action objective of improving Silver Bow Creek to support a self-reproducting trout fishery? /// It is only fair to the citizens of Montana and the environment that this stream be returned to its natural state. A self-reproducing trout fishery would be a logical step toward restoring the area. /// In conclusion, MEIC supports moving all contaminated wastes out of the floodplain and transporting it by rail to a permanent repository at Opportunity Ponds. Using STARS in the floodplain would be a inadequte temporary solution. /// Thank you for the opportunity to comment. /// Sincerely, Anne Hedges, Issue Specialist.
I	103	St. John, M.D.	Robert M.	"I believe the Greenway Project is the best way to proceed. I can't believe trying to move as much contaminated soil as the state wants to move is either safe or cost effective, even ARCO has only so many resources to spend on the project. Why would the people in Opportunity or Brown Gulch or Ramsay want the toxic material dumped in their back yards and to put it North of Butte is to have to deal with it again in 50-100 years when it is redeposited in Silver Bow Creek. /// It has be in its present location for the last part of a century. STARS may or may not work but it appears ???, planting over the contaminated areas stabilizes them and if the stream bed can be stabilized and I believe there can be along, then the Greenway project has a much better chance of ??? this land to a safe protective area. All the moving of the soil, as the State wants to do, is ? it will simply be put ? in litigation and limbo and I'll never see any ? for clean up in my life time. I can't believe the ? anyone and simply makes the state out to be an obstruction to any progress in the near future. /// I can't believe moving the matieral by truck is safe & by rail limits the ? so much as to make it unfeasible. Treating it in place and improving the area is the only logical way to proceed."
I	104	Strong, MD	Paul T.	"I am writing to let your know that I heartily support Alternative 6 or Alternative 7 to clean up Silver Bow Creek. /// Please help to save this stream, & to remove hazards to future humans as well as fish. /// Thank you, Paul T. Strong."
I	105	Stewart	Robert F.	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	105	Stewart	Robert F.	"The U.S. Department of the Interior has reviewed the Proposed Plan for the Streamside Tailings Operable Unit, Silver Bow Creek (original portion) Superfund Site, Montana, and has the following comments. /// General Comments /// We support the selection of a cleanup alternative that provides effective long-term protection of human health and the environment. This protection requires eliminating exposure to deleterious concentrations of hazardous substances. Alternative 7 (total removal of tailing/impacted soils, total removal of in-stream sediments, limited removal of railroad materials, consolidation in a regional dry repository and source control for ground water) would eliminate such exposure and thus provide the most effective long-term protection of the Silver Bow Creek riparian and aquatic ecosystems, as well as for Grant-Kohrs Ranch National Historic Site and public lands administered by the Bureau of Land Management. /// The State's preferred alternative (Alternative 6) would not remove all contaminated material, but rather relies on the Streambank Tailings and Revegetation Study Technology (STARS) treatment to immobilize the contaminants along certain reaches of Silver Bow Creek. Although the STARS demonstration areas along the Clark Fork River appear to be successfully revegatated and are being recolonized by riparian/wetland species, the natural meandering of Silver Bow Creek may cause erosion of the contaminated materials into the Creek. The metals associated with these materials would then be available for uptake by both benthic and water column organisms. /// A component of the proposed plan calls for approximately 540,000 cubic yards of tailings to remain in place and treated with STARS if equivalent performance can be demonstrated to comply with applicable or relevant and appropriated requirements (ARARs). If it can be demonstrated that all the tailings/affected soils that are to be left in place and treated by STARS will not be eroded into Silver Bow Creek, then we would agree that Alternative 6 would provide environmental protection equivalent to Alternative 7. If, however, such equivalence cannot be demonstrated, then the tailings should be removed as called for in Alternative 7. /// The Department agrees with, and fully supports, the remedial action objective of improving Silver Bow Creek to support a self-reproducting trout fishery. Fulfilling this objective will require not only the elimination of exposure to deleterious concentrations of hazardous substances, but also reducing non -chemical stressors, as discussed in the Baseline Risk Assessment. /// Fish and Wildlife Resources /// Riparian, aquatic and uplant habitat restoration alternatives were not discussed in the Feasibility Study. For the remedy to be protective of the environment and to comply with the applicable or relevant and appropriate requirements, these habitats must be restored as an intergral part of the remediation. Habitat restoration alternatives should be fully evaluated during the remedial design phase. /// Grant-Kohrs Ranch National Historic Site /// Grant-Kohrs Ranch National Historic Site, administered by the National Park Service, is located adjacent to the City of Deer Lodge on the Clark Fork River within the Milltown Reservoir/Clark Fork River Operable Unit. The Ranch has historically been the recipient of upstream hazardous tailings and contaminants that have been and continue to be released to the Clark

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I	105	Stewart	Robert F.	Fork River. The primary vector of contaminant release affecting Grant-Kohrs include Silver Bow Creek in the SST OU, as well as the Warm Springs Ponds area and the Upper Clark Fork River and floodplain. In order for response actions to occur and be effective at Grant-Kohrs Ranch, a permanent and resilient remedy must first be implemented in the SST OU. /// Grant-Kohrs Ranch and the Clark Fork River must be protected from recontamination. The short-terms risks associated with implementing the proposed plan, i.e, removing the majority of tailings from the floodplain, are justified relative to the long-term risks and continued exposure associated with leaving the tailings in the floodplain even with STARS treatment. Any alternative to merely relocate and treat contaminants in the floodplain poses unacceptable risk to resources and human health downstream at Grant-Kohrs Ranch. The dynamic flows of Silver Bow Creek and the Upper Clark Fork River provide empirical evidence that any contaminants left in the floodplain will be re-entrained and redeposited downstream. STARS treatment will not adequately protect against recontamination from erosion associated with overbank flows and natural stream meandering, and saturation of soils and tailings from fluctuating ground water levels and flows. /// Public Lands/// The Bureau of Land Management does not manage any suface lands in this operalbe unit. The BLM lands are located downstream below Gold Creek along the Clark Fork River. Silver Bow Creek was a source of contaminated sediments for the public lands downstream before the Warm Springs ponds were constructed. Remedial actions at the Streamside Tailings Operable Unit will help prevent contaminated sediment from moving downstream to the public lands. /// The long-term risks of leaving contaminated tailings in the Creek are more significant than the short-term risk of excavating and hauling the tailings to disposal sites. /// Summary Comments/// We believe that Alternative 7 provides the most effective, permanent, and environmentally-protective remedy. However, if it can be demonstrated that the tailings/affected soils to be STARS-treated will not enter Silver Bow Creek, Alternative 6 may be equally protective. /// Signed Robert F. Stewart"
I	106	Watson	Vicki	"I congratulate you & the rest of the state team for the rational approach you developed to evaluate which mine wastes should be removed from Silver Bow Creek & which should be treated in place. The criteria developed by the state are based on both science and common sense. By proposing these scientifically defensible criteria and allowing criteria to select what to remove and what to treat, the state has clarified the scientific and economic issues and helped us see more clearly the costs and benefits of varying levels of removal and treatment. /// I am convinced that the state's criteria have selected for removal those mine wastes which pose the greatest risk to Silver Bow Creek, the Clark Fork River and human health. The tailings which the state proposed to treat in place in Alternative 6 do pose a lesser threat than those proposed for removal. /// However, a rational argument can be made that

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I	106	Watson	Vicki	any wastes deposited by the stream can be eroded by the stream in a flood similar to the one that deposited the waste. When, not if but when, this waste is eroded, it may undo the efforts put into removing the contamination in the stream bed. /// So the state should have a strong argument to convince the public that land which was in the floodplain when the wastes were deposited by the creek is no longer in the floodplain. If the state cannot provide good evidence for this shifting floodplain, then all wastes transported by water should be a priority for removal. /// For exmaple, in the Ramsey Flats area, the state has concluded that some wastes extend beyond the 100 year flood plain. The floodplain was probably estimated using a flood model that assumed unobstructed flow. However, ice dams or debris dams can cause flooding over a much larger area, and we must plan for such events. /// If after considering the risks of erosion from a flood broadened by such debris dams, the state still concludes that 20% of the wastes should be treated in place, this in place treatment should be treated as an experiment. There must be a commitment to long term monitoring of the effectiveness of this treatment. By effective, I mean instream water quality standards and groundwater standards must be achieved. Not just that grass grows on the site. Remember that STARS is still an experimental technique, not a proven technique. Short term effectiveness studies are still in progress, and long term studies require a long term commitment. /// STARS may prove to be an effective technique that can be used on aerially contaminated sites in the Upper Clark Ford basin and at other mine waste contaminated sites that meet the criteria set by the state. We have an opportunity to find out by using STARS on those sites that Alternavite 6 proposes to treat. /// I am somewhat concerned about the plan to remove contaminated material from the streambed. The discussion of this procedure was inadequate for me to evaluate its effectiveness and its potential impacts. The fraction identified for removal is likely a significant source of contaminants. However, the stream bed may be recontaminated by contaminants washing down from Butte, suggesting that streambed cleanup wait until the Butte area is better stabilized. Unfortunately, logistics seem to dictate that the streambed cleanup proceed with the removal operation. Given this dilemma, I can only urge swift work on Butte area remediation. /// In sum, I support the state's approach and its preferred alternative 6 with these caveats: 1) The state should show why wastes deposited by floods are not in the floodplain and reconsider the floodplain in light of debris dams. /// 2) Any STARS treated areas should be treated as experiments with a commitment to long term monitoring of thier role in the achievement of water quality standards. In addition, ARCO should sign a separate agreement with the state (outside of Superfund in which long term commitments may change) to conduct removal at these sites if long term studies show that these sites prevent attainment of water quality standards. /// 3) Removed wastes should be transported by rail to reduce fuel costs and impacts to local communities. /// 4) Given the large size of the Opportunity Ponds, it is the logical repository for these wastes. /// 5) I must reserve my support of the streambed cleanup until more details of the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	106	Watson	Vicki	methods to be used are clear. /// Respectfully submitted by, Vicki Watson."
I	107	Ellerman	Edward	"Thank you for all your efforts to come to the decisions presented in your proposed plan. /// Having heard Sandy Stash repeatedly say ARCO wanted to get it right the first time. I don't under stand their objections to Alternative 6. The Gully Washer Rain of July 10 near Miles Crossing convienced me STARS is not 100% safe. /// I would prefer the 1 repositories rather than as many as 30. The idea of using Ramsay Flats is better than Brown's Gultch. /// In our cemetaries we are required to put body in casket then seal that in 4" concrete to protect the water. I wonder if a concrete retaing wall to prevent movement of respositorie might be in order. /// I feel that county, state, or federal agencys intimidating private property owners is in violation of my basic constitunal right's. As far as I'm concerned ARCO should clean up the mess and existing land owners should have surface control period!. /// I very much encourage use of rail to it's max. /// Signed Edward Ellerman.
I	108	Murphy	Pat	"I am writing you in regards the Silver Bow Creek cleanup plan. It is very encouraging to see a proposal such as alternative 7 being promoted by your state agency. I am very much in support of this proposal. I feel it is high time we begin the process of leaving these mining messes closer to the way we found them instead of poison disasters that contaminate every thing and everyone for miles around. The technology is available to return this area to its natural splendor and I feel that those who benefited from this mess should be held financially responsible for the cleanup. Thanks for your time and keep up the good work! /// Sincerely, Pat Murphy."
I	109	Casick	Steve	"I support the Clean up plan for Silver Bow Creek. /// Thank you, Steve Casick."
I	110	Casick	Matt	"I support the State Clean up plan, for Silver Bow Creek - /// Thank You, Matt Masick."
I	111	Casick	Agnus	"I support the State Clean up plan for Silve Bow Creek. /// Thank You, Agnus Casick."
I	112	Lockwood	Gretchen	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	112	Lockwood	Gretchen	"I am writing to show my support of Alternative 6 because removal of contaminated tailings/impacted soils is the best way to ensure permanent protection of water quality and human health at this site. /// Thank you, Gretchen Lockwood."
I	113	Schubert, D.D.S.	Roger S.	"Please act to save Silve Bow Creek - and give your support to Alternative 6 or 7. /// Your action will benefit all of us. /// Thank you, Roger Schubert."
I	114	Manning, Planning Directo	James M.	"Regarding the preferred alternative on Streamside Tailings Operable unit, it is the Anaconda-Deer Lodge County Planning Board's opinion that the "Greenway" concept must be considered in any alternative. It is the Board's feeling that the end use of any alternative chosen must be considered. The use of the land must be productive, even if institutional controls regulate the use. It is ot necessary for the land along Silver Bow Creek to be used as residential, in fact the Land Use Plan for Anaconda-Deer Lodge County recommends that set-backs be in place for all waterways in the County, not just in the Superfund areas. /// Sincerely, James M. Manning, Planning Director."
I	115	Ballard	Bill & Lee	"I write regarding Superfund cleanup on Silver Bow Creek. /// It is imperative, especially considering Silver Bow Creek's role as headwaters of the Clark Fork River, that cleanup be thorough and sure. The plan designated Alternative 6, which entails removal of the offending wates, meets the criterion. The cheaper alternative advocated by ARCO, which can fairly be said to consist of some chemical treatment and a great deal of trusting to luck, does not. It is improtant to opt for no less than Alternative 6. /// Current law favors us by recognizing ARCO's responsibility in cleanup. It is to be hoped that real cleanup, by ARCO, can be in place before that aspect of the Superfund law changes (as I fear it well may). /// Thank you for your attention to my thoughts. /// Sincerely yours, Bill and Lee Ballard."
I	116	Stebbins	Hannah	"I am very concerned about Silver Bow Creek. I believe that the toxic sediments and tailings should be cleaned up immediately. The creek is currently so contaminated by arsenic and toxic metals that its waters do not support fish or vegetation. This is extremely sad to me. Montana's scenic wildlands are rivers are the backbone of our health and our economy. /// I support the state's efforts to clean up Silver Bow Creek. I urge you to continue your efforts and in addition, adapt Alternative 7 which would remove all contaminated mine wastes from the Silver Bow Creek floodplain. This is the only way to

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	116	Stebbins	Hannah	ensure that Silver Bow Creek will be permanently clean. Thank you for your time. Sincerely Hannah Stebbins."
I	117	Marangelo, Resource Speci	Glenn	"We would like to commend the state's proposed cleanup plan for Silver Bow Creek, possibly the most polluted tributary of the Clark Fork River. Although in agreement with the actions presented within Alternative 6, we urge that the stronger, more thorough clean-up measures presented with Alternative 7, which would remove all contaminated mine wastes from the Silver Bow Creek floodplain, be given adequate consideration. We view Alternative 6 as achieving the minimum acceptable cleanup. We believe that the removal of all contaminated waste from the floodplain is the only way to fully restore Silver Bow Creek and meet Superfund requirements in attaining a permanent and effective cleanup. /// As proposed in Alternative 6, the use of STARS treatment would be suitable within subareas 2 and 4 of the operable unit. Although it is maintained that STARS treatment would be appropriate for these areas, we are concerned that in the long run, effective protection of the subareas would not be maintained. Even when properly used, STARS does have serveral limitations: /// Use of STARS treament actually increases arsenic mobility (a major human health concren of this site). /// Metals like cadmium and zinc are not completely immobilized using STARS. /// In order to maintain site protection, STARS treated areas must be restricted from future land uses which can potentially disturb the area. These stresses include grazing, irrigated agriculture, residential development, and recreational uses. /// As identified by the state, STARS treatment works best only in the top 6 inches of soil. Due to its ineffectiveness below two feet, STARS treatment will not allow trees to grow over most of the site, an aspect that would ensure longer term soil stability. /// STARS treatment requires long-term maintenance, which emphasizes our previous concerns. /// Other Concerns: /// 1) Repositories for Contaminated Materials: For use of a repository site, we recommend the use of Opportunity Ponds. This would not involve contamination of relatively clean areas or on-site relocation areas. Although some economic and environmental costs are associated with such an alternative, we feel these costs are warranted in order to achieve a truly effective cleanup. We insist that, under no circumstances should a failure to reach agreement on an acceptable repository site promote justification of a lesser cleanup of the Streamside Tailings Operable Unit. If Opportunity Ponds or Brown's Gulch are not deemed suitable, another suitable repository site must be found. /// 2) Method of Transport: For transporting the removed materials to a repository we support the use of railroad. Employment of this method would prove cheaper, and less disruptive to the surrounding community. /// 3) Continuation of Natural Stream Changes: In various ways a stream is a living thing. It is illogical to assume that the present course of Silver Bow Creek will remain stationary. Stream banks and floodplains are subject to long term changes. The use of STARS does not

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I	117	Marangelo, Resource Speci	Glenn	account for the fact that areas currently not in contact with the creek or groundwater today will remain that way into the future. /// We urge that the best cleanup methods possible be employed for this heavily impacted creek. It is disturbing to realize that this creek is contaminated with arsenic and other toxic metals to the point where its water can no longer support fish and that its floodplains have been so heavily impacted that they are nearly devoid of vegetation. In support of efforts to protect and restore water quality throughout the Clark Fork River basin, we insist that the minimum cleanup method, at the very least, employ those measures described within Alternative 6. /// We request that these issues be fully considered in the cleanup proposals for Silver Bow Creek. If you have any questions about any of the issues we've identified in this letter, please call me at the Ecology Center. Also please keep our organization on the list for all future mailings concerning this cleanup. /// Sincerely, Glenn Marangelo, Ecosystem Resource Specialist."
I	118	Tollefson	Gregory M.	"I am writing in support of the State of Montana's proposed plan for the cleanup of the Streamside Tailings site on Silver Bow Creek. It makes no sense to address a problem such as this in anything but the most complete, effective and permanent manner, and it seems to me that the State's Preferred Alternative, Alternative 6, comes close to doing that. I would only differ from the State's reommendation in suggesting that the more protective provisions of Alternative 7, that recommend the removal of all contaminted mine wastes from the floodplain as well, be incorporated in the final plan. /// It seems to me that the only way to do this job right, is to do it in a way that assures Silver Bow Creek the best chance of some day permanently regaining its biologic health and diversity. /// I believe that our future here in Montana, both economic and spiritual, stands to be shaped directly by the measure of resolve with which we choose to deal with the historic and potential threats to the quality of our waters our air, and the other resourced on which we depend. Thank you for considering my opinion. /// Sincerely, Gregory M. Tollefson."
I	119	Knight	Ellen	"I am writing to support the position taken by the state regarding the removal of stream-side tailings from the floodplain area at the Streamside Tailings site. /// Several years ago I was active with the "MESS" committee that studied the Superfund situation up and down the river. At that time I testified on this very issue on behalf of the Missoula League of Women Voters. I'm still here and still interested in getting the junk out of the river bottom. We are supposed to be cleaning up these sites so that the clean-up would not be jeopardized by less than a 100 year flood event. As I recall, this is the law. /// Therefore, the tailings should be removed and the polluted soils treated within the 100

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I	119	Knight	Ellen	year floodplain area; the contaminated stream sediments in Silver Bow Creek need to be removed; the railroad bed materials need to be removed and treated where they are a problem. /// I was appalled that the legislature increased the allowable arsenic levels in our waters. So I am quite concerned that the STARS process cannot treat aresenic. This is unacceptable. /// I appreciate the fact that the state has taken a strong and progressive--and legal--stand on this issue. Hold the line. /// Sincerely, Ellen Knight."
I	120	Schweber, Chairman	Phil	"The Missoula City-County Board of Health and Missoula Valley Water Quality District Board of Directors commend the Montana Department of Environmental Sciences and the U.S. Environmental Protection Agency for the professional work the agencies have performed in developing the proposed plan for the Streamside Tailings Operable Unit. We are pleased that your agencies have recognized the important principles of achieveing a permanent and effective remedy for this site, and that you have recommended the removal of the majority of tailings and contaminated soils and streambed sediments from the site. At the same time, we have significant reservations regarding your preferred alternative number 6, and strongly urge you to implement Alternative 7, which included plans for the complete removal of tailings impacted soils along Silver Bow Creek. /// The Missoula City-County Board of Health has consistently commented to your agency and the U.S. Environmental Protection Agency on matters concerning the cleanup of the Clark Ford Superfund sites. We have requested that your agencies proceed with cleanup measures that will effectively and permanently remediate contaminated areas in the upper Clark Ford watershed. Such measures are necessary to protect the health and welfare of the residents of Missoula County, which lies at the downstream end of the upper Clark Fork watershed. /// We do not support the agencies' preferred alternative 6 because of it's reliance on ARCO's revegatation techniques in place of tailings removal. The agencies proposed plan suggest revegetation of the farthest downstream protion of the site, which lies in closet proximity to the Clark Fork River and Missoula County. /// We object to the use of revegetation techniques because they will not effectively immobilize metals over the long term. Revegetation may succeed in termporarily beautifying the area. But in the long-term, floods, will occur, the stream channel will meander, and tailings will once again be distributed downstream, accompanied by a release of metal contaminants into the headwaters of our watershed. In fact, the revegetation techniques will lead to increased mobility of contaminants such as arsenic and possibly cadmium and zinc. This concerns us, because arsenic contamination has already occurred in the Milltown and Missoula Aquifers. /// The release of contaminants in the upper Clark Fork watershed has resulted in groundwater contamination and damages to aquatic resources in Missoula County. If the contaminants along Silver Bow Creek are not removed from the floodplain, we anticipate continued recontamination of

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I	120	Schweber, Chairman	Phil	the Milltown Reservoir, Clark Fork River, and Missoula Aquifer, irrespective of any measures which may be taken to clean up current contamination at those sites. /// We certainly do not oppose the concept of a greenway along Silver Bow Creek, but suggest that it be constructed following tailings removal, not instead of tailings removal. /// Please carefully consider our support for Alternative 7. It is critically important to the citizens of Missoula County that the plan provide for a permanent remedy. In the long run, this will be the least cost solution. /// Sincerely, Phil Schweber, Chairman, Missoula City-County Board of Health and Missoula Valley Water Quality District Board of Directors.
I	121	Zygo	Brian H.	"National Wildlife Federation (NWF) appreciates having the opportunity to comment on the Montana Department of Health and Environmental Sciences' (MDHES) Proposed Plan for the Silver Bow Creek/Butte area Streamside Tailings Operable Unit. NWF hopes that our comments and recommendations will be useful in reaching a final decision. /// NWF is the nation's largest conservation education organization. Founded in 1936, the Federation works to educate and assist individuals and organizations to conserve natural resources and to protect the earth's environment. Many of NWF's members are not only conservationists, but also hunters and anglers. /// NWF supports the adoption of a Modified Alternative 6 for the following reasons: /// 1) Silver Bow Creek is essentially a dead stream, and the implementation of this plan will enable it to become habitat for aquatic life again. /// 2) It removes the majority of contaminants from the floodplain, thus preventing recontamination of the creek by contaminated soils and in-situ tailings following floods or land use chages. /// 3) It removes a good portion of the bed sediments which contain the highest concentrations of metals. /// 4) It eliminates the contaminated materials from railroad crossings and other areas of the railroad bed which contain concentrations of tailings. /// 5) It eliminates the major source of contaminants that migrate downstream to Warm Springs Ponds and the Upper Clark Fork. /// 6) By reducing the contaminants in Silver Bow Creek, the pond's effectiveness for removing metals before they reach the Clark Fork will be improved. /// 7) The removal of contaminated soil and tailings from the floodplain is a proven, effective way of preventing further erosion of contaminants into the stream. /// 8) The removal of these contaminants will also eliminate further leaching of metals and arsenic into groundwwater supplies. /// 9) It is consistent with goals for a greenway. /// 10) Removal of the wastes is the only way to ensure that Silver Bow Creek will support fish populations. /// 11) It ensures that Silver Bow Creek will have the potential for producing wild trout for local angerls and for recruitment to the Clark Fork River. /// 12) It ensures that the Silver Bow Creek corridor will open to all future land uses. /// 13) It creates more jobs than the alternatives that leave materials in place. /// NWF suggests the following modifications for Alternative 6: /// 1. Streamside Tailings and Revegetation Study (STARS) technology

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	121	Zygo	Brian H.	should not be used on materials left on-site with elevated levels of arsenic. When STARS is necessary for immobilizing other metals in material containing arsenic, the material should be removed. This is the best source control for reducing drinking water contamination. /// 2. All contaminated material should be removed from the floodplain. This is being contemplated for Subarea 4, but it ignores the fact that these materials were deposited by floods during the last 100 years and are likely to be entrained and deposited downstream in the future. /// 3. The design and operational phases of removing the contaminated sediments should be coordinated with the cleanup activities upstream, to ensure that once the stream bed is clean it stays that way. /// NWF also makes these additional comments: /// 1. STARS should NOT be a prime element in the final remediation because it has yet to pass scientific muster as a permanent remedy for eliminating metals sources. The efficacy of STARS in immobilizing cadmium and zinc is uncertain, as well as its potential for mobilizing arsenic. Nor should it play a majory role in the final remedy because its effectiveness will be undermined by morphological changes in the floodplain. 2. All STARS applications should be subjected to rigours monitoring, and alternative plans should be developed for dealing with areas where it fails. /// 3. Opportunity Ponds should be the preferred depository for the materials. Since the amount of materials to be removed under a Modified Alternative 6 will be less than 1 percent of the total currently found at the Opportunity Ponds, the addition of this material will have little if any impact to local groundwater in the ponds area. /// 4. The preferred method of transporting this material is by railroad. A system is already in place that can be modified with minimal disruption and additional local risks. /// Thank you for your consideration, and NWF hopes that its comments will be reflected in the final decision. /// Sincerely, Brian H. Zygo."
I	122	Schafer, Ph.D.	William	"I would like to submit the following as written testimony for your consideration in developing the Streambank Tailings Operable Unit Record of Decision. I have been involved with many of the technical aspects of the Streambank Tailings Remedial Investigation since 1984, and served as one of the primary investigators and authors in charge of the Streambank Tailings and Revegetation Study (STARS). The team involved in the STARS treatability study developed and evaluated the performance of in situ treatment options for tailings along the stream corridor. /// In my opinion the conclusions reached by MDHES are not consistent with the findings of the STARS program. I believe that MDHES has placed unnecessary restrictions on the application of in situ remediation techniques developed in the STARS evaluation. /// My comments relate specifically to criteria proposed by MDHES that identify areas in the Streambank Tailings OU where a STARS remedial approach is suitable. Unnecessary restrictions imposed by MDHES on use of STARS include the restriction of STARS use within the 100-year floodplain (except in subarea 4),

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	122	Schafer, Ph.D.	William	and the requirement areas treated with STARS have at least two feet of separation from seasonal high groundwater levels. /// Restrictions on STARS use within the 100-year Floodplain /// STARS technology has been proposed for use in removed tailings placed in selected repositories. It is therefore evident that MDHES agrees with the overall effectivenss of STARS techniques for reducing the mobility of metals. The concern expressed by MDHES is that two primary trasport mechanisms may cause metals in tailings to become mobile again in STARS-treated areas. These are erosion of tailings through normal stream meandering processes and/or flood events, and via proximity of the tailings to shallow groundwater. Use of STARS is restricted by the MDHES where the presumed risk of erosion or contact with groundwater are high. /// Erosion and runoff modeling of STARS-treated and untreated tailings indicates that erosion of tailings by runoff of rain or snowmelt is greatly reduced through the utilization of STARS treatment. In addition, the rate of erosion of even bare, unamended tailings was surprisingly low due to the flat slopes found near tailings deposits. As a results, erosion from rainfall or snowmelt (that can affect areas within or outside the 100-year floodplain) was not considered a serious risk by MDHES. Tailings in contact with the stream channel, however, are more prone to erosion. This is the reason for the 100-year floodplain restriction. /// I agree that erosion of tailings can occur in areas immediately adjacent to the stream channel. I strongly disagree that the 100-year floodplain demarcates the zones of risk. A floodplain in a hydrologic sense is a broad plain which parallels a river that becomes flooded with water to a shallow depth when the river has an "out-of-bank" flood event (which typically occurs for a few days every 3 or more years). When water spreads across a floodplain, the veolcity of flow decreases and sediemnt is deposited. Erosion risk in the floodplain is very low. Where a channel is narrowly confined and lacks a true floodplain, then materials that border the channel but are outside the 100-year floodplain may be at high risk of erosion. Therefore the 100-year floodplain zone overestimates erosion risk in reaches of the channel bordered by flow-lying tailings. /// The restriction of use of STARS within the floodplain appears to discount the fact that the great majority of metals in chemically-amended tailings are far less soluble than in unamended tailings. The lower metal solubility is expected to decrease the potential impact to fish or macroinvertebrates from eroded tailings. In addition, the rate of channel migration, and therefore the quantity of eroded tailings, can and will be decreased using streambank stabilization and riparian restoration techniques. /// For these reasons, the MDHES should re-consider use the 100-year floodplain as a criteria restricting use of STARS. The zone of erosion risk should be re-defined based on criteria other than the 100-year floodplain and STARS techniques should be endorsed in reaches of Silver Bow Creek where it is not tightly confined. /// Restrictions on STARS use where groundwater is within 2 feet of surface /// The second transport mechanism of concern is the movement of metals from tailings, through shallow groundwater, and into Silver Bow Creek. In most areas along Silver Bow Creek, natural soils that were

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	122	Schafer, Ph.D.	William	buried by tailings have served as a natural barrier to migration of metals. Groundwater in these areas is unaffected by the tailings. In a few reaches, notably near Rocker, where tailings lie within groundwater some portion of the year, the shallow system has elevated levels of metals. The shallow groundwater concern is related to the potential effect on the river from flows of contaminated shallow groundwater. Groundwater typically developed for residential, municipal, and agricultural uses is a deeper system that has little risk of impact from the tailings. /// The STARS program did not specifically address the suitability of chemical amendment and revegetation for areas with elevated groundwater. In one area treated with STARS techniques near the Butte Reduction Works, efforts to establish vegetation failed. In the Butte Reduction Works and in other areas near Rocker where tailings were seasonally saturated with groundwater, adequate incorporation of chemical amendments appeared to greatly reduce soluble metal levels. Full-scale application of STARS treatments to a shallow groundwater zone would have been required to fully evaluate STARS effectiveness, however. Therefore, the effectiveness of STARS in seasonally saturated tailings is still unknown. /// The reason that more emphasis was not placed on the use of STARS techniques for areas saturated with groundwater was that input of shallow groundwater was not thought to be a serious concern. Mass loading studies of Silver Bow Creek indicate that most if not all of the load of metals in Silver Bow Creek is present in the Metro Strom Drain or immediately below the Colorado Tailings. During low-flow conditions, loads of many metals declines in a downstream direction. Therefore, the potential for impact to Silver Bow Creek from the influx of contaminated shallow groundwater during low flow is not evident from the available data. /// Mass loads of metals are contributed by tailings along Silver Bow Creek during higher flow conditions associated with precipitation, snowmelt and attendant runoff. Modeling conducted by STARS team members (but not included in the RI of FS) indicates that STARS technology will be effective in greatly reducing input of dissolved metals and eroded tailings during high flow conditions. More recently, small watershed monitoring along the Governors Clark Demonstration Project has verified the results of modeling. /// The restriction on application of STARS techniques to zones with more than 4 feet of separations from groundwater appears to be somewhat misdirected and is too conservative. The nature of the soils underlying the tailings is at least as important as the distance from groundwater. Where coarse-textured soils underlie tailings, such as at Rocker, they have less ability to attenuate metals. Sampling of natural soils buried beneath tailings for 80 or more years indicates that most metals have moved 6 inches or less, and more rarely to 12 inches. A more realistic and equally protective criteria for restriction of STARS use is in zones where groundwater is within 18 inches of the tailings for a month or more of the year. /// Finally, the removal of material to the depth of groundwater will very likely have profound effects on the fluvial hydrology of Silver Bow Creek and results in serious short-term effects on the stream sediment system and water quality. /// Sincerely,

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I	122	Schafer, Ph.D.	William	William Schafer, Ph.D." Attachments: Schafer, William M., John G. Goering, Tom R. Grady, Edward Spotts, and Dennis R. Neuman; "Modeling Recharge and Runoff to Predict Copper and Zinc Transport from Lime-Amended Tailings at the Silver Bow Creek CERCLA Site"; Paper presented at the International Land Reclamation and Mine Drainage Conference and the Third International Conferenced on the Abatement of Acidic Drainage, Pittsburgh, PA, April 24-29, 1994.
I	123	Morrison	Bruce H.	"The process of cleaning the Superfund mess generated by the old mining operations at the headwaters of the Clark Fork River in Butte has been long and arduous. I hope the site can finally be properly cleaned up and commend the state in its selection of Alternative 6, although I would prefer the even stronger Alternative 7. /// I congratulate the state in its commitment to cleaning up Silver Bow Creek through the choice of Alternative 6. However, the surest way of ensuring the potential for full restoration of both the biological health of the waters and future complete land uses within the river corridor is with the Alternative 7 option calling for the complete removal of all contaminated mine wastes as opposed to the 80% as planned in Alternative 6. /// The permanenet removal of the contaminated mine tailings and tainted soils is best way to secure the safety of both the water quality and human health. Thank you for your efforts in this matter."
I	124	duPont	Mrs. B.G.	"I am writing you to say that I support Alternative 7 for the clean-up of Silver bow Creek in the Upper Clark Fork River basin. /// I support this because removal of contaminated tailings/impacted soils is the best way to ensure permanent protection of water quality and human health at this site. /// Sincerely, Betty duPont"
I	125	Jeske	Mary Frances Laird	"I support the State's Alternative Number Six for a thorough clean-up of Silver Bow Creek. I have attended the meetings when possible and given careful consideration to the various plans suggested and truly believe the States Alt. No. Six offers the best and the most - for Silver Bow Creek' thorough cleanup, for protection of our health, and for the future economy of our city. /// Good Work! /// Sincerely, Mary Frances Laird Jeske"
I	126	McGree	Thomas "Tuck"	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	126	McGree	Thomas "Tuck"	"I oppose the State's selected alternative for cleanup of Silver Bow Creek. I am a Butte native who would like to see a cleanup that goes beyond the simple approach taken in most Superfund projects. I think that environmental and future land uses are compatible objectives. Brown's Gulch is not a good place to locate a repository. Creating a toxic dump out of a previously unaffected site makes no sense whatsoever. Transporting 1.8 million cubic yards of tailings over a ten year period isn't safe. When the first person is killed or injured due to this massive transportation effort we have lost whatever benefit we could have hoped to gain from consolidation of materials. /// I would prefer that the state relocate the materials at or near the affected site. This should be done in a way that accomplishes the same environmental protection for the creek without the risks of transportation. Reducing risks through near site relocation and use of STARS is the best remedy. The long-term land use restrictions that would result can be completely mitigated by creating a greenway along with the cleanup. /// This community needs more than a simple Superfund solution. Millions will be spent on these cleanups and they should result in something innovative that the community can use and be proud of. I oppose your plan and would like to see an innovative remedy selected that meets the environmental objectives of Superfund, and allows for future beneficial use of remediated properities. /// Sincerely, Thomas "Tuck" McGree"
I	127	Peoples	Don	"After reviewing the State's proposed alternative for Silver Bow Creek cleanup and other information, I am sending this letter as my official comment on the proposed plan. /// Initially, let me say your plan seems unreasonable and dangerous. While it accomplishes the environmental objectives of Superfund law it does little to realistically take advantage of the end land uses proposed by the communities of Butte and Anaconda. It is true that with the level of cleanup you propose virtually any land use could occur in the area. However things are not that simple. My concern is that from a practical stand-point (i.e. financial) the end use ideas developed in plans such as Project Green are all but eliminated. No one but ARCO can realistically absorb these costs and demanding such an unrealistic and expensive cleanup eliminates the likelihood that ARCO will participate in the building of a greenway. I would like to see the state negotiate a safe long-term remedy to Silver Bow Creek that allows for inclusion of a greenway as part of the remedy. This involves a different approach and reaching a middle ground that is acceptable to the State and ARCO. I think that's a good idea. /// I would now like to address the points upon which you specifically asked for public comment. My views are as follows: /// (1) The State should make maximum use of the STARS technology. Where the technology can be approporiately used, even within the floodplain, the State should take advantage of the technology. I prefer use of the STARS technology to hauling the material to Browns Gulch or Opportunity. /// (2) Where 15-30 relocations

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I	127	Peoples	Don	sites are required near steram versus transporting wastes to Browns Golch or Opportunity, I much prefer the near site alternative. This is a community safety issue that I feel in not adequately addressed in your proposed plan. The site is already affected, and if tailings can be successful immobilized or capped to protect the long-term health of the creek, that is the action that makes the most sense. /// (3) I am strongly opposed to hauling the waste to Browns Gulch. Taking the wastes to Opportunity does nothing to begin effectively solving the environmental problems of the Butte/Anaconda area. /// (4) Land use restrictions integrated with the cleanup and Project Green are acceptable actions. Creating the right kind of end uses in concert with long-term protection of near site relocations is, in fact, no restriction at all. /// (5) Relocating some of the wastes already in the Ramsay area is an acceptable alternative. Creating a regional repository, where all or much of 1.8 million cubic yards is deposited is not. /// (6) I think the State can come up with a plan that provides long-term protection for the creek and eliminates the short-term risks associated with transportation and other factors. /// (7) Neither truck or rail is preferable. Relocation is the best alternative. /// (8) Any action involving instream sediments should be scientifically based and defensible and should be coordinated with remedial activity taking place on the Butte Hill. /// (9) I support the State's objective to provide some kind of sustainable fishery. /// Additionally I would like to comment on remarks made about the community based conceptual plan--Project Green. As you indicated in a letter to me, your remarks were out of context. However, I do want to reiterate our position so that it is abundantly clear. Project Green wants a safe long-term remediation that provides a future beneficial use of lands within the creek corridor. The citizens of this area did not commit countless hours toward forming a plan meant to confuse the issues regarding Silver Bow Creek cleanup. We put forth a vision for future use in the area meant to be compatible with environmental protection objectives of Superfund. EPA and the Montana Legislature have recognized the importance of enhanced community participation in the Superfund decision-making process. I would like to see a Record of Decision that reflects the importance of community participation in accordance with EPA reforms for FY 95 and 96 and the new state law Senate Bill 381. /// Thank you for your consideration of these comments. I look forward to reading a Record of Decision that reflects a long-term remedy to environmental problems along Silver Bow Creek and the end land use ideas voiced by the affected communities through Project Green. /// Sincerely, Donal R. Peoples."
I	128	Haas, Jr.	Albert	"As a native of Montana, who returns each year to flyfish, I urge you to support the strongest possible cleanup plan for the headwaters of the Clark Fork. /// ARCO can well afford to do it right end must be required to do so. /// Sincerely, Albert Haas, Jr."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	129	Thoma	Heather	"I am writing to support the state's decision on cleanup of Silver Bow Creek. Alternative 6, calling for removal of 80% of contaminated materials at ARCO's site is a favorable plan. /// Please hold to this alternative, or if possible, enact Alternative 7 to remove all contaminated materials from the site at the Streamside Tailings Operable Unit. /// Removing all tailings and impacted soils now would allow a wider range of future uses for the area, and it would ensure that ground-and surface waters could not be re-contaminated after the first cleanup is done. /// The use of Opportunity Ponds as a location for the contaminated taiings is a good proposal, better than using on-site areas. Transporting the contaminated materials by railroad will be safer and cheaper than by truck. /// Thank you again for proposing a strong cleanup plan for the Streamside Tailings Operable Unit. /// Sincerely, Heather Thoma."
I	130	Beatty, Chief Executive	Cheryl S.	"Comments on /// Proposed Plan: Streamside Tailings Operable Unit - June, 1995 /// The Anaconda-Deer Lodge County Local Government Officials encourage the Montana Department of Environmental Quality (formerly MDHES) and the U.S. Environmental Protection Agency to carefully consider a number of issues prior to finalizing the Record of Decision concerning the Streamside Tailings Operable Unit. Of the many related and interdependent issues concerning the holistic cleanup of the Clark Fork basin, the salient and immediate issues of utmost concern to Andaconda-Deer Lodge County are as follows: /// 1. It makes absolute sense to first clean the upstream portion of the basin. With the final plans in place for Butte Hill, Montana Post and Pole, Colorado Tailings, the proposed sewage/metals wetlands, and others, the issuance of the Record of Decision is logical and prudent. A Record of Decision prior to a milestone event such as final plans for the referenced projects may be presumptutous as well as premature. Should the Record of Decision be issued in advance of the develpment of the remedies for these other critical sites, then it must be flexible so as to accommodate modifications which would allow for synergistic basin wide solutions. /// 2. Anaconda-Deer Lodge County is concerned with determinations concerning all the upstream project. The effluent from any upstream site will eventually affect the operations of the Warm Springs Ponds with ultimately is planned to be operated by and out of the Anacona-Deer Lodge County institutional controls presently enumerated in the county's Development Permit System (DPS) document enacted by Ordinance No. 121. Anaconda-Deer Lodge County and Butte-Silver Bow have developed insitutional controls programs that work effectively within each county. The DPS can easily be amended to include Streamside Tailings management. Additionally, the Record of Decision must mandate and identify a funding mechanism for the bi-county Institutional Controls program and subsequent project maintenance. /// 3. In the absence of a long range plan for the Opportunity Ponds, there is no community support for any plan which requires transporting waste materials into Anaconda-Deer Lodge County. Furthermore, by experience we have learned that massive earthmoving throug our community is

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	130	Beatty, Chief Executive	Cheryl S.	extremely disruptive and unsettling. Such projects have serious detriments including traffic safety, infrasturcture damage, and health and spill risks. Certianly, there is a solution which incorporates the critically important criteria while not requiring a monstrous tailings transportation to the Opportunity Ponds. /// 4. Anaconda-Deer Lodge County has established a precedence for site specific end land use to be a significant consideration in the remedial plan selection of the Record of Decision. Because Silver Bow Creek traverses through three counties, it appears that a recreational/open space corridor as suggested by the "Green Way" project is an acquiescent end land use which has received much support from the impacted communities. Anaconda-Deer Lodge County remains ready and willing to designate the use of the "Silver Bow Creek Corridor" as recreation/open space in accordance with targeted end land use by the regulatory agencies. Upon identification of the corridor boundary, Anaconda-Deer Lodge County will begin the process for such designation. /// 5. The Anaconda-Deer Lodge County Commission and Community preference is for the tailings and sediments to be treated near stream. Near stream treatment of tailings is preferred only if the treatment assures that amendments will be added to the tailings material and efforts will be made to return these materials to a vegetation supporting medium. /// Attachements: 5 signed petitions."
I	131	Ferguson	Laura	"I'm writing to you today because I am concerned about the clean-up of Silver Bow Creek. I want you to know that I fully support Altnernative 7. All contaminated mine wastes ought to be removed. To leave some of the waste there is to do the job only half way. /// I realize that ARCO resists the option of removing all the tailings and waste in the floodplain. Their plan, however, (STARS) is absolutely unacceptable as the creek would eventually be re-contaminated and, thsu cost more money, time & energy once again to clean up. /// One hundred percent of the arsenic, lead and other toxic wastes and metals must be removed from the creek and floodplain. I believe that Alternative 7 is the best option and want you to know that I, as a Montanan, support it fully. /// Sincerely, Laura Ferguson."
I	132	Kambich	James J.	"This is my official comment on the State's proposed cleanup plan for Silver Bow Creek and the selection of Alternative 6. I am a Butte native. A safe long-term remediation that includes future uses beneficial to the local economy are important to me. That is why we started Project Green and why I have been so active in forming such a plan. /// Here are my comments on specific matters as requested: /// (1) Hauling Tailings to Opportunity of Brown's Gulch: Truck or rail haul of this waste is impractical and dangerous. The best option is to appropriately handled the materials at or near the site. This can be done through near site relocation or use of the STARS technology. Many smaller

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	132	Kambich	James J.	repositories are preferable to hauling to Opportunity or Brown's Gulch. The dangers respresented in a 7 to 10 year haul negate the benefits gained through consolidation of materials. Resulting land use restrictions are acceptable where the visions presented by Project Green are incorporated into a safe remedy. Many of the ideas outlined in the Project Green Plan can become institutional controls in and of themselves. Furthermore, they create a community asset at the same time. This represents a win win situation. I think the Anaconda golf course is a tremendous example of this kind of an approach. /// (2) Brown's Gulch: Brown's gulch is not a place to put these wastes--treated or otherwise. I strongly oppose putting materials in this area currently unaffected by Superfund and our mining history. /// (3) STARS Technology: We should use the STARS technology wherever it is scientifically defensible to do so. I think you should be willing to expand use of the technology beyond what is indicated in the plan. ARCO bears the risk if the technology whenever possible. /// It is also important for the state to look at other area concerns. Project Green should be a vital part of the final remedy. We have a tremendous opportunity to negotiate with ARCO to see that future uses and Project Green are addressed as a part of the remedy. We should take advantage of such an opportunity while serving the primary environemntal and health objectives. Environmental objectives and future beneficial land use are by no means mutually exclusive concepts. They can be blended together in a plan fashioned to provide the affected community the maximum possible benefit. /// As I went around and spoke to groups about this cleanup and Project Green I realized more and more the importance of what we were proposing. Economic development is an important issue in this area. So too, is the nutrient problems at Butte Metro Sewer Treatment Plant. Superfund itself is seen as a failure by most folks. The Project Green plan was developed with these concerns in mind. We heard from over 800 area residents, took their ideas, and fashioned a plan. That plan deserves the utmost recognition while selecting a final remedy. What we need is a safe long-term remediation that is of economic and recreational benefit to area residents for generations to come. This is the message I heard, and I think we can have both a sound cleanup and a greenway. /// Thank you for the opportunity to comment. /// Sincerely, Jim Kambich.
I	133	Ford	Jim	"I'm writing to you to voice my opinion on the clean up at Silver Bow Creek. /// I support the state's position #6, except I would like to see more done, so I strongly support the idea to remove all contaminated mine wastes from Silverbow Creek floodplain, Alternative #7. /// I know this is more work and costs a lot to do, but I think it is worth it in the long run. /// I think ARCO should pay the entire amount of the clean-up costs. There is not any reason I can see that makes ARCO not accountable for their mess, thank you. /// P.S. It seems strange to be writing to someone with the same name as me! /// Thanks, Jim Ford."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	133	Ford	Jim	
I	134	Finnegan	William P.	"On behalf of the Old Workd Golf Course Authority Board, I am writing to express our support for "Project Green" as a form of remediation of the Silver Bow Creek Superfund Site. "Project Green" is a concept that has been developed by residents of Anaconda/Deer Lodge County, Butte/Silver Bow County and MERDI. We firmly believe that the greenway corridor concept will satisfy state and federal laws in protecting human health and the environment and, at the same time, provide an economic stimulus to our two counties. Economic development will come through opportunitities provided by the enhanced recreational, social and environmental appeal of the greenway corridor. /// The Old Works Golf Course Authority Board is the governing agency charged with operating and maintaining the Jack Nicklaus Signature Golf Course in Anaconda/Deer Lodge County. As you are aware, this golf course was the preferred alternative selected by the State of Montana and the Environmental Protection Agency for the reclamation of the Old Works/East Anaconda Superfund Site. This world class golf course has attracted national attention and we expect it will help revitalize the economy of the Anaconda area. This course will be an asset to our area and the State of Montana through increased tourist trade, increased tax revenue from real estate development and job creation. /// We believe that a greenway corridor or "Project Green" will offer similar opportunities to the Butte/Anaconda area and also the State of Montana. The corridor will compliment the Old Works Golf Course and has potential of being directly linked to it through historic walking and biking trails. We oppose the "preferred alternative" selected by the State of Montana for cleanup of the stream side operable unit. Protection of the environmental and human health along the corridor can be accomplished without removal of 78% of the stream side tailings to distant repositoreis. The utilization of STARS Technology and removal of certain tailings out of the flood plain into a series of more localized repositories, along with the development of wetlands concept for treatment of the effluent of Butte Metro Sewer will be sufficient to remediate this site. This form of remediation will not preclude ARCO from supporting the greenway project. The State of Montana's plan will prevent ARCO from participating in the greenway development because of the high cost of transporting contaminated soil and the length of time to implement. /// We are asking for your support and compromised solution that will be satisfactory to all interested parties and allow for the development of the greenway project to go forward. /// Sincerely, William P. Finnegan, President."
I	135	Larson, M.D., P.S.	Gordon E.	"I want to indicate to you my support for Alternative 6 or 7 concerning the proposed plan to clean up the headwaters of the Clark Fork. /// The state of Montana is to be heartily commended for its

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	135	Larson, M.D., P.S.	Gordon E.	commitment to cleaning up that area. ARCO's plan is certainly unacceptable. /// Thanks so much for your attention to the matter and we look forward to watching the progress of the cleanup. /// cordially, Gordon E. Larson, M.D."
I	136	Farmer	Eugene E.	"My comments on the Proposed Plan for the Streamside Tailings Operable Unit are enclosed with this letter. I am a consultant to the Montana Department of Justice, Natural Resource Damage Litigation Program. /// I have had more than 30 years experience in finding solutions to problems associated with mined land reclamation, acid mine drainage, acid soils and metal contaminated waters, and the hydrology of mined lands. I have a Ph.D. in watershed science and hydrology and have published more than 50 papers dealing with land reclamation. /// Sincerely, Eugene E. Farmer." "GENERAL COMMENTS: Basically, this plan is a good plan. It has many things to recommend it. I believe that moving the tailings and contaminated soils to the Opportunity Ponds is a reasonable plan and removes these contaminant sources to an area that is already contaminated. However, I am concerned about using the STARS technology on some 780 thousand cubic yards of contaminated tailings/soils. I will specify my concerns in the comments that follow. /// HYDROLOGY AND FLOODS IN SILVER BOW CREEK: How has this plan accounted for the fact that from time to time flood events in Silver Bow Creek will cause it to shift the location of its channel? The proposed plan suggests leaving tailings outside of the 100 -year floodplain. Why have you selected such a short return period event? The impact of longer return period floods will be to erode tailings material back into the SNC channel. /// While I have not seen the 1989 report by CH2MHill, Silver Bow Creek Flood Modeling Study, prepared for MDHES, the proposed plan speaks about bank full flows in Silver Bow Creek. In western interior streams, such as Silver Bow Creek, a bank full flow can be expected on an average interval of 2.3 years. Does this reflect the deisgn return period for flood events in Silver Bow Creek? That seems woefully short. /// What is the design return period for floods in the study area? I believe that a 500 year return period event has been used on many other NPL mining sites, e.g., Leadville, Colorado, Iron Mountain, California, The Blackbird Mine, Idaho (strictly speaking, not an NPL site), White Kine-Lucky Lass, Oregon and so on. /// STARS: /// The use of STARS technology is an integral part of preferred alternative, #6. Although development of the STARS technology is an admirable development in the reclamation of mine wastes, it appears to fall short of the cirteria established by EPA for evaluating remedial options, NCP 300.430 (e)(9)(iii). Specifically, it is my view that STARS violates items (C) Long term effectiveness and permanence. It is probably that is also violates item (D) Reduction of toxicity, mobility, or volume through treatment. /// STARS is a short term technology, unsuited for long term protection of riparian resources. The success that has been realized to date by the application of lime and fertilizer to

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	136	Farmer	Eugene E.	tailings and soil materials containing hazardous levels of noxious metals is almost certainly bound to reverse itself over time. Lime materials applied to sulfide tailings/contaminated soils will ultimately be depleted, as will plant nutrients. As the treated materials revert to an acid soil condition the vegetal cover will be lost. How long will this serious setback take? I don't think that science can presently provide hard answers to that question. An approach that has been used on other mining sites has been to determine the total sulfer content of the system and rates of oxidation. These calculations yield an estiamte of the time required to deplete the system of oxidizable sulfur. Our longest actual experience with reclaimed tailings in tailings ponds is on the order of 20 years or so. However, we do know that the oxidation of all of the sulfide sulfur in a metalifferous pyrite system usually takes many centuries. I believe that it is also important to point out that STARS technology will not change the total metal loading in the streamside areas. /// Some of the most interesting results from the reclamation of metalifferous tailings has to do with the persistence of vegetation and the result of establishing a vegetal cover on tailings. With respect to the question of vegetal persistence, the jury is still out. Over time periods of about 20 years some vegetation will persist, but the vegetal cover appears to be on a long downhill slide, i.e., over time the vegetal cover is diminishing with regard to both species richness and total weight and density. For those people who understand the requirements for plant growth and persistence that results seems entirely reasonable. How long will the vegetal cover last as a results of a STARS effort? That answer is unknown, but my expert opinion is that the vegetal cover will disappear altogether within 35 to 50 years. /// But, vegetal persistence is probalby not the controlling factor in reducing the flow of metal ions into the environment. In those examples of tailings ponds that have been successfully revegetated, the unhappy fact is that the ponds will emit acidic drainage contaminated with metal ions. Therefore, in my opinion it is not enough that STARS cover the surface with vegetation; STARS must also demonstrate that the treatment will immobilize metal ions into the forseeable future, certainly for more the 100 years. In the instant case that has not been demonstrated; quite the contrary. The MDHES states that both cadmium and zinc are not immobilized by STARS and arsenic may actually be mobilized by the treatment. /// In a 1995 paper by Munshower, et.al.1 the authors state that during this 6 year study the most effective treatment did not include STARS treatment at all. The data supported coversoil as the most effective treatment. They also cite camium, zinc, and arsenic levels as being difficult to predict as a results of the STARS treatment. As to the chief problem of implementing STARS, the authors cite the difficulty of incorporating soil amendments (lime) to a depth sufficient to maintain a healthy plant community. /// The very real difficulties of incorporating lime to a depth greater than 12 to 18 inches cannot be overlooked. As we are dealing with a hazardous tailings material with an ultimate lime potential as great as 200 tons per acre furrow slice (6 inches) the question becomes one of just how much lime is really needed and how

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	136	Farmer	Eugene E.	much is it possible to apply? /// At this point it is important to address liming materials. STARS technology was developed using regular ground limestone (calcium carbonate) and quicklime (calcium oxide). Quicklime (calcium oxide) is completely miscible with water and forms calcium hydroxide, an extremely caustic agent. It is applied as a liquid slurry and is short lived in the taiings/soil profile. It neutralizes all acidic agents in its path and then exits the system with the first flush of water. In all likelihood, most of the hydroxide accomplishes little good. It rapidly exits the soil-water system, leaving unoxidized sulfide minerals to produce additional acid over time. In the neutralization of an acid tailings/soil system quicklime has very limited use. It can produce an immediate effect, but not a long lasting effect. /// On the other hand, agricultural lime (calcium carbonate) is slower acting, but longer lasting. Agriculture lime is not miscible with water and it is nearly insoluble in pH 7 water. As the soil water pH drops, forming an acid system, the solubility of the lime in the soil water increases, neutralizing the acidity. This forms a positive feedback system that acts to neutralize soil acidity as it is formed. For this reason, standard agricultural lime is a superior liming agent to quicklime for neturalizing sulfide tailings. Furthermore, quicklime should not be counted as part of the total applied lime in a revegetation effort designed for long term success. /// If quicklime is limited to short term uses, how much agricultural limestone can applied on a per acre basis? The answer depends to some degree on how finely the limestone is ground, but as a general rule it is very difficult to apply, and work into the soil more that about 20 tons per acre of finely ground agricultural lime. If one is willing to spend great time and effort you might even apply up to 30 tons per acre. If more than that is applied it is likely that the seed-bed will be made in the calcium carbonate dust. The simple truth is that there are practical limits on the amount of limestone that can be usefully applied on a per acre basis to tailings/soils and explains why it will be necessary to relime time and time again if we are trying to achieve a "permanent" long-term solution. /// Beyond considerations associated with the simple act of liming acidic tailings material, the long term success of reclaimed tailings and metal contaminated soils depends on the ability to the reclaimed materials to recylce plant nutrients. This is perhaps the most critical area if long term success is to be achieved. To achieve nutrient recycling it is criticaly important to build the soil caution exchange capacity, by adding composted organic matter to the soil profile. In addition, it is also necessary to grow organic matter in place through the use of vegetation with high root to shoot rations, primarily selected grasses. Organic matter additions on the order of 20 to 30 tons per acre, or even higher, would be appropriate. Such additions of organic material will also increase the water holding capacity of the reclaimed materials. That is important during the dry summer season. /// Therefore, it appears to me that STARS failis on five county as a long term remedial technology: (1) it is a short term technology; but is proposed for application to a long term probelm, (2) The STARS technology relies on the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	136	Farmer	Eugene E.	application of calcium hydrozide (a noxious material) that is short lived in the tailings/soil enviornment and inappropriate for large scale applications, (3) liming rates will not approach the total acid potential of the tailings materials, and will therefore require regular reapplication, (4) the STARS technology has not addressed plant nutrient cycling, an absolute requirement for long term success, and (5) STARS treated areas will continue to show metal contaminated water drainage from the treated areas. /// Based on the foregoing considerations, it is my considered opinion that STARS technology will not be a successful treatment for application over the long run to the Streamside Tailings Operable Unit. Therefore, my suggestion is to eschew alternative #6 and go directly to alternative #7 as the best compromise between cost and long term effectiveness based on proven technology." /// 1. Munshower, F., D. Neuman, D. dollhopf, S. Jennings, and J. Goering, 1995. Revegetation of streambank tailings along Silver Bow Creek, Montana. Proceedings of the 12th Annual National Meeting, American Society for Surface Mining and Reclamation, Gillette, WY., pp 729-740. ASSMR, 21 Grandview Drive, Princeton, WV 24740."
I	137	Clough, Regional Supervis	C. Richard	"In response to the request for comments on the Streamside Tailings Operable Unit Proposed Plan, we offer the following observations: /// We support the protection of human health and the environment. In general, it is our opinion that Alternative 7 best meets this goal. /// The MDHES preferred alternative seems to have many good featues, but allowing contaminated materials to remain in place even with some soil modification does not offer compete protection for the aquatic environment. Of particular concern is the Alternative 6 proposal to leave large volumes of contaminants in Subarea 4. It is unclear how, in this relatively low relief area, future stream channel realignments can be kept from occurring naturally. New channel configurations could erode into toxic waste contaminated deposits and bring these materials into the stream ecosystem with deleterious effects on stream biota. Since the existing stream channel is Subarea 4 appears to be artificially aligned, it seems more likely that natural stream mechanics processes will contribute to new channel development in the future. For any meaningful recovery to a naturally selfsustaining fishery to occur, either the stream must be prevented from seeking some energetic, steady state configuration to prevent reentrailment of toxic sediments or the toxic materials must be removed and replaced with uncontaminated soil. We believe the latter options, as described in Alternative 7, to be more protective. /// The proposed cleanup of contaminated stream sediments is certainly a necessary precursor to achieveing the ARARS. It is not clear how this fine sediment removal process would be achieved nor what degree of cleansing could be anticipated. A more secure and reliably effective mechanism might be new channel construction through newly placed clean fill material. If some instream toxic metal removal process is attempted, an extremely thorough process

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	137	Clough, Regional Supervis	C. Richard	must be utilized to achieve the naturally self-sustaining trout fishery goal. /// We assume that the sequencing questions regarding timing of cleanup in the SST/OU and upstream sourced of contamination will be satisfactorily resolved prior to initiation of SST remediation. /// Redevelopment of a healthy and diverse riparian biota is clearly a desired end product. We do not believe that soil amendment techniques will be adequate over the years to allow this to occur. Many important nongame and other wildlife species are dependent on this habitat type. Removal of contaminated soils seems the only long term option for the recovery of this ecotype. /// The efforts of MDHES personnel in this process have been very much appreciated. We thank you for your cooperation and the opportunity to comment on this proposal. /// Sincerely, C. Richard Clough, Regional Supervisor."
I	138	Everingham	Catherine B.	"We wish to support Alternative 6 or 7 of the plan to clean up the toxic waste and sediments in Silver Bow Creek. #7 would be more protective because it would remove contaminated mine wastes. This would allow the creek to heal permanently. /// Sincerely, ?"
I	139	Mayberry	Jerry	"I support alternative 6 or 7 for clean up of Silver Bow Creek and headwaters of the Clark Fork River. /// I believe removal of contaminated tailings/impacted soils is the best way to ensure permanent protection of water quality & human health. /// Jerry Mayberry."
I	140	Brunsvold	Ed	"I would like to express my gratitude for your agency's hard work concerning arriving at a solution on the est alternative for cleaning up Silver Bow Creek. I would like to offer my opinion that the State should see that the problem is dealt with in the most permanent fashion possible. Though "Alternative #6 goes a long way towards dealing with the problem, I feel that "Alternative #7" accomplishes this goal in the most comprehensive way and assures that the problem will not reappear in the future. Please put me on record as supporting "Alternative 7". Thank you. /// Sincerely, Ed Brunsvold."
I	141	Antonioli, President	Steve	"Skyline Sportsmen's Association believes that the Silver Bow Creek clean-up should focus on the establishment of viable fisheries and wildlife habitat. Although any number of remediation options would bring back some fish and wildlife, an integrated system for the Silver Bow Creek corridor could optimize the resulting habitats. /// For instance, simple removal of tailings will not result in a stream channel that has the right characteristics for producing an excellent fishery. At the same time,

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	141	Antonioli, President	Steve	optimizing the stream channel doesn't do much good if the next flood brings tailings into the creek and kills off the fish. Of course, adequate flows of clean water are the prerequisite for any fishery at all. /// We are suggesting that the State of Montana design a clean-up plan with the following elements: Stream channel design for optimal fishery potential. /// Ponds and wetlands to provide water treatment and storage along with additional wildlife habitat. /// Tailings removal and stabilization to adequately protect the reestablished habitats. /// We appreciate the opportunity to comment on this important issue. /// Sincerely yours, Steve Antonioli, President."
I	142	Tuesday, Geochemist	Mr. David S.	"As a concerned citizen in the Butte area, I thought I should forward my opinion of the proposed "preferred remedy" for the Streamside Tailing OU of the Silver Bow Creek CERCLA site. I am familiar with both this particular CERCLA site, having worked on it as a State contractor in 1985-1985, as well as the scope and intent of CERCLA. I have also been involved with both the Federal and State Superfund issues, having performed many of the technical studies required to address risks to human health and the environment and feel well qualified to technically review and comment on this proposed plan. /// I completely approve of the State's proposed remedy regarding this OU. I believe the proposed plan achieves significant risk reduction while not requiring ridiculous and expensive remedies to ameliorate vanishingly small residual risks. Yourself and Mr. Marsh are to be commended for balancing the extremes of those who would require a "zero risk" remedy and those who would chose only the least costly option. /// Two issues within my particular area of technical expertise concern me regardding the ARCO plan or "green way" currently being pushed as a short-term political solution. First, no reduction in groundwater metal loadings to Silver Bow Creek will occur without significant removal of metal contaminant sources within the floodplain. To assert otherwise or to claim that STARS is an adequate treatment for this pathway is to bear false witness and ignore the long-term effectiveness criteria required by CERCLA. Secondly, without removing tailings from the floodplain, the threat of flood failure of any remedial action remains forever. Sure, the cheap plan may work well for 2,5, or even 20 years, but it will only take one 100-year flood event, and all that reclamation and all those tailings will be downstream in the Clark Fork. This aspect of the ARCO preferred remedy also ignores the long-term effectiveness criteria required by CERCLA. /// In closing, I urge the State and the USEPA to reject the self-interested petitions by ARCO, thier highly paid contractors, and their mouthpieces in the Butte -Silver Bow County government. No amount of short-term cost avoided (by ARCO) or bribe money offered (to MERDI, other contractors, and BSB) can compensate for not removing the long-term human health and environmental threats by removing most or all of the tailings from the floodplain of Silver Bow Creek. /// Sincerely, David S. Tuesday, Geochemist and Hydrogeologist."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	142	Tuesday, Geochemist	Mr. David S.	
I	143	Joslin	Kay	"I am writing regarding the Streamside Tailings Operable Unit from Butte to the Warm Springs Ponds along Silver Bow Creek. /// Essentially, I would like to see this area made as safe and usable by the public as possible. I do not want to see it fenced off. The only way to permanently clean it up is to haul off as much of the contaminants as possible. I also favor this idea because it would generate jobs for Butte. /// I concur with the positions of the Citizens Technical Environmental Committee and the Citizens for Labor and Environmental Justice; thus I favor the state's cleanup proposal, Alternative Six for the STOU. /// Thank you for consideration of my opinion. /// Kay Joslin."
I	144	Mulcaire-Jones	Mary	"I am writing to voice my support for Alternative 6 or 7 for cleaning Silver Bow Creek. As a Butte resident I am very concerned about the halth implications for me and my family of an imcomoplete cleanup job. /// I fully support the state's effort for a thorough clean up. /// Sincerely, Mary Jones."
I	145	Smith	Ronald J.	"My name is Ronald J. Smith and I have lived in Opportunity, Mt. for 49 years, so I have seen what is now called Silver Bow Creek at its worst. Over the years I have also seen this area begin to heal itself as nature tends to do. I realize that natural flooding and run-off into the creek is just moving the pollution down stream to cause problems elsewhere. The E.P.A. clean-up proposals do the same thing. They clean the area, but they can also cause problems. /// The citizens of Opportunity do not want the tailings moved to the Opportunity Ponds. A major concern is 86,200 to 172,000 loaded trucks moving the tailings over a time span of 4 to 8 years. The potential hazard of that amount of traffic to other motorists and local children, animals, and livestock is unacceptable. I believe that this poses a far greater threat to us than if the tailings were left in place even untreated. Fortunately, we have a workable alternative. /// The Stars remedy of moving the immediate stream-side tailings and other tailings that pose a threat to ground water to higher ground and treating it makes more sense than hauling it away. The remaining tailings could be treated in place. The Stars remedy could be done in a much shorter time span with a lot less money. I find it difficult to believe that a responsible government agency would ignore a remedy that costs less money and creates less hazard to local citizenry and environs. We believe the Stars remedy will leave the land asthetically pleasing and environmentaly sound. /// I am now serving as president of the Opportunity Cow Pasture Associates and I have been a member for a great many years. We have pastured cows on Silver Bow Creek, and I can honestly say we have never had a problem because of tailings or pollution. Over the years we have raised excellent

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	145	Smith	Ronald J.	calves and our livestock comes off this pasture in prime shape in the fall. I have yet to have any livestock return from this area and begin to glow in the dark. /// I attended the meeting at Fairmont in July of this year. I wasn't able to stay for the conclusion of the meeting, but the arguments I heard for the Stars remedy were generally scientific and practical. Most arguements against the Stars remedy were emotional and without basis. As I recall, there were 4 or 5 residents from the Missoula who were in favor of the more expensive remedies. I would maintain that they could have stayed home as the area in discussion is above the Warm Springs Ponds, which are doing an excellent job of containing upstream pollution. /// In conclusion, we wish to remind you that the vast majority of citizens most directly affected by the pollution are in favor of the Stars remedy. After all, this area is our home and provides our livelihoods. Thank you for your consideration. /// Sincerely, Ronald J. Smith."
I	146	Trenk, Executive Director	Peggy Olson	"The members of the Western Environmental Trade Association appreciate the opportunity to comment on the proposed clean-up plan for Silver Bow Creek. For the record, I did attend the public meeting held at Fairmont Hot Springs Resort on July 10, but had to leave before being called to testify. /// WETA is a coalition of mining, oil and gas, argriculture, timber and others who have an interest in promoting economic opportunity while protecting the environment. We believe there is a need in Montana, and in this country, to make some positive things happen on the ground as opposed to tying ourselves up in red tape or unnecessarily costly action plans that may not produce the desired result of making the environment better. /// Some of our members have a more direct involvement in Superfund issues than others, but in general, we believe that while protection of human health and the environment should drive reclamation efforts, they can and should also be conducted in as productive, creative, and cost-effective manner as possible. Equally important, those remedies should serve the best interests of the people who live in the area. /// At this time, we believe ARCO's proposal best embodies those elements. Their proposal is science-based, incorporating new technology with demonstrated effectiveness. The state's current proposal seems to be driven more by fear of what might happen, instead of what we can make happen for the benefit of all parties. /// At a recent Environmental Quality Council meeting, there was some discussion about whether some of the new provisions of Senate Bill 382, which deals with the state's Superfund law, have application for the effort to clean up Silver Bow Creek. That bill calls for selecting remedial actions that: /// - use treatment technologies that give due consideration to institutional controls and engineering controls, /// - are cost effective, and /// - are acceptable to the affected community. /// While there may be some difference of opinion about the bill's applicability, unless it is "illegal", it doesn't make sense to ignore the direction of the Montana Legislature which felt those provisions would better serve our efforts to remedy environmental problems.

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	146	Trenk, Executive Director	Peggy Olson	Clearly the ARCO proposal has already taken those factors into account. /// In closing, I'd like to re-affirm our position that ARCO's proposal seems best suited to responding to the situation at Silver Bow Creek. We encourage the state to work with the company and the community to adopt an action plan that will get things moving toward a productive conclusion of the project. /// Thank you again for the opportunity to comment. /// Sincerely, Peggy Olson Trenk, Executive Director."
I	147	Gless, Ph.D.	Elmer E.	"This letter is in support of Montana State's plan to clean Silver Bow Creek under the Environmental Protection Agency Superfund. /// I have been a resident of Montana since 1968 and as a semiretired Professor of Biological Sciences at Montana Tech I have had first hand experience with mining engineering and its inherent reluctance to clean up after its operations. Also, I have had first hand experience in conducting baseline studies on Silver Bow Creek and its tributaries. /// The only way to make the Silver Bow Creek drainage safe for present and future generations is to remove as much of the contaminated materials as possible from the waterway and to isolate them from all possible future contact with living things. /// CTEC has outlines alternative cleanup methods and it is obvious that complete removal of contaminants is in the best interest of Montana and this community. The high incidence of all diseases in the area is no coincidence and leaving the contaminated materials covered and in place is inviting trouble. Time and nature have a way of prevailing over man's efforts and the contaminated materials eventually will be exposed, making their harmful effects available for uncontrolled contact with people and a continued high incidence of disease. /// It appears to me, when utilizing past experience with the Anaconda Company and other agencies in this area of the state, that people in charge of the so-called greenway and other quicker and less expensive methods of dealing with the problem, have vested interests, and are more self serving than interested in looking out for our residents, future generations and for future business development. Those that have the check book(s) and control the payrolls have immediate interests at heart and are really looking for cooperation from ARCO, MSE and SBC officials for personal gain. In all probability, contaminant exposure will come about well after all principal parties of today's considerations are dead and gone. So why should those people worry? /// Montana's Department of Environmental Quality is charged with just that -- our environmental quality. To consider and do anything less than total cleanup would be a dereliction of duty. /// Yours truly, Elmer E. Gless, Ph.D."
I	148	Gonshak	Henry	"My wife and I completely support the state's plan, and are completely opposed to ARCO's plan, for the clean-up of the Anaconda Superfund site. For us, the central issue is very simple: whose plan best

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	148	Gonshak	Henry	serves the health interests of the Butte/Anaconda community and our descendants? A plan that proposed to leave the toxins in the soil and ground water and cover these poisons with a glitzy golf course? Or a plan that promises to clean up these toxins properly? /// The people of this community are well aware of the catastrophes that can be wreaked by unchecked, unregulated industries, because we all must live with the environmental devastation left by the Anaconda company. My wife and I have small children and we worry constantly that they will be affected by the lead and other toxins in the soil in this area. More than anything else, we want our children to grow up in a safe, healthy environment. /// I am certain that my views are shared by the vast majority of the ordinary members of this community. I realize you will be under considerable pressure from ARCO and their cronies to cave in to unacceptable compromises. But I am convinced that if you stand up to these pressures, and make the case simply and clearly that your plan will better serve the health interests of this community, that you will win the admiration and overwhelming support of the members of this town. Good luck and hang in there. /// Sincerely, Henry Gonshak."
I	149	Atcheson	Jack	"I am for the state plan."
I	150	Armstrong	Dr. W.E.	"I support Alternative #7 or #6 as a second resort. These contaminated tailing should be removed now. Covering them over will only lead to problems in the future. /// Your truly, Dr. W. E. Armstrong."
I	151	Sherry, President	Brian	"The Milltown Technical Assistance Committee (MTAC) has reviewed Proposed Plan: Streamside Tailings Operable Unit (June 1995) and related literature, and had our technical advisor, Dr. Harry L.F. Houpis, attend the Public Hearing at Fairmont Hot Springs on July 10. With the deadline for public comments given as August 7, we with to convey our latest feelings and suggestions for your consideration in the preparation of the final version of the remediation scheme to be applied along Silver Bow Creek. /// First, MTAC applauds the state's commitment to cleaning up Silver Bow Creek. We believe that the total removal of hazardous waste material along Silver Bow Creek and within its 100-year floodplain in the principal objective for any remediation activity in this area. This objective is best exemplified by Alternative 7 with the added provision that a further investigation of repository sited be conducted (either use the one major site at Opportunity Ponds or a series of smaller sites along and just outside the floodplain.) MTAC also feels that Milltown and Missoula County residents could accept Alternative 5 or the State's choice of Alternative 6 as a comopromise in terms of cost versus risk, but we cannot

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	151	Sherry, President	Brian	endores these alternatives as offering the maximum protection for our local water. Additionally, MTAC does not support any solution that includes heavy reliance on STARS technology and over-emphasis on end use. Neither STARS nor the "green" recreation sites can insure that contaminants will not be reintroduced into our waterways during a large flood event, and it is foolhardy to use these ideas as the cornerstone of a proper cleanup. Finally, given any selected solution for the Streamside Tailings Operable Unit, we encourage the Montana Department of Environmental Quality (MDEQ) and EPA to have a well-coordinated plan with solutions at operable units upstream of Silver Bow Creek; there is no point in remediating the creek if it will be continually threatened from these other contamination sources. /// This evaluation of the proposed Silver Bow Creek alternatives is the result of the following Missoula County perspective. The Milltown reservoir and its surrounding areas represent a very long-term repository for a variety of materials transported into it from the Upper Clark Fork River Basin. Consequently, the citizens of Missoula County are very much interested, as well as concerned, with Superfund cleanup activities that are presently being planned and implemented upstream of the reservoir. When it comes to a choice of remediation for Silver Bow Creek, whether it is one of the seven alternatives as detailed by MDEQ and the EPA, or some variation of these alternatives, MTAC takes a before-and-after viewpoint of the area in question: Are the physical and chemical conditions along the river and within its 100-year floodplain markedly improved after the remediation efforts have finished? By markedly improved we mean that during any natural event equivalent ot a 100-year flood, the reintroduction of any remaining contamination into Silver Bow Creek will not require another major cleanup operation. In other words, nature placed most of the contamination where it is today, and nature can certainly place it somewhere else tomorrow. MTAC is concerned that the chosen remediation option not be such that we will eventually be faced with another large-scale cleanup process. For Milltown and Missoula County residents, the consequences are obvious - the area will be continually threatened by upstream contamination from inadequately remediated sources. /// Admittedly, there have been suggestions about STARS and its ability to hold contaminants in place within the floodplain for extended periods of time. However, MTAC believes that the research done to date indicates otherwise. Besides the well-documented shortcomings of STARS during normal (and meandering) flow conditions, it is our position that a 100-year flood, which has a very high probability of occurring with our lifetimes, represents a very real threat to redispersing the left-in-place tailings along Silver Bow Creek, and that that dispersal will include contmination in the Milltown Reservoir area. In fact, it has been suggested that much of the present contamination in the Milltown Reservoir is the result of the 100-year flood that occurred in 1908. Furthermore, the inadequate performance of the Warm Springs ponds during this past Spring's rains, barely a 5-year event, does not give MTAC confidence in any scheme that leaves contamination in Silver Bow Creek's 100-year floodplain. /// If we now deviate from this"Milltown-o-

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	151	Sherry, President	Brian	centric" point of view and take on a more Silver Bow Creek perspective, we find that a significant number of residents of the creek area have serious reservations concerning Alternatives 5,6 and 7, and that these reservations will need to be clearly addressed if a consensus is to be reached for a proper cleanup. At the July 10 public hearing in Fairmont, it was clear that many individuals found the "greenway" picture very enticing. However, MTAC has not found anything in Alternatives 5,6, and 7, that would restrict such an end use; it is simply that their first responsibility is to clean up the contamination. End use can be discussed and finalized as the remediation process progresses. It may behoove the state to better inform the public on this point. /// A possible solution to this repository monitoring and maintenance dilemma is to incorporate a solidification and/or stabilization technique in addition to the lining and capping method implied in Alternatives 5,6 and7. Solidification (stabilization) means physically (chemically) encasing the contaminants on a microscopic level through a cement, pozzolanic, thermoplastic, or organic polymer process. For Silver Bow Creek, a cement solidification technique is probalby the most cost-effective and is highly compatible with heavy metals. Additional cost savings can gleaned, without appreciably increasing the risk or becoming overly dependent on monitoring, by selectively encasing contaminants (for example, at a give repository instead of solidifying all of the contaminants, some of the waste can be used to form a solidified honeycomb structure to entomb the remaining waste). To limit the distance for hauling hazardous waste (and its associated costs), the solidification technique may be used at several repositories along Silver Bow Creek, preferably in locations just outside the 100-year floodplain and above groundwater levels. /// Summarizing, what we are suggesting is a remediation solution that incorporates the full cleanup concept of Alternative 7, the multi-repository emphais of Alternative 5, and the added health security of a waste solidification technique. This solution will require minimal monitoring, maintenance, and long-distance hauling of hazardouse waste, and will even allow "greenways", if that is what the community desires, in the areas around the solidified repositories. /// To conclude, MTAC very much appreciates that state's efforts in determining the best cleanup plan for Silver Bow Creek. We believe that the total removal of the waste material along the creek, as emphasized in Alternative 7 (modified perhaps with regard to the number and location of repository sites), will satisfy everyone's best interests and we encourage the state to strongly consider this option. Alternatives 5 and 6 represent possible compromises in terms of cost and risk, but we remain uncomfortable with this assessment. Furthermore, recognizing that Alternatives 5,6 and 7 have all met with strong resistance from Silver Bow Creek area residents, particularly with respect to hauling distance, repository site locations, and even land end use, we have suggested a possible method (cement solidification) for alleviating these concerns. Finally, we wish to emphasize again the need for MDEQ and EPA to coordinate efforts in the Silve Bow Creek area with upstream Superfund activities. /// Thank you for your time and consideration. ///

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	151	Sherry, President	Brian	Sincerely Brian Sherry, President."
I	152	Beul	Cameron	"I support the state's proposed plan for the Streamside Tailings Operable Unit. Based on my background as an environmental engineer with training as a hydrologist and mine waste specialist, I believe that removal of the contaminated material from the floodplain it is the only way to guarantee a permanent solution. While, the STARS reserach has demonstrated that the use of in-situ treatment and revegetation is effective for neutralizing the fluvially deposited mine tailings for a period of three dry years, the reserch has not proven that STARS will be effective for the long-term in the dynamic setting of a floodplain. Two factors have to be considered in the long-term: Silver Bow Creek will change its course and the lime treatment may lose it effectiveness before the acid generating potential of the tailings has been depleted. As aerial photographs of any riverine system clearly show, all rivers (creeks) change their course over time, and as the state has correctly argued, the lime/tailings/soil mix will be separated and differentially settled downstream during major events. Additionally, the long-term effectiveness of the lime amendments still needs to be proven. /// In order to minimize the disturbance to non-impacted land, using the Opportunity Ponds as a regional repository is the only option. /// Additionally, I will respond to some of the criticisms I have heard against the state's proposed plan: /// CRITICISM: "Its crazy to truck all this material over several miles to the Opportunity Ponds." ///MY RESPONSE: I agree, however, trucking is not the only option. Rails run the length of the operable unity, and I urge the state to call for using trains to move the material. /// CRITICISM: "The state is screwing the community out of a greenway." /// MY RESPONSE: I disagree for several reasons First, it is the state's primary responsibility under Superfund to protect human health and the environment, and to meet ARAR's. To meet the primary mandates of Superfund with a permanent solution, the state must stick with its proposed. Second, ARCO is offering the community a beneficial land use only if the community can pressure the state to issue a ROD that will offer a solution that will most likely be less than permanent. THE BEST GREENWAY WILL BE ONE WHICH REQUIRES MINIMUM MAINTENANCE AND RESTRICTIONS. /// CRITICISM: "By removing the majority of material, many problems will be created through the disturbance of streamside materials." ///MY RESPONSE: This may be true; however, many of the same problems will be created by massive lime treatment using an agricultural till or deep plow; additionally huge clouds of caustic will blow through the surrounding communities and onto the interstate. /// As a citizen of Butte, I urge you to issua a ROD that closely reflects the proposed plan. /// Sincerely, Cameron Beul."
I	153	Technical Staff		

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	153	Technical Staff		"The Board of Directors and members of the Citizens' Technical Environmental Committee (CTEC) wish to thank the staff of the Montana Department of Environmental Quality (MDEQ), in conjunction with the US EPA, for developing a technically practical Proposed Plan for the clean up of Silver Bow Creek within the Streamside Tailings Operable Unit. The staff of the MDEQ, especially project officers Jim Ford and Neil Marsh, have been extremely helpful in addressing technical concerns and explaining the substance and implications of the plan to our membership. We appreciate the lead taken by the state on this challenging, yet necessary clean up. /// CTEC wishes to express our support for the use of Alternative 6, of the Proposed Plan for the clean up of the Streamside Tailings Operable Unit. Of all alternatives considered, implementatin of Alternative 6, as the clean up remedy for Silver Bow Creek, will be most protective of human health and the environment for the citizens of Butte-Silver Bow and Anaconda-Deer Lodge Counties. Benefits reaped will include unrestricted land uses, improved terrestrial habitat for flora and fauna, and protection of health of citizens and the environment in which we live. /// An end land use plan is not included in the Proposed Plan; as a citizens group, CTEC realizes that the MDEQ and US EPA have an obligation to protect human health and the environment and leave land planning to the citizens. Once the removal of the toxic tailings from Silver Bow Creek and the surrounding area is complete, the adjacent land will be open to a multitude of uses. CTEC appreciates that a permanent clean up remedy, such as Alternative 6, will offer fewer institutional controls, allowing landowners to reap greater economic benefits from the development of their land. A clean environment will flourish naturally; trees and grasses will grow on their own and wild animals will be naturally attracted to these areas. This is evidenced by areas around Rocker, where the STARS demonstration project has shown limited success, but where an adjacent area that has had contaminated material removed and clean fill added, plantlife is flourishing. CTEC additionally urges the State not to rely on local Master Plan ordinances to drive amount of cleanup done. Also, CTEC appreciates the need for development of a careful Remedial Design to achieve the Proposed Plan goal of a self-sustaining trout fishery. /// Additionally, CTEC supports Alternative 6 of the Proposed Plan due to the positive citizen and environmental health effects which will result from removal of sediment from Silver Bow Creek, and tailings from the Streamside Tailings Operable Unit. Though we would like 100% of the tailings to be removed and treated, we understand the impracticability of this situation. By removing sediments and tailings, cancer risks should be reduced and the stream will cleanse itself and become an attractive area, once again supporting life. /// CTEC recommends, in areas where tailings are to be moved to, a leachate collection system (or drain field) be considered to ensure that arsenic from the treated tailings does not contaminate the repository area. /// CTEC urges MDEQ to begin remedial action immediately. As an organization which assists the Butte community in understanding Superfund issues, we have been pleased with both the objectives and technical feasibility of the Proposed Plan.

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	153	Technical Staff		Consequently, our membership has passed two resolutions in support of Alternative 6 of the Proposed Plan. The resolutions follow as a continuation of our comments. /// Attachments: Proposed Resolutions Before the Membership, July 13 1995, Resolution #1; Proposed Resolutions Before the Membership, July 13,1995, Resolution #3; State-EPA plan based on science, Prodgers, Richard; Check documnets for the facts, Kennedy, Karen; ARCO approach is not adequate, Hay, John W.; Expensive PR affects reporting, Craig, Mary Kay."
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	"The Confederated Salish and Kootenai Tribes (the Tribes) first wish to commend your measured and professional efforts, in particular, and those of Neal Marsh, in formulating this Proposed Plan under difficult circumstances. We look forward to working closely with you in the future as developments unfold. The efforts of both of you are greatly appreciated. /// In response to the State's and EPA's request for comment, and in keeping with the Tribes' fiduciary responsibility as a trustee of natural resources associated with the entire Clark Fork River basin, including the Silver Bow Creek/Butte Area Superfund Site, the Tribes offer the following comments, primarily of a technical nature. At the outset, the Tribes underscore and, to the extent that it is necessary to do so, remind the agencies and the public of the fact that, pursuant to the 1855 Treaty of Hellgate, the Tribes retained an array of rights to hunt, fish and gather natural resources in the entirety of the Clark Fork Basin, including the affected area, a portion of the Tribes' aboriginal and ceded territory. Incidental to these retained rights are the rights to access, egress, use and enjoyment of natural resources. Of particular concern to the Tribes are the fishery and, of course, the aquatic habitat supporting it. In addition, the Tribes have, since time immemorial, depended upon the resources of the Clark Fork River Basin for spiritual and cultural renewal, and thus have amassed an extensive array of traditional cultural properties in the area, as that term is used in the National Historic Preservation Act. /// Technical Comments /// As notes in the Draft Feasibility Study (FS) and the Proposed Cleanup Plan (Proposed Plan) for the Silver Bow Creek Operable Unit (OU), there are sources of arsenic and metals contamination to Silver Bow Creek located both within and outside of the OU. /// The sources outside of the OU include mine wastes in the Butte area, storm water runoff from Butte, mine and ore processing wastes in the LAO, contaminated groundwater, and the Colorado Tailings. These sources result in the introduction of dissolved metals and contaminated sediments to Silver Bow Creek upstream of its entry into the OU. /// Contaminant sources within the OU include streamside tailings and contaminated soils, contaminated bed sedimnets in Silver Bow Creek, groundwater, and, according to the draft FS and the Proposed Plan, contaminated railroad bed materials. The Proposed Plan is concerned only with sources located within the OU. /// There are several pathways by which these sources supply contaminants to Silver Bow Creek.

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	Contaminated streamside tailings and soils can enter Silver Bow Creek by erosion, including rill and sheet erosion, slumping, and mass wasting. In addition, soluble metal salts which have accumulated on the surface of streamside tailings can be dissolved and enter Silver Bow Creek through sheet runoff erosion. Scouring of contaminated streamside tailings and soils by ice can also introduce these materials into the Creek. /// In additional to supplying contaminants in the dissolved and solid phases directly to Silver Bow Creek, streamside tailings and contaminated soils serve as a reservoir of contaminants for groundwater. Contaminants may be transported to groundwater by the infiltration of precipitation through the tailings mass to groundwater and contaminated tailings and soils; or by both of these pathways. The subsequent recharge of groundwater to Silver Bow Creek introduces the contaminants to the Creek. /// Contaminated bed sediments in Silver Bow Creek may present a source of metals to the water column, depending upon the biogeochemical environment of the bed sediments and other physicochemical variables. The contaminated bed sediments may be transported to other downstream locations in the Creek. The contaminated sediments present a source of metals to biota through the direct contact pathway. /// The water column of Silver Bow Creek also serves as a source of metals to biota through the direct contact pathway. Silver Bow Creek may also serve as a source of contamination to groundwater in areas where the Creek discharges to groundwater. /// According to the draft RI and the Proposed Plan, railroad beds and embankments contain mine waste rock and slag, and ore concentrates were spilled from railway cars onto the beds and embankments. These beds and embankments may serve as sources of precipitation infiltration pathways. /// According to the Proposed Plan, the introduction of contaminants to Slver Bow Creek from the sources and via the pathways described above have created a toxic environment for fish and benthic invertebrates. As a result, Silver Bow Creek is devoid of fish and most aquatic insects. (Other biota, such as algae, vascular plants, microbiota, and vertebrates and other invertebrates probably also experienced a similar devolution). Water column concentrations of copper and zinc in Silver Bow Creek exceed applicable water quality criteria, and drinking water standards for cadmium and arsenic have been exceeded in groundwater. Furthermore, some contaminants potentially pose human cancer risks of greater than one in ten thousand (10,000), and may present other, non-cancer health risks to humans. /// Remediation of Silver Bow Creek will require the blocking of pathways of contaminant migration from sources to the Creek, the installation of barriers to prevent exposure to contaminants, or the removal of the sources of contamination. /// The Proposed Plan offers Alternative 6 as the preferred alternative for the remediation of contamination within the OU. Alternative 6 would presumably be constructted in sequence with remedial actions undertaken at upstream operable units. Alternative 6 contains several components; these are presented below, with specific comments relevant to each component: A. The removal, or partial remoavl of streamside tailings from the 100 year floodplain of Silver Bow Creek. The amendment of remaining streamside and other tailings with

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	lime and the seeding of the amended tailings with drought and contaminant tolerant vegetation. /// The excavation of streamside tailings from the 100 year Silver Bow Creek floodplain would remove the significant source of contaminants to the Silver Bow Creek water column, groundwater, and bed sediments within the OU. /// However, according to the Proposed Plan, tailings would be left in the floodplain downstream of Fairmont (subarea 4), if an equivalent standard of performance to removal could be demonstrated with the application of a procedure involving the amendment of tailings and the establishment of drought and metals tolerant vegetation on the amended tailings. This cultural amendment/vegetation procdure has come to be referred to by the acronym "STARS", because the procedure was derived from the results of the Streamside Tailings and Revegetation Study, and not from any stellar or siderreal attributes inherent in the procedure. (The use of the term "Revegetation" in the name of the study imiplies that tailings will be, could be, or may be revegetated. While the substrate upon which the tailings were deposited may have been vegetated, the tailings were not, and cannot therefore be revegetated. The focus of the STARS study was the intentional experimental cultrual manipulatio of the tailings to the extent that some degree of vegetative cover could be produced on them, and not their revegetation. Because of this, the phrase "amendment/vegetation procedure" <or similar phrasing> is used herein instread of "revegetation" when referring to the cultural manipulation of tailings using procedures derived from the STARS study. /// The Proposed Plan does not present a specific set of criteria which define "equivalent performance", nor does it identify what activities will be undertaken to judge the meeting of the criteria. /// It is suggested here that the criteria for acceptance of "equivalent performance" be the remedial action goals and objectives for the operable unity. It is further suggested here that complete removal of all tailings in Subarea 4 be assumed to be the necessary remedy (as it is at other locations within the OU floodplain), until such time as quantitative modeling or other rigorous analyses clearly demonstrate or indicate otherwise. /// The so-called Ramsey Flats which, according to the Proposed Plan, consist of approximately 240,000 cubic yards of tialings, are located near the town of Ramsey and are within the OU. These tailings are, however, estimated to be presently outside of the 100 year floodplain of Silver Bow Creek. (How this mass of contaminanats came to be outside of the 100 year floodplain is not explained in the Proposed Plan). Alternative 6 would not remove these tailings but would apply some combination of the STARS amendment/vegetation procedure and/or soil capping and/or consolidation to this contaminant mass. The specifics of the combination would be determined at some later date during remedial design. /// The benefits to be achieved by the application of these procedures to the Ramsey Flats in contrast to those achievable through removal and sequestering in a controlled waste repository are not specifically identified in the Proposed Plan. The application of STARS-derived amandment/vegetation procedures and/or the placement of a soil cap will require continual monitoring, maintenance and protection of the integrity of the cap and the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	amendment/vegetation procedure results. The Porposed Plan is silent on the nature of the protection which will be required, but access restrictions of some nature will surely be an important feature of a remedy protection scheme which leaves wastes in place. (Access restrictions to the Ramsey Flat locale may also occur even with complete removal of this tailings deposit. Such restrictions would not be put in place to prevent exposure to wastes which are no longer present, however). /// Removal and secure, controlled storage of the Ramsay Flats tailings pile should be the salient focus of the remedy for this contaminant mass. If it can be convincingly demonstrated by quantitative measures that a specific mix of amendments, caps and consolidations can achieve at least the eequivalent to removal and secure storage, then the State should submit that set of actions and supporting justification for comment. This specific set of actions must insure that this mass of tailings does not "return" to the 100 year flooodplain. /// B. The removal of fine-grained bed sediment from Silver Bow Creek. /// This component contemplates the removal of bed sediment less than 1 millimeter in diameter from Silver Bow Creek. The justifications offered for the selection of this fraction of the bed sediment size distribution for removal include the concentration of contaminants and the ability of the sediment below this cutpoint to be mobilized and transported during bank-full flows. /// The concentrations of metals (and other contaminants) in fine size fractions of particulate matter has be observed not only in sediment but in the atmospheric aerosol. Most of the surface area and volume of a mass of particulate may be found in the fine size fraction. This explains why metals may be concentrated there particularly if surface chemical reactions and physical processes are important in the partitioning of contaminants. The size distribution of tailings discharged from ore processing facilities may also be important. /// The Proposed Plan does not offer any quantitative estimates of the environmental or health benefits to be achieved by the proposed sediment removal component of Alternative 6. Sediments are a pathway for contaminants to surface and possible groundwater, and are an exposure point for various life stages of organisms. Sediments may be a pathway for contaminant exposure to humans. /// The removal of the fine size fraction would logically reduce the probability of exposures and block pathways for contaminant transport. The size distribution of the residual bed sediment mass would be altered and the contaminant concentration and migration potential of these sediments would be reduced. The risks posed by the residual bed sediment mass should also be reduced. /// The proposed Plan does not provide a quantitative estimate of the degree to which the removal of this fine fraction of the bed sediments will meet remediation goals, however. The Proposed Plan should be revised to provide such estimates and define procedures which would be used to assess their efficacy in the achievement of the goals of remediation. The revised Plan should identify a set of contingencies which might be undertaken in the event that this component does not achieve the goals. /// C. The removal of certain contaminated railroad bed materials. /// This componenet would remove those contaminated railroad bed and embankment materials which are or

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	may be in contact with Siver Bow Creek. In addition, certain areas where concentrate has spilled may be removed. Certain areas of the railroad bed may be amended with procedures developed as a result of the STARS. /// The removal of contaminated railroad bed material which is or potentially could be in contact with Silver Bow Creek is resasonable. It is unclear, however, from the Proposed Plan, what benefits would be achieved by capping and/or amending other areas rather than removing them. Caps and amendments need monitoring and possible use and access restrictions to protect them. The Proposed Plan is silent in regard to how remediation goals will be sustained by cappig and amendments as opposed to source removal. /// The Proposed Plan should hold removal of railroad sediments to be the standard, and quantitatively compare, contrast, and evaluate alternatives against that standard. The present Proposed Plan merely suggests that certain unspecified areas may be amended/vegetated without providing quantitative assessments of the efficacy of these cultural ministrations in achieving remediation goals. /// D. The placement of the removed tailings, railroad materials and sediments in two regional repositories situated in the Opportunity Ponds and Brown's Gulch, respectively. /// Alternative 6 would sequester tailings/contaminated soils, railroad bed/bank materials, and bed sediments into two regional waste repositories. One of these would be constructed in the Browns Gulch area. The other would be in the Opportunity Tailings Ponds. These locations were apparently selected for the OU as described in Appendix E of the draft RI. /// Appendix E of the RI consists of Technical Memorandum (TM) which describes how these two repository locations were chosen for the OU. In summary, these locations were selected from an array of possible repository sites which themselves had been identified and scored during two previous "...comprehensive..." Repository Siting Studies (RSS studies). One of these RSS studies concentrated on the Butte area, the other on the Anaconda area. These potential repository sites were evaluated and the Opportunity and Brown's Gulch locations were selected for the OU removals. /// A review of the TM does not identify any indication that any Treaty reserved rights and related interests of the Confederated Salish and Kootenai Tribes were included in criteria used to evaluate potential repository sites either in the RSS studies or in the TM. The same review fails to identify any indication that traditional cultural properites or other locations of particular significance to the Tribes were considered prior to site selections. There are, furthermore, no indications that persons knowledgable in such matters were included in the "DELPHI" process which apparently was a central component of the RSS studies, or in the subsequent assessments and evaluations undertaken for the TM. /// There is no evidence in the FS or the TM that either the involvement of, or consultation with the Tribes was contemplated or undertaken during any facet or component of the selection of the specific repositories identified in the Proposed Plan at Alternative 6. /// The removal of contaminant sources and their controlled sequestering in regulated repositories (following the specific consultation regarding Tribal interests) is specifically supported in these comments unless demonstrably superior

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	alternatives are quantitatively justified. The choice of the location, configuration, and administration of the specific repositories should include all possible affected interests. The same interests should be included in the development of site selection criteria. /// E. The application of "source controls" for contaminated groundwater. /// Tailings/contaminated soils are considered the significant source of metals and aresenic to groundwater. There appear to be two imporant pathways by which contaminants enter the upper aquifer. The first is by direct contact of contaminated solid media with groundwater. The second is by infiltration of precipitation through the contaminant mass and vadose zone into the saturated zone. /// The removal of the contaminant source wherever it contacts, or may contact groundwater will block the direct contact pathway. While this action will prevent future contamination from tailings/contaminated soils, it will not remediate presently contaminated groundwater in the upper aquifer. The Proposed Plan leaves this remediate to be accomplished by an assemblage of processes referred to as "natural attenuation". These processes logically include dilution, and chemical and physical precipitation. /// In locations where the second pathway (infiltration through the vadose zone) is important, the Proposed Plan would apply the cultural amendment/vegetation establishment procedures to tailings/contaminated soils left in place. Provided that vegetation establishment is sufficient, precipitation infiltrations should be reduced. The amendment procedures introducing bases to the system should reduce metal solubilities and acid-forming potential in the tailings/soil mass. These results may be expected to reduce and may significantly attenuate precipitation-drive infiltration of some contaminants to groundwater. /// The Proposed Plan is silent on the potential for the "natural attenuation" processes to be reversed, and on the possible effects of such reversals should they occur. While quantitative estimates of the probabilities of occurrence of such reversals may not be possible, estimates of the ranges of the effects of their possible occurrence may be made. At least, the Proposed Plan should contain provisions for monitoring of the attenuation processes and of the potential of actuality of their reversal. /// The Proposed Plan is also silent on specific monitoring of the efficacy of the amendment/vegetation procedures to be applied to tailings/contaminated soils. At least, quantitative measures of reduction in precipitation infiltration and metals migration should be made. Particular attention should be given to the solubility and mobility of aresenic and cadmium. Since amended areas may present loci for colonization by biota, some measure of the potential for food chain transfer of metals should be disigned into monitoring endeavors. /// Conclusion /// The foregoing are submitted for the purpose of providing considered technical comments on proposed actions with serious potential impact upon the Confederated Salish & Kootenai Tribes, one of several governmental trustees with respect to the natural resources of the Clark Fork River Basin. As noted above, and in several pieces of correspondence to EPA, the affected and potentially affected area subject to the proposed plan constitute an important portion of the Tribes' ceded and aboritinal territory subject to the protections

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	154	Tourangeau, Coordinator	Phil & Marion Yoder	of the 1855 Treaty of Hellgate and other protections. /// Without acceding to any claim the State has made or may in the future make with respect to its lead trusteeship to "all" Clark Fork River Basin natural resources, including those which are the subject of this Proposed Plan, the Tribes offer the preceding comments in a spirit of cooperation toward a greater goal of achieving comprehensive clean-up. They are offered with the explicit expectation that the Tribes will be consulted, on a government-to-goverment basis, as clean-up plans progress and remedial design develops on the Streamside Tailings Operable Unit. /// Such consultation must include, but is not limited to, recognition of the Tribes' traditional cultural properties, specific consultation on fisheries and water related issues, and general technical consultation. In this regard, it is submitted that the lack of inclusion of, and consultation with, the Tribes in the processes and the decisions leading to the selection of the Opportunity Ponds and the Brown's Gulch as specific repository sites in the Proposed Plan is a matter of immediate relevance. We have no doubt you agree, and look forward to your response. /// Sincerely, Phil Tourangeau, Clark Fork Coordinator; Marion Yoder, Tribal Attorney."
I	155	Kerr, Research Specialist	Mark A.	"The State of Montana's Natural Resource Damage Litigation Program (NRDLP) would like to take this opportunity to submit comments on the Proposed Plan for the Streamside Tailings Operable Unit. In short, the Program strongly supports the overall approach of the Plan with its emphasis on tailings removal and supports the selection and implementation of the Preferred Alternative 6. This remedy would be a positive step towards restoring both aquatic and riparian resources of Silver Bow Creek. However, the proposed remedy will not and, as stated in the Plan, is not intended to, restore injured resources. The Program's comments are submitted with the intent of identifying additional actions that would be required to restore injured resources. /// First and foremost, STARS has not been demonstrated to be viable and effective over the long-term. (See the State of Montana's Restoration Determination Plan, January 1995, Chapters 4 and 9.) A number of the State's expert consultants, including Dr. Gene Farmer, agree with this opinion. (See Dr. Farmer's letter and comments submitted to the State Superfund Program dated August 2, 1995.) Furthermore, even the originators of the STARS program recognize that it "was not intended to be cure-all for streamside tailings" and "is not appropriate when tailings are in a location that may be subject to erosion by a meandering stream in the future." (See attached letter from Dr. Frank Munshower, dates February 22, 1995.) Under the Proposed Plan, approximately 780,000 cubic yards of streamside tailings in Subareas 2 and 4 would be treated by STARS. While vegetation has reestablished at the Governor's Project and at Demonstration Projects along Silver Bow Creek, this vegetative cover will not be maintained over the long term. Failure of the vegetative cover in STARS-treated areas along Silver Bow Creek in the future will jeopardize the remedy by increasing the loadings

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	155	Kerr, Research Specialist	Mark A.	of hazardous substances to the Creek due to floodplain erosion and streamchannel migration. In addition, wildlife habitat created by short-term vegetative success would be lost. Furthermore, it has been found that the STARS' technology does not immobilize certain metals such as arsenic and zinc. The negative effect of these metals on fish has been demonstrated in the aquatic studies of the State's Natural Resource Damage Assessment. In short, the DRDLP believes that restoration can be accomplished only by complete removal of contaminated floodplain tailings. /// Second, NRDLP does not believe that a baseline trout fishery can be restored unless all containated streambed sediments are removed. The Plan proposes to remove fine-grained sand and silt-sized sediment fractions. While hazardous substance concentrations may be highest in these fine-grained fractions, fine-grained sediment removal does not address contamination associated with larger sediment fractions (such as gravel and cobble sized material), nor does it address the fine-grained sediments incorporated within the stream substrate. NRDLP is concerned whether DEQ's objective of establishing a self-sustaining trout fishery can be achieved without removal of all contaminated streambed sediments. /// Third, it does not appear, from costing presented in the feasibility study, that streambank reconstruction will be of the intensity of diversity that is necessary to establish appropriate trout habitat. Fourth, costing in the feasibility study does not indicate that growth media would be applied to the floodplain to better stabilize and enhance revegetation efforts. Fifth, costing in the feasibility study also indicates that revegetation efforts will rely largely on a limited number of grass and shrub species. Such vegetation efforts are necessary to restore injured resources and anticipates that such actions will be undertaken as part of the Restoration Plan in the event they are not part of the Superfund remedy. /// As a final comment, the Proposed Plan leaves open the question of the fate of 240,000 cubic yards of tailings in Subarea 2 outside the present-day 100-year floodplain. These tailings should, at a minimum, be relocated away from the active streamchannel into a repository outside of the 100-year floodplain. Disposal of these tailings at an existing repository, such as the Opportunity Ponds, would be NRDLP's preferred action. The proximity of these tailings in the historic floodplain and near the active stream-channel creates the potential for surface water and streambed sediment recontamination in the event of channel migration, erosion by suface runoff, or through bank slumping or mass-wasting. These tailings should not be treated in place by STARS due to their proximity to the active streamchannel. /// Finally, NRDLP supports the statement in the Proposed Plan that "the implementation of the selected remedy may be coordinated to the maximum extend possible with the possible implementation of the State's Restoration Plan in order to avoid duplication of effort and unnecessary costs and to maximize the benefits to the area." As we previously agreed, this coordination may involve, for example, an adjustment of the schedule for implementation of the Record of Decision or allowing certain remedial actions and restoration actions to be combined to allow for more cost-effective implementation. /// Again, we

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	155	Kerr, Research Specialist	Mark A.	strongly support Alternative 6 of the Proposed Plan. NRDLP assumes that restoration and response actions will be coordinated by the State and EPA to the maximum extend feasible in order to restore injured aquatic and riparian resources. /// Very truly yours, Mark A. Kerr, Research Specialist. /// Attachment: Frank F. Munshower, Director, RRU; February 22, 1995."
I	156	Lynch, Chief Executive	Jack	"Butte-Silver Bow Local Government Comments on Proposed Plan: Streamside Tailings Operable Unit. /// The decision about how to clean up the streamside tailings along Silver Bow Creek is complex. First, there are some complicated technical questions about how to do the job most effectively and safely. And second, the decision is affected by complications on the "front end" of the creek due to the status and timing of other Superfund cleanup activities in Butte, particularly as related to storm water and sewage discharge into the creek. /// The right decisions will require a unique and creative solution, both in terms of technology applications and in the implementation/administrative process. "Business as usual" will not be sufficient nor render the most innovative solutions to this critical community problem. The Butte-Silver Bow local governemnt, through its Chief Executive and Council of Commissioners, submits the following comments on the Proposed Plan: Streamside Tailings Operable Unit to the State of Montana, Department of Environmental Quality in hopes of fostering the level of innovation and creativity needed to meet the environmental and health concerns of our citizens. /// 1. Use several near-stream repositories /// There are two choices: 1) The State's preferred alternative, to remove and transport all wastes to one, large regional repository, for example to Opportunity Ponds or up Brown's Gulch. 2) Remove the waste to a series of near-stream "relocation areas." Neither option is perfect, and both have substantive disadvantages, yet both options can be designed and implemented to provide equal protection. /// The constuction and proper management of several, smaller, near-stream repositories appears preferable. This option would eliminate the adverse impacts of long-distance hauling of wastes and the associated safety, health, and land use concerns. This option would be considerably less expensive. Funds saved should be directed other priorities: To enhance other elements of the overall cleanup remedy, to solve related cleanup problems in Butte's urban area, and to implement final end uses in the urban area and Silver Bow Creek corridor. /// 2. Remove all tailings from water's way /// All tailings presently in water's way for the entire stretch of Silver Bow Creek must be moved to the higher and drier relocation areas, outside the floodplain. This volume must include all saturated tailings, all tailings within two feet of groundwater, and all tailings currently exposed to erosion in the floodway (surface flow of the creek). /// All tailings removed form water's way must be treated with STARS (Streambank Tailings and Revegetation Study, a technology to immobilize metals in place by tilling in lime). These relocation areas must also be made suitable for a variety of beneficial end uses. ///

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	156	Lynch, Chief Executive	Jack	These design elements should be absolute. Other elements of the removal design should be more flexible. For example, if all tailings in water's way are removed, and less than an equal amount of backfill materials are used to replace the tailings, there could be significant differences in the depth and width of the stream channel, the determining what to do with the tailings in the floodplain that are not presently in water's way and where there is a considerably lower risk of such tailings causing any future damage. /// It should also be noted that access and availability of suitable replacement soils/materials must be addressed immediately. Suitable backfill materials will be hard to come by. /// 3. In-stream sediments /// An estimated 70,000-100,000 yd3 of sediments in the stream channel are proposed for removal under Alternative 5 (Re-location) and 6 (Removal). These sediments are likely to remain as a long-term, low-level source of metals (copper and zinc) if they are left in the stream channel. However, before removal is executed, the upstream sources of contamination must be controlled and stabilized. /// Over geologic time, stream sediments will be washed downstream into the Warm Springs Ponds. Because natural processes could take thousands of years to flush the creek of these sediments, it makes sense to remove or neutralize the sediments once the upstream sources are controlled. The State plan sets a criterion of <1mm sediment diameter for removal. This standard will be very difficult to meet and enforce in actual construction. Realistically, if stream sediments are removed, most of the 25-mile channel will have to be dredged. /// The ROD should specify a sequence to ensure upstream sediments have been effectively controlled before the in-stream removal takes place. In the interim, the ROD should call for an accurate determinatin of the actual weathering potential of these stream sediments and the long-term potential for these sediments to release metals to Silver Bow Creek. The ROD should call for monitoring of sediments during and after the Lower Area One (LAO) removal and expedited Butte storm water work. With these results, a precise remedial design can specify the appropriate removal options and volumes. /// 4. Allow the use of STARS technology with caution and monitoring. /// The ROD should provide some flexibility to allow the use of STARS to treat some of the tailings in place, for example, as the State proposed in Subarea 4 near Warm Springs Ponds, and also within the outer limits of the floodplain in other Subareas. The use of STARS, however, must be done with caution, tempered by its known limitations based on in-field demonstrations. Its use must be conditional and linked to a firm commitment to a competent monitoring program to ensure the effectiveness of any application and the provision of adequate resources to correct deficiencies and problems. /// STARS use must not undermine the adequate protection of the overall remedy. If STARS is used extensively, the following problems must be solved to ensure long-term success and protect residents and workers: /// a) Tailings deeper than 3 feet will not be treated by STARS. /// b) Complete mixing of lime will not occur, except in the upper 30 cm (50-75% mixing and neutralization would be expected at greater depths, based on results of STARS research and the Governor's Demonstration

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	156	Lynch, Chief Executive	Jack	Project). /// c) Calcium hydroxide flue dust is extremely caustic and should not be spread near populated areas when the wind exceeds 10 mph. This dust will pose particular problems when applied in Subarea 2 (Ramsay) and special precautions will be needed there. /// 5. Line streamside tailings cleanup to solutions for related, upstream problems and end uses on the Butte Hill and in the stream corridor. /// The ultimate environmental quality of Silver Bow Creek depends equally on the proposed streamside improvements AND solutions to other problems upstream within Butte's urban corridor. Storm water runoff carrying sediments and metals, eroding off poorly vegetated soils, and nutrients from sewage effluent pose significant threats to the health of the creek. The ROD should specify how all necessary corrective actions will be coordinated effectively and allow needed up-stream measures to be implemented without undermining or delaying downstream activities. /// Before cleanup of streamside tailings begins, sediment basins should be built on the Butte Hill and most reclamation should be completed (or repaired), otherwise metals from the Butte Hill will continue to be deposited in Silver Bow Creek. The ROD for the Streamside Tailings Operable Unit should serve as a tool to get work completed on the other operable units, such as the Priority Soils, both in terms of soils and the storm water improvements, the Lower Area One and Colorade Tailings removal, the Montana Pole Treatment Plant, the Clark Tailings reclamation on S. Montana Street, and the water diversion facilities associated with the Berkeley Pit. /// This coordination effort should also include a long-term solution to effective treatment of nutrients in METRO sewage effluent. Although the nutrients issue is not directly a Superfund problem, it is another water quality regulatory issue within the Silver Bow Creek drainage. Therefore, an integrated solution to improve the creek should address the nutrients issue in concert with the metals loading problem. /// Likewise, the ROD should address how the implementation of remedial actions can be timed and coordinated to accommodate the installation of facilities and improvements that will serve the end uses in the remediated areas. For example, the future land uses for the Hill areas and the stream corridor, as outlined in the 1993 Regional Historic Preservation Plan, the 1995 Update of the Butte-Silver Bow Master Plan, and the Project Green Conceptual Plan should be considered in the remedial design phase. Thus, these beneficial, end use improvements can be made in the most efficient and cost-effective fashion as the remedial activities are implemented. /// The preliminary timelines to actually implement the Streamside Tailings remedy indicate work may not start until 1997. Thus, it appears there is sufficient time and ample opportunity to take immediate action on the upstream problems and not delay the schedule for streamside remedial work and end use improvements downstream. /// 6. Define the use of institutional controls and stipulate roles for county governments /// The ROD should define precisely how institutional controls will be used to sustain the selected remedy in perpetuity and stipulate the provision of financial resources required to operate and manage these controls. The ROD should clearly designate the county governments of Butte-Silver Bow and Anaconda-Deer Lodge to manage these

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	156	Lynch, Chief Executive	Jack	responsibilities and related resources. The tasks should be integrated with the comprehensive institutional controls program presently established in each county as related to the land use management procedures and other institutional controls to complement other operable units. /// In executing its management functions, Butte-Silver Bow would make a firm commitment to involve all community-based groups with vested interests in the final end uses of the Siver Bow Creek corridor, such as Project Green, the Anaconda-Butte Heritage Trails Committee, the First Montana Heritage Park and Partners, and the Citizens Technical Environmental Committee, among others. /// In particular, the county governments should be given a direct oversight role in the remedy implementation process. The county officials should be directly involved regarding when, where, and how much the STARS technology is used, and be provided with the resources to oversee all monitoring activities associated with the use of STARS. Ground water monitoring and controls should also be addressed in the institutional controls program. /// 7. Additional Comments /// a) SSTOU Contaminated Groundwater /// Shallow groundwater contamination exists in the Streamside Tailings Operable Unit (SSTOU). This contaminated groundwater will need to be closely monitored after STARS treatment is applied. The Butte-Silver Bow Water Quality District will develop and administer the appropriate protective measures, but this work will require long-term financial support through institutional controls. /// b) Brown's Gulch Repository /// Butte-Silver Bow County does not support the location of a waste repository in Brown's Gulch. There has been no public support for this plan. /// c) Remedial Constructioin Activities /// Special attention should be given to protecting both workers' and residents' health and safety during the actual implementation of the remedy. Calcium hydroxide flue dust must be contained on-site and workers should be well protected from this caustic material. No construction should be undertaken when the wind is strong enough to blow dry tailings and flue dust off-site. /// d) Silver Bow Creek Fishery /// Discussions with the Montana Department of Fish, Wildlife, and Parks should begin immediately to assess the ecological requirements of a sustainable fishery on Silver Bow Creek. If such a fishery is not feasible, a stocked fishery should be developed. /// e) Project Green /// The Council wishes to give special recognition to the grassroots planning effort Project Green, and particularly to the more than 850 residents who committed their time and energy to this six-month effort. The Council shares the desire of Project Green participants for a selected remedy that meets the environmental objectives of safe, long-term remediation and provides future beneficial end land uses form the reclaimed creek corridor. The Council is in complete support of the visions presented in the Project Green plan, Silver Bow Creek Greenway Conservation Corridor: A Community Planning Process. The ROD and selected remedial actions should reflect consideration of this Plan as it is a clear indication from the affected communitities of acceptable end uses for the creek corridor."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	157	Rollo, MWF President	Al	"The Montana Wildlife Federation (MWF) appreciates the opportunity to comment on the proposed remediation for the Streamside Tailings Operable Unit. MWF represents almost 8,000 members and is the largest conservation group in the state. /// We applaud the State's commitment to cleaning up Silver Bow Creek. We support the state's selection of Alternative 6 as the preferred clean-up alternative, with one exception: we believe the state should remove all of the contaminated mine wastes from the Silver Bow Creek floodplain as outlined in Atlernative 7. /// Right now, Silver Bow Creek is essentially a dead stream. MWF wants to see it cleaned up so that it supports a self-reproducing fishery. /// We have looked at the various alternatives and have come to the conclusion that removing all the tailings from the floodplain and removing the majority of the contaminated in-stream sediments is the best way to clean up the stream. Removal is the only proven, effective way to eliminate a pollution source. Removing the wastes will eliminate the major source of contaminants to the creek and associated threats to aquatic life. In short, removing the wastes will create the conditions necessary to ensure that Silver Bow Creek can one day sustain a wild trout population. /// Because removing the wastes will reduce, and eventually eliminate the need to treat Silver Bow Creek's water in the Warm Springs Ponds, we expect that water quality in the upper Clark Fork River will improve as well and that its fishery will be revitalized. /// We are adamantly opposed to using the techniques developed in the Streamside Tailings and Revegetation Study (STARS) in the 100 year floodplain. Streams are dynamic -- over the years, they carve new channels; and when flooded they ofted adopt new pathways. Because of that, we do not believe it is appropriate to use STARS in the active floodplain. Thank you for considering our comments. /// Sincerely, Al Rollo, MWF President."
I	158	Morrill	Bud	"I feel that the more these contaminated soil's are distrubed the more hazardous they will become. /// I would prefer the see one or two repositories outside the 100 year floodplain if moving the contaminated soil is deemed the proper thing to do. /// As a resident of Brown's Gulch i am very much opposed to any use of this area as a repository for any more contaminated waste. the state and Butte Silver Bow has already burdened us with a landfill that is very offensive. /// If this material must be moved, i would think that the least exposer to the general public would be the best way to go. /// Bud Morrill."
I	159	Lynch	Elisa L.	"Thank you for accepting the Clark Fork-Pend Oreille Coalition's comments on the Draft Feasibility Study Report for the Silver Bow Creek/Butte area NPL Site Streamside Tailings Operable Unit and the Proposed Plan for the Streamside Tailings Operable Unit (SST OU). /// We support the state's plan to remove the sources of contamination from Silver Bow Creek. While we support the state's selection of Alternative 6

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	159	Lynch	Elisa L.	as the most appropriate way to address the in-stream sediments and the railroad beds, we believe human health and the environment will best be protected if the state removes all of the contaminated mine wastes from the Silver Bow Creek floodplain as outlined in Alternative 7. This is because it is inappropriate to use STARS where the tailings deposits contain high concentrations of arsenic and anywhere within the 100 year floodplain. /// The details of our comments on the proposed plan and other cleanup alterntives follow. We hope the comments will be useful to MDEQ and the EPA in developing the final cleanup plan. Please call us if you have any questions. /// Sincerely, Geoffrey S. Smith, Staff Scientist; Elisa L. Lynch, Intern. 1. Tailings/Impacted Soils Remedies /// The Coalition has reviewed the state's criteria for determining which area will have tailings removed, and which areas will be "treated" with STARS technique. In addition, we have completed a detailed analysis of the STARS reserach papers and related technical comments by scientists familiar with the technique. The following discussion summarizes our review of the state's criterion and the reason we believe MDEQ should modify them and the proposed plan. /// STATE'S FIRST CRITERION: 1) STARS should not be used where the tailings/impacted soils are saturated in groundwater during any part of the year. /// We agree with this criterion and support the state's plan to remove all tailings that are in direct contact with groundwater at any time of the year. /// STATE'S SECOND CRITERION: 2) STARS should not be used where a depth of tailings is thick and where underlying native soils cannot also be tilled into the taiings to help immobilize cadmium, zinc and arsenic. /// The Coalition agrees with the conclusion that STARS is ineffective at immobilizing metals below the depth of lime incorporation. We also agree that STARS may not completely immobilize cadmium and zinc, and may in fact increase the mobility of arsenic. We disagree with the state's conclusion that underlying native soils will attenuate arsenic released from STARS-treated tailings deposits. The results from the STARS Phase III Final Report showed that lime addition in conjunction with the adsorptive capacity of buried soils leads to a significant reduction in metals in pore water, but does not reduce arsenic in pore water. (STARS Phase III Final Report, P. 5-85). Because of this, we believe it is inappropriate to use STARS in any area containing elevated levels of arsenic. Arsenic is the primary human health risk to people living on or near the Streamside Tailings OU, and ultimately limits groundwater uses. These groundwater supplies may never improve to drinking water standards if arsenic concentrations remain the same or increase as a result of STARS treatment. /// Therefore, we recommend, as does the STARS Phase III Final Report, that arsenic solubility must be considered when evaluating the effectiveness of STARS treatment as a remedial alternative. In addition, we believe MDEQ should adopt an additional criterion, namely that STARS should no be used where tailings/impacted soils contain elevated levels of arsenic. /// STATE'S THIRD CRITERION: 3) STARS should not be used where the tailings/impacted soils are located where they may be eroded and re-entrained into the creek system

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	159	Lynch	Elisa L.	through normal stream processes or major flood events. /// We agree with this criterion, however, we are concerned that the state overlooked this criterion in Alternative 6, which calls for using STARS treatment both in the floodplain and where the tailings/impacted soils may be eroded or re-entrained into the creek system. Although MDEQ justifies this decision by claiming the floodplain in Subarea 4 is wide enough to disperse stream energy, that argument ignores the fact that normal stream processess will, over time, result in Silver Bow Creek meandering across the flooplain, and into STARS treated areas. In addition, it ignores the fact that these tailings, as well as those supposedly outside of the floodplain in Subarea 2, were deposited by natural stream and flood events within the last 100 years, and thus can be expected to be eroded in the future. /// Thus, we recommend that the state apply this criterion within the 100 year floodplain, i.e.: we recommend complete removal of tailings, as outlined in Atlernative 7. /// OTHER COMMENTS RELATED TO STARS /// The STARS treatment technology has not been adequately tested to be considered a proven technology. We believe that STARS can only be considered an experimental technique until its uncertainties can be resolved. If for some reason the state should decide to use STARS treatment at any part of the site, we recommend that the tailings/impacted soils be moved outside of the 100 year floodplain and consolidated before treatment, to lessen the likelihood of recontaminating surface water. In addition, these areas should be closely monitored for contamination in the vadose zone, groundwater and soils, and a removal plan implemented if the technology fails to be protective. /// 2. In-Stream Sediment Remedies /// The Coalition supports the state's proposed plan to remove all fine-grained in-stream sediments from Silver Bow Creek. These are highly contaminated sediments, and pose the greates potential impact to ecological and human receptors. The proposed removal is an effective way to attain the primary objectives of protecting human health and the waters in Silver Bow Creek and attaining ARARs. /// In addition, we urge the state to develop a specific plan during the design phase of the remediation plan that coordinates in-stream sediment removal with the cleanup of up-stream sources of contamination. /// 3. Railraod Material Remedies /// The Coalition supports the state's proposed remedy for contaminated railroad materials, as it addresses the sources of contamination to Silver Bow Creek and of risk to human health. ///4. Groundwater Remedies /// The Coalition supports the state's proposed plan to use source controls to remedy groundwater contamination at this site. However, we disagree with the conclusion that the proposed partial removal of tailings/impacted soils with partial STARS treatment will result in "good achievement' of protection of human health and the environment and compliance with ARARs. As discussed earlier, STARS treatment does not decrease arsenic mobility, and may even increase it. Consequently, the state's plan to leave tailings in place with STARS treatment will not protect groundwater resources or human health. Therefore, we ask that total removal of tailings/impacted soils be implemented as the source control measure for groundwater protection. /// 5. Repositories for Removed Materials /// The Coalition supports

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	159	Lynch	Elisa L.	the state's decision to use an off-site repository. The state presents two preferred repositoreis, Opportunity Ponds, and Brown's Gulch. We support the use of Opportunity Ponds as the relocation area. /// Although contaminated materials would be limed and revegetated at Brown's Golch or other land repositories, there is likely to be a failure to protect groundwater where this is implemented, due to continued aresenic mobility. Additional problems with such repositories are the contamination of relatively clean areas, and the use of institutional controls to restrict land use in the future. We believe a more appropriate place of the removed materials is Opportunity Ponds. Using this area will allow us to clean up 24 miles of Silver Bow Creek, while adding less than one-half of one percent to what is already there. /// If the state or community should decide that Opportunity Ponds or Brown's Gulch will not work as repositories, we request that the state revisit the Repository Siting Study. Under no circumstances should a failure to reach agreement on a repository site for removed wastes be used to justify a lesser cleanup at the Streamside Tailings Operable Unit. /// 6. Transportation of Removed Material /// For transporting the removed materials to a repository, the state suggests either the use of trucks or railroad. The Coalition supports the use of railroad: It will be safer, cheaper, and less disruptive to the surrounding community. /// 7. Superfund Compliance of Cleanup Alternatives and Preliminary Remedial Action Objectives /// Preliminary Remedial Action Objectives /// The Coalition supports the Preliminary Remedial Action Objectives set out in the Feasibility Study for the site, as they will achieve the standards set forth in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) for protecting human health and the environment. /// State's Proposed Alternative /// To best comply with the CERCLA requirements for protecting human health and the enviroment and to meet PRAO's, the Coalition urges the state to modify its selection of Alternative 6 to include the complete removal of tailings as outlined in Alternative 7."
I	160	Lund	Kari M.	"I am writing in support of Alternative 7 - the state's plan to clean up toxic sediments and tailings along Silver Bow Creek. Removal of the soils will be the best way to ensure protection of our water quality and the health of our state's wildlife and people. /// We support your efforts and applaud your commitment to environmental quality."
I	161	Furlong, M.D.	Roger C.	"I strongly support the most comprehensive cleanup plan, alternative 7, for the upper Clark Fork River basin. /// Any materials left in place will ultimately find their way into the watershed, simply delaying the process of cleanup to a later time, probably at a much greater cost. /// Thank you, Roger Furlong."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	161	Furlong, M.D.	Roger C.	
I	162	Klinefelter	Angela	"As a concerned citizen and resident of Montana I urge you to use the best possible alternative to clean up Silver Bow Creek. I feel alternative 7 is just that. All contaminated material should be removed from the area in order to restore the health of this stream. Please use Alternative 7 to clean up Silver Bow Creek. /// Thank-you /// Sincerely, Angela Klinefelter."
I	163	Schombel	Stephen	"I am writing to let you know how happy I am that the State of Montana and the MDHES is trying to implement a thorough cleanup plan for the Silverbow Streamside Tailings superfund unit. I belong to many groups and have followed the superfund process for several years. I really would like to see Silverbow Creek restored to support a healthy self reproducing trout fishery, along with other wildlife. I'd also like to think that this area someday could be a nice recreational area. To accomplish this I feel that most, if not all of the contaminated tailings, instream sediments and railroad materials should be removed. STARS technology may work in some areas, but much of the Silverbow unit needs a more complete cleanup. And in the long run having many small repositories near the stream probably would result in new sources of contamination. Thus I support having one or two large regional repositories and hope that the State will implement either Alternative 6 or Alternative 7. /// Thank you, Stephen Schombel."
I	164	Brooke, State Senator	Vivian M.	"I am writing to you in support of the state's decision to select Alternative 6 as the preferred cleanup alternative for Silver Bow Creek. It is important for the health of the Creek and for the health of the entire Upper Clark Fort River to pursue either Alternative 6 or Alternative 7 very aggressively. /// I have served on the Upper Clark Fork Management Steering Committee since 1992 and have been most concerned about the progress of the cleanup in and around Silver Bow Creek. Because it is important to accomplish what we can to restore the health of its contaminated tributaries. /// It is most encouraging to know the state's agencies and employees are doing such a fine job in their analytical work and recommendations. I hope either Alternative 6 or Alternative 7 will be course selected and over time the Clark Fork River will be much healthier. /// Sincerely, Vivian M. Brooke."
I	165	Gallus	Chris J.	"This is a letter opposing the State's proposed alternative for the Silver Bow Creek cleanup. /// Your proposed plan has received a lot of attention in Butte and Anaconda as well as, I am sure, in Helena.

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	165	Gallus	Chris J.	As always, the debate has been centered on "How clean is clean?, and "What plan is best for the affected community?" From my perspective, MDHES selected an environmentally sound plan. However, it focuses completely on environmental aspects and ignores economic opportunitites and future use. /// The citizens of Butte and Anaconda understand the public participation problems in Superfund cleanup as well as any communities. We watched Superfund stumble along for over a decade and saw little or no headway until Anaconda citizens approached EPA and ARCO with their future ideas for the Old Works cleanup. Anaconda citizens recognized how important these cleanup decisions were to their future. Like most, they recongized that these severly contaminated sites in and around their community must be cleaned. Unlike some, they also realized that their economic future depended on the reuse of relcaimed sites. When these economic concerns were meshed with enviromental objectives the results was a sound environmental reclamation project and a world class Jack Nicklaus golf course. Anaconda set what should be a local, if not national precedent, for how government agencies and affected communitites should go about making Superfund cleanup decisions. /// Until Anaconda stepped forward there was not a single example of meaningful community participation in Superfund decision-making in our area. Meaningful community participation has been the most overlooked aspect of the Superfund decision-making process. Here at home and nationally the original intent of Congress for long-term efficient cleanup has suffered as a result. Over 30,000 sites throughout the U.S. have been investigated and 1,300 sites have been placed on the National Priorities List. As of 1993, after passage of a decade, 30 sites across the nation had been cleaned. /// Community acceptance of remediation alternatives played a role in slowing the government's effort to move toward rapid cleanup. Yet in our area one need only look as far as our back door to see the rapid response that can occur when citizens, government agencies, and responsible parties work together. Coming up with an environmentally sound reclamation project that incorporated an approporiate end use allowed the Old Works/Anaconda golf course project to move forward. Shortly after the idea was introduced the first round of golf will be played. The process need not take forever if communities, agencies, and ARCO get to and read from the same page. /// No doubt, the government is beginning to recognize the value in community acceptance and future use in making cleanup decisions. In February of this year, EPA announced the "Superfund Administrative Reforms for FY 1995 and 1996." These reforms are intended to strengthen the Superfund program. Of the twelve adopted reforms, two are particularly important to affected communiites. First, EPA will incorporate "economic redevelopment initiatives which foster cleanup and reuse of propoerties" into Superfund. Second, EPA expanded community involvement and outreach efforts to "ensure that cleanup objectives are responsive to the needs of the community served." /// The 1995 Montana Legislature also incorporated future uses and community accpetance as important criteria in cleanup decisions. The Montana Legsilature provided the MDEQ "shall select remedial actons, considering present and reasonably anticipated future uses," that protect human

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	165	Gallus	Chris J.	health and the environment. The Legislature also provided the MDEQ, in selecting remedial action, "Shall consider the acceptability of the actions to the affected community, as indicated by the community members and the local government." /// EPA and Montana legislative reforms are substantial and important. The reforms intend that government agencies take a broader vision to incorporate active citizen participation into the decision-making process. Final cleanups are required to be environmentally sound AND TAKE INTO ACCOUNT ACCEPTANCE BY THE LOCAL COMMUNITY AND FUTURE USES AS IMPORTANT OBJECTIVES. As indicated, MDEQ met the primary objective of environmental protection. However it overlooked important concerns of the affected communities. /// MDEQ can't force ARCO to participate in a Greenway project. As you have mentioned Superfund does not provide a legal remedy that would give the state the authority to force ARCO to participate in the greenway. However, the state has the authority to negotiate environmentally safe remediation that includes future use. MDEQ cannot ignore the fact that ARCO has demonstrated a willingness to incorporate affected community concerns in cleanup decisions. Environmental protectivness standards do not need to be compromised. As the Anaconda golf course shows us, when government agencies, ARCO and affected communitites openly discuss their needs and concerns something positive can result for everyone involved. /// I urge the State to give Project Green the utmost consideration. A practical alternative should be found that does not involve hauling the wastes to either Opportunity or Brown's Gulch. Use of STARS is preferable wherever is is scientifically defensible. I favor the near site repository approach, rather than any intensive transportation of the tailings. /// Thanks for the opportunity to comment. Good luck with your decision. /// Sincerely, Chris J. Gallus."
I	166	Smitham	Jim	"After reviewing the State's selected alterantive for the Streamside Tailings Operable Unit we wish to write in opposition to the plan. We have appreciated the opportunity to meet with you and discuss our views over the last several months. One of the primary objectives of Project Green was to establish a positive relationship with the state and other officials to provide for the most beneficial long-term remedy for Silver Bow Creek. We hope this important dialogue continues throughout the decision-making process and into the remedial phase.///Comment on the State's Selected Alternative Number 6:///1. We support maximum use of the STARS technology. Tailings should be removed from harms way. We think it is practical that some of the tailings can be left in the floodplain if treated with STARS. Our view is that even in the event of ahundred year flood that materials on the outer edges would not be disturbed if treated with the STARS technology. Where STARS use is scientifically defensible we think it should be applied.///2.Use of near site or on site relocation areas is preferred over hauling of materials to Brown's Gulch or Opportunity. The level of protection for the creek is what is important. If a similar

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	166	Smitham	Jim	level of protection can be achieved, and done without the dangers inherent in a ten year transportation project, that is the most sensible alterantive.///3.We cannot support taking any of this material to Brown's Gulch.///4.A properly crafted remedy that includes end use provisions should result in little if any actual restrictions. While institutional controls will be necessary to protect the remedy selected, if the controls are blended with uses such as those proposed by Project Green no substantive restrictions will result.///5. Neither truck or rail transportation is preferable. The tailings should be treated in place, or treated or capped near site.///6.Instream sediments should be handled after work on the Butte Hill is completed. The remedy should be scientifically defensible.///7.An objective to provide some kind of a fishery is supported.///As the Project Green Steering Committee we are also concerned that our grassroots planning effort receive more than cursory consideration in the selected remedy. Over 800 area residents committed their time over six months to a process that expresses the affected community's desire for a safe long-term remediation providing a beneficial end use of the lands. It is clear from that document, other discussions, and public meetings, what remedial actions are most acceptable to the affected community.///The nutrient problems at Metro Sewer are of great concern to this community. Although these problems are not Superfund related, they deserve serious consideration if they can be handled as part of the remediation process.///Thank you for your time and consideration of these comments."
I	167	Renfrew	Malcolm	"We have been warned by the Clark Fork Pend Oreille Coalition that you are reaching a decision on the clean up of Silver Bow Creek. We strongly urge your approval of Alternative #7, the best available. /// As residents of Idaho we are concerned about all mining operations that drain into the Clark Fork and then carry heavy metal pollutants into Lake Pend Oreille. /// Lake Pend Oreille already has been damaged by poorly controlled mining in Montana, but thus far has not suffered the fate of lake Coeur d'Alene. Now that the hazards are recognized and remedial measures can be attempted, we must rely on you to protect Lake Pend Oreille's future. /// Yours sincerely, Malcolm Renfrew."
I	168	Rowling	Mel	"These are my comments in regards to the State's plan to cleanup Silver Bow Creek: /// I believe that high emphasis on the use of good calcium carbonate should be given to Silver Bow Creek operable units. During my indepth studies and working with calcium carbonate, I have discovered that this is "Mother Nature's" way of doing remedial work on acid land. /// In regards to developing another repository site in Browns Gulch, I am opposed to this. I cannot see where it can be justified creating another repository site when there are existing large sites in the Opportunity Ponds. Why should another area

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	168	Rowling	Mel	of contamination be created? /// In regards to the transportation of these contaminated material to the Opportunity Ponds: Special conditions should be placed in the plans, specifications, and bid documents. Then issue the contract and just get the job done. I cannot see that the transportation of these materials is going to be that much of a problem. We have a good highway system and the railroad system has been used in the past. Safety standards can be critiqued and placed in the plans, specifications, and bid documents. /// These are my comments, /// Respectfully yours, Mel Rowling."
I	169	Belsey	Jim	"My congratulations on the state's selection of Alternative 6 for Silver Bow Creek clean-up. Although I don't know the chemistry or biology of the situation, I'm assuming that removal of 80% of the tailings & contaminated soils is sufficient to meet aquatic life standards. If not I urge you to go to Alt. 7 - The upper Clark Fork deserves a chance to heal from the industrial insults it's suffered. Respectfully, Jim Belsey."
I	170	Jeniker	Charles	"Although I am only a "lay" person insofar as the Silver Bow Cleanup Stramside Tailings (technically speaking) is concerned my "education" on the case has been derived from attendance at many of the advertised meetings, and from the many pieces of literature that were available on the subject. /// Therefore, in reviewing the 7 alternative, the Dept. of Health and Env. Sciences has provided for the cleanup, it seems obvious to me that the #6 alternative is the most solution to the remediation problem. /// This plan would include all the objectives of the other, but instead of resorting to a more limited plan, with a basically untried and unproven STARS treatment, and up to 30 relocation respositories, would restrict it to possibly 2, and more probably 1, the Opportunity site. /// Alternative 6 would provide more constructive land uses, which might be subsequently developed in a greening plan. /// I am concerned that the "Greenway" proposal submitted by Merdi will only add to the confusion in the cleanup effort and should be considered only after Plan #6 has been implemented. /// In addition, I feel that Plan #6 would provide economic opportunities which could lead to a major recreational area, with a creek free of toxic substances and able to sustain a welcome trout population, and protective of human health. /// Plus, the proposed alternative would provide a number of good paying jobs which would be greatly welcomed in the communities of Butte, Ananconda, and Deer Lodge. /// Sincerely, Charles Jeniker."
I	171	Ore, Chair	Florence	"Northern Plains Resource Council is a statewide membership organization whose basic tenet is good stewardship of our State's resources - water, land, air and people. Our 3,000 members take seriously

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	171	Ore, Chair	Florence	the duty imposed by the State's Constitution to maintain and IMPROVE our natural resources, particularly water. Therefore, we support the State's efforts to clean up the toxic sediments and tailings left in Silver Bow Creek by past mining activity. /// We support Alternative 7, which would remove all contaminated mine wastes from the floodplain. This alternative will give the greatest protection to groundwater and future uses of the creek. The citizens of Montana, present and future, have a right to a clean and healthful environment and expect the State to ensure this. We urge you to adopt Alternative 7 as the preferred Alternative. /// SINCERELY, Florence Ore, Chair, Hard Rock Task Force."
I	172	Marchion	Chris	"My name is Chris Marchion. I am a resident of Anaconda. /// With the exception of the Berkley Pit I see Silverbow Creek as the most complex and complicated cleanup challenge in this area. Extremely toxic waste has continuously been deposited in this watershed for more than 100 years from a variety of sources. The forces of nature have continued to move and spread this waste, increasing the size and complexity of the cleanup task. /// To consider that this site can be cleaned up and returned to a healthy and productive riparian area seems an impossibility, no matter what the price. To think that this task can be accomplished for less than $100 million seems almost a bargain although it is substantial investment. /// The question I have is "Is the watershed worth the investment?". My initial reaction is yes. Free flowing streams and the associated riparian area are the most treasured and significant resource we have in Montana. They are home to our diverse fisheries and the lifeline for most of our wildlife. They are the most popular spot for people to live and recreate. As a comparison Silverbow Creek is many times more valuable to the public than the reclaimed smelter hill site in Anaconda or even the new "world class" golf course. /// Is this cleanup too much to ask of ARCO? I don't know, but if you compare the cost of this cleanup with the investment ARCO made in renovating the smelter, or in building the Arbiter plant, you see the costs are in the same range. The smelter is gone and the Arbiter plant offers only some hope for future economic benefit. A cleanup of Silverbow creek, done correctly, offers benefits to future generations in perpetuity. /// However the future riparian value of Silverbow Creek is lost unless there is sufficient and consistent water flows and I see problems for those flows. Most current flows are at risk to future decisions. The discharges from the Butte-Silverbow Waste Water Treatment Plant and the storm sewer system could be lost depending on their chosen cleanup method. The MRI pipeline brings water from the Anaconda watershed to the Butte operations. Excess water is discharged at Ramsey and is a significant increase to the flows. When there is a more economical use for MRI's water it remove water for their operations as soon as it is safe for agriculture use. /// No matter what cleanup alternative is chosen, a consistent water soure protected by an instream flow reservation will be needed for a clean flowing creek capable of supporting

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	172	Marchion	Chris	native fish populations. I don't see this issue as a problem for the plan but there are many uncertainties that will continue to affect the recover of Silverbow Creek and any development that relies on a natural riparian area. /// I am surprised at the concern for public safety associated with the transportation of waste by train or truck. If this project we are debating was for a new 10 year gold mine instead of a mining cleanup, the folks raising the public safety issue would instead be endorsing this as a jobs program and they would dismiss the safety issue as the price of economic progress. /// Truck and train traffic is nothing new to this area. Trains moved mountains of concentrate from Butte to Anaconda - up to 700 car loads a day. Trucks ran 24 hours a day 7 days a week moving limerock from the limequarry 8 miles west of the smelter through Anaconda. No one publicaly questioned safety and I don't remember any incidents that would have generated a concern. With the increased efficiencies of todays equipment it is reasonable to assume this waste can be moved just as safely as the concentrate and limerock for past operations. /// I imagine that the STARS treatment would also require substantial truck traffic to transport lime to the site. In addition there will be truck traffic to bring topsoil to the cleanup for either option. /// Although I am not anxious for additonal waste to be deposited in the Opportunity ponds I see this as a reasonable solution because it is a small increase to an already large repository. These wastes will be a burden on our county but we would only compound the affect if we built a new repository. /// We hear criticism of the proposed plan by some because of cost and duration but there has been no strong voice to lower the objectives. Thus the selection of final plan must be driven by the certainty with which it will accomplish those objectives. The law requires it and the public supports that priority. /// I have reviewed the objectives for the cleanup and the proposed plan and alternatives. Although I understand the concepts presented I do not have the technical expertise to know whether ARCO's alternative will accomplish the objectives with the same certainty as the proposed plan. That judgement is for the professionals who have been hired for that purpose. /// I do expect that when this project is complete the public can be confident that the health risks associated with Silverbow Creek have been put to rest. The recent experiences at the Warm Springs ponds didn't completely accomplsih that public confidence. Althought ARCO made great improvements to the pond system it is clear that at times of extreme weather conditions there is genuine anxiety about failure of the system. We owe it to future generations to get this cleanup done correctly. /// Hopefully ARCO can prove that a less costly option can meet the objectives with the required degree of certainty because they have promised a portion of the savings for the Greenway and a solution for the Butte-Siverbow Waste Water Treatment Plant discharge. ARCO has proven with the golf course and smelter hill projects that they want solutions which are useful to the public. We all want to get the most public benefit for the dollar spent but ultimately cost and cleanup duration are secondary priorities. /// Finally I would like to thank the state officials who worked with the public in developing the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	172	Marchion	Chris	plans. These folks made sure that the public had an opportunity to be involved and the material was presented in a fashion that allowed non technical people to understand the issues and proposals. They have been very professional in the execution of their duties. /// Chris Marchion."
I	173	Decker	Bob	"I urge you to adopt Alternative 7 of your Feasibility Study for the Streamside Tailings Operable Unit. It provides the surest means of rehabilitating Silver Bow Creek. /// Although ARCO has been bombarding the public with advertising for the "STARS" method of recovery, there are several shortcomings of that method, as I understand it: it does not immobilize arsenic and some other metals, it does not work at deeper soil depths, and it does not resist flooding. /// I beleive that the situation on Silver Bow Creek requires 100% removal of contaminated materials. /// Thank you for your consideration of my thoughts. /// Sincerely, Bob Decker."
I	175	Stone-Manning	Tracy	"I would like to applaud the state and its commitment to cleaning up Silver Bow Creek. Please consider this letter as part of the public comment regarding the state's cleanup plan for Silver Bow. /// I support the state's preferred Alternative (6), but also feel that the state should have all the contaminated mine wastes from the Silver Bow Creek floodplain removed, as outlined in Atlernative 7. /// Again, thank you for your commitment to cleaning up Silver Bow and the Clar Fork. /// Sincerely, Tracy Stone-Manning."
I	176	Glueckert	Bev Beck	"I am writing to express my strong support for Alternative 6 or Alt. 7. I am interested in ensuring permanent protection of water quality and human health. The State of MT. has my and my husband's support in the cleanup of Silver Bow Creek. We cannot allow any opposition to this incredibly important effort. YES! to Alternative 6 or 7!! /// Sincerely, Bec Beck Glueckert."
I	177	Brown	James K.	"I want to support the State in its effort to cleanup Silver Bow Creek. At the very least, implement alternative 6. I prefer Alternative 7 because all the protection possible is needed to ensure downstream supply of safe drinking water and an uncontaminated acquatic system. Don't buy-off on ARCO's short sighted fix of another former short term benefit for a few. Montanan's must look ahead to ensure a safe and healthy environment for future generations. /// Sincerely, James K. Brown."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	178	Ellingson, State Rep.	Jon E.	"I am writing to indicate my strong support for the state's proposed plan to clean toxic sediments and tailings from the headwaters of the Clark Fork River. I support Alternative 6 of the state's proposed plan with the addition that I believe that all contaminated mine wastes from the Silver Bow Creek flood plan should be removed. /// This is a great opportunity to reclaim the damaged headwaters of the Clark Fork River. Please do not lose this chance to revitalize this important public asset. /// Yours truly, Jon E. Ellingson."
I	179	Kreisberg	Michael	"I write to urge support for serious & thorough cleanup of Silver Bow Creek, headwater for what flows through ?. The state's proposed plan for cleaning up waste sediments & tailings is almost good enough to cheer for - & if it came to that I'd support Alternative 6. However, it is Alternative 7 that is ultimately serious & thorough, as it would mandate cleaning up all contaminated wastes from the floodplain of Silver Bow Creek. Bravo for #7!! /// I am appauled that ARCO should be allowed to bully & bluster so. You/we owe it to our kids & their kids to do what is right - not what is politically safe. /// Thank you Michael Krreisberg."
I	180	Peters	Doris	"It is my understanding that the condition of Montana's rivers and streams is at a crucial point of no return. The decisions made now will have irrevocable consequences for the future of these waters. /// I fervently hope that you will stand on the side of caution and prevention of further degradation by utilizing Alternative 6, or even better, Alternative 7. /// The citizens of Montana have seen the gradual deterioration of the state's rivers by industrial "big-money" interests while leaders in government seemingly are looking the other way! Small wonder we are angry and frustrated at being ignored and patronized. /// Please by accountable to the people you serve and take this opportunity to be instrumental in the clean-up of Montana's waters. /// Sincerely, Doris Peters."
I	181	Craig	Patrick W.	"I am mostly homebound so haven't been able to attend your meetings. I have stayed pretty well informed, however. I have followed the debate on Silver Bow Creek as presented in the paper here and in the CTEC newsletter and have discussed it with family members and friends. I think Siver Bow Creek has to be cleaned up before anything else is done with it. People have to be able to walk off trails and find that real trees are able to grow; and the creek must be able to support its own fishery habitat. /// I firmly support your Preferred Remedy and make the following comments which I would like to have replied to in your responsiveness summary: /// 1. The greenway that MERDI wants can be done without compromising

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I	181	Craig	Patrick W.	the cleanup and leaving most of the tailings in the floodplain. There is nothing about yur plan that keeps people from getting together and creating a greenway if that is what they want (the RITT and other such programs have grants for just such efforts). But there are things about the Greenway proposal that can keep you form doing the kind of cleanup that is best for human health and the environment. /// In the first place, it would downgrade your cleanup. If Greenway backers are successful in getting the Butte-Silver Bow government to change their Master Plan to not allow "residential" zoning, we could end up with "open space" designations only. If this happens, I urge you to disregard these sorts of preemptive measures. Do not let future land use plans by a potentially responsible party government cause you to specify lesser degree of clean than you would have otherwise as exemplified in you Preferred Plan. These kinds of local government moves are not in the best interst of future gernations who would have the burden of maintaining restrictive land uses. ARCO has publicized extensively to people that a good cleanup would mean the creek would be fenced off. They have actually done a double-speak here, because when it is clean, the only reason for it to be fenced off is if ARCO owns it and wants to punish people for not supporting their lower quality cleanup ideas. Future owners of land along the creek should have the ability to use the land as they see fit, not as ARCO sees fit. You must assure they can do so by requiring a good cleanup. /// In the second place, it would leave so much tailings in the floodplain that there is no way you can protect human health adequately. Most of the arsenic behind the Milltown dam got there from Silver Bow Creek. (There is arsenic behind the Noxon dam also, but I don't know how bad it is or if anyone is looking at protecting people from it.) When you leave tailings in the floodplain and then ARCO uses millions of tons of lime to neutralize the acid in the tailings, that lime frees up Arsenic. Have you looked at how much worse the Arsenic will be in the stream and behind the dams after you have allowed even 22% of the tailings to be limed and left along the creek? Don't you think it necessary to have a good understanding of what the results will be before you allow ARCO to continue their massive liming of Arsenic into the Clark Fork River? /// Please describe how green a greenway can be under the ARCO plan if you go along with it in any degree. There is no information available anywhere right now that would indicate it could be much more than a brownway for most of the year. Whether it is done with ARCO money or by other funding, there isn't enough water up here to keep the creek area really green. I understand that this has been stated by surface water experts, not just by me. So this "greenway" title of itself makes people think the whole thing was just hatched up to keep ARCO from having to do a real cleanup. Plus, the idea didn't even come into public view until after your investigative documents were completed and public comment periods were opened; yet backers of the greenway said they have worked with ARCO on it for a few years... So why did they wait until the last minute to provide their opinion? They seem to have needed to make the cleanup into a political affair where no one cares about the technical work you have done. It is not fair to Butte

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	181	Craig	Patrick W.	people to be coerced into going along with ARCO by taking advatnage of their love for the greenery of the Columbia Gardens and their need for beautification. Unless people followed the process along, they aren't aware that nature will clean up and beautify the corridor once the tailings are removed. ... And that they can then build whatever amusements they like on clean soil. /// 2. Isn't it a "takings" for government to restrict land use in order to save ARCO money? If your agency lets ARCO do only a 20% removal of tailings and in order to do so, forces some landowners to not use their land for residential purposes or cattle grazing or anything other than "recreational," it seems to me the State could be liable to those landowners who might have been able to use that land for more profitable purposes. Perhaps the fact that the Butte-Silver Bow government is a potentially responsible party makes them have a conflict of interest when they change land use designations to correspond to where the pollution is. Please answer these question in your responsiveness summary. /// 3. Liability in Superfund would appear to allow a downstream landowner to sue an upstream landowner if hazardous waste of tailings move downstream. Is it not ture that in a circumstance where a landowner has good removal done on his property, then tailings move down onto it again during a high water event, that downstream landowner could recover damages from his neighbor whose land the tailings came from. Here again, good removal for all landowners would appear to be the best policy. /// 4. Silver Bow Creek should be made usable by kids for wading and for fishing in a spawning trout stream. Butte is unusual in the fact that kids here, like myself, grew up thinking that it was normal to have a creek place off-limits due to pollution. This Superfund cleanup is the one chance for future Butte kids to have a clean Silver Bow Creek. This one chance should not be compromised by powerful entities with dollar signs ruling their actions. What I did not have as a child, I would like to see other kids have. It is ludicrous for local entities backing the Greenway to expound in favor of "recreational" only designations for creekside property at the same time that they rail against a spawning trout habitat. Even if it takes a few years to get there, your plan, with removal of toxic streambed sediments, is the only way to get such a stream back. /// 5. The tailings (78%) must be removed to a safe repository away from the floodplain. The actual repository can be decided on after that decision is made. ARCO has attempted to make people think there is no place to put the tailings. It is very logical for the tailings to go to the Opportunity Ponds, or to a repository in the Rocker area as your plan prefers. Alternately, I think the very best place for them is behind the Berkeley Pit, and almost everyone you talk to about it say the same thing. This is where the stuff came in the first place. We alreaady have decisions made that there will be a pump and treat operation at the Pit to protect the creek. Since this must occur in perpetuity, what better place to put these metals? It is a permanent remedy -- at least as permanent as the decision the was made for the pit. You should have the authority to be able to force MR to allow the tailings to be placed there. Regarding Opportunity Ponds, on the one hand, ARCO has convinced the local geovernment there to say the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	181	Craig	Patrick W.	tailings should not go in the Opportunity Ponds -- that nobody wants hazardous waste in their county. On the other hand, the Anaconda-Deer Lodge government has supported ARCO leaving similar mine waste in their county without it even being remediated. All the waste in the East Anaconda area is being left where it was and only a part of it is being capped. Either these leaders in Anaconda are concerned about the hazards of hazardous waste or they are not. They would like to have it both ways. Since the Opportunity Ponds is a fact and because the tailings your plan would send there are such a small percentage of what is there, I believe it is a responsible decision if you send the tailings there. Regarding the Browns Gulch area for a repository, again I think this is logical. However, I would rather see those tailings trucked behind the pit. ARCO has cited that there would be too many accidents with that many trucks moving around. Such argumnet is ludicrous in Butte, a town where, for the past 45 years, folks think the best thing in the world is a job driving a truck full of mine ore or mine waste. Again, opponents of your plan can't have it both ways. Either they think it's fine to have truck driving jobs associated with mining or they don't. Also, ARCO has said Butte-Silver Bow doesn't want the tailings hauled through town to a repository behind the pit. Did the County say this as a matter of Record by the Commissioners? I'd like to see them say so when so many jobs are involved. Also, there are enough dirt back roads running from the Rocker area to behind the Big M and behind the Butte Hill that neither Walkerville nor Butte would have to be affected by the trucks in the streets of town. One opponent of your plan said it would take eleven years. Eleven years! What great news! How many new mines could promise eleven year of boon before bust? Even the East Continental Pit is estimated to only operate until 2006 in the Berkeley Pit and Mine Flooding documents. Again, your plan would be good for Butte and for workers of Butte. /// There are many other things about the Silver Bow Creek cleanup that are of concern. I think you plan has done a good job of addressing most of them. Most people here think the whole thing is too complex, so they are afraid to voice an opinion. It does take dedication to watch what is involved, and many people don't have the time. On the other hand, those who oppose your plan are doing so on company time. I think you should consider that when you look at who is in favor of your plan and who is not. Stick to your guns and get a good cleanup for Butte. You said you'd clean it up. So CLEAN IT UP. /// Yours, Patrick W. Craig."
I	182	Ort	Harold	"I am very concerned about the cleanup of the Clark Fork River headwaters. I have read about what ARCO proposed to do and I consider their plan, using the STAR technique, to be woefully inadequate and a mere ruse to get out from under their obligation to permanently clean up the mine waste. /// The state of Montana's plan, Alternative 6, is a minimum and should not be considered as a point from which to negotiate. The right approach to protect the river and progress toward restoration is to adopt

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	182	Ort	Harold	Alternative 7. /// I am not a wide-eyed environmentalist radical. Rather, I was a Republican conservationist businessman until people like James Watt, and now many Republican state and national legislators, tried to eliminate our environmental protection laws to accomodate irresponsible business interests. /// I urge you to fight for protection and restoratio of our Clark Fork River by insisting on a complete cleanup of Silver Bow Creek, certainly no less than Atlternative 6. /// Sincerely yours, Harold Ort."
I	183	Smith	Marvin	"I am writing to let you know I support Alternative 7 and alternative 6 if 7 isn't possilbe. /// Removal of contaminated tailings/impacted soils is the best way to ensure permanent protection of water quality and human health. /// Please do everything you can to ensure a proper and complete clean up. /// Yours, Marvin Smith."
I	184	Waring	George H.	"I have been attending the CTEC meetings dealing with the Silver Bow Creek cleanup for the past year. I've attended each of your presentations on this issue and presented testimony at the Fairmont public comment session in July. I have walked with Mr. Chuck Stillwell along the section of Silver Bow Creek at Rocker that was treated with the STARS technology. I listened carefully to his remarks and heard his responses to questions posed by Montana Tech environmental engineering students employed as staff techical people for CTEC. /// I support Proposal Number Six on page 15 of your July publication: Proposed Plan: Streamside Tailings Operable Unit. /// My major concern is that the tailings should be totally removed from the floodplain in those areas that your scientists consider risky for recontaminating the Creek. The STARS technology is an unproved one. Therefore, the twin dangers of a meandering Creek and a flood should motivate as much removal of tailings as possible. /// I believe the tailings should be removed to Opportunity Ponds or to a site up behind the Berkeley Pit, north of Butte. I favor one or two repositories rather numerous ones. Monitoring can better be done at fewer sites. /// I believe that the people of Butte desire a self-sustaining trout fishery in Silver Bow Creek. Further, they wish to be able to take their families for picnics and recreational activities along the banks of Silver Bow Creek with as few restrictions placed on themselves as possible. I don't know how you achieve these goals without a thorough removal of the mine waste. /// Your sincerely, George H. Waring."
I	185	Warden, President	Bill	"In reference to Silver Bow Creek clean up plans: I urge you to support Alternative 7, which includes removal of tailings and in stream sediments. /// We all need clean water & mining damage repaired for

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	185	Warden, President	Bill	future generations protection, and our own. /// Thank you, Bill Warlow, President, The Shack Restaurant, Inc."
I	186	Whalen, President	Bob	"The Westslope Chapter of Trout Unlimited thanks the MDHES for their efforts to develop a comprehensive cleanup plan for the Silverbow Streamside Tailings Operable Unit. We like the proposed alternative six. Our main concerns are water quality in the entire Clark Fork system and the idea of restoring Silverbow Creek into a healthy cold water fishery. We are also interest in restoration of habitat for other wildlife, human health issues, and the ability to use the stream corridor for recreation. We feel that alternative six is the minimum that will meet these goals in the long term. We think the MDHES has clearly pointed out many of the limitations of STARS technology in their Proposed Plan and we cannot support other alternatives that will leave most of the contaminated sediments in place. We like an alternative that will deal with all contamination sources like number six does, not only the tialings but also instream sediments and sources along the railroads. We feel the alternatives that would create many small repositories just outside of the 100 year flood plan are not as good as alternative six for the long term. As pointed out in the Proposed Plan this would create a situation much more difficult to monitor; and the stream naturally will meander and erode over the long term, and some of these repositories will then be within the floodplain. Also a lot of repositories near the stream could restrict recreational use along the corridor. Better to remove most of the tailings to a permanent repository. Actually we feel that alternative seven would be even better at addressing our concerns, especially the goal of restoring Silverbow Creek into a helthy fishery and wildlife area. We feel this alternative is more compatible with the States Natural Resoruce Damage Claim which we as a chapter of Trout Unlimited have supported in the past. However we wish the State and MDHES luck in implementing alternative six. /// We would also like to comment briefly on some of the key concerns listed in the proposed plan summary. /// We feel that treating tailings in the floodplain with STARS technology is not good for the long term because in many areas the tailings are too thick to till in lime; because the groundwater fluctuates and periodically contacts some tailings; because the stream will meander and erode into tailings in the future; and because this does not solve other contamination sources such as instream sediments and railroad materials. /// We have commented above on our preference for one or two regioinal repositories. We do not always endorse waste repositories in uncontaminated areas. In this instance we feel that removing contamination sources from the floodplain is more important./// Land restrictions around the repositories will probably be necessary to protect human health. /// We think Opportunity Ponds are the best nearby site for a repository. Local residents should have a large say in whether or not to use Browns Gulch. /// Ramsay Flats we feel is too developed and has too much potential

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I	186	Whalen, President	Bob	as a future recreational area to use as a regional repository. /// We do not feel that the short term risk of excavating and hauling is that great. Some has been successfully done at Warm Springs. The long term beneifts far outweight the risks. /// We have no preferenced for either truck or rail haul. If transportation consultants feel that rail haul is cheaper and/or safer then use it where possible. /// We strongly support the objective of improving Silver Bow Creek to support a self reproducing trout fishery. In fact, as stated above we prefer the objective of restoring the creek to premining conditions as outline in the State's Natural Resource Damage Claim. /// Thank you for the opportunity to comment, Bob Whalen, President Westslope Chapter."
I	187	Crisp	Fred	"I support removing all contaminated materials from Silver Bow Creek as outlines in Alternative 7. At the very least remove 80% as outlines in Alternative 6."
I	189	Grayson	Michael B.	"This letter is to inform you that I support the State's plan to clean up Silver Bow Creek. /// I believe it is essential for ARCO to remove as much of the tailings as possible. In the long term, all contaminants left in the flood plain will surface and wash down stream. All tailings should be removed - 80% is too conservative. /// The Greenway concept is useful in one respect; it is a good idea to place bike and walking paths by the creek and to re-vegetate the creek as much as possible. However, there is no proof that treating the waste in place will work. Long term proof must be produced, and since none exists at this time, more emphasis should be placed on removal of tailings from the flood plain. /// I believe many others in Anaconda would support the state's plan; however the ARCO propaganda machine has many too intimidated to speak out. Good Luck! /// Michael B. Grayson."
I	190	Lyon, Vice President	James S.	"Thank you for this opportunity to comment on the Streamside Tailings Operable Unit Feasibility Study. With a field office based in Bozeman, Mineral Policy Center keeps abreast of the various projects and issues throughout the state of Montana. Given our emphasis on preventing mining damage for the health of present and future generations, we have tracked closely the Clark Fork River site. /// On behalf of the Mineral Policy Center, we respectfully urge the Montana Department of Health and Environmental Sciences to choose Alternative 6 or 7 for the clean-up of Silver Bow Creek. In order for the Silver Bow Creek corridor to be able to heartily support aquatic and vegetative life once again, we believe it is imperative to take the opportunity to completely remove the contaminated mine wastes. This makes Alternative 7 even more preferable than Alternative 6, which would remove only 80 percent of the wastes.

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I	190	Lyon, Vice President	James S.	/// Further, we recommend the use of the Opportunity Ponds for holding these materials. We have visited the site, and it makes sense to use the existing Ponds for waste repository. The amount of wastes from the Silver Bow Creek would be comparatively small to what is already in the Ponds. /// Let me close by saying that we are encouraged by the state of Montana's apparent determination to thoroughly clean-up Silver Bow Creek. Thank you for considering our comments, especially that of supporting Alternative 7. If you have any particular questions about our position, I encourage you to contact Will Patric in our Bozeman office (406-585-9009). Please keep us posted with all relevant information and decisions regarding this study. Thank you. /// Sincerely, James S. Lyon, Vice President for Policy."
I	191	Coopmans	Jerome & Yvonne	"We support Alternative 6 or 7 for the clean-up of the Superfund site on Silver Bow Creek. A permanent treatment for the tailings must be used ... the time is now. Removal of the contaminated tailings as well as the surrounding soils will insure that our children will not have to deal with the "legacy" of pollution we inherited from our parents. /// Sincerely, Jerome Coppmans."
I	192	Gassenberg	Sue	"Growing up in Butte, I am aware of young people in the 1950's using Mercury in Silver Bow Creek in amateur mining efforts. This likely occured in much more than my own experience. This, combined with with all the Mercury that came down into the creek from old commercial mines such as the Alice, causes me to believe there could be a very substantial amount of Mercury along Silver Bow Creek. /// I understand that there were not many samples taken in your efforts to determine if Merucry is a health problem, but that all the samples had Mercury show up in them. I imagine it might be hard to find all the pools of Mercury because it stays in a liquid form and is so heavy. Nonetheless, it seems that there should have been more testing done by ARCO in order to try to locate them. In my estimation, you should require removal of all the Mercury. And the best way to do that is to remove the tailings. /// I understand that the remedy you think should be used is one that removes about 80% of the tailings, so I believe it is a good remedy. If you only pull the tailings back outside the floodplain, how will you control the Mercury? Being liquid and heavy, it would seem to have a tendency to move through the tailings, and roll back downhill and into the creek again. If you lift it out of the floodplain along with the tailings and put it all into safe, dry repository, that would seem to be the most protective remedy. /// I don't think that cattle should be allowed to graze on any of the grasses planted into the tailings because of the cadmium in the tailings. I don't think kids should be playing on the tailings either. How could you keep people from digging into them over the years? I don't believe that could be done. We can't even get good maintenance of the hillside grass that was planted in Butte under this

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I	192	Gassenberg	Sue	Superfund program! /// I like the idea of trucking the tailings to Rocker or to somewhere behind the Berkeley Pit as long as back roads are used. I am a member of the Citizens for Labor and Environmental Justice and of CTEC, so amy pretty familiar with the issues involved. I support your Alternative number six, or would support number seven. Less cleanup than these would not protect human health and the environment adequately.. /// Thanks for the good work. /// Yours truly, Sue Gassenberg."
I	193	Douglass	Kristin Snyder	"I attended meetings this summer concerning the clean-up of Silver Bow Creek. After listening to the Greenway proponents and to the meeting you conducted presenting the State's proposal I became concerned about how this issue is perceived by the public and the interpretation by the media. /// This letter is in support of your proposal. In part I feel that you are a non-biased party and have had equal access to the issue and the problems and therefore are presenting us with the best possible solution. At the same time, I feel that the Greenway proponents, in their determination to present a 'vision,' have no real quarrel with your solutions except that their clean-up measures do not seem to take into account historical events beyond the hundred-year measure, nor do they realize that the communities herein have historicaly been content to live in the wake of large pieces of equipment moving large amounts of earth for economic gain. /// I will be delighted to have Silver Bow Creek cleaned up to the extent you propose, and to have the material moved to the Opportunity location. And of course, the Greenway will follow. /// Thank you for the opportunity to voice my opinion. /// Sincerely, Kristin Snyder Douglass."
I	194	Doggett	Arminda & Victor	"We support the State's plan - Alternative 6 or Alternative 7. Cleaning up the toxic sediments and tailings at the headwaters of the Clark Fork River, at the Streamside Tailings site, is the best cleanup plan for a federal Superfund site. /// Please do all you can to influence the powers that be to support the State of Montana's proposed plan."
I	195	Gichwald	Linda	"I am extremely concerned about the Silver Bow Creek cleanup decision. considering the cutbacks in Congress and the lowered environmental concerns in our state government, I strongly encourage you to support a permanent and thorough cleanup of contaminated tailings/impacted soils in the Upper Clark Fork River basin - /// I especially encourage you to support Alternative 7 to include all contaminated mine wastes from the Silver Bow Creek floodplain. /// Sincerely, Linda Gichwald."

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I	196	Archie	Michele L.	"I'm writing in support of the state's proposal for cleaning up the streamside tailings site along Silver Bow Creek. This proposal -- Alternative 6 -- goes a long way toward permanent protection for the water quality that is vital for the health and well-being of Montana's residents. I am encouraged to see Montana's governemnt taking a firm stand in the face of opposition from companies like ARCO. /// I also urge you to look again at the more extensive removal of wastes from the floodplain that is proposed in Alternative 7. To me, it seems sensible to remove these tailings rather than merely stabilize them. With this year's heavy rains and runoff, we've seen plenty of examples of streams changing course. Unless strictly channelized, Silver Bow Creek will do that, too. That seems likely to destabilize the entire "stabilized" situation in the floodplain. I'd like to see a healthy, meandering Silver Bow Creek in the future, and Alternative 7 seems like the best way to accomplish that goal. /// But at the very least, please stick with your current proposal. Alternative 6 is a good plan that we need to put in place now. /// Sincerely, Michele L. Archie."
I	197	Erickson	Nancy N.	"The best way to ensure permanent protection of water quality and animal health is to remove the affected tailings on soils - I entirely support yur plan #7, and applaud your commitment to cleaning up Silver Bow Creek. /// Sincerely, Nancy N. Erickson."
I	198	Mueller	Ronald	"I am writing to express my support for the state's plan "Alternative 6" for clean up of the headwaters of the Clark Ford River at the Streamside Tailings Site. However, I do have some concern with the STARS technique, which I hope will be improved/modified so that it adequately reduces the mobility of arsenic. If that can not be accomplished, I believe that additional tailings and impacted soil removal should be considered. /// Thanks for the excellent work that you and your team have done on the project. /// Sincerely, Ronald Mueller."
I	199	Weaver	Jana	"I am writing in support of alternative 7 clean-up for Silver Bow Creek. From the information i have read, removal of contaminated tailings and soil is the best way to protect this site and the water quality there. Water is the lifeblood of our beautiful planet and without clean water we all lose. /// I appreciate that the state of Montana has a committment fo cleaning up Silver Bow. Removal of the wastes will allow Silver Bow Creek to heal. /// Sincerely, Jana Weaver."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	200	Slack	David C.	"I support alternative 6 or 7 for the clean up of Silver Bow Creek. /// Thank you, Dave Slack."
I	201	Craig	Mary Kay	"Over the past three years, I have attended all of the public meetings on Streamside Tailings--including the three meetings for landowners and neighbors you co-hosted with E.P.A. in the fall of 1992, all of your department's subsequent meetings and Roundtables, all the many Streamside public meetings hosted by the Citizens' Technical Enviornmental Committee (including a presentation by the Agency for Toxic Substances and Disease Registry, Atlanta, and the Risk Assessment meeting you co-hosted with CTEC earlier this year), and five informational meetings this year hosted by Butte Citizens for Labor and Environmental Justice. I have toured the Silver Bow Creek O/U several times and am familiar with the demonstration projects, including the Governor's Project. I support your Preferred Remedy, Alternative Six, and have so testified before the Butte-Silver Bow Council of Commissioners and at your oral public hearing. /// I followed issues at this O/U as the Butte representative of the Clark Fork Coalition until February of this year. Since July, 1994, I have been president of CTEC, the EPA-funded technical assistance Group charged with translating technical Superfund date for the public. In the past year, we initiated Simply Superfund, an informational newsletter for the public and have mailed six editions to date. Each issue delt in depth with the Streamside Tailings O/U, especially the four issues this year which have been mailed.to 600 to 700 residents affected by Butte-area sites. All CTEC meetings have been publicized well so that the general public has know of opportunities to learn about the technical issues of the site; yet we have rarley seen anyone associated with Project Green at our meetings and we have never seen anyone from the Butte Chamber of Commerce, or a member of the Butte-Silver Bow or Anaconda-Deer Lodge Council of Commissioners at our meetings. Please do not be swayed by rhetoric that Project Green "clearly has a consensus," for as you know, CTEC and the general public have been shut-out of meetings held by those who oppose your plan. /// As president of CTEC, I was involved in a lengthy attempt to have Project Green backers make a presentation to our membership and the public and, when they finally agreed, I attended the meeting. That night, along with at least a dozen other members of CTEC and the public, I signed up to become a member of the "core groups" of Project Green. Despite a promise at the meeting that we could help with that group's planning, we were not contacted by Project Green. And our subsequent inquiries, including a letter, were ignored! As president of CTEC, when I learned of another series of meetings "of all parties" concerned with the Streamside O/U hosted by Butte -Silver Bow, I instructed the CTEC staff to attend despite the fact we were not invited. I make these points so that you will seriously consider the fact that the Project Green effort was not a true public effort, as has been your own process and that of CTEC. I attended the two Project Green meetings at the War Bonnet Inn where most of the "general public" attending was known to me and to others there as

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I	201	Craig	Mary Kay	employees of companies backing the Project Green effort. It was obvious to us that even the leaders of the "core groups" had little idea of, or concern for, the Supuerfund issues at the site. And the economic development they supposedly stand for must not be well understood by them, or they would likely look toward the many, many years of blue-collar jobs to be created by removal of the tailings from the streamside, and consider that to be of far more value than the unspecified amount of money ARCO purport to give as grants for a greenway. Perhaps they though the ARCO grants would go to their companies. In any case, the majority of the "public" at those meetings simply did what they were told to do by their employers. Therfore, I believe you must consider the opinions of most of those backing Project Green to be a dutiful response of employees, and not give those opinions the weight you would give to other truly "affected residents" from whom you solicit community acceptance opinions. /// The following are my specific concerns: /// 1. End Land Use as Remedy Criteria is not legal. /// Withing the first three paragraphs of the major changes to Superfund Law in 1986's SARA reauthorization, the word, "permanent" or permanence" is used four times. End land-use or future land use planning is not cleanup criteria. This is the law under which you must make your decision. /// Backers of ARCO's Project Green use the term, end-land-use, as if their plan for eventual use of the stream corridor with "recreational" only zoning has some validity at law. The know that the possibility of "residential" use of the corridor requires removal of a greater amount of contaminants at higher cost to ARCO then if not removed. ARCO has seriously co-opted these folks, promising them grants for developing picnic tables amoung tailings piles, etc. If they will help ARCO get a lower cost remedy. Project Green hopes to capture some of the dollar difference between ARCO's hoped for 20 to 40% removal and your 78% removal. That this is true can be seen from a quote by Sandy Stash in an enclosed newspaper articl. Backers of Project Green expound their belief that the U.S. Congress may change Superfund Law (CERCLA/SARA) at some time in the future to reflect land use plans as a means to help determine how clean a site must become. On behalf of future generations of Butte-area residents and future landowners along Silver Bow Creek, I ask that you not limit the kinds of ways in which land may be used in the future, and that you not place a perpetual burden of operation and maintenance of STARS (or of a put-and-take fishery) on future generations. This could happen if you decrease the degree of cleanup you require (to "recreational" only) in order to facilitate grants from ARCO to Project Green backers. The history of the United States is only 200 years old; of this area, only 100. In only the past few years, Butte residents have been terribly disappointed with upkeep of new Superfund run-off years, Butte residents have been terribly disappointed with upkeep of new Superfund run-off basin(s) and Butte Hill "wheat fields" that cover contamination. How can you assure future generations of the permanent remedy (required by SARA) if a great deal of tailings must be maintained in the floodplain for many hundreds or thousands of years? /// Great effort has been made to convince the Butte-Silver Bow County Commissioners to change the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	201	Craig	Mary Kay	County Master Plan to show "recreational" future planning. This would be the first time they would adopt a Master Plan as an ordinance, not a resolution, and that would make it harder for anyone to be able to change it in the future. This limiting designation is unfair to future generations and preemptive of good cleanup. It may be a "takings" from current landowners who do not support the ARCO lower quality cleanup. And it is ridiculous in a floodplain to attempt to maintain up to 80% of the contaminants in situ in perpetuity! /// 2. Human Health is of Concern. /// I have had cancer of unknown cause, two associated surgeries and nasty chemotherapy. So I am one of those cancer statistics that it is supposedly OK to have happen. Data in a paper published in the 1990 Proceedings of the Clark Fork Forum by Drs. Samuel Luoma and Johnnie Moore discusses the mine waste problems in this headwaters area. It cites studies done in the 1960's and 1970's that showed the Anaconda/Butte area had the highest per capita incidence of "all diseases" and of "heart disease" in the nation. It showed extremely high incidences of lung cancer here vs. nationally. It seems odd that Butte would be outstanding in these disease statistics vs. other areas in the country (such as PIttsburgh, PA) with the same ethnic groups and cultural habits, but where mining of different minerals took place. Earlier this year, I passed the Luoma and Moore paper on to the folks from the Agency for Toxic Substances and Diseaase Registry for their study, but have not heard anything from them to date. I realize their staff is short-handed and their responsibilities great, but ask that if you receive any data from them relative to the studies cited, you include such in your Responsiveness Summary. /// I am very concerned about the possibility that unidentified quantities of Mercury may remain in the Silver Bow Creek floodplain if ARCO does not do all the removals you have cited in you Preferred Remedy. ARCO provided your agnecy with only twelve Mercury test samples for the entire 25 mile length of the creek. All had mercury. In addition, I have heard local stories about a very large "pool" of mercury that was once uncovered by a local man in Lower Area One. I know people who have had jars of mercury in their basements that they collected out of Missoula Gulch. There are a lot of abandoned workings along the upper creek that may have released mercury. Mercury alone is good enough reason for you to stick to your guns and require the full 78% of tailings removal you have preferred. /// More reason for getting the tailings our of the floodplain is the uptake of cadmium by cattle which can occur under the STARS program. Since cattle often overgraze and often pull plants by the roots, it doesn't matter whether or not cadmium is up taken into the plants. If the plants are grazed, there is a good possibility of contamination of the food chain. A Rocker-area rancher tells the story that another state's health department traced cadmium-contaminated beef to his ranch many years ago. He states he has changed how his cattle are grazed since then. This kind of thing should not be left up to individual ranchers on STARS treated land. Your Agency must require removal of the cadmium -- removal of the tailings -- so that the land may repair itself and once again be available for such use as cattle grazing. At an area near the Rocker demonstration project,

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	201	Craig	Mary Kay	removal was done and the subsequent Green by Mother Nature is far more abundanct and lush than the meager STARS type plantings. This is proof that the land can repair itself better than STARS can. /// 3. Your objective of a self-reproducing trout fishery must not be compromised. /// Please stay with your objective. Butte kids deserve a real natural stream, not a put-and-take fishery. All of us deserve that your remedy not have to be redone by the Natural Resources Damage Program folks when they win the funds from ARCO to remove enough metals to provide the spawning trout fishery that once was in Silver Bow Creek. /// Copper and zinc, aquatic toxins, must be removed not only from the streambed, but from all areas in which the stream may meander in perpetuity. Where you may rely on railroad beds to hold the creek from meandering, some strategy must be devleoped and funded by PRP's to assure that those railroad beds will always be there. /// Hydraulic washing as a method of removing the "fines" from the streambed has been criticized by opponents to your plan. While I am sure you would not have chosen this remedy without good scientific suport for its efficacy, I suggest you reconsider the idea of excavation for those areas where your critics do not feel hydraulic washing is sufficient. The end-result is what is important to your Record of Decision: removal of contaminants so that a self-reproducing fishery is enabled. How you get there may be stated as a multiple of ways. /// STARS is an unproven technology and it was not implemented properly at the demonstration sites. If you are going to allow use of STARS, there must be ongoing monitoring wherever it is used. In addition, support the monitoring idea from the folks in Ramsey -- that liners must be placed under any tailings pulled back from the creek. Only with testing of a point of dishcarge from the liners can we truly know whether or not STARS is holding the metals in check in groundwater. /// 4. Your preferences for tailings repositories are very good; behind the Berkeley Pit would be even better. /// I applaud your desire to listen to residents of the Brown's Gulch area about a repository near there. Some Brown's Gulch folks hope to keep their propoery nice for their children; yet, they have already been disappointed by the potential from contamination far greater than that posed by the high, dry repository of tailings: the area is already impacted adversely by the Butte-Silver Bow regional landfill. A few years ago, I met with area residents in their efforts to dissuade the County from locating the landfill there. They were concerned about possible contaminant leak to Silver Bow Creek among other things. With them, I testified at a public hearing before the County Commissioners. There were no area residents who wanted the landfill there; yet, the County continued with its plan to locate the landfill up the Brown's Gulch road from Rocker. /// The point is, it is not a "pristine" area; moreover, there is a great deal of conjecture presently about how safe the landfill is and will be in the future. Economics of the close proximity of the Brown's Gulch repository to the removals also makes it logical site. So, from the information I have, I support the Brown's Gulch. /// The Opportunity Ponds are a good choice. The tiny impact of the streamside tailings as a ratio to the amount of tailings now present there makes it a logical choice, as does the logistics of

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I	201	Craig	Mary Kay	rail transport, which is already in existence. While leadership of Anaconda-Deer Lodge County does not like the idea of additional rail traffic to the Ponds, I firmly believe that the people of Butte-Silver Bow County would appreciate very much the number of jobs that would be created if all the tailings could be hauled by truck out of the flooplain to repositories here. /// I have spoken with many people at CTEC meetings who believe the tailings should "go into the pit." I understand that this would change the chemical makeup of pit water and preclude future mining of the liquid minerals, so do not support it. However, I believe that the tailings would most propoerly be placed behind the pit in the drainage behind the Yankee Doodle Tailings Dam. That would be my first preference. With MR as a PRP, it would appear you could make that a reality. /// Other issues of concern are discussed in the attached articls from The Montana Standard which I also sumbit (12 pages) as public comment. /// Thanks to you, Neil Marsh, Mike Bishop, and the entire staff who have worked so diligently on this O/U. Most folks here greatly appreciate your professionalism and the seriousness with which you take your job to protect the health of the people of Butte and Anaconda, as well as your devotion to finding good solutions to the problems of our century-long dead creek and floodplain. /// Yours very truly, Mary Kay Craig. Attachments: "
I	202	Judge	Patrick	"I'm writing to express my support for the state's proposed plan to clean up Silver Bow Creek, (specifically Alternatve 6 but also feel that Alternative 7 has strong merit and should be carefully considered as a possibly preferable permanent solution. Thanks for your work and your consideration. /// Sincerely, Patrick Judge."
I	203	Langley	Gary A.	"The Executive Committee of the Montana Mining Association has discussed your request regarding the tailings in the Silver Bow Creek flood plain. /// Because the situation involves scientific data on both sides of the question, the Executive Committee has decided that the Association be silent on the issue. It has been a long-standing policy of the Association not to lend unconditional support or opposition to a project, but to base its position on the best scientific data available. /// I hope this answers your inquiry, and we look forward to your continued participation in the Association. ///Sincerely, Gary A. Langley, Executive Director."
I-III	28	Stosich	Steve	"I am writing to express my views regarding the MDHES Streamside Tailings Project. The July 10 meeting at Fairmont was quite informative and very enlightening.///I feel that more attention should be paid

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
I-III	28	Stosich	Steve	toward controling the root of the problem. Attack the run-off coming from Butte, fix the Berkley Pit problem and clean up the Metro-Sewer situation. Unless these problems are addressed, any cleanup project would be fruitless.///I am totally opposed to the transportation of 1.8 million cubic yards of waste to either the Opportunity Ponds or Browns Gulch. It is completely insane to contaminate an area like Browns Gulch. This area has been virtually untouched by mining operations and should remain as such. Not only that, but the use of trucks to haul from the site to the repository destroys the grassroots of the project and that is a safe cleanup which protects the environment and human health. It would be interesting to know whose brilliant idea this was.///I support the Greenway project as a viable solution to the problem. Wen can't wait another ten or fifteen years to get started -- now is the time. Greenway provides for a COMMON SENSE approach to a century old problem of a long term, safe cleanup of Silver Bow Creek.///It also provides an economic asset for the citizens in the Butte/Anaconda area by providing recreational land use within the creek corridor once cleanup has been completed.///Greenway can effectively treat the tailing in place or relocate them outside the flood plain within the Creek's corridor. These tailings should NOT be removed from the corridor.///An end use approach toward the cleaned up area is critical to the success of the entire project.///Thank you for your time and consideration of this matter!"
IA11	37	Everhart	Nancy M.	"I am writing to you in reference to the most recent state hearing held at Fairmont concerning the clean -up of Silver Bow Creek. It sounds like there are many views on either side of the proposed plans. I hope the state will taken an objective look at the plan ARCO has put forward and consider its merits.///My concern is the comments in the Montana Standard made by Mr. Ford concerning "ARCO's big checkbook". Yes, ARCO is a large corporation - but that doesn't give Mr. Ford or anyone else the right to assume they should fund any amount of money he sees fit to charge. The state of Montana has reaped many financial benefits from the 100 plus years of mining in this area, yet now they seem to be of the mind that they need to find a golden goose for their problems. Corporations such as ARCO employ thousands of people who pay axes and support many non-profit community activities. Many of these people have lost their jobs in recent years due to irresponsible attitudes like Mr. Ford's. The "checkbook" belongs to shareholders (including many Montanans), not some nebulous group of evil polluters.///I think it is time for the state to cooperate with ARCO and other industry. Comments like Mr. Ford's do nothing to encourage goodwill or help the discussion towards a reasonable solution. Please think about your comments before you speak them - if the state doesn't treat ARCO as its personal unlimited bank account a workable solution is more likely to happen."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IA23	48	Haffey	J. Ray	"On July 10, 1995, I testified at Fairmont Hot Springs regarding streamside tailings of the Silver Bow Creek drainage. My testimony centered on the need for a compromise to get the job started and completed. When I mentioned the Colorado tailings as being a "black eye" to Butte's image, I forgot to mention a thought that I had. An ideal location to relocate the Colorado tailings and other pollutants from the pole plant would be in the old landfill south of Butte. Butte's old landfill, which was recently relocated, is higher and drier. Trucks would not have to cross or be on the interstate. A repository could be developed and covered. Butte could even build a golf course over it when finished. I really believe Brown's Gulch should be left alone. Using the Opportunity pond would only fuel a fire that is not necessary. Butte and Anaconda need to work together on this project and not be at odds or feel resentment.///I know your job is complicated and difficult. If a compromise can be agreed upon which includes much of Project Green, the job will be done. Who knows, Benjamin Franklin may even smile down on you.///If I can be of further assistance, please contact me. Good luck."
IA33	71	Leiss	Nicki	"The best treatment of streamside tailings in Silver-Bow Creek is using the STARS Technology and avoiding the risk-factor of future contamination of other land when you move any toxic substance. Thus treating and containing the tailings on site is the best and only way.///As for the Rocker OU, using the same treatment that was used for the streamside tailings in a small laoding area, with a relocation of much of the contaminantion to a on-site repository-thus again you would avoid the risk factor in moving the contaminaiton.///As for use of the Opportunity Ponds and Smelter Hill as a regional repository is completely wrong! The Opportunity Ponds and Smelter Hill were designed and built for the wastes of Smelting in Deerlodge County. If you do not know this, I,m telling you now!!!"
IA45	101	Evans, Chairman	Barbara	"In our letter, dated July 21, 1995, we supported Streamside Tailings Operable Unit alternative No. 7 as our preferred recommendation. Our basis of that recommendation came from our belief that the STARS system would not meet evaluation criteria 3 and 4. Since writing that letter, we have concluded that additional commentary is in order. /// The Missoula Board of County Commissioners again commends the Montana Department of Environmental Sciences and the U.S. Environmental Protection Agency for the professional work the agencies have performed in developing the proposed plan for the Stramside Tailings Operable Unit. We are pleased that your agencies have recognized the important principles of achieving a permanent and effective remedy for this site, and that you have recommended the removal of the majority of tailings and contaminated soils and streambed sediments from the site. At the same time, we have significant reservations regarding your preferred Alternative No. 6, and strongly urge you to

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IA45	101	Evans, Chairman	Barbara	implement Alternative No. 7, which includes plans for the complete removal of tailings impacted soils along Silve Bow Creek. /// Missoula County has consistently commented to your agency and the U.S. Environmental Protection Agency on matters concerning the cleanup of the Clark Ford Superfund sites. We have requested that your agencies proceed with cleanup measures that will effectively and permanently remediate contaminated areas in the upper Clark Fork watershed. Such measures are necessary to protect the health and welfare of the residents of Missoula County, which lies at the downstream end of the upper Clark Ford watershed. /// We think the agencies' support of alternative No. 6 is a strong step toward solving a most serious environmental problem. At the same time, we support Alternavite No. 7 which calls for complete removal of problem wastes rather than employing questionable revegetation technology to mitigate their efforts. /// The agencies' proposed plan suggests revegetation of the farthest downstream portion of the site, which lies in closest proximity to the Clark Fork River and Missoula County. We object to the use of revegetation techniques because they will not effectively immobilize metals over the long term. Revegetation may succeed in temporarily beautifying the area. But in the long-term, floods will occur, the steam channel will meander, and tailings will once again be distributed downstream, accompanied by a release of metal contaminants into the headwaters of our watershed. In fact, the revegetation techniques will lead to increased mobility of contaminates such as arsenic and possibly cadmium and zinc. This concerns us, because arsenic contamination has already occurred in the Milltown and Missoula Aquifers. /// The release of contaminates in the upper Clark Fork watershed has resulted in groundwater contamination and damages to aquatic resources in Missoula County. If the contaminants along Silver Bow Creek are not removed from the floodplain, we anticipate continued re-contamination of the Milltown Reservoir, Clark Fork River, and Missoula Aquifer, irrespective of any measures which may be taken to clean up current contamination at those sites. /// We do not oppose the concept of a greenway along Silve Bow Creek, but suggest that it be constructed following tailings removal, not instead of tailings removal. /// Please carefully consider our support for Alternativel No. 7. It is critically important to the citizens of Missoula County that the plan provide for a permanent remedy. In the long run, this will be the least cost solution. /// Sincerely, Board of County Commissioners, signed: Barbara Evans, Chairman, Fern Hart, Commissioner, Michael Kennedy, Commissioner."
ID10	83	Beer	Mrs. Mary S.	"I am writing to let you know that I support Alternative 6 or 7 for the cleaning up of Silver Bow Creek. It would be best to remove all the contaminated mine wastes from the creek, but removing 80% as in Alterantive 6 would be better than ARCO's plan of treatment which would be only temporary. The State must see that a permanent cleanup of this devastated area is accomplished."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
ID18	27	Fischer	Susan	"Please consider this as a letter of support for ARCO's proposed solution to the Silver Bow Creek Corridor. In my opinion, the option of remediating "treatable" soil in place and working to provide the Butte-Anaconda area with an economic and aesthetic opportunity is the kind of solution we need from Superfund.///To me, Project Green in conjunction with ARCO's proposal is a positive, constructive, and creative step to expedite Superfund cleanup, solve other environment concerns and provide future benefits such as economic development, historic preservation, and recreation. However, the window of opportunity is now. It may not be here in one to five years.///I am totally opposed to transferring 1.8 million cubic yards of dirt over or across public roads to store it in another county or on "clean" soil. I believe that ARCO will work to make a green-way corridor a success. I have watched closely the progress on the Old Works golf course. Anaconda will be left with a signature golf course that MUST be maintained by the legal requirements placed on PRPs. I know that ARCO will do the same for the Project Green corridor.///Please encourage the acceptance of ARCO's proposal. I believe that it has worked closely with the Project Green group to arrive at a viable, safe option."
III		Ammondson	Mark	"I'd like the state to demonstrate some sanity and "back-off" the position of transporting the material to the Opportunity Ponds or Browns Gulch."
III		Anonymous		"Expedite - Expedite - Expedite /// I favor on-going work ASAP! Please pursue quick action."
				"You can't rollerskate in a buffalo herd."
III		Barnes	Richard J.	"Relocation between opportunity, Highway 48, Highway 2 and Interstate 90. Treated water from Berkley Pit may help."
III		Barry	Edward G.	"Why can't these contaminate waste be made into a slurry and pumped down old mine shafts. Mt Con mile deep, Steward 4,000 Kelly 4,000. This is where the come from. The old Berkley pit would hold all of them and then some. It might also seal the water courses."
III		Battleson	Dan	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
III		Battleson	Dan	"We need the "Green" project to "? add" to the cleanup effort."
III		Brooke	T.	"Consider "a pilot" in place clean up to confirm reliability."
III		Carlson	Cindy	"The attitude that "ARCO has a big checkbook" is not constructive. Work toward the solution that gets the work done without being punitive or greedy & gets Butte the Greenway!"
III		Cass	Ron	"If ARCO does not do it right, they will have to do it agian. Lem them do it."
III		Costin	T.	"I participated at the Public comment session at Fairmont and observed overwhelming support for the Greenway Project. The state should "seriously consider" the need of our community."
III		Darlington	Sue	"I agree with SL Graff (ed. Mt. St. 7-16) comments. Also about potential of haz materials from Butte (& pit). Thanks for info & involvement. I'm willing to get involved."
III		Erickson	Ralph	"We already have beavers & muskrats seven miles West of Butte and grass on the stream bottom & sides! If you make the gree way then you had better police it. We'll have every bum & hitchiker in the country camping out. It is bad enough now."
III		Fitzhugh	Elvin & Patricia	"I think the State of Montana should share the burden of clean up at this site, as well as others that it permitted & benefitted from in the past. All Montanans, not just ARCO benefitted & share the clean up responsibility equally."
III		Green	C.W.	"On site treatment & stabilization is preferred second would be nearby treatment, stabilization, and/or safe depostiion the wet lands component sound very good."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
III		Gwynne	G.	"Why not use the Anaconda golf course strategy but on an smaller scale?"
III		Heath	Leo A.	"Mr. Ford, you are in a position to support these positions also. We depend on you to make these wise choices."
III		Hildreth	Ed or Eathal	"Be practical, don't spend more money than necessary to correct bad problems."
III		Johnson	Keith P.	"Lets get on with this, in a sensible, practical way."
III		Kehler	William	"I reserve support of inte #2, without knowing the cost of a new Columbia Garden and who is funding this. Need more information concerning itesm 5 & 6."
III		Lewis	John T	"Proceed with clean up immediately. Make this a reality and have it completed within 10 years."
III		Maney	Richard L.	"I like everything about the Greenway except the proposed Columbia Gardens location is too close to the noisey interstate. Good Luck!"
III		Maxson	William	"I am 70 years old and nothing would please me more than to see a fact similiar to the Columbia Gardnes before I leave this world."
III		McDermitt	Pat	"With 2 railraod lines running thru concerned area, why don't you haul waste my rail & dump in Berkley Pit in Butte. Take back where it came from."
III		Mohan	Pat	"Would like to help!"

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
III		Nuthah?	Scott	"Stop giving into special interest groups like Robert & John Ray of Tech. The thought of disturbing ? soils seems it'll create more problems than capping."
III		O'Donnell	John	"Stabilize the wastes close to the present sites. Don't spend more time and money moving waste to other sites, contaminated or not."
III		Parker	Bruce	"Support the project green! Butte-Anaconda residents want project Green."
III		Periman	Nita	"Support Project Green! As a 20 year resident of this area I would like to see this project be undertaken."
III		Reardon	Pat	"This issue has lingered too long - I simply don't agree with the State's position toward ARCO and I think the state of Montana shares responsibility in this effort.
III		Reynolds	B.	"Let the experts guide us in deciding the best long term solutions. I know I would like to see the Greenway concept become a reality but don't feel that I have enough knowledge to decide or advise others as to the best clean up procedures to follow."
III		Richardson	J.	"It's time to listen to the citizens of Butte who obviously support Project Green by a vast majority."
III		Scott		"State mandated removal of tailings must be accomplished before other remedies can be implementes. ARCO bought Anaconda Co. assetts & liabilites."
III		Scown	Jim	"Clean up the tailings so they're usable!"

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
III		Stepam	Ed	"I am in favor of Project Green solution."
III		Thompson	Jim & Margie	"Please use common sense and be mindful of solutions and service you can give this area along with end land use."
III		Ulrich	Don	"Prioritize efforts - Do Priority soils first - so run off does not contaminate stream further down & make efforts to clean these areas ineffective as a waste of money."
III		Verstraete	Richard	"Let's use common sense!"
III		Williams	Brian E.	"Motorized recreation should be a part of the Greenway!"
III		Winter	Steve	"Perhaps the state should recognize that they should also be a PRP to the extent of tax revenues received during the mining of the Silver Bow Area."
IV		Antenioli	Tim	"I feel that the "STARS" technology should be considered. /// If the decision is made to move them they should be moved to Yankee Doodle Tailings Pond. /// No land use restrictions along Silver Bow Creek. /// Prefer Rail haul to repositories. How much money is ARCO and the taxpayers going to pay. /// Someday this is going to be considered quite a luxury."
IV		Bahr	Greg	"I feel you should remove the tailings along the creek and place in the flats north of the Berkley or in the tailings pond. This seems to be a good permanent fix. And shouldn't cost anybody anything in the future."
IV		Berube	Louise	"Expending large amounts of societal resources without first considering the magnitude of the risks to be abated is a poor approach to resolving environmental concerns."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Berube	Louise	
IV		Black	Dan	"I would like to see the tailings moved by truck to the tailings pond north of the Berkeley pit. I would also like to know who is going to care for this area after the clean up."
IV		Blom	Michael S.	"I do not think that mixing lime with tailings is the answer. I think the tailings should be removed and store in one area, one that is already contaminated like the berkley pit or the Yankee doodle tailings pond. /// If repositorys are to be used I believe a few large ones should be used rathr than many smaller ones."
IV		Both	Dennis	"State plan is the best"
IV		Bower	William	"Grass should be planted on reclaimed land after done mining."
IV		Bradshaw	Stan	"This is written in support of preferred Alternative #6. /// The reason is simple: It provide the most optimal clean-up at a reasonable cost. /// Second, the amount of uncertainty surrounding the long-term efficacy of STARS tratment, when combined with ARCO's rather checkered performanc, (See Memorandum frm Reclamation Research Unit/MSC to Jim Ford Date 1/4/95), suggest only limited application of STARS. /// I support the idea of 1 or 2 reional repositories such as Opportunity Ponds. /// The bottom line is to provide a clean up that is permanent and not the one that inflicts the least financial pain on ARCO. Alternative 6 does that."
IV		Brulla	Ed	"I agree with the state."
IV		Burke	William S.	"I feel the most logical proporties for the regional repository would be flats, North Berkley Pit and Yankee Doodle tailings pond. /// The STARS technology would be fine for the safer regions farther down stream."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Casey	John	"They should be sure that the STARS technology works before they use it. It will cost alot of extra money if they have to go back and do it again."
IV		Cashell	Jennifer	"STARS technology does not appear to be a good long-term solution concern over stream contamination. /// One or two regional repositories appears preferable. Numerous local stream respositories may require land restriction which is not preferable. /// Not Berkeley Pit/Yankee Doodle Tailings Pond is considered a preferable site for repositories."
IV		Cerise	Ted	"I agree with the state plan."
IV		Compton	Don E.	"One and only things is get this situation under control. The longer this is in the air the more problems its going to create. Have ARCO and use get together and just get it done."
IV		Crosby	Lawrence	"I feel that the Stars program would not be satisfactory in the long run. I believe that the muck should be deposited in the tailings area in the pit - it should be deposited in the tailings area in the pit - it should of coarse be trucked in. I would be happy if the land use were designated for municipal parks."
IV		Denny	Mike	"I agree with the State Plan. Remove the tailings in whatever manner it has to be removed and because one already have a tailings why not put it in the ?"
IV		Dummir?	Dave	"I agree with the State Plan. /// The mine waste should be cleaned-up at the Silver Bow Creek Bed."
IV		Dunmire	Dan	"Tailings should be hauled by truck to North of Berkley Pit or the Yankee Doodle tailings Ponds."
IV		Friesz	Gale	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Friesz	Gale	"I really don't have any comments on the 5 issues on the front side of the form. However, based on ARCO's past performance on cleaning up the Warm Springs Ponds. It is evident to me that they have once again taken the shortest and cheapest route to solve an environmental nightmare. /// Public meeting, hearings will be held on the eventual method of clean-up of Silver Bow Creek. People should speak up. /// I am not sure whether or not ARCO's plan is a good long term solution to the problem. /// Good technology exists in cleaning up environmental disasters. A sound plan should be adopted and ARCO should be forced to pay for the clean-up regardless of the cost!"
IV		Garcia	P.	"STARS technology not adequate. Move the amount of tailings the state proposed to a site north of Berkeley pit or to Yankee Doodle Tailings pomds. Could use rail up to Kelley mine and extend track to get to area north of Berkely pit (rather than use Brown's Gulch or Opportunity ponds) Fencing off small repositories is not an adequate solution. There should be few restrictions to silver bow creek truck if necessary or rail as described above."
IV		Gelle?	Tyke	"I fell that North of Berkley Pit & Yankee would be the most logical place to put it. They are already a dump site might as well use them, instead of making new ones."
IV		Getz	Gerald	"One or two regional repositories would be easier to maintain. The Yankee Doodle taling pond would be a easy location to transport the waste by rail since it is still in use it would also be easy to maintain because it is still in use."
IV		Giacomino	Brad	"I think the "Stars" technology sounds like a good system to use but due to lack of history it should wateched carefully. I think there should be 1 or 2 repositories that should be fenced off, I think they should locate the repositories North of Berkeley Pit and/or the Yankee Doodle Tailings Ponds."
IV		Goodwin	Charles W.	"State hands are more educated about what need to be done, than I am."
IV		Graham	Keith	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Graham	Keith	"I feel approx. 50% of all tailings should be removed from Silverbow Creek basin and that tailings material should be deposited in the Yankee Doodle tailings pond so no additional areas are contaminated by tailings. /// I don't think adding lime to the tailings is an adequate solution for reclaiming tailings."
IV		Gransbery	Ron	"I think the state plan is best."
IV		Groves	Larry	"I think the state plan is best."
IV		Hall	Robert J.	"The Yankee Doodle Tailings Pond should be used to get rid of the tailings so we don't put it into Browns Gulch or Ramsey Flats and ruin more ground."
IV		Halloway	Jim	"Why not dump it back in the old Berkly pit."
IV		Harrington	Brian	"All tailings should be removed. The state plan is a good idea."
IV		Holland		"Tailings should be hauled to 1 or 2 central repositories where it could be capped & fenced off."
IV		Hoppe	L.	"No regional repositories this is not a good long term solution. Put it North or Northwest of Berkly Pit. /// Truck or rail should be cost effective."
IV		Hunter	Dan L.	"Haul the tailings into these sites ends the problems except for long term care, who will be responsible in the future."
IV		Johnson	Jim L.	

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Johnson	Jim L.	"The Berkeley Pit is where the tailings belongs. The water has to be treated anyway. The tailings would seal off the water from getting into groundwater. Most of tailings came from Berkeley in the first place."
IV		Jorensen	Joey A.	"Sounds to me as if cooperation between parties concerned would speed up a solution. Instead of tying up the issue, a forced deadline with severe financial penalties for delay would get involved parties to bargain and keep delays out of the court system and all of the stall tactics."
IV		Kachtyn	Duane	"The tailings pond seems like the best idea."
IV		Kinghorn	Thomas E.	"Will the people of Butte be able to use this area when it is done?"
IV		Konerny, M.D.	A.M.	"1) Don't cause more pollution by hauling the tailings around and the having to do the same thing elsewhere to fix a problem that was created by the move. Fix in place and fix the problem where it now occurs. /// 2) No repositories. /// 3) I am not sure /// 4) No repositories. /// 5) Do not transport the waste elsewhere."
IV		Kramer	Raymond	"Would like to see tailings sent to Berkley Pit or Montana Resource tailings pond."
IV		Leary	Jim	"I feel that ARCO should do the reclamation in the proper manner. Not do it as cheap as they can. Let them clean it up right. Also they should have to put up some kind of fund to take care of future problems. /// When ARCO bought the Anaconda Co. they took on all the liabilities that go with it. They are now trying to pass the buck."
IV		Leathers	L.R.	"As long as it is in the works to clean up the creek then it should be cleaned so that people can use it."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Lewis	Jim	"Who is going to take care of this when the mine is done?"
				"I would like to see Yankee Doodle Tailings Pond or the Berkley Pit used as a repository. The only feasible way to transport this material to these locations is by truck. /// If Silver Bow Creek is cleaned up properly, I hope to see no land use restrictions."
IV		Lubick	Thomas	"100 years of mining the tailing belong to ARCO and should be brought to Berkeley or Tailing dam."
IV		Lutz	John	"I feel that the STARS technology is not an appropriate way to permanently clean up the area. The tailings should be placed in the Yankee Doodle Tailings pond or North of the Berkley Pit. Tailings should be trucked if disposed of in this fashion. I do not feel local repositories along the creek area would be appropriate. In conclusion I feel the proposed plan it the only way that would be feasible."
IV		Martinez	Fred	"How is going to pay for this."
IV		McBride	Jon P.	"STAR'S is only temporary, I don't care how much fill you put over the hot rock it still could be washed off. Move the taiings up out of the flood plain & then use lime and cover it. Its worth the money spent."
IV		McGinnis	Matthew	"The tailings problem belongs to ARCO and should be brought to the Berkley Pit or tailings dam."
IV		McGowan	Ed	"The Berkelly Mining Area still has potential mining value. With restriction so outstanding to develope any mine it becomes likely that Cu demands will force the reopening of mines such as this. Consequently it would be unwise for mine operators, the State, or for any special interest group to allow dumping of waste from cleanup in or around the Berkelley. This mining potential should be exploited to its fullest...Which in turn would profit everyone in MT. /// The continental Mine Excavation project will mine in 20+ years the equivalent Ore Tones as the berkely...Not total Tons, but yet a huge pit capable of being back filled. Unlike the Berkely the Continental Pit will be totally ? with not a ton of

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		McGowan	Ed	economic reserve to be left behind. Most certainly an operating mine, whom at present is not required to backfill, would not welcome the repository idea. But at the end of mine life or at least 3/4 the way through that hill, at a cost, most cleanups could be safely deposited there. If a mine operator had incentives to change the mine plan to favor the repository concept then their willingness to become part of the solution would be more likely. /// The Continental Mine has offered to place the sand fraction of their tailings into the Berkley ... everyone agreed... but no-one committed. Now the Berkeley H2O problem is more costly to manage, liabilities have increased, and land degregation is greater at yankee doodle... Each party, and their respective legal departments, held on to their own as a form of damage control. So by doing, created a bigger problem, with not less solutions." "No drilling or exploratiion is taking place in the Butte area... Small efforts to gain entry to the known reserves have all failed. Without major incentives associated with "Superfund" the situation will remain "Cat and Mouse"...and all parties/citizens suffer. /// Do most of the tailings contain traces of metals and are they sulphide or oxide? Sulphide materials with residuals of copper could be ran through a mill... again. The economic value may offset the cost knowing that tailings from old works probably report a higher grade than the low grade being mined on the cast ridge. If an assay was favorable and the ore ot sour then maybe an opertor would except the material as ore. The PRP's would be admonished, old workings gone, and new revenues and incintives for mining ventures on the hill would be created. Mistakes of the past, poor planning, indescriminate permitting, and the rush to develop can be used in a positive way... AT present these mistakes require operators to hold on the the law as they applied to them then...damage control not solutions. /// Allow mining in the Berkelly and grandfather in the backfill stuff, let the water plans be developed at the coarse established by teh EPA and then see whay repository solutions beocme available. Recycle Yankee Doodle as well. The Cu in tailings from the Berkeley was higher than the now profitable low grade cont. East. at $1.25 Cu/# almost every mine dump and taiings area could be milled at a profit thus consolidating all tailings for the entire district. The rail from Butte to Anaconda is still capable of shipments from Anaconda to Butte - Pay MRI and/or open the door to develop more and solutinos better than those listed will be ?. No drilling or exploratiion is taking place in the Butte area... Small efforts to gain entry to the known reserves have all failed. Without major incentives associated with "Superfund" the situation will remain "Cat and Mouse"...and all parties/citizens suffer. /// Do most of the tailings contain traces of metals and are they sulphide or oxide? Sulphide materials with residuals of copper could be ran through a mill... again. The economic value may offset the cost knowing that tailings from old works probably report a higher grade than the low grade being mined on the cast ridge. If an assay was favorable and the ore ot sour then maybe an opertor would except the material as ore. The PRP's would be admonished, old workings gone, and new revenues and incintives for mining ventures on the hill would be created. Mistakes of the past, poor planning, indescriminate

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IV		Merrick	Mike	"They should be sure the STARS process will work effectively before they use it. It would cost a lot of extra money to go back over it if the system does not work for the long run."
IV		Motland	Norman	"I would like to see the tailing disposed of in the North of Berkely Pit/Yankee Doodle Tailings Pond area, rather than any of the other available sites."
IV		Myers	Serge	"After living in Opportunity 44 years and been by Silver Bow Creek - Clark Fork Creek - Yellow river - Sh-t creek which this creek is called by many of us. I have been by this creek thousands of times and have seen the creek at many differenct stages over the years. /// I know the only way to make this stream environmentally sound is the remove all toxic metals and tailings from creek area and flood plains that are bad. This creek can only be reclaimed by this being done, then there will be no health restriction along the creek area."
IV		Niland	George	"My feelings towards the "Star" proposal is this "I beleive the tailings should be dugout and hauled to the Yankee Doodle tailings Dam. It is obvious to me that this area is allready contaminated with tailings so another 2 million tons isn't going to make a difference one way or another. I don't think the stars proposal will work in the long term issue, I don't think the tailings should be hauled anywhere other than the Yankee Doodle tailings Dam or dumped into the Berkley Pit. I beleive the contaminants where mined in Silver Bow County so it should stay in Silve Bow County, Not Opportunity. I have children and I don't like the idea of leaving the contaminates to destroy the ground water of the

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Niland	George	future."
IV		Nugent	Dan	"Who will pay to maintain two repositories, Mines or tax payers. 2) If trucked, what route to use to move the waste."
IV		O'Redli	Steve	"State plan best."
IV		Peaslee	Art	"Its not a proven technology; I think the state plan is the best."
IV		Pelter	Gabe	"I agree with the state plan."
IV		Piazzola	Frank	"I agree with the state plan."
IV		Puccinelli	Larry	"Stars tech. was used in Anaconda on a pond and it is doing excellent, it was mixed with topsoi."
IV		Radcliffe	T	"Will there be a trust set up to keep up the project?"
IV		Robbins	Doug	"Need more time for "stars" to prove itself. Tailings should not be hauled to areas that are not currently contaminated. Small repositories would be harder to control & monitor."
				"I think the states plan is the best for the area."
IV		Robinson	Neil	"Put it in Berkley pit came out of there start with."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Seitz	Mark	"STARS plan is not proven to be a permanent solution. We might put tons of money into stars and later on we have to go through it again and fix it right. /// 2. I think one or two would be better than having 15-30. That would be more areas to find to put the repositories and more people being made if its put near their homes. /// 4. North of Berkley/Yankee Doodle would be a good area. Theres tailings up there now so it wouldn't be that big a deal. /// 5. Rail or truck would either be ok. Which ever would benifit Montana Resources. While we are running to not efect our production."
IV		Shea	Jimmy	"1) I would prefer that STARS are not used. 2) Several large ones. However, I don't think the Brown's Gulch area should be used as a repository. 3) It depends on what is done to the area. Certainly restrictions should be used if any further concern about contaminants harmful to the public. 4) The Berkley Pit has its own concerns. Also the Yankee Doodle should not be used as a repository. 5) It depends on the site chosen, Economies and the best means of transportation should be used after considering all locations."
IV		Stanley	Cal	"I agree with State plan to remove tailing - Why not put tailing in tailing pond at M.R. ? of Bercley Pit."
IV		Stepper	David	"Put tailings into Berkely Pit or Montana Resources tailings Pond."
IV		Stiles	John	"I haven't kept up with these issues. Without background knowledge I have no opinion."
IV		Sullivan	Pierce	"Is there a fund to finance the clean up for the long term (hundred of years)? If not there should be. That way if the "STARS Technology" Doesn't work then there will be money for other clean up effort. The state plan is probably better."
IV		Taylor	Darrell	"I think the state plan is good."

CAT	REF NO	LAST NAME	FIRST NAME	COMMENTS
IV		Tiovanen	John	"I believe in the state plan."
IV		Truzzolino	Rick	"One other concern would be the upkeep of the greenway, the citizens of Montana do not want to be held liable for ARCO's leftovers. Hopefully a trust fund could be set up for this purpose."
IV		Wright	Jeffrey C.	"The STARS technology is not enough, the state plan is better. /// Better to use rails to move the tailings to a major repository."

APPENDIX D-2
Comments Received during the Public Hearing

Site/O.U. SST CU
DHES File # 5-04-14-18
Admin. Record: Yes ✓ No.
Administrative Record #
Confidential: Yes ___ No ✓
Key Words/Comments: Hearing transcripts

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STATE OF MONTANA
DEPARTMENT OF ENVIRONMENTAL QUALITY

HEARING
STREAMSIDE TAILINGS OPERABLE UNIT
of the SILVER BOW CREEK/BUTTE AREA
SUPERFUND SITE

TRANSCRIPT OF PROCEEDINGS
Taken at:
Fairmont
Anaconda, Montana
July 10, 1995
BILL KIRLEY, presiding

INDEX

INDEX (Continued):

INDEX (Continued):

MONDAY; JULY 10, 1995

MR. KIRLEY: My name is Bill Kirley. I'm an attorney with the Environmental Remediation Division, the new Department of Environmental Quality.

We don't want the term "hearing" to put anybody off tonight. What we want to do is hear your comments, your views on what has been proposed for the possible remedy at the Streamside Tailings Operable Unit.

When you present your comments, be aware that we would like to hear thoughts on all of the alternatives considered as well as the proposed plan. This is the people's chance to give their impressions of whatever ideas they have about the remediation. If there are innovative ideas out there that someone has that no one else has thought of, that would be very valuable information for DEQ and the EPA to consider before a final decision is made on the remedy here.

This hearing will be your opportunity to present verbal comments. We're not going to have a question-and-answer session. No one will engage you in debate. No one will try to interrupt your comments unless you speak beyond five minutes, in which case I will interrupt your comments and ask you to hold the remainder of your comments until after everyone else

has had a chance to speak so that everybody will have an opportunity to present up to five minutes worth of comments.

If there is someone who has a long presentation that they do not want to have interrupted, you can waive your chance to speak until everyone else is done and then you can have a solid block of time at the end.

We'll call the commentors up in the order in which you've signed up on the sign-up sheet. If there's anybody who has not yet signed up and wishes to present comments, the sign up sheet is right up here on the front table. Come up at anytime and sign in.

Our first commentor will be Dr. S. L. Groff.

S. L. GROFF: Concerned citizens, it's a pleasure to see so many people here. It's been a long time since I've spoken before an audience of this size. My name is Sid Groff. You see it in your readers column in the paper once in a while. I hold a bachelor's, master's, and doctoral degrees in geology, minor in physics and groundwater. I'm a graduate of the University of Montana and the University of Utah.

I've done statewide work at the Bureau of Mines and Geology over 26 years, specializing in groundwater, mineral fuels like coal, and administration.

I want to congratulate the guys on their proposal. It's well written and succinct. It's unfortunate that I disagree with it. I do not concur with the alternatives presented and am of the opinion that the proposal is flawed in that, so to speak, they did place the cart before the horse a little bit and the proposal does not present other pertinent alternatives.

I like the concept of a pristine stream with fish where you can go out and catch fish all the way from the Warm Springs Ponds up into the mountains, but in thinking it over, it's going to cost an awful pile of money and it's going to take a lot of years to do that. As a matter of fact, I think it's going to cost too much and take too long, and there are alternatives.

Now, before you clean Silver Bow Creek up, I think you better do something about the pit and everything else in the city of Butte itself and guarantee that if you clean up the creek, you won't have a wreck here in Butte and pollute it again. I think that's important.

Then you have an argument in there from the EPA that 1 person in 10,000 will catch cancer from arsenic. I think that's the EPA's way of always trying to put the lowest option in there. I don't think it's right and I've never known anybody who got cancer from arsenic. They use it for medicine, they use it to kill potato bugs, and I've never heard of anybody who puts that stuff on potatoes to go to the hospital with cancer. So they'll have to, as far as I'm concerned, I think we better drop the cancer-arsenic argument. I would love to have you people prove it if you can, but I don't think you can.

Well, there is another concept that I ran into in Tennessee many years ago. It was in the disposal of radioactive waste, where they mixed up clay and the waste, baked it, and made a cylinder out of it and dug a hole in the ground. And a salt miner over in Nevada set it in intersections like on a checkerboard. They said it worked and I believe it would, but the people being what they are, they acted like dogs in a manger and they couldn't get it done.

I think they could do that with the waste, set up concrete mixers, pour the cement that is designed specifically for that purpose and make something usable like building blocks and use them in

this project. And you wouldn't have to dig it all up and haul it away. That's what gets me, you haul all that stuff away and bury it and make it somebody else's problem.

And there has been mentioned a dumping up in Brown's Gulch. I don't think the people in Brown's Gulch are going to want that because simply it is valley fill. And I don't care whether you put in the vadose zone or the saturated zone. That stuff's going to get in the water and it's going to move with the water and it's going to spread out. So why put our poison where there is no poison now?

I think if you're thinking about a place to plant specific poisonous or hazardous material, why not dump it in the pit itself? I know if you dump it in there, the level of the water's coming up, but that's a problem we better get to solving fast and quick or it's going to be too late.

I do favor the greenway concept. I think we ought to plant all the trees we can. Silver Bow Creek has been like it is now for a hundred years. And I think it can be slowly cleaned up with the help of nature by putting in ground limestone periodically and in several places, build up the pH to as high as 8, and change those sulfides into oxides which are

much less dissolvable.

The sewage treatment plant has got to be taken care of and that sewage can be converted. If you can dry it and take care of it, you can make fertilizer out of it and it might be something to enhance the Greenway Project.

To summarize quickly and get into my five minutes, I have to say first, that I oppose cleaning up or dredging the stream bed. I think that's wrong and it's going to be too expensive and it isn't necessary. I think that we better be darn certain that the pit and other potential hazardous material, seepage of the fluid is contained before now and the future, before we get this thing involved in a massive cleanup.

The argument that arsenic will cause cancer, I'll repeat that, I don't think it's the right argument. I consider the concept of cementing tailings, that might be something new to you, but it's something we should look into. And you're going to have to hire some experts to set it up.

Forget, as I said, burying the tailings in Brown's Gulch. Consider dumping hazardous materials in the pit. It won't hurt anything; the pit's already polluted. Speed up what you're going to

11

do with the pit and the fluids. Consider long-term time conditions rather than doing everything quick. I think you can clean the creek up by adding that stuff and nd taking care of it. And stop dumping sewage into Silver Bow Creek because it absorbs oxygen and you need all the oxygen you can get in there to oxidize sulfides, which are the biggest problem we've got.

I cut that as short as I could. Good luck to you guys and I'll listen a while.

MR. KIRLEY: Our next commentor is Dr. John Ray.

JOHN RAY: There is an old maxim of Roman law that the people's safety is the highest law. And I think that this principal must guide our deliberations as to determining what we should do about the streamside tailings in Silver Bow Creek.

The central issue that we face is what plan will clean up Silver Bow Creek so as to protect Human health and the environment. Everything else is secondary to that goal, both in terms of Superfund law, but most importantly in terms of our responsibility to protect the public. Everything relates to what will give maximum achievable

12

protection to human health and the environment. As I said, all other considerations should be secondary to that. Questions of cost, questions of future land use, all are secondary to the issue of protecting the public's health and safety.

So the question is: What plan does that? What approach to streamside tailings is most protective? And I would make the argument that the State's Preferred Alternative No. 6 achieves that goal more than Alternatives 1 through 5 and more than ARCO's hybrid plan as an approach to streamside tailings.

Why? What are the advantages of the preferred alternative? First, the preferred alternative calls for the removal of tailings out of the flood plain that pose a serious threat to human health and the environment. As long as those tailings are left in the flood plain, there is a risk to human health and to the public safety. The only sure way to protect public safety is to remove those tailings from the flood plain as proposed under the State's Preferred Alternative No. 6.

I would also make the argument that the State's preferred plan is more conducive to multiple use of the land. If we have all sorts of little mini

13

waste dumps along the stream, institutional controls are going to severely limit land use. For those people who are sincerely interested in a greenway or in some kind of greening of the streamside corridor, you should all be behind the State's preferred plan because that's the only one that is going to give a level of cleanup that will minimize the use of institutional controls so that we could have a real greenway.

I would say that the State's alternative is also more protective of property rights. By definition, institutional controls which you will have if we don't have a good cleanup, institutional controls limit property rights. They tell property owners what they can, and more importantly cannot do with their property. So if we really support property rights, we should support Alternative 6, the preferred plan.

The preferred plan also relies on STARS technology only where appropriate. Alternatives 1 through 5 and the ARCO plan want to use STARS all over the place and there's serious problems with STARS in terms of implementability, in terms of whether or not it works, in terms of whether or not it provides a permanent solution to the problem. There's serious

14

questions, studies, and other evidence that shows it is a very limited approach and is not protective of public health and is not protective of the environment. The State plan only uses STARS where appropriate.

And finally, I would argue that the preferred Alternative No. 6 comes closest to meeting the requirements of Superfund law, the criteria laid out for Superfund decisions. As I said, Approaches 1 through 5 and the ARCO hybrid plan don't measure up because of an overreliance on an unproved and questionable STARS technology. This approach would not protect public safety, would not protect the environment. It would be susceptible to problems such as erosion, stream meandering.

There are implementability problems because of various pH levels, depth of tailings. There are problems because it would not reduce the volume of contaminants, the heavy metals that pose a serious risk to human health as has been documented time and again would still be in place, could still pollute the stream. And it makes no sense to spend millions of dollars cleaning the area above streamside tailings and the area below streamside tailings and leaving a contaminated mess in the middle, which you

15

would do with STARS technology.

I would finally make the argument that Alternatives 1 through 5 and the ARCO hybrid plan are not protective of property rights and are not conducive to multiple land use because they would demonstrate or they would mandate institutional controls all over the streamside tailings areas, which by definition limit land use and limit property rights. So I would urge support for the preferred Alternative No. 6. Thank you.

MR. KIRLEY: Comments from Dick Tretheway.

DICK TRETHEWAY: My comments are going to be much shorter. I'm a landowner down there on the creek. I own quite a bit of land down there. And I've studied this over and I have come to the conclusion that the most practical way of cleaning this thing up and doing the right thing is the STARS concept as presented by ARCO.

I also like the greenway. I feel the Butte people in Butte and Anaconda deserve something like this greenway. I was very much impressed when I'd seen pictures of that. That's something we could use.

I have heard in the past and read about different places where they were going to do this and they were going to do that and they were going to do the other thing, and they drug it out long enough that nothing was done or it was worse than when they started, in some instances. That was before a lot of new laws have been passed.

So that's all I want to say is I'm in favor of the greenway, I'm in favor of the ARCO plan. I think it's the most practical way to go. Thank you.

MR. KIRLEY: Can everyone hear sufficiently? It doesn't need to be turned up? It's okay? Okay, great.

Comments from Vicki Watson.

VICKI WATSON: I'm Vicki Watson, I live in Missoula. I'm a professor of biology and environmental studies in the University of Montana.

Like everyone else here, I want what's best for the river and communities that live along the river. And it's great to see that there are this many people willing to come out in an evening and spend some time trying to achieve that purpose.

I'd like to congratulate the state team for the rational approach that they developed to

evaluate which mine waste in the Silver Bow flood plain should be removed and which should be treated in place. The criteria that the State developed to choose between removal and treatment for each individual patch of waste are based on both signs and common sense.

By proposing what are really scientifically defensible criteria and then allowing the criteria to select what to remove and what to treat, the State has helped to clarify the scientific and economic issues here and help all of us to see more clearly the cost and benefits of the varying levels of removal and treatment in several different alternatives.

I am convinced that the State's criteria have selected for removal those mine wastes that pose the greatest threats to Silver Bow Creek and to the Clark Fork. The tailings that the State proposes to treat in place do pose a lesser threat than those that they propose to remove.

However, a rational argument can still be made that any wastes that were deposited by the stream during the flood could be eroded by that stream in a flood of a similar magnitude to that which deposited the mine waste in the first place. So when, not "if",

but when those wastes are eroded back into the stream again, it may be a very long time from now and none of us will be here, but children or grandchildren and great grandchildren may be here when those wastes are eroded back into the stream. It could undo or at least partially undo the effort that was put in to remove contamination from the stream bed.

So the State should have a very strong argument to convince the public that land which was in the flood plain when the waste was deposited by the creek is no longer in the flood plain. If the State can't provide good evidence for this shifting of flood plain, then all the wastes that are transported by water should be considered for removal.

For example, in the Ramsay Flats area, the State has concluded that some of those wastes extend beyond the 100-year flood plain. The flood plain was probably estimated using a flood model that assumed unobstructed flow of a stream. But I'm sure all of you have seen ice dams in the creek that cause it to back up and flow out over the land, or debris dams often occur during floods and can cause a much larger area to flood and be contaminated. These are natural events so we have to plan for them.

So I guess I'm asking the State to

consider that when they consider where the flood plain is. And if after considering the risk of erosion from the flood that's been broadened out by such a debris dam, if the State still is convinced that the 20 percent of the waste that could be treated in place can be treated in that way, then this in-place treatment, the STARS treatment, should be regarded as an experiment.

There must be a commitment by the State to long-term monitoring the effectiveness of this treatment. And by "effective" I mean that in-stream water quality standards and groundwater standards are achieved, not just that grass can be grown on the site. Remember that STARS is still an experimental technique, not a proven technique. Short-term effectiveness studies are still in progress and long-term studies will require that long-term commitment that I mentioned.

So STARS may prove to be an effective technique that can be used at the other mine waste contaminated sites that meet the criteria developed by the State. And we have an opportunity here to find out if STARS does work that well in those limited sorts of sites by using it in the 20 percent of the sites that the State proposes to use.

I do want to point out what I consider to be a potential problem with coordinating the Silver Bow Creek cleanup with the upstream work. Until contamination in Butte is better stabilized, the Silver Bow Creek stream bed could be continually recontaminated again by the flow coming down from Butte. So I think that the State should consider a two-stage cleanup: The flood plain could be tackled as soon as possible now, but the stream bed part of the cleanup should not be carried out until after completion of the Butte area cleanup.

I guess I'd also have to say that I didn't feel that the documents that I looked at provided sufficient information on the stream bed removal for me to understand how it was going to be done or even if it's a good idea. So I'm still somewhat reserved on the stream bed removal part itself.

So in summary, I support the State's approach and its chosen alternative with these caveats: First, that the State should show why wastes that were deposited by floods are not now in the flood plain and should reconsider the flood plain in light of the idea of debris dams; and two, they should treat any STARS-treated areas as experiments and commit to

long-term monitoring, monitoring how well they help to achieve water quality standards; three, that the transport of wastes should be by rail so as to reduce fuel costs and impacts on local communities; and lastly, that they consider a two-stage cleanup with the flood plain being tackled as soon as possible and the stream bed waiting until after the Butte area has been cleaned up. That's all I have.

MR. KIRLEY: This is a public hearing where we want to encourage everyone to speak freely without any pressure from any corner or any opinion, so I would ask people to withhold their applause or any comments directed toward any speakers and avoid that during the hearing, please.

Also, we have a number of speakers, and I have been a little lenient on the time to this point. We're going to have to make sure that we stay on track. So that you know what I'm doing, when you have reached your five minutes to speak, I'll stand up and that will give you the clue that you have a few seconds to wrap up your comments. Okay, thank you.

Our next commentor is Elisa Lynch.

ELISA LYNCH: For the record, my name is Elisa Lynch. I'm a graduate student in environmental

studies at the University of Montana. I'm here to give my support for the removal of contaminated wastes from the Streamside Tailings Operable Unit.

I support most aspects of the State's proposed cleanup plan, including the removal of all in-stream sediments of one millimeter or smaller size, and removal of railroad materials wherever they pose a potential threat to human health or water quality.

Regarding the State's plan for tailings and impacted soils, I differ and ask that total removal be implemented. I believe that there is scientific evidence to support a conclusion that removal of all contaminated tailings from the site is the only sure way to support the cleanup objectives of protecting human health, groundwater, and Silver Bow Creek.

I disagree with the State's conclusion that STARS treating the tailings left in Subarea 2 and within the flood plain in Subarea 4 will result in acceptable protection of groundwater in Silver Bow Creek. For the creek, the danger from such a plan comes from the fact that the creek will over time naturally meander, and its course could easily take it into the areas of STARS treatment.

STARS treatment does not remove any of

the metals of concern to human health and animal life but just temporarily holds them in place with vegetation and a change in pH. If the stream comes into contact with those treated tailings, it will erode them into the waters, endangering once again the fish and other aquatic life that the cleanup work at the rest of the site has already restored.

In addition to the danger of re-entrainment of tailings into the creek, STARS does not protect groundwater from arsenic or livestock from cadmium uptake. The STARS study concluded that arsenic is not mobilized by this treatment and in some cases, it's solubility is actually increased. This is important because arsenic is the primary carcinogenic risk to people living on or near the site. Achievement of the goal of cleaning up groundwater to drinkable standards is questionable with the continued or increased arsenic release which will occur in STARS-treated areas.

Cadmium is also a metal of concern at this site and the STARS study found that it was taken up by plants at all of the study sites with concentrations that often exceeded recommended tolerances for livestock consumption. With the removal of all tailings in the State's proposed plan,

24

the clean up to the Streamside Tailings Unit will have the best chance of protecting human health, groundwater and the creek. This is the intention of the Superfund law and I believe that these are worthy and important goals. Thank you for hearing my comments.

MR. KIRLEY: Comments from Dr. Thomas Ginn.

THOMAS GINN: Good evening. My name's Thomas Ginn and I'm a principal with the firm of PTI Environmental Services. I'm speaking this evening as a toxicologist and an ecologist who's been studying the situation in Silver Bow Creek for the last four years. I'm a sediment scientist and my specialty is evaluation of the ecological risks of metals and organic chemicals in sediments and soils. In addition to my work in Silver Bow Creek, I have been doing studies of this kind since 1983 at Superfund sites throughout the country.

My comments tonight, I'd like to discuss some very important technical problems associated with the proposed plan. First I'm going to comment on the ecological risk assessment itself that would presumably form the basis for the decisions made in

25

the proposed plan; and second, I'm going to comment on the appropriate remedial actions that should be undertaken for Silver Bow Creek.

Now, from a risk assessment standpoint, there are two distinct environments that should be addressed for Silver Bow Creek. The first is bed sediments in the creek itself, and the next is the historically deposited tailings on the flood plain.

First I'd like to start with a positive comment. With regard to the historically deposited flood plain tailings, I fully agree with the State's position that the risks are minimal to terrestrial animals. I've conducted extensive studies in Silver Bow Creek on plant and animal communities and I have found insignificant risks to deer, birds or small mammals that use those habitats.

With regard to the stream bed sediments themselves, the sediments in the stream, I have significant disagreement with the State's proposed plan, however. The State has conducted a simplistic and overly conservative risk assessment that is based on theoretical numbers supposedly relating concentrations of metals to adverse effects. These values are derived from the general literature and are not valid from a scientific standpoint for estimating

26

risks in Silver Bow Creek.

Why is this important? It's important because the use of these numbers by the State has resulted in a gross over-estimate of the risks of sediment metals to aquatic biota and results in a biased perspective concerning the need for any remedial action in the creek.

In the proposed plan, the State has suggested that all sediments less than one millimeter in size, and that's up to sand grain size particles, be removed from the creek. I strongly disagree with this position regarding the need for removal of these so-called fine grain sediments. Any removal, and I stress "any removal" of stream bed sediments in the near term is unwarranted, it cannot be substantiated by scientific information, and it's inconsistent with national EPA policy.

First, as I stated before, the State has over-estimated this risk of sediments. The State has also ignored the recovery of some biotic communities, insects living in the bottom sediments in Silver Bow Creek. And second, laboratory experiments and field data have shown that these sediment-bound metals in Silver Bow Creek will not be a significant long-term source of metals to the creek, and that is dissolved

27

metals. This concept of dissolved metals is important. It's supported by EPA. If there is a potential toxicity, it's dissolved metals; it is not the metals that are bound up in particles.

Now, although isolated removal of truly fine sediments, and those are the silts and clay-size particles, from pool areas may have some beneficial and limited effects at some point after all other response actions are implemented, there will never be a need for large-scale removal of bed sediments that are in the one millimeter or smaller size range.

The truly fine grain particles have the higher concentrations of metals and these are the particles that are very easily flushed from the system by natural processes. High flows like we had this spring, flush them and we have an excellent system in Warm Springs ponds to trap those metals once they are flushed.

So what should be done concerning sediments in Silver Bow Creek? The answer is: Right now, nothing. Any active removal of stream bed sediments should be deferred until the planned source control actions are completed. These actions near Butte will control the sources of metals to the creek and it would channel stabilization and implementation

28

of STARS. The input of any new metals will cease and the sediments can clean themselves up naturally. The natural flushing action of the stream will remove these fine grain sediments, promoting the natural recovery process.

Now, for an example of how this will work, we only have to look down to the Upper Clark Fork River. Once the sources of metals were controlled in the 1960s and '70s, there's been dramatic improvement in the water quality below Warm Springs Ponds. There is abundant fish, abundant fish food organisms that are healthy. This is in an area where the sediment metals are the highest in the Upper Clark Fork River, and yet we have the highest numbers of fish in that area.

Now, there's several merits for deferring any of these sediment removal actions. The first is time is needed, at least five years for these upstream sources of metals to be controlled. Any sediment actions during this period would be unwarranted.

Once again, the bottom line is defer these sediment actions until all other cleanup alternatives are implemented. Thank you very much.

MR. KIRLEY: I will apologize in advance

29

tonight for anyone whose name I butcher as I try to pronounce it up here. And if no one responds when I pronounce a name, I'll keep trying until you recognize it.

The next comments are from Con Malee.

CON MALEE: Good evening. My name is Con Malee and my hometown is in Anaconda where I work in Butte for Montana Power and am on the Anaconda - Deer Lodge County Planning Board as well as the Zoning Board and many other city organizations. But tonight I'm here to represent myself as a taxpayer, and I'm here to offer comments on Silver Bow Creek.

I also want to go on record as both a friend and a foe in Superfund for both EPA and the State as well as ARCO. I have been on both sides of the fence and so I don't purport to pose any particular interest tonight except point out some issues that I think are important. We all know the alternatives: The State of Montana wants a relatively very expensive option; ARCO wants a less than expensive option. They want a greenway and they think perhaps we're going to mitigate that.

But my initial reaction to both of those alternatives is that ARCO wants off the hook as

30

inexpensively as possible and thus are supporting the Project Green. On the other hand, the State supports one of the most expensive alternatives that wreaks of punitive damages to better posture the State for a legal battle over natural resource damages.

Some of you may call me correct on both of my assumptions, some of you may not. I think what we have to look at here is a compromise between the two. And there is middle rode, and I hope that we don't confound any hidden agendas with what needs to be done.

What seems to be missing, in my opinion, is common sense. Have we gone so far, so overboard on the technicalities that we've forgotten to take into account what just makes sense? You know, the book that's out, The Death of Common Sense, is a frightening account of how potential benefits are strangled by regulations and memos and meetings and studies and litigation and arbitration and hidden agendas. We need to work towards a consensus to avoid that kind of thing in all of Superfund.

In my opinion, the State's approach seems to lack common sense. I am supporting of ARCO's position simply because they have taken into account end uses for that land. And I think that's important

31

as a taxpayer and as a long-time resident of Butte and Anaconda. It just doesn't make sense to transport thousands of tons of tailings anywhere. It just doesn't make sense to me. Now, we take contaminated soil and we put it on dirty soil and we hope it doesn't rain or something doesn't happen to cause all of that to come back. It just doesn't make sense when the opportunity and the technology is in place to be treated where it is.

We have a unique opportunity here just like we had in Anaconda to do something unique and something creative with Superfund. Nowhere does Superfund law require a PRP to be aesthetically pleasing or to offer anything that potentially improves the economy of the area. We were able to do that with the Old Works golf course. Let's do that again right here on streamside tailings.

Decades of mining and smelting have left us with a robust and colorful history. Yet along with it, we had tailings, smoke stacks, overburden, and all kinds of remnants. It's only fitting that we cooperate to turn the present, known as "Superfund", into a period of remediation efforts resulting in things like Project Green, the Old Works golf course, and parks.

32

I am confident that ARCO's preferred alternative will work for one reason, and that's because it's required by Superfund, it's required by federal law. ARCO has responsibility for maintaining the stability and safety of their remediation in perpetuity. That means if it doesn't work, in five years they're back in here with millions of dollars to make it right. You know, maybe I'm a gambler but I'm willing to give them the option to try it because I know that they have responsibility in perpetuity to come back and make it right.

I believe that ARCO wants the proposal to work for all the parties involved. To me that's what the State's plan is lacking. I question who the real beneficiaries are in the State's plan. Are they the citizens present and future of Butte and Anaconda, or is it a committee or a staff in another city whose members do not live and raise their families in this area?

ARCO has solicited the citizens of this area to provide input into land use after remediation. I encourage you to listen to the citizens and weigh their comments. Thank you.

MR. KIRLEY: Comments from Senator Tom Beck.

33

SENATOR TOM BECK: Thank you for the opportunity to come here tonight and talk a little bit about the cleanup. I participated in the last STARS program that was instrumented by Governor Stan Stephens below the Warm Springs Ponds. Even though it probably isn't the panacea to solve all the problems, it was a real distinct improvement of those slickens down there. You'd have to go take a look at the property itself to see what an improvement it did make with the growth of alfalfa, all kinds of vegetation, root developments, the stabilization of the soils, less erosion. And it appears to me that you don't want to throw this program, even though all the tests and even though it's in its virgin state, you don't want to throw all this out just because we haven't got the final results of the technology on it.

Now, I look at your plan and your plan is very, very conservative. And coming from where you guys are coming from, I believe that's probably the proper perspective for you. I think that ARCO's plan is probably a little bit more on the other side of the economic side.

What I would ask of you people, and you people are the ones that will draw the final position on this whole scenario, is that you would take a look

34

and try to come to the middle, try to avoid any litigation that might result of the plan that you have right now. I would like to see a greenway developed in my time here living in the Deer Lodge Valley and certainly for my kids' times. But if this winds up getting into the courts or getting into a litigation problem, it could be 20 - 25 years before we see any development here.

I think both proposals probably are a little extreme. I think that there's probably some more removal that should be done but maybe not the 1.8 million. That could take up to 15 years just removing that much. My concern is if we're going to have to do it there and if the STARS program isn't working on below the ponds, are we going to continue on down the stream all the way to Missoula removing soils all the way along?

And when you remove the soils, are you going to go back and you're going to put soils back in its place, and what kind of a scar are you going to leave in the earth if you take the soil to put back in so you do have vegetation along that stream? I think that's absolutely essential that you have vegetation.

I think coming from the public perspective, we are concerned about where the

35

depositories are going to be. And I've heard the two comments, Brown's Gulch or Opportunity. Representing the district of Opportunity, there is a lot of concerned citizens about hauling that down here. I would hope that you would take that into consideration in these hearings.

I guess pretty much that's mainly the concern of the public here. The bottom line is, yes, I think we all want to see clean water, we want to see fish in the stream, and we want to see a certain quality of water that we can all live with. I don't know what your quality standard is.

I'm not a scientist, I'm just one of the public that's going to be here to participate tonight, but I hope that you can see that what we are asking for, the bottom line is we want a nice greenway down through there and we don't want any further erosion. We've got the collection pond down there to still help maintain any flush that might come through there that creates a problem. But on the bottom line, we want to see fish in the stream all the way to the headwaters of Silver Bow Creek. I hope you will listen to the comments tonight. Thank you.

MR. KIRLEY: Comments from Rick Griffith.

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36

RICK GRIFFITH: As a member of the Butte Historic Park and Railroad Board, I have been on that board for about 10 years, and our involvement with this project has been both as a sideliner and as a PRP. We were named as a PRP on that project because a lot of the railroad or a lot of the railroad bed has hazardous wastes and some of the first solutions in the remediation effort was to go ahead and fix the soils under the railroad but leave the railroad go and not replace it. And I don't think that does anybody a service and I certainly wouldn't want to see that happen through this corridor.

The history of this corridor is it's a railroad corridor, first of all. And there's a lot of history that serves that railroad corridor. I think we need to take into account, No. 1, the end use plan, not so much the land use plan but the end use.

If you take a look at some of the sites that we had that were down on the north side that were reclaimed and there was no end use planning put into it, no permanent maintenance efforts put into it, they're weed-infested, they don't have a tree on the lot, there's no growth other than the weeds now in a a lot of areas. And what are you going to do with that property? I mean are you going to build a house

37

there? It may be eligible to build a house there but the end use plan is not available.

I think if you look at the whole issue of what we were able to accomplish in the same period of time it took the State and EPA and everybody to study this, back in the early Eighties we wrote legislation, wrote grants, we installed reclamation projects, the Scown field on the northwest ball field, the Emma Park, people have been using that for five years. That's a historic preservation success, it's a reclamation success. That's using end-use planning to prepare us for the future.

I think when you take a look at that whole process, there are a lot of things that the community took into account that was important to the legislature and to people like that. When we wrote the grants, they talked about the things that happened in Butte in the past and the history that was involved there. Marcus Daly had a lot of heap roasting and things going in town. And Butte, in its infinite wisdom, was the very first environmental legislation that was enacted, and that was to prevent heap roasting in town. There was so much heap roasting you couldn't see this map on the wall. And Marcus Daly said of that, "Well, there's just enough arsenic in

38

the air to make a woman's complexion pretty."

And we have a lot of things to look forward to. I think we need to take a look at the end-use plan. I think we need to look at a permanent solution and one that's going to take into account a permanent maintenance solution. That's why I think the greenway proposal takes into account land-use planning, takes into account historic preservation, takes into account other planting methods like trees and shrubs and things that wouldn't normally be in a state plan, and it also takes into account permanent maintenance. I would hope you would take a look at that. Thank you.

MR. KIRLEY: Next, comments from Sonia Nagorski and Devin Shea. Do you want to put on comments together?

DEVIN SHEA: Okay, first of all, I'd like to introduce us. I'm Devin Shea and this is Sonia Nagorski. We're from the University of Montana. We are currently doing research at the Miles Crossing study site.

First of all I'd like to commend the State on their plan and say that I support this plan. I think they have already, in using STARS treatment in

39

Subareas 2 and 4, have come to a logical ground with ARCO. I would like to also voice my support for the idea that the use of the STARS treatment should be very closely monitored because nobody knows how long this treatment is going to work for, if it's going to last for five years. We don't know how long it's going to last. I mean 20 years down the road, it could be totally worthless. So we need to have some kind of idea that this is going to last before we get into using the STARS treatment.

I'm going to turn it over to Sonia for some comments from her.

SONIA NAGORSKI: Well, perhaps I should start off by talking about what I'm studying out at the site. I'm working down by Miles Crossing, too. At my site there's about three to four to five feet of tailings and this is in direct contact with the creek. And what I'm looking at is this interface or boundary between the groundwater and the stream water to see what kind of chemical transitions we have there because the groundwater is at a higher or the same level as the stream water.

Now, the groundwater, as I'm sure most of you know, is very contaminated with these metals. So

40

far all the data I've collected from sitting out there and taking surface water samples and groundwater samples, I'm trying to find -- well, I'm trying to see if there's any evidence of this groundwater infiltrating into the surface water.

So far all my data which I've collected has been showing this. In my opinion, what this would mean ultimately is that lining the top six inches of the soil, as the STARS treatment is proposing to do, is not only not a long-term remediation or permanent remediation, it's not even a short-term way of treating the site. It's not a treatment because you still have metals getting transported through the groundwater and then discharging into the stream water.

So there is just no way the STARS treatment is doing anything but covering the surface, making it look like there's grass growing there -- well, there will be some stuff growing there and stopping some of the erosion into the stream, and so it will stop a lot of the harmful effects of surface runoff after storms. But what I'm finding is that there's groundwater constantly passively and dangerously discharging metals into the stream.

So the STARS treatment is not a solution.

41

The only way to get rid of this problem is to actually get rid of the metals. You can't try to lock them up, you can't try to do anything like that because it's just too large of a system. And the only way to get rid of the problem is to really get rid of it and dispose of it and take it to Opportunity Ponds where it's ready, where there's a concentrated contamination site, and then deal with that problem away from the stream and stop polluting the Clark Fork River.

DEVIN SHEA: I would also like to voice some support for the use of the Opportunity Ponds as a temporary disposal site for the flood plain tailings. I think that use of Brown's Gulch or any other areas is a bad idea because it's not contaminated right now. Opportunity Ponds is already a highly contaminated area. Bringing a small amount, a relatively small amount of contaminated material and placing it on top of the ponds is going to make absolutely no difference in this area, so I would also like to support this. I know this is in the State's plan and I think it's a good idea. Thank you.

MR. KIRLEY: Comments from Judy Martz.

JUDY MARTZ: My name is Judy Martz. I work as field representative for Senator Conrad Burns.

42

I'm going to not try to comment on what Conrad's feeling is about the Greenway Project other than he is really in support of the Greenway Project. But I think I will leave those comments for him when he is asked.

I want to comment for myself as a business owner, as a landowner - our land adjoins the stream bed down past Rocker - and as an interested citizen. I want to see the soils treated and I want to see them moved, but I don't want to see them moved out to Brown's Gulch. We used to live out there, also. That's a beautiful area and I wouldn't like to see one Superfund site become another Superfund site. I want the soils to be moved just above so that they are out of the flood plain.

Three years ago as President of the Butte Chamber of Commerce, I had proposed that when the Colorado tailings were cleaned up and removed, that we build an amusement park somewhat line Lagoon in Salt Lake City or like Silverwood in Idaho. I still want to see that happen.

The money saved from not hauling contaminants into Brown's Gulch by treating them and hauling them to higher ground would be a tremendous savings. With that savings, we could build this park,

43

we could create jobs, we could capture tourism dollars that pass by Butte every single day.

And I get very tired of hearing people want a 100-year fix on something. We're in the garbage business and if I could buy a garbage truck that would last 100 years, I would really be tickled. There are no guarantees. I think we need to do the best we can and get going with it so that we can have something for our children to appreciate and create some jobs, something that will cause people to spend money in Butte.

I guess I'm asking that we end up soon with the Greenway and the amusement park and through ARCO's plan. I want to see this done. I want Butte to have something like Anaconda's golf course. I want to have the amusement park and the greenway. Most all of us know this could be done relatively quickly and well. This would be good for Butte and the surrounding area. This can be a win-win situation. Thank you.

MR. KIRLEY: Comments from Ed Beaudette.

ED BEAUDETTE: My name is Ed Beaudette. I am currently the county attorney in Anaconda-Deer Lodge County. I am not speaking in that capacity at

44

this time. I am speaking as an individual citizen and also as a member of the Arrowhead Foundation and ADRA, which is the Anaconda-Deer Lodge County Reclamation Advocates, an organization. Both of these two organizations have been involved in the Superfund process since 1989. We have been instrumental in working with ARCO and the State of Montana on a very limited scale because we have been dealing with the Environmental Protection Agency as the lead agency in the Anaconda Superfund area.

I have had extensive experience in working with all of the different proposals that were used in the Anaconda area and also I was very much involved in the development of the idea for the use of the Old Works Golf Course, which we all believe is a success and is going to be a continued success as we proceed.

At this time I would like to speak in favor of the Greenway Project, and contrary to the State's proposed plan. My initial reasons for opposing the State's plan is first, it's not economical. From my understanding it's the second most expensive remediation of all the alternatives; and when it is completed, it's going to end up with land that is absolutely unusable, not because of the

45

process that was used but because of the ownership interest.

It's my understanding at this time that ARCO owns approximately two-thirds of the land involved and in all likelihood will be an owner of more than that property as the individuals who, as Mr. Melee indicated, are responsible in perpetuity. They will protect their investment and their interest by keeping people and persons and activities away from their property.

Secondly, it's not practical. We need huge transportation requirements. Either rail or truck transporting of the materials is unreasonable, it's unworkable, and it's highly dangerous and it's not productive. It's going to result in a situation, as I indicated before, where the greatest institutional control of all that is the private property owner locking up his land and is going to be in control.

The process that the State has used also has been, I believe, a misuse of the information that we learned in the process in Anaconda. Everyone throughout the Superfund process is trying to work on the concept of brown fields to green fields where there's a changeover from nonproductive misused land

46

to productive used land. The State's proposal will not do that.

The public should have been involved at the very beginning of this process, not now some six weeks before the final decision is to be made. And there should have been many more hearings and much more discussion concerning items such as the Opportunity Ponds and the Brown's Gulch repositories.

The State's proposal, again I would agree with Dr. Ginn who discussed the issue of the one in one parts per million cancer risk level which the State indicates is their goal. In a state with a population of less than 800,000 people to have a goal of having no one in one and one million people have a full lifetime contamination by that particular water is certainly unpractical, unreasonable, and certainly does not do anyone any good in the long-term process.

And finally, I would say that we should look to our mistakes and look to our successes. I think anyone who's been involved in the Colorado tailings and the problems that have arisen in the attempt to remove particular contaminants from one place and put them in another place and what happens when you start removing things will see that it creates more problems than it solves.

47

And anyone who can look at the process and the progress that we made in Anaconda with the Old Works Golf Course and the remediation of some of the other levels into a practical end use will agree that cooperation amongst all the parties is the best way to go. Thank you.

MR. KIRLEY. Comments from Chuck Haeffner.

CHUCK HAEFFNER: My name is Chuck Haeffner and I'm the chairman of the ADRA group that was started in Anaconda. The reason that we started that was that the person in the State office with Superfund says either you people get together and start a group or somebody outside of your area is going to control your destiny of what's happening in our county here in Deer Lodge.

And so we did start the group and it's been a very effective group and has led to a lot of good projects. And finally, the result was that we did end up with a golf course like Ed said. We could have just had a big pasture sitting out there with nothing but just rough barren land and nothing to use in it. Now what we have is we have a usable project in our community.

48

This could be economical help for our community. We lost the 2,000 jobs when the Smelter went down and I believe that right now what I want to get back to is I think that our organization has kind of come to the conclusion that the method of the cleanup in our county is a bit overkill. With the people I've talked to around our area - I'm fairly visible in my job and people come in - I haven't heard anybody speak out of what I happened to say in the newspapers.

I think we're taking this, it's a good economic issue as well as a health issue. It takes a lot longer to die of some of these things that they throw these scare tactics in and we can die a lot quicker of starvation.

And people throw these things out. I don't know if everybody was at the meeting a couple weeks ago or maybe a month ago, somebody throws out saying, well, there's cadmium they found in these cattle. Well, the fellow that was here just happened to be here that did a study on that, says, "Well, the only place you find it, it's in their liver and you have to eat that liver for about five - six years to have any appreciable effect on your own body." So I think those scare tactics by some people are very

49

visible, do not look at this.

I think I would like to see a lesser removal and more money spent on cleanup after it has taken place. I think we can do a much better job of doing this by some of it maybe is pushing ARCO into maybe spending a little bit more money on cleaning up the mess after they have pulled back and done some of the -- taking care of some of the tailings right in place.

I think with the idea of just hauling the stuff around is a very big health hazard, too, to all the people involved of either doing the job and the ones that are living along the route where the trucks or train might be moving. So by hauling it around is kind of like throwing a handful up in the air every once in a while, just kind of an unhealthy area to be living in or working in. Plus the time frame, I don't know how many of us here want to stay and wait for another 14 - 15 maybe 20 years to get all this stuff moved out of there.

I'm not pushing the fact that, you know, that I'm letting the health issue go because I believe that they have done these little test areas along the stream and they have worked very well. I think we should go along with some of this. I think we can be

50

very appreciative of what ARCO has done for our community.

I'm not employed by ARCO nor will I be but I think the people in our community have a lot of faith in what ARCO is doing. I think right now the whole country is kind of taking a good look at what they are doing with this streamside and the whole Superfund area, of what is going to happen to their area if they happen to come in and decide to extract minerals out of grounds in their residential area.

So I think that this is as much of a push for ARCO to get this thing done in a very effective, in a healthy manner for us to live in. And I think that the main thing is our health and also the second issue is probably the end use. That's very effective on what is going to happen to this land. Economically, it can be very useful and very helpful to all of us that are living here.

So with that I think -- I hope that the State kind of backs off in their push to try to remove all this land to another area because I know living in the area where I live, it does come down the creek a little bit at a time, but I don't think we need to have it all dumped in our backyard. And I know that people in Brown's Gulch, if I lived up there, I would

51

be standing out here saying, "Hey, you people have gone overboard on this stuff. You've taken an area that's not even contaminated at all and you want to dump it into this."

So I think I would like to go along with ARCO and their plan. Thank you.

MR. KIRLEY: I should indicate that people can submit their comments in writing as well and if anybody has a written version of their comments or comments, other comments to submit in writing tonight, we will accept them up at the front table. You can present them either after you give your comments or meet us during a break.

Just so people know, what we're going to try to do, when we get through half of the comments, we might try to take a quick break then, five minutes or something, but we're going to keep going because we're not close to halfway yet.

Comments from Don Ulrich.

DON ULRICH: I would just like to reemphasize the importance of prioritizing these many projects that are being done to help clean up our greenway between Butte and the Warm Springs Pond. You've heard from Ms. Watson and Dr. Ginn on the

52

importance of curtailing the runoff of the water, toxic water from the hill between the Colorado tailings and the Berkeley Pit, how unreasonable it is to let that go and clean up the rest of the way and have this pollution coming in all the way there. So it seems like No. 1 would be to getting done, cleaning up the water, the toxic water coming off of the hill.

A matter of similar importance to our community is the controlling of the effluents out of the Metro Sewer Plant. Trying to work towards meeting the standards of the health and environmentalists is really challenging to us. Unless we get with that in just a very few years, the citizens of Butte-Silver Bow are going to be faced with a tremendous increase of their Metro Sewer taxes. We don't want to have that happen when it's possible to alleviate that.

Because we can do something about not having to reclaim the Silver Bow Creek, by curtailing the water and by doing something about the effluents now while there's time, I think these two items should have real high priority in the cleanup of this area. Thank you.

MR. KIRLEY: Comments from Geoff Smith.

GEOFF SMITH: Thank you. For the record,

53

my name is Geoff Smith and I'm here to testify tonight on behalf of the Clark Fork-Pend Oreille Coalition.

We're a membership organization working to protect and restore water quality throughout the Clark Fork River Basin. For the last several years we've advocated permanent and effective cleanups of the Superfund sites in the Upper Clark Fork River and we will continue to do that today.

I want to begin by saying that we applaud the State's commitment to cleaning up Silver Bow Creek. I think that's what everybody here in the room wants is to have a clean creek. We support the State's selection of Alternative 6 as a preferred cleanup alternative with one exception; that is, we believe that the State should remove all the contaminated mine wastes in the 100-year flood plain as outlined in Alternative 7.

I think it's important for all of us to take a second and think about Silver Bow Creek. Silver Bow Creek is essentially a dead stream. It's so contaminated with arsenic and toxic metals that its waters do not support fish and its flood plain is nearly devoid of vegetation. Removing these wastes will eliminate the major sources of contamination to

54

the creek. Removal will prevent further erosion of contaminants into the creek and will drastically reduce the threats to aquatic life in the creek. It will eliminate the leaching of metals and arsenic to groundwater, and it will end the need to perpetually treat the Silver Bow Creek stream water in the Warm Springs Ponds.

In short, we believe that removing the majority of wastes from the flood plain will allow

Silver Bow Creek to heal once for all and to open it for future land uses.

Now, in addition to restoring the biological health of the stream, removing the wastes is the only way to ensure that fish will one day live in that stream again, one of the initial goals of this Superfund cleanup. It's also the only way to guaranty that the Silver Bow Creek corridor will be open to all future land uses, including residential, agricultural, and recreational, including the greenway proposal.

Now, as you've all heard tonight an issue related to the removal of the contaminated waste is where we're going to put them. For the record, the coalition supports the use of the Opportunity Ponds for the repository for these materials. These ponds already contain between 300 and 400 million cubic

yards of contaminated wastes. That means that the amount that would actually be put in there so that we can clean up 25 miles of Silver Bow Creek would be about one-half of one percent.

Now, it's obvious that some aren't too happy about the idea of putting these wastes in the Opportunity Ponds and that's understandable. However, if the State and those communities should decide that Opportunity Ponds or Brown's Gulch is not an appropriate place for the repository of these wastes, we suggest the State go back to the repository siting and find another site that is appropriate. Under no circumstances should the failure to reach agreement on the repository site lead to a lesser cleanup of the Silver Bow Creek system.

Another important issue that's come up is the issue of the STARS treatment. As I've said, we believe that removal of the wastes is the most permanent and effective way to treat these wastes. ARCO continues to promote the use of STARS as the cleanup alternative for the site.

Now, we don't believe that STARS is an appropriate use or an appropriate cleanup alternative for the site because of the many limitations it has. We certainly agree that it has shown some short-term

success in reducing overland flow and the washing of metal salts into the creek. But at the same time, it has numerous limitations. The biggest one is it does nothing to reduce the volume or concentration of wastes in the creek. In addition, it does nothing to immobilize metals where groundwater is in contact with the stream. It's unable to withstand the erosive flows that occur routinely on Silver Bow Creek like the ones we've seen this Spring. And finally, it actually increases the mobility of arsenic, one of the biggest human health concerns on the site.

In addition to these technical shortcomings, STARS also requires long-term maintenance, which with it carries costs and also limits the development and future use of the Silver Bow Creek corridor. Finally, STARS does not take into account the simple fact that stream systems are dynamic and streams will meander. Just because a stream is one place today doesn't mean it will be there in 10 years or in 15 years. That's why we think it's critical to get these wastes out of the flood plain and into a dryer location where they may be treated or capped in a repository.

In short, we believe that removing the wastes is the only way to clean up Silver Bow Creek,

to ensure that groundwater will be restored to drinking water standards, and to assure the land will support any future land use that anybody wants, including the greenway proposal. I thank you for the opportunity to speak tonight.

MR. KIRLEY: Comments from Bruce Parker.

BRUCE PARKER: My name is Bruce Parker. I'm here tonight as President of the Butte - Silver Bow Chamber of Commerce. My comments will hopefully give a little perspective on some of the thoughts that the business community has on the subject at hand.

I would start with saying, No. 1, the panacea and perfection I think in the business community would suggest that we in the long run will get very little, if anything, done and accomplished. I think we need to focus on doing in fact what is do-able.

The business community would like to see a comprehensive approach towards remediation that also brings into a balance future and beneficial land use. The business community would like to see continued broad community input and participation in this process. We think this kind of process works. if anything, I think the Chamber has been disappointed

that there were not more public hearings offered as part of this process for even more participation on the part of the citizenry.

The business community would like to see a plan that encompasses and incorporates upstream cleanup issues as well as downstream issues to assure that in fact what we do clean up downstream stays cleaned up. The business community would like to see an inclusion in all of this with a meaningful solution towards the discharge problems associated with the Butte-Silver Bow wastewater treatment plant.

The communities of Butte and Anaconda I think have for too long sat and watched and listened as we've seen polarized groups doing battle on these subjects. Cooperation and collaboration is what we need to see. Again, we think this is a healthy process. If we're going to get anything done, it's going to take all sides working together.

I guess I would like not necessarily on behalf of the business community but maybe a personal comment: I think the State could lead that charge by maybe reducing its tendency towards the bureaucratically imposed punitive damages that we seem to read about at times. Our business taxpayers and residents have experienced too much legal

59

environmental gridlock.

The business community, I think speaking for everyone, would like to see the process move along. Let's start to generate some results. And I guess with all of that in mind, the Butte Chamber would like to see the State give serious considerations to the elements that are in the Project Green proposal and for the greenway corridor as a long-term benefit for the communities. Thank you.

MR. KIRLEY: Comments from Bea McCarthy.

BEA McCARTHY: I'm Bea McCarthy from Anaconda. The proposed plan, Streamway Tailings Operational Unit, is a thorough, well thought out, academic review of the Silver Bow Creek Superfund site. Throughout the paper with all its alternatives, it abounds in facts and figures regarding the possible remedies and the justifications for all these proposals. None of us dispute any of the scientific facts or information that's given. We all have a right to disagree either totally or partially with your conclusions that have been drawn.

To many of us living in the area, it's sadly lacking in the time of pollution. It's understood that the cleanup of over 100 years of

60

mining activity isn't going to occur in a day, but it would be nice to see an end to this tunnel, at least within a reasonable time frame or our lifetime.

Alternative 6, which is your preferred choice, calls for removal of almost all of the streamside tailings. This is estimated to be about 2.3 million cubic yards. During the '93 - '94 hauling season, ARCO hauled approximately 280,000 cubic yards of tailings from the Colorado mine site to the Opportunity Ponds. Projecting that figure into the amount of residue that is to be removed under this proposal could conceivably require about 11 years to complete. If the EPA would permit longer trains, maybe more than 17 cars per train, maybe more than two trains per day, this could, of course, be finished in a shorter period of time. I deliberately did not calculate the hauling by truck because personally I don't feel that's a safe alternative for the citizenry.

Everyone recognizes that recovery has to be done as well as removal. This would entail additional time and money beyond the 11 years that have already been proposed. In finding a solution to the present project, it would seem that a compromise between Proposal 6 and the Greenway proposal, which is

61

a result of community hearings and input, would be both reasonable and workable.

The proposal by the Department lacks community input and has little support. This is needed if the people involved are going to feel safe with the work and if it isn't going to be another case of bureaucrats from the capitol telling the community what's good for them.

On the ground around Ramsay are two test plots that were constructed under the supervision of the EPA and ARCO. Both of these are in their third and fourth season of growth. From all appearances and reports, they are doing excellent. The health considerations that are paramount to all of us have been addressed and the growth of the natural grasses lend credibility to this as a possible alternative to be considered.

The communities have been going through a lot of turmoil since the shutdown in 1980. We've had demolition hearings, hearings, and more hearings. It took 2.5 years of hearings before the final decision was made to haul the materials from the Colorado tailings. The work was barely begun and now it's been stalled.

The streamside tailings, as they are

62

proposed, will be a more disruptive process, but if the outcome in the area is a greenway or walking trails or natural animal habitat with a stream that can be returned to a healthy environment, this is worthwhile. We don't need any more fenced-off, no-trespassing property that none of us can use. We need faster, healthy solutions for all of our cleanup problem. Thank you.

MR. KIRLEY: Comments from Milo Manning.

MILO MANNING: I'm Milo Manning. I'm the planning director for Anaconda-Deer Lodge County. First I'll give the position of the Anaconda-Deer Lodge County Planning Board.

The Planning Board supports the greenway concept. They feel that the remedy must ensure that the creek support aquatic life and that the remedy must consider the end use of the land.

For my own comments, I feel that the Anaconda-Deer Lodge County community will not accept the years of hauling contaminated materials to the Opportunity Ponds. They may accept the use of the ponds as a repository if and when an end use of those ponds is forthcoming, and that has not been decided yet.

63

I question the proposed alternative where tailings that are in the flood plain of Area 4 is okay to be treated in place, but the other areas, all the tailings that are in the flood plain must be removed. I fail to see the concept of that. I question the wisdom of removing the materials that are within the creek bed and I'd like to know what technique is going to be used for only the material that's one millimeter or less can be removed and the rest not.

I would suggest that contaminated materials can be pulled out of the flood plain where possible, or where not possible, out of the floodway and treated in place on higher ground. The treated materials would be well below EPA acceptable levels of 1,000 parts per arsenic and is acceptable for recreational use. And it's recreational use which is recommended for that corridor, not residential use. Thank you.

MR. KIRLEY: Comments from Haley Beaudry.

MR. BEAUDRY: Thank you. I'm Haley Beaudry. I'm a resident of Butte, native of Butte. In fact I grew up over on the east side where I was right next to Silver Bow Creek, and that neighborhood is all gone now. I'm a registered professional

64

engineer and I'm here to speak on behalf of myself as a Butte resident and Butte citizen.

We know that the EPA and the Superfund law are there specifically for the protection of human health and safety, but there has to be some kind of reason in how far you go. We probably all remember the alar incident, worrying about the effect of poisonous apples. And in putting up with that, in combating the overly conservative estimates, to borrow somebody else's words here, of the effects of alar, we saw young mothers with babies in cars driving to supermarkets to return apples and apple juice they had purchased before the alar incident came to light. Their risks in some instances in some cities in driving the baby in the car was some 30 to 50 million times higher than they would have had by just eating those apples.

I think we're kind of getting off on that direction here, too. You know, we can't go backwards in time. The solution that we hear about from the State now I believe says, "Let's go back to the days before we had any mining in Butte and let's make this thing like that." I don't know if many of us would want to go backwards in time that far. We wouldn't be here now.

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Butte and Anaconda exist because of mining. All of the groundwater that is now contaminated has always, always since the beginning of time carried arsenic. The arsenic that it carries comes out of rocks that are right here. All of the rocks you see here, all of the rocks that went through Butte and Anaconda are our own. They come from where we live. We drink arsenic, we breathe asbestos. I mean that's part of our everyday environment here.

In fact we all even eat arsenic all the time. Arsenic is in seafood, clean, fresh wholesome seafood naturally. Arsenic is important, more important to some of us, arsenic is in potatoes. We've all heard that the only problem with potatoes is butter and sour cream.

So we don't want to get off on a tangent simply to punish ARCO. Somebody else brought up the point that ARCO maintains the liability. We have a situation here, if we look at it logically, we have somebody out here who can get started soon, clean this up, use the greenway plan, make usable land, get it done now, get it done safely, and they're liable forever for its adequacy. They're there forever. I mean this thing is a tar baby. They are there forever. They always have that liability so we have

66

nothing to lose. The worst it can be is the way it is today. If any cleanup doesn't work, the worst it can be is get back to today.

I want to bring up another point. If we do take all the tailings out and bring them someplace, first of all as a mining engineer, I know that that will be a sizably larger project than the State envisions. That's a big, long, narrow corridor; that's not one big pit. The whole material movement and that logistics is significantly more complicated.

But above and beyond that, something will come back in there. Somewhere we're going to go out in the neighborhood and find undisturbed clean ground, dig it up, make a new pit, bring it over and dump it in the banks of Silver Bow Creek. That must be the plan. So we have a new pit, we have haulage everywhere and we have tailings waste moved to a place that if people don't mind them being there, they certainly will mind literally hundreds, hundreds of truckloads passing through on a daily basis.

I suggest we follow the greenway plan and we abandon the currently proposed State plan. Thank you for hearing me.

MR. KIRLEY: Comments from Sam Worcester.

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67

SAM WORCESTER: I'm Sam Worcester. I'm a resident of Butte and I'm here primarily as such. I must say I'm prejudiced by the fact that I've been on the kind of the steering committee for the Project Green because I went to a lot of hearings before we got together with the Project Green. And every time I said we ought to do something about what we're going to do with the land when we get it fixed up, I never got an answer. I think Project Green is trying to make an answer to come of those things. So I want to put that plug in for Project Green.

My first comment is: Brown's Gulch is a lousy place to put waste. My second comment is: We should put as little as possible in the Opportunity Ponds.

I've been very impressed over the last three or four years in reading the detail of the STARS experiment. And I guess when I really got impressed is when I got to see a couple of the sites and seen what has happened from the STARS treatment. I was even more impressed when I rode my skinny-tired bike down to Rocker the other day and saw how STARS survived after the last flood. There's grass that is just totally matted over. It's had the hell beat out of it but the STARS treatment area held during that

flood.

So I think there's something more than just the simple fact that we just say all we're doing is liming this stuff. I don't think that's the case. If you look at the literature - and I've got a stack about a foot high that I have been trying to understand, and believe you as a metallurgist, it's hard to understand this stuff about soils - but I am impressed with the science of the STARS treatment. That's where I think we ought to take advantage of that treatment and our knowledge that we already have and use STARS in place of suck, muck, and truck.

Now, if I were living in Opportunity and every time I turned around somebody said, "I want to dump some more junk in your yard," I'd get uptight too. At least I'd do like the people in South Carolina just did and said at the Barnwell site, "We're going to charge you $375 a cubic foot to put it there."

But I think we should really concentrate this plan on the minimum movement. If it means moving it a little ways out of the creek and get it up off of the groundwater and up to where we can then treat it and grow stuff on it in accordance with what the people of this community want as a land-use plan, I

think we ought to do it and I think it ought to get more attention.

Of course we've got to coordinate what we do in the creek with Lower Area 1, the priority soils, and the other problems we've got in Butte. We've heard it said a lot tonight and I think it just has to be said over and over again because the problems in place in Butte are tremendous.

One thing I think still should be considered is the Subsection 1, I still think should be considered for wet closure as possibly part of the Butte-Silver Bow sewage treatment plant. There's quite a lot of acreage there. Instead of digging up all of the stuff that's already in the creek bed, if we wet-closed it and used it as treatment ponds, I think it would be a very viable potential solution.

I am very frightened about the concept of trying to go through all of the creek and eliminate all of the sediments. I was impressed with the presentation of Dr. Ginn. He seemed to have his ducks in order. I think that the removal of all of the sediments in the creek is a horrendous logistics problem.

I guess the last thing I'd like to say is that when we're in these public meetings, we tend to

think about, oh, what's 30 million or 60 million? I don't know of those that read the paper the other day about the renovation of the Fox Theater, that was a full-page spread on how people in Butte bundled up $1.6 million. Of course it was nice, we had a sugar daddy that put up one million of it, okay, but that was a major project for the city of Butte.

I just sat down and I took -- at the last hearing I went to, we had the ARCO price versus the State price. The difference between the high estimates, which is what we're going to get to anyway, was $50 million. Fifty million dollars is 30 Fox Theater renovations. We're talking about big bucks and we're talking about trying to drag somebody into it. And they're the ones that are saying, they're putting their name on the line saying, "We'll fix it. Let us get going on it and we'll do it in cooperations with the City of Butte and the City of Anaconda and the City of Deer Lodge." So I think we ought to listen to them. Thank you very much.

MR. KIRLEY: Comments from Kathy Hadley.

KATHY HADLEY: My name is Kathy Hadley and I live in the Deer Lodge Valley. I commute to Butte every day on the way to work. I work at the

National Center for Appropriate Technology as the associate director. I see Silver Bow Creek and the mine tailings twice each and every day.

I'm here to testify on my own behalf in support of the State's preferred Alternative No. 6. I believe that Alternative 6 represents the best long-term permanent cleanup of the Silver Bow Creek corridor because it will permanently remove most of the mine tailings and that represents a permanent solution to the problem.

Second, it will give the greatest flexibility in future land use. It only makes sense that the cleaner the land is, the more possibilities are available for us to use it. Third, Alternative 6 also requires the least amount of long-term institutional controls. And fourth, Alternative 6 could provide a lot of good-paying jobs for a lot of hard-working people for a long time.

Think about all the numbers we've heard here today about how many trucks or trainloads it would take to move these mine tailings and think about how many people in Butte or Anaconda or Opportunity could be paid in these jobs that would include hauling trucks or big equipment operators. I think somebody would be driving those and I think it ought to be our

72

local people.

I'm against Alternative 1 through 5 contained in the State's plan. To me they all represent a Band-Aid approach to a situation that requires major surgery. Alternative 1 through 5 leaves most of the contaminated tailings in the flood plain where when the stream meanders, as we all know it will, they will go right back into the stream, and we're right back where we started from.

Finally and most importantly to me, Alternatives 1 through 5 require a heavy hand of institutional controls to make certain that land use restrictions will be adhered to. And I can tell you from personal experience, institutional controls do not always work.

Years ago I lived in a community where there was a municipal and toxic waste facility. The owners of the facility covered it up with a clay cap. They did that to prevent leakage and migration of the wastes and to protect public health and safety. Then they gave the land to a local government entity for a dollar and placed institutional controls on that piece of land.

We all have to remember that local governments are mostly managed by elected people and

73

as time goes by, people come and go in office. In this community after a while, the local people, the local elected people, the local government couldn't quite remember why those institutional controls were put on this particular piece of land.

So one day a developer came in and said, "Hey, that looks like a good piece of land to put some moderate-income homes on. And by the way, it will increase the tax base." And sure enough, he got the permit to develop the land and he built moderate houses on it.

What followed next was an elementary school. It was a school where my nephews and nieces went. It was the place where my day-care was. Well, unfortunately, when the developers built the residences, the clay cap was broken. And when that clay cap broke, slowly but surely those underground wastes started to seep out.

The local residents started getting sick, really sick, especially the small children and pregnant women. The State finally declared the area a disaster and they declared it a health emergency. They closed the school, they moved out the residents and they boarded up the homes. People's lives were destroyed. Children were sick and are still sick from

74

that experience.

And make no mistake about it, lawsuits, many, many lawsuits were filed to determine who the heck was to blame for this mess: The developer, the local government, the entity who put the waste there in the first place. All this happened in part because of the lack of an institutional memory for institutional controls.

To conclude, I support the good work that has been done by the State. I believe that Alternative 6 represents the best long-term solution to protect our public health and permanently clean up Silver Bow Creek. It's a solution that's sustainable overtime and presents the greatest opportunities for the future for all of us and our children. Thank you.

MR. KIRLEY: Next comments from Virginia Turnbull.

VIRGINIA TURNBULL: I'm Virginia Turnbull from Butte. I support the State plan. The State's preferred Alternative No. 6 will allow for the best cleanup of Silver Bow Creek. We need to have a cleanup that protects the health of children and future generations. Place kids before greed. Thank you.

75

MR. KIRLEY: Comments from Ray Ueland.

RAY UELAND: Thank you very much. Yes, it is Ray Ueland. I'm a lifelong resident of the beautiful Brown's Gulch. I'm very familiar with the Brown's Gulch drainage and the Silver Bow Creek area.

First I'd like to take this opportunity to commend the grassroots efforts aimed at community development cleanup and enhancement of this area. The 800 or so more citizens of Butte, Rocker, Brown's Gulch, Silver Bow, Ramsay, Anaconda, and the Opportunity areas who have participated in the Project Green are to be highly commended.

Our communities have suffered economically and environmentally with that ups and downs of Montana mining throughout history. Project Green and the STARS technology offers a great opportunity to use Superfund reclamation to provide innovative solutions and create economic, recreational, and beautification opportunities for this area. In short, it presents an absolute win-win-win opportunity.

With the little bit of reclamation and remediation that's been done already, there's already presence of beaver in this creek as high up as Rocker.

76

But and only if these streamside tailings are so bad and contaminating as the Department of Environmental Sciences implies, removing them from Silver Bow Creek with all the health hazards, the liabilities of transporting across two federal highway systems, through communities, up public county roads, over private land, and redeposit them into Brown's Gulch, does this make sense?

Brown's Gulch and Brown's Gulch Creek is a drainage area. And where do you think this drainage empties into? Right back into Silver Bow Creek. I'm opposed to the State's plan as proposed but, Mr. Ford, I'd like to recommend that a new state plan does become a reality and it does become the greenway and the STARS treatment plan. Thank you.

MR. KIRLEY: Comments from Don Ueland.

DON UELAND: I'm Don Ueland. I'm a rancher and property owner along Silver Bow Creek. I came to state our support for ARCO's plan and Project Green.

There's been a lot of information put out previously and here tonight, and as a PRP we've studied that information pretty close. I think the advantages of ARCO's plan far outweighs the

77

disadvantages. I think we would be missing a great opportunity if we didn't take advantage of Project Green and ARCO's plan. Thank you.

MR. KIRLEY: Comments from Sandy Stash.

SANDY STASH: My name is Sandy Stash. For the record, I'm here representing ARCO or the Atlantic Richfield Company, one of the entities that will be asked to fund and do the cleanup being discussed.

In short, I'm here this evening in opposition to the State's plan, but I'm not here in opposition without another alternative, and that is the one that you've heard referenced this evening; that is the ARCO proposal.

Very simply what we're proposing is a combination of select removals, removals in those areas where STARS will not work, that is, areas in contact or potential contact with the groundwater, combined with an absolutely amazing technology developed at Montana State University, STARS or Streamside Tailings and Revegetation.

We believe that the select removals, however, the State should reconsider where they're taking that material. In short we believe that

78

material should be dealt with near place, near the creek.

We have probably as much experience as anybody with moving materials around. And I tend to agree with one of the folks that spoke earlier, as somebody who's done a whole lot of this, the State has grossly underestimated the problems associated with this. We estimate somewhere between 100 and 200 truckloads a day during the construction season for a period of about seven to nine years. So it's a substantial impact on the community. On the flip side with the near creek and STARS, we believe we have something that works.

But I was kind of interested, I heard a lot of folks refer to this as the untried technology, do we really know it will work? I wish with the others remedies we've done in the area that we had as much information as we have on STARS. This technology has been in development for almost ten years and we have full-scale, mile-long of river types of areas that have been in place four and five years. I encourage anybody who hasn't seen some of the photos we have in the back room to look at the before-and-after pictures. It's nothing short of remarkable.

79

Coupled with how it looks is the tremendous amount of data that's been collected. We feel absolutely confident that this technology will stand up for the long-term. I wish we felt that way about some of the other remedies that we have been requested to do in the basin.

Secondly, ARCO believes that this technology and this remedy needs to be combined with a concept much discussed tonight, and that is beneficial land use. Why? Very simply, it's important to us to see the remedy maintained out into the future. As several people said, we will be held responsible into the future. We want to see that corridor managed and those treated wastes managed.

With that, we have two options. I think as somebody suggested, as a prudent landowner we can fence it off, or we could work with the local communities and make that into something beneficial. Through some very good experience we've had both in the community of Butte and Anaconda with coupling our remedies with future land use, again, we're very supportive of Project Green and will stand by it if coupled with a reasonable remedy.

In short, we would encourage the State to work with the communities and to work with us on

80

coming up with a reasonable remedy so we can move on with this. ARCO stands very committed to cleanup in this basin. I think that almost $250 million we've spent in this area in the last five years speaks for that commitment. And we believe that if we all work together, we can have something very valuable at the end. Thanks.

MR. KIRLEY: Comments from Arnie Barnett.

ARNIE BARNETT: I'm Arnie Barnett. I was born and raised in Anaconda and I've resided in Butte for the last 45 years. I represent the senior citizens of the area, pretty much of them. I probably have talked to 250 of them in the last six months, and I haven't found one that is against Project Greenway.

I haven't found one that is in favor of the State plan.

So all I ask you people to think about is let's get on with it and forget the bureaucratic BS that we're going through. Let's get the greenway started. Let's get the fish back in Silver Bow Creek. Let's have some walkways and trailways and picnic grounds and what have you.

It just seems ridiculous to me that they would want to move that many million tons of ground

out of the Silver Bow Creek and deposit it in a clean area, pretty much, especially Brown's Gulch, when we could just move it out of the flood plain and treat it with treatments that are available.

So all I ask you folks to do is forget about all your bureaucratic BS and let's get on with it and let's get the Project Green on the way. Thank you.

MR. KIRLEY: Comments from Mel Stokke.

MEL STOKKE: I'm Mel Stokke. I worked for 34 years in the Smelter in Anaconda for both Anaconda and ARCO. The last eight years I was general manager of the Smelter. I can say now that my experience in the Smelter working there for that length of time is very indicative that we worked in the conditions that supposedly are real toxic and should kill you.

Now I'm a senior citizen, and quite a senior citizen. And I've worked in the arsenic refinery in the days when they didn't have respirators, we used a piece of gauze over our face, we wrapped our wrists, we wrapped our ankles with gauze, and we put a brown salve on us. I shoveled arsenic out of the cooling kitchens, into

wheelbarrows, down to the roasting furnaces. The fellow that was a foreman there, a fellow by the name of Mr. Bodeen, worked in that arsenic refinery making arsenic trioxide until he retired, and he finally passed away at age 85. Now, he worked all the time in the arsenic refinery.

Now, I have written a letter to Jim Ford. He has a record of it right now. I'd like to tell you a little bit about the history of the arsenic problem in Anaconda. In the early days, the State and whoever else allowed the smelters in Butte to dump their tailings into Silver Bow Creek. After that, they went into high grade ore and it was high in copper. This was from the deep vein mines. It was high in copper and it was high in arsenic. We treated that in Anaconda.

After that, we had the Berkeley Pit. Sections of the Berkeley Pit were high in arsenic, sections of it were low in arsenic. And in 1962 they built the Weed Concentrator in Butte and instead of sending us 700 cars of ore a day, they shipped us 15 to 20 cars of concentrate. These concentrates ran approximately 2 percent arsenic.

Now, we treated ores or concentrates from Warnex in Canada, from British Columbia, from Twin

Buttes, from Malmax, from the Yerington properties. And these ores and concentrates were free of arsenic. All of the arsenic that came from Anaconda came out of the Berkeley Pit.

We were not a profit center. The cost of a pound of copper was Butte - Anaconda - Great Falls. So we were not allowed to penalize the Butte Operation for the arsenic or the zinc which was not treated, and silver and gold. Now, a commercial smelter, you pay a penalty for arsenic, you pay a penalty for zinc, and you also take a deduction on the silver and gold.

All of those benefits went back to the Butte Operation. The reason they went back is because all of the people that were high up in the Montana Operations were mining men and they were trying to make the mines in Butte look good.

Now, I'd like to bring up another point; and that is, in 1971 we started Phase 1 of the Smelter renovation, and in 1973 we started the second phase. The first phase was 33 million and the second phase was 30 million. On each one of those phases, we came in with a half percent, half of one percent, or approximately $150,000 out of that $30 million project.

Now, the State has made a proposal saying

that it's going to cost somewhere from 39 million to 68 million. Can you imagine me going to corporate office either in New York or in Los Angeles and saying to them: I need a budget that's to this extent?

Now, these people have been studying this process for a good number of years. They come up with the figure, they came up with a figure of 1.5 million yards or cubic yards of material that has to be moved. You know, contractors can tell you how much it costs to pick it up, to transport it, to dump it. ARCO can give you the numbers telling you how much it cost to spread the material, to lime it, to revegetate it, and then you add a certain percentage for incidentals. I think that these are professional people and yet they come up with an estimate in this category. It's not reasonable.

I very much support ARCO's plan and the greenway. Now, I just want to tell you the State is not infallible. When this Superfund project first started, the thing that came up was that the worst contaminated area around the smelter was Mill Creek, the town of Mill Creek.

So the decision was made at that time ARCO bought all the residences, moved all the people out, they fenced it off, and they posted signs. Then

later on in the years after that, they came back and they said there is nothing wrong with that ground. It can be used. Now, that's not what they said in the first place.

Another time the State came up with the idea of putting a tailings pond above the Opportunity Ponds. At that time Opportunity people objected very strongly because they were afraid of contamination of all their wells, so the State at that time changed their mind. I'm hoping at this point in time that the State is negotiable. Thank you.

MR. KIRLEY: You can reserve more comment at the end if you wish.

MEL STOKKE: That's fine.

MR. KIRLEY: We've accomplished something like the halfway point. How about a five-minute break and we'll start again with comments in just five minutes.

(Recess taken from 9:15 P.M. to 9:30 P.M.)

MR. KIRLEY: Out next commentor is Albert Molignoni.

MR. MOLIGNONI: Good evening, ladies and gentlemen. I'm Albert Molignoni from the town of

Rocker, Montana, a past recipient of contaminated water and soils for the past 55-plus years.

I want to state a few facts for the record here. Some talk was given about arsenic and not causing cancer. I come from an area where I've had over four of my friends, personal friends, die of one form of cancer or another. We were the Rocker Timber Framing Plant which was highly contaminated with arsenic, adjacent to the stream banks. I'm talking contaminations of 20 percent arsenic.

When this was known by the community of Rocker, ARCO came in and the State of Montana and said immediately that they would remove these soils. Through the negotiation process -- these were soils, now, that were exposed to children that played in that area. Almost a year went by before the State finally mandated ARCO to get those contaminated soils containing 20 percent arsenic out of our area and out of the pathways of human exposure.

ARCO is presenting you with the proverbial golden carrot here, people. Listen to what's being said. One said that maybe we could have a playground, a recreation area like Lagoon. We had that at one time, but you know what, the corporate greed eliminated that for the community of not only of

Butte-Silver Bow but also Anaconda, and that was known as the Columbia Gardens.

You have to look at this thing for the future. The future of your children, your children's children, and your grandchildren. I come from the community of where STARS has been adopted, but it is fake. The grass isn't the same grass that normally grows around that area. No trees grow in that area and the trees are coming back in other areas that haven't been contaminated.

The STARS approach will not work. I've lived there for 55-plus years, I've seen that stream channel meander three to four times out of the stream channel into another channel. And I've also seen this in my years of experience with construction, that even streams that have been riprapped will meander. They'll literally come out of the channel. When that happens, you're wreaking devastation upon the groundwater and also the stream itself.

So I urge you people, don't look at this proverbial golden carrot because when all of these people leave, they'll pick up their dog and pony show and go back to their corporate headquarters and say, "Boy, did we pull a fast one on them dumb shmucks up in Butte-Silver Bow County and Anaconda." The same

thing with the State. The people of the State of Montana want to make sure we get the best possible cleanup we possibly can have that will last forever.

Believe me, Project Green's a great idea, wonderful idea, but if they can guarantee or bond it and say that it will never, never ever create any contamination, I'm for it 100 percent. But there is no bonding put in place. And as you well know, everybody says ARCO's going to be on the stick. Well, there's a lot of these major corporations that are filing Chapter 7 and Chapter 11s. And when that happens and we get a stream bank overflow and it washes all of this remediation action out, the people of Montana are going to have to pay for this all over again.

So remember this. Plan ahead. If you want to think about something, think about this: Why are other areas in our state growing? Because we don't have the large contamination factor. When they leave, we're going to have one of the largest contaminated bodies of water, known as the Berkeley Pit, known to mankind. We're going to have one of the largest contaminated bodies of soil known to mankind, and we're going to have one of the largest bodies of contaminated groundwater known to mankind.

Believe me, whenever you can take this particular material, put it in a repository that's a safe place so that Mother Nature or maybe even man in his infinite wisdom some day will come up with a solution to solve and get rid of the contamination, that's the easiest way to process, and not process it when it's strung out 25 miles. This is a very important thing to remember here. This is our community, we want our children to live here and we want our grandchildren to live here. Thank you very much.

MR. KIRLEY: Comments from Julie Warner.

JULIE WARNER: Hi, I'm Julie Warner. I'm currently a student from the University of the Montana and I'm here representing two groups. The first group is myself and my five small grandchildren currently growing up in Montana, and the West Slope Chapter of Trout Unlimited.

When we at Trout Unlimited heard that they were talking about taking what is now a dead stream and turning it into trout habitat, we of course like this idea. So we want to really stress that we would prefer restitution over cleanup. We would like a permanent solution to the stream problem and keeping

90

it as permanent trout habitat.

The STARS, I would like to really congratulate the people at MSU for coming up with the STARS project. This is the sort of creative things that are needed in situations like this. But I would like to stress that I feel it's still at the very least a very young process. We don't know everything that's needed to know about it, and I really have this horrible feeling that 40 years from now we're going to be looking at what is essentially the STARS equivalent of saline seep.

As far as alternative sites for putting the tailings, we don't feel Brown's Gulch is a good site. The Opportunity Ponds are acceptable but we would prefer that they maybe find alternate sites closer to the original source of contamination for placing the sediments.

We would like to go with Alternative 7. We feel 6 is adequate but 7 provides the best long-term permanent solution available. Thank you.

MR. KIRLEY: On this next name, I can only guess. It's Patricia Sorich.

PATRICIA SORICH: Sorich, S-O-R-I-C-H.

MR. KIRLEY: Sorich, thank you.

91

PATRICIA SORICH: My name is Pat Sorich and I'm just here as a concerned citizen. I'm here as a concerned citizen, and a concerned senior citizen. I wish I had attended meetings like this when the Columbia Gardens disappeared but I didn't and it disappeared.

So first of all, I want to give you a little background. I'm a third generation native, well, I've lived in Butte. My grandma came from Ireland and was left a widow and had a boarding house down in the Eastside in the shadow of all those infamous mine dumps. She died of heart failure at the age of 86. Arsenic, we've never heard the word until this last few years. We heard it but it didn't concern us. My mother played on those dumps; she died about five years ago at the age of 83, heart failure. I'm an old lady now and I'm still in there. I'm not afraid of arsenic. Maybe if I was drinking glasses of it every day, I would be, but I'm not.

Putting all this aside, I feel that the decision, at least decisions that are being made by the State of Montana affect us directly and they should be made by the people who live here and those who speak for them and vote here and pay taxes here and raise our families here. And that's Butte,

92

Anaconda, Opportunity and Brown's Gulch.

After weighing all the technical talk this evening, I must say that my support goes to the ARCO plan. First of all, it may be finished in my lifetime; second, it's a great financial solution to any future sewage treatment problems that the City of Butte would have. We've just come through a horrible cost increase in our water and you know what the water situation was there. I'd hate to see that happen again with the sewer. It seems to me this would be the logical way to go.

Third, the State plan for moving 1.8 million cubic yards of tailings is really mind boggling. I want to tell you, I lived on South Montana Street in the shadow of the Emma Mine. I don't know if any of you even remember what it was or where it was, but Emma Park is there now in Butte, incidentally, on top of a mine.

During the war, the big one, WWII, they moved that ore out of that mine from Silver Street down to the BAP tracks, which was about seven or eight blocks. And those ore trucks moved 24 hours a day up and down Dakota Street. And I'm here to tell you it was terrible, but it was war time so we didn't complain. They were noisy, they were dirty and when

93

it snowed, they were muddy. The rocks, they weren't covered, of course, the rocks flew off of them. It was your life. They didn't have to stop; you stopped to them. That Dakota Street was through. And I would truly hate to see my neighbors in Opportunity and Brown's Gulch have to live with that.

It was mentioned here tonight that all the jobs that would be generated by this moving. Well, I'm not Superfund intelligent but I've never read that it was ever, ever designed to provide public works opportunities. So I would leave all the technical safety environmental problems up to those that know what they are doing. I would trust those people. I would trust ARCO to do what they're saying they're going to do because they are going to be the owners.

I just don't like to see any more of my

tax dollars go down the river. It would seem to me that the most logical solution financially and safety-wise would be to support the Greenway, ARCO plan. Thank you.

MR. KIRLEY: Cheryl Beatty.

CHERYL BEATTY: For the record, Cheryl Beatty. I am the Chief Executive, Anaconda-Deer Lodge

94

County. The County has not made a formal decision as far as comments, but I will comment tonight more on a personal note on just some of the observations that I have made in dealing with this.

I've done extensive Superfund work over the last 2.5 years now. And it just surprises me that in government work that we don't bring out crowds to do Superfund work. In most government work the only thing that brings crowds is sex and scandal, and yet tonight there's enough citizens concerned and I really want to thank all of you for being here just to express your concern.

This is a good example of why people have not been happy with Superfund work is because the State and the Feds have consistently left out the communities in the Superfund arena. This is a good example of why I hope that you here tonight will continue and write written statements to the State that say: We want to be a part of this decision, allow us to be; and let's get together to make what is a decision for the future for all of us, including children, including the adults, safety for everyone.

I do know one thing that our community is strongly opposed to and that is having more tailings taken to Opportunity. The last time when we discussed

95

taking tailings to Opportunity was the Colorado tailings. It was not specifically expressed that they would absolutely no way ever bring any more tailings to Opportunity, but it was strongly voiced by our community that, okay, we'll take it this time but don't be looking for us for a dumping site again.

I want people to hear us. I don't care if it's a half of one percent and I don't think the people of Opportunity care that it's a half of one percent. A good example, take a glass full of water and take an eye dropper and that half of one percent in that eye dropper is going to make it overflow.

Neither the technical people or the people that have been involved with Superfund in any way, shape, or form can guarantee that that half of one percent is not going to do damage to the future and to the residents of Anaconda and Deer Lodge County. What we need to remember is that it is by choice and it is by democracy that we make choices in this country and we need to follow that principal in all walks. It doesn't matter what we're doing.

There are consistent words that we're hearing tonight and just to sum them up, some of them are: Planning, logic, comprehensive, long-term solutions, being careful of hysteria, the use of

96

technology, let's act now, safety, what is responsible, what is timely, let's use the greenway, let's use technology.

All of those have been sent as a clear message and I do personally support most of those words. I can say in the process in Anaconda, we hope that we have set a national model that has involved ADRA, community leaders. We hope that we have set a national example of what Superfund can be, and that is Superfund projects that are effective, that work for the people, and that will work for our future.

The Old Works golf course didn't come by just casual thought. It didn't come by people just sitting on the sidelines. It came through a lot of hard work from a lot of people, including the Feds, the State, Anaconda, and ARCO sitting down and discussing what is reasonable, what is logical, what is planning, what is going to be the end use or land use. All those things can be taken into consideration if only we all work together.

I think that land use and end use, as it was referred to, either/or, is very important to Superfund. And that should be considered in this project as well. Timeliness is essential. I don't know about the rest of you, but I sure don't go to

97

other states and brag to my friends that, "Hey, we're the largest Superfund site in the world, isn't this great?"

No, you don't brag about that. What we want to brag about is that we're a successful cleanup project and that we can successfully do what is necessary to protect the environment, to protect the long-term use of that land, and that we the people have said what we want to say about it. Last time I checked, this was a democracy. I hope the State will listen. This is a democracy.

MR. KIRLEY: Comments from Don Peoples.

DON PEOPLES: For the record, I'm Don Peoples and I'm the president and CEO of MERDI. I think we have to recognize that what we're going through tonight is a very unusual opportunity. Cheryl just mentioned the Anaconda golf course. I think that was really the impetus for Project Green. We saw what had happened in Anaconda when people decided they wanted something better, something better than just a fenced-off area, and they decided that a golf course made a lot of sense. And frankly, that's what gave us our impetus.

I first of all need to remind everybody

98

that since 1980, the national Superfund, Congress has appropriated and spent $15 billion for Superfund. To date five percent of the sites have been cleaned up. Fifty percent of the costs have been involved in litigation. We can't afford to let that happen with the streamside cleanup. That's why I think we're all here tonight is to make sure that we get our views across and that the State and the federal EPA adhere to the new emphasis on Superfund; and that is, letting communities decide themselves what has to be done.

We need also to really recognize that Project Green as it was formulated has never, has never advocated anything less than safe and efficient cleanup. That's been paramount from our discussions from Day One. We think we can do that, provide the safe and efficient cleanup, and still come out with an appropriate land use that can be used and enjoyed for generations to come. We think that's very important.

Comments about the State plan, and I think that are clearly obvious tonight, is there's a problem with sequencing. There is no sense cleaning up the streamside operable unit and at the same time ignoring the priority soils and not moving forward with Lower Area 1. We think that's a serious problem that needs to be addressed in the State's plan.

99

We also think that the State plan gives scant recognition to the Metro Sewer problem. You have to remember that that creek, that 50 percent of the flow of that creek comes from the effluent from the treatment plant. We need to be talking about what happens to the treatment of the nutrients that are coming out of that plant. We believe the State should look at that as well, and they don't give much more than scant recognition to the Metro problem in the study.

Cost is another area that we think is of serious concern. I think Mr. Worcester hit it on the head tonight when he talked about the cost of 50 Fox Theater projects being the difference in cost. Cost is a factor, let's be honest about it. If we're going to do the greenway, we're talking about a cost of $10 to $15 million. Where is that money going to come from? Well, I can tell you personally that our conversations with ARCO have led us to the conclusion that if there is a reasonable cost of cleanup, that we can go to ARCO for assistance. And I say "assistance" because there's going to have to be other people involved with it as well. But that's obviously a serious concern.

I visited a town outside of Wallace,

100

Idaho, called Burke, Idaho, about four or five months ago. That is a community that at one time was a silver mining community, had about 10,000 to 15,000 people. The PRP up there filed bankruptcy. There is no one to clean up that area. We're fortunate that we have a corporation that is willing to participate with the development of a Greenway Project, provided, of course, that it is safe and efficient, and long in permanence in its cleanup.

So, obviously, Project Green is something that we think provides an outstanding opportunity. It's an opportunity of a lifetime. We can't afford to let this go by.

On May 28th, I wrote to the Department of Health and asked for more participation, more in-depth discussion regarding the community's desire for the streamside cleanup. Those hearings and those meetings are beginning but we need to involve more people and we need to involve the State and all of the players in this process to a great extent.

If it takes longer to come up with a solution and an appropriate plan of action, then so be it. But we think there are ways to speed up the remediation in certain areas and at the same time we can start talking about the development of a greenway

101

that will have an appropriate end land use and it will be something of extreme value to this community.

Project Green I need to emphasize again and again is promoting nothing more than safe and efficient cleanup, but we also believe that the citizens of this community deserve much more than simply a remediated area that is going to be in all likelihood fenced off if we cannot move forward with the greenway proposal.

Again, I encourage the State to take seriously the offer that we have made to facilitate the discussions between the local governments and between the State and Project Green to move forward with the development of a total cleanup plan that will result in a safe and efficient area, but also will result in an area that we can all take advantage of for years to come. Thank you.

MR. KIRLEY: Comments from Dennis Wright.

DENNIS WRIGHT: Dennis Wright, I'm a physician in Butte. You know if somebody tomorrow would say to me, "Well, all the tailings in Butte-Anaconda and all the wastes are going to be gone," I would say, "Great." And then they'd say, "All we're going to do is 200 trucks a day through the area."

102

and all of a sudden, I'd say, "Maybe those tailings aren't so bad."

But I look at Montana Street or any of the construction areas, and I am involved in a lot of the trauma in the area. If we're really talking 100 - 200 trucks a day moving in the area, you're going to look at accidents and injuries that are unbelievable because anytime you put up a construction zone or trucks entering, the accident rate goes sky high, and we see that happening.

So I hope I have 15 years left to live around here and I know for one thing, people I have talked to myself, we don't want 200 trucks a day during the best time of the year traveling on the roads that we're going to travel on.

Now, in my field in radiology, the very best that we can do in a diagnostic exam happens to be ultrasound of the gall bladder. And we pick up gall stones and 97 percent and that's the very best we do in radiology or in diagnostic medicine. And then our exams go down from there. Most people don't realize that.

But as a patient, if you came to me or came to your doctor and said, "I want a hundred percent guarantee that there is nothing wrong with

this particular thing," it's going to cost you a lot of money because we're going to end up doing ultra sounds, CT, we're going to do all these exams and you're going to spend all your money and we're going to say, "Well, it's not 100 percent."

So what I'm saying is that in looking at this whole project, people who are demanding 100 percent certainty that STARS or these projects are going to work, it's just not going to happen because the West, as you drive around and it's full of these projects, and the only way that we're going to accomplish somewhat of a good cleanup in the West, it's not just Butte, Montana, is to be able to compromise and reach areas of cleanup that are not going to cost a fortune.

Now, in talking to people, what I find is they want several things. In summary, they want a safe cleanup project. And I can't believe 200 trucks on the roads for 15 years is going to be a safe project. They want something that's going to be over a short interval. We discussed this a lot and I can tolerate three years - four years of a project, but 15 years is beyond belief.

I think the most important thing and the final thing I have to say is I personally, and in

talking to people, I know that if we follow the State project, we're not going to see this done. And if we don't start as a group of people accepting maybe a 90 percent certainty, 85 percent certainty, sure, maybe at that 100-year flood there's going to be some leakage, but we're going to have to accept that because I don't think we can afford as a group of people to demand perfection in cleanup.

I think it's a wonderful project. I've read everything I could read on it and I think the Project Green will be something I can see in my lifetime and I'm for it and most people I talk to are for that and not for a long litigation in the courts for an expensive project.

MR. KIRLEY: Comments from David Owen.

DAVID OWEN: Thank you very much. For the record, I'm David Owen with the Montana Chamber of Commerce. As I was sitting here thinking of starting to comment, the first question I should probably answer is: What in the hell is the State Chamber doing down here? There are a couple of things that bring me down here in the name of the Montana Chamber.

One, there's about a dozen businesses in this room including the facility that we're in that

are members of ours, we happen to have a board member that lives in this community. But more importantly, we have as members of the State Chamber small businesses that face tremendous environmental challenges. We've got gas stations that have put in $15,000 to $20,000 sump traps that have filters that are filling up and people have yet to tell them what to do with those filters once they are full. I have as members printers who have certain kinds of old ink laying around and no one can tell them how to get rid of it. I have as members dry cleaners who pay $25,000 to $30,000 to change out equipment.

So the issue of environmental protection is one that has become a daily concern to us as advocates for a variety of businesses in the State. I have no intentions of bringing the State Chamber into local kinds of issues and concerns but I did want to take some time to come here and address the message that the State's decision in this case will send to other businesses around the state.

We travel to about 21 cities twice a year to try to listen to business people and their concerns. And one of the things they have told us over and over again when it comes to environmental concerns is: How much is enough? How much do you

have to spend to go from clean to ultra clean? Do we have to sanitize the State?

One of the messages some of you have read that was put in a publication, a member of ours said, "It's like they are telling me my kitchen isn't clean and I shouldn't eat in it because it's not as clean as an operating room."

When we started this, one of the first speakers said safety should be our highest calling regardless of the cost. And it dawned on me when he said that, that that's not the way we live our private lives. Because if we were to pursue safety without regard to cost, all of us would be driving tanks down the road or at least big, huge Suburbans. But some of us have made a decision to drive something a little more fuel efficient and take the risk it may not hold up in a crash. If we truly lived our lives trying to eliminate all risk, none of us would get in an airplane ever. People die in those things.

I just recommend to the State and to others, there's a book we were circulating among the board that Alvin Toffler of Future Shock fame wrote, it's 95 pages, real quick reading, talks about creating a new civilization. What a powerful point they make is: Do we really need a congruity between

107

public policy and private lives?

So I come here to advocate the State not pursue this alternative necessarily because I think it lacks that congruity with the way people live their lives as they pursue their own balance to risk and reward. Unfortunately for this process, I can't sit here and say, well, this is one that we can recommend. Our board hasn't had that level of discussions, but we've clearly talked about: How much do we pay for safety? What kind of risk do we live with? What are the trade-offs? And how do we be reasonable?

That brings me to the conclusion that in making this decision, we're sending a powerful message and one that has a lot of small businesses concerned all over the state, and be very careful. Thank you.

MR. KIRLEY: Comments from Greg Mullen.

GREG MULLEN: my name is Greg Mullen. I'm a staff scientist with the Montana Natural Resource Damage Litigation Program.

The State of Montana filed suit against the Atlantic Richfield Company for damages to the natural resources pursuant to Superfund law. The lawsuit was filed to protect the interests of the public by recovering monetary damages for the economic

108

losses associated with natural resource injuries and for the costs necessary to restore the injured resources to the condition of a healthy, functioning ecosystem.

The proposed plan for the Silver Bow Creek Operable Unit is an excellent proposal for remediation at addressing public health and the environment. The proposed plan on page 22 explains the differences between this plan and the State's restoration plan for Silver Bow Creek. Restoration strives to return the injured resources to baseline conditions, which are the conditions that would result absent the release of hazardous substances; in this case, metals.

Remediation does not attempt to restore the area to baseline condition but strives to protect human health and the environment by complying with standards set in federal and state laws.

Presently, surface water and stream bed and bank sediments are contaminated with hazardous substances, primarily copper and zinc throughout the length of Silver Bow Creek. The contaminated sediments act as a critical exposure pathway to injured surface water, aquatic insects, which in turn injure fish. Due to extremely elevated concentrations

109

of hazardous substances in Silver Bow Creek, trout populations have been eliminated entirely. Restoration of fish populations to baseline conditions requires restoration of surface water sediments and aquatic insects, all which serve as exposure pathways to fish.

Also, riparian wildlife habitat has been injured throughout the length of Silver Bow Creek. These injured areas no longer provide sufficient habitat to support viable populations of wildlife species typical of riparian habitat in western Montana.

Due to these injuries to the State's natural resources, the citizens of Montana have lost opportunities for fishing, hunting, and other recreational activities along this important corridor. We are seeking compensable damages for these lost opportunities which can be used for enhancing recreational activities across Silver Bow Creek and could be used for the components of Project Green.

A major common goal of most of us here is to improve surface water quality to support fish and wildlife. This common goal takes significant efforts and notable source removal to achieve. While the DEQ/EPA proposed plan may not restore the injured

110

areas to baseline conditions, it is a step in the right direction.

By removing a substantial volume of flood plain tailings and a portion of contaminated sediments, additional efforts to restore the fishery and to repair the lost wildlife habitat are necessary to fully repair the loss of the creek. The funds obtained in the lawsuit against ARCO will be used for these efforts.

The State's restoration plan goes beyond remediation by removing all tailings in the 100-year flood plain, removing all toxic sediments in Silver Bow Creek, adding substantially more topsoil to support vegetation efforts, revegetating the riparian with a diversity of species including trees, reconstructing stream banks and bed.

Finally, implementing a lesser remedy, i.e., one that is largely relying on STARS as advocated by ARCO, in which our experts have grave concerns about, would result in waiting many centuries for recovery of resources due to the toxic nature of these contaminants. If considerable amounts of contaminants are allowed to remain in the flood plain, the ability of the area to remain green and the trees to grow for any length of time is doubtful.

111

In addition, unreasonable, long-term maintenance would be required. The Natural Resource

Damage Litigation Program supports implementation of the State's proposed plan, which in conjunction with the restoration plan for the Silver Bow Creek will ensure a healthy ecosystem in a short period of time. Thank you.

MR. KIRLEY: Comments from Lyle Nalivka.

Did Mr. Nalivka not want to wait this long to give his comments?

Comments from Val Buzz Galle.

VAL BUZZ GALLE: It is "Galle", you can correct that.

MR. KIRLEY: It's "Galle", okay, I'm sorry.

VAL BUZZ GALLE: We're sometimes called "Galle", sometimes "Galle". My grandmother always preferred "Galle", so that's what we go by.

I live under that big stack up there, have all my life, in the Lost Creek area. A lot of you know the Lost Creek State Park. My granddad had a ranch there. He died at 92. My grandmother died at 96. Well, my grandfather worked for the Smelter but my father worked on the Smelter and the Arsenic Plant for 45 years. He died at 91 just the other day with

112

congested heart failure.

I don't think the arsenic has really hurt the Galle family any. I don't think it's stunted my growth. I don't think it's shrunk me any. But I just wanted to point out that we lived there, we lived under that stack, we raised cattle, we raised hay, had gardens, everything grew. I don't where there's really that big a problem with the arsenic.

The other thing is the people in Opportunity have expressed their opinion over and over again that they do not want that contaminated material in the Opportunity Ponds. I want to add, want to say to you that just think, now, you young people that are talking for the Opportunity Ponds, just think of these trucks, trains, or whatever, passing your homes every day with that dust and dirt coming into your home. You're not going to want it; neither do they.

The other thing that I'd like to know is: What kind of a stack or pit is it going to take to have all this material? How high is it going to take to haul these 200 trucks? Nobody's ever said anything of how much dirt that is going to be piled up or how deep a pit it's got to go into. How are you going to cover all this? That dust is going to be coming off of that material for years if it's stacked, and it's

113

going to contaminate the area. We can't have that.

I represent those people in Opportunity as a county commissioner and they said to me over and over again, "We don't want it." When we had the hearings on the Colorado tailings, I was under the impression that the State, the EPA and ARCO promised those people in Opportunity that there would be no more contaminated material brought to the Opportunity Ponds. And I would like to see the State stand and the EPA and ARCO stand with that statement and live with what the people want in that area. Thank you.

MR. KIRLEY: Comments from Karen Kennedy.

KAREN KENNEDY: My name is Karen Kennedy, representing Citizens Technical Environmental Committee. CTEC's board and staff wish to go on record as fully supporting Alternative 6, the State's chosen remedy, given continuing monitoring of the STARS treatment areas. It is the view of CTEC that Alternative 6 provides the most protective and cost-effective cleanup remedy of Silver Bow Creek.

The primary advantage of this remedy is the removal of most tailings from the flood plain of Silver Bow Creek, preventing the reintroduction of tailings contaminants dangerous to a healthy Silver

114

Bow Creek requires the removal of the tailings from the flood plain. As long as tailings remain in the flood plain, a substantive probability exists for tailings to again come into contact with water. This contact is the primary mechanism through which contaminants are released into the waters of Silver Bow Creek.

Additionally, unconstrained land use of Silver Bow Creek and the surrounding area requires the consolidation of the removed tailings into one or two regional repositories rather than relocation of tailings to sites adjacent to the flood plain. Localized repositories adjacent to the flood plain would result in both access and use restrictions to land along Silver Bow Creek due to residual health risks associated with contaminated tailings, and the substantial maintenance these repositories would require.

For these reasons, CTEC supports the removal of tailings to a regional repository such as Opportunity Ponds. The proposed Opportunity repository provides suitable storage at an already heavily impacted site, trivial additional impacts, competitively priced rail access, and no additional institutional controls.

115

Regarding STARS, CTEC believes that used under appropriate conditions and properly implemented the STARS institute tailings treatment has great potential and low to moderate risk for immobilization of contaminants within tailings and prevention of their reintroduction into Silver Bow Creek in the designated portions of Subareas 2 and 4.

STARS treatment is inappropriate, however, where tailings are either proximal to shallow groundwater or in areas where stream meander and high flow erosion may allow re-entrainment into the creek of STARS-treated tailings and their subsequent separation from their added amendments. But even applied in an appropriate location, the efficacy of the STARS treatment is severely compromised when inadequately implemented.

MSU's Research Reclamation Unit, the people that developed STARS, recently reviewed ARCO's current treatability studies. At two out of the five sites that they reviewed, their Research Reclamation Unit stated: "Treatment of these tailings with lime was a complete failure." At the other three sites, the site neutralization of the tailings was incomplete.

Now, bear in mind the Research

116

Reclamation Unit are the people that developed STARS. They are the people best suited to review how it's implemented.

The Research Reclamation Unit also summarized ARCO's implementation of STARS in the treatability studies and summarized their findings with the following comments, and I quote:

Lack of initial sampling and analysis of tailings, inappropriate logic used in finding lime application rates and poor amendment incorporation have resulted in incomplete site neutralization.

For these reasons, CTEC requests that the State provide a monitoring mechanism to evaluate both the long-term efficacy and initial adequacy of STARS treatment applied to Subareas 2 and 4. Thank you.

MR. KIRLEY: Comments from Mary Kay Craig.

MARY KAY CRAIG: My name is Mary Kay Craig. I'm a Butte native living in the shadow of the Anselmo Mine. I'm also president of the CTEC, Butte Citizens Technical Environmental Committee, which is working on the detechnicalizing of technical documents for the public.

I've been at every meeting, perhaps 100

117

of them, well-advertised, public, community meetings on this subject over the past three years. There was an exception; and that is, CTEC's request to be involved in planning the Project Green project were ignored.

I believe that we can have jobs and a green belt and a spawning trout fishery, not ARCO's put-and-take fishery, which could be described as pluck and then truck to the muck.

Having been personally severely attacked for my support of the State's scientific plan, tonight I will speak personally as a citizen. I believe we all need to remember why Superfund came to town in the first place, for one reason. The reason is to permanently protect human health and the environment which sustains us. They did not come to town to decree unnecessary movement of toxins, so to be a burden on the seventh wealthiest corporation in the nation.

ARCO merged with The Anaconda Company and continues to enjoy great wealth from that merger. With the merger, they also took on a burden to clean up after themselves. This area lacks epidemiologic scientific health studies of the ARCO metals.

If data were available, there would be

118

less controversy here tonight. I am a victim of cancer of unknown cause, so was my dead mother, so were many of my now dead friends. A business woman in Butte from Milltown tells me she has the same black skin moles associated with the arsenic that her mother and her aunt have which are, she said, cancerous.

Two of my best friends died of "rare" systemic lupus erythematosus, which I have been told is associated with cadmium, one of the deadly metals in the Silver Bow Creek flood plain. Another state's health department traced cadmium in cattle to a Rocker ranch some years ago. At Butte Central Class Reunion this past weekend a former classmate, another business person in Butte, said that all nine of the people who have died from our class have lived near mining-impacted soils. That's not scientific data, but we don't have any. We haven't had a health study in the Butte-Anaconda area in at least 20 years.

The last one was in the early Seventies and was cited in the paper in the proceedings of the 1990 Clark Fork forum. It shows people in this area had the highest per capita incidence of all diseases in the nation. Earlier studies in the Fifties and Sixties listed in that report show highest in the nation heart disease, and show women with as much lung

119

disease as their husband's who worked underground.

It's time for new epidemiologic studies. In the meantime, what is scientific is the cadmium is known to cause cancer, so is arsenic; mercury is an even greater toxic to the human body. All three of these as well as some pentachlorophenols are now within the flood plain of Silver Bow Creek in sufficient quantities to pose health risks to us and to future residents unless removed.

The scientists who wrote the risk assessment for Silver Bow Creek acknowledge that ARCO did not provide us with enough data on where and how much mercury is in the creek area; very, very, little data. The bottom line, they said they believe that there will be, has to be, such a good removal of contaminants that this should not be a concern.

I thank the scientists with the State of Montana for the tremendous job of characterizing the flood plain of Silver Bow Creek so we know where the contaminants absolutely have to be removed. They are also to be commended for sticking to their guns on what is really important: Protection of human health and the environment.

I support a greenway, a natural one that will remove toxins and remove the Superfund onus from

economic development. With a good removal of contaminants, Mother Nature will give us a no-maintenance green belt end use down Silver Bow Creek like there once was.

Then to MERDI and other groups, please look for grants to add cute picnic areas and gardens and amusement parks. There is not just one source of funding. There are many, many organizations that fund such community endeavors and we would be happy to help you if you'd let us.

Keep your good ideas but don't be used by ARCO's unspecified gifts of free goodies on the top of toxins as a price for allowing them to leave unsafe amounts of contaminants in the flood plain. That just doesn't make sense to Superfund law or to thinking individuals who care about the well-being of future generations in the stream corridor.

I support the State's Alternative 6 as a common-sense compromise. I only ask that where STARS is used in the appropriate specified areas, that they be monitored in the long-term with a change to remove if indicators show it is losing effectiveness. Thank you very much.

MR. KIRLEY: Comments from Tony Schetzsle.

TONY SCHETZSLE: "Schetzsle."

MR. KIRLEY: "Schetzsle," I knew I was going to get that one wrong.

TONY SCHETZSLE: My name is Tony Schetzsle and I serve as superintendent of Grant-Kohrs Ranch, National Historic Site, in Deer Lodge. I came to Grant-Kohrs a year ago, June, and am quite tickled to be there, quite frankly. My kids were born in Billings and moved to the other side of the state now. I'm pleased to be there, but I do not take particular pleasure in knowing that I'm the superintendent of the only national park system unit on the national priority list for Superfund cleanup.

Grant-Kohrs Ranch has historically been the recipient of upstream tailings and contaminants that have been and continue to be released to the Clark Fork River. We have been monitoring ongoing removal and remedial actions upstream and will soon be an active participant in the CERCLA process as they proceed with their remedial investigation and the feasibility study for the operable unit in which Grant-Kohrs Ranch is located. However, I've come to the conclusion that in order for the removal and the remedial actions to occur at the ranch, there has to

be effective, there has to be a permanent, and there has to be a resilient remedy implemented in the Streamside Tailings Operable Unit and all other source locations upgradient.

The National Park Service supports the preferred remedies proposed by the Montana Department of Environmental Sciences and the Environmental Protection Agency for this operable unit.

We have to be protected from recontamination. The short-term risk associated with the implementing of the proposed plan, that is, removing the tailings from the flood plain are justified relative to long-term risk of continued exposure associated with leaving tailings in the flood plain even with STARS treatment. Any alternative to merely relocate and treat contaminants in the flood plain poses unacceptable risk to resources and human health.

The proposed plan calls for approximately 540,000 cubic yards of tailings to remain in place and treated with STARS in Subunit 4 if equivalent performance can be demonstrated to comply with Applicable or Relevant and Appropriate Requirements, the ARARs. If the ARAR standards cannot be satisfied nor a waiver granted, the tailings should be removed

as called for in Alternative 7.

Grant-Kohrs Ranch National Historic Site is a unit of the National Park System. It serves as the institutional memory of this nation as it commemorates the frontier cattle area and its role in American history. It also bears testimony to the mining history of the region with its slickens along the river.

The National Parks Service's task was preserving the ranch. In order for the service to remediate, protect, and restore Grant-Kohrs Ranch, the same must occur at all potential release sites upstream in the Streamside Tailings Operable Unit.

Just today I witnessed one of those flood events on a minor tributary -- a minor drainage to the Clark Fork River in Deer Lodge. I wasn't sure I was going to make it here because I got caught in that mud that carried downstream.

We have to eliminate the need for Warm Springs Ponds. Associated with that flood event I watched today was it once gain confirmed for me that these rivers, these streams do exactly what they do. They meander and they erode. And the STARS treatment will not adequately protect against these flood events and release of contaminants.

We agree with the objectives of the plan and the criteria invoked for selecting the preferred alternative. The preferred alternative is not perfect but it's the best that has been offered and it allows us the best chance for restoring Grant-Kohrs Ranch. Thank you for this opportunity.

MR. KIRLEY: Comments from George Waring.

GEORGE WARING: I'm George Waring. I belong to a newly formed group in Butte, the Citizens for Labor and Environmental Justice. I have attended something like ten meetings of CTEC in the past year and I would second what Cheryl Beatty said about the importance of democracy. I would also second the truth in Mary Craig's statement that the members of CTEC are not invited to participate in the MERDI greenway plan, even though some of these members have spent three years in doing these kinds of studies. It makes me very suspicious about what the purpose of the MERDI plan was.

I'm glad to see Mr. Tretheway is still here, even though he's getting up to leave. He said that he was impressed by the pictures he saw of MERDI's greenway plan. Those are marvelous artist's conceptions. Those pictures show community gardens,

125

deciduous trees, model farms, trails and picnic areas. All of these are public benefits that I would joyously welcome.

However, according to the bulk of scientific analysis, these public benefits can only be guaranteed if the Department of Health's Alternative No. 6 is adopted. I want to congratulate all the folks who were allowed to participate in putting together the MERDI greenway plan. Not only is that plan a masterpiece of public relations, it also allows Butte to gain something equal to Anaconda's golf course, as a former chief executive of Butte acknowledged tonight. And that is an important consideration, given the athletic rivalry of these communities.

I do want to suggest to the Butte folks supporting greenway that they dessert the ARCO cover-up proposal and throw their support behind Alternative No. 6. That alternative will protect human health. You'll allow us real trees, not little willow bushes. You'll allow us picnic areas. It will create a number of jobs in the restoration project.

As I kidded my old Tech colleague who has left, Dr. S. L. Groff, earlier tonight, I kidded him a while ago about a thorough cleanup of the creek. I

126

said to him, "You got me and Dr. John Ray of Tech down there planting trees. Those trees aren't going to grow in that STARS-treated soil, Dr. Groff. We might as well go down there and put in a bunch of pink plastic flamingos."

Dr. Groff mentioned tonight that the Berkeley Pit problem should be solved before any cleanup of Silver Bow Creek. If memory serves me, I attended a Butte-Silver Bow County of Commissioners meeting a year ago in which 3,000 names on petitions were presented signed by the people of Butte wanting a quick cleanup of that Berkeley Pit. ARCO, EPA, and the Butte-Silver Bow Government came to a solution that takes 30 years. I wonder where Dr. Groff was that night.

Let's not allow another opportunity to pass for a thorough cleanup. Let's learn from the Berkeley Pit experience. As I see it, the Department of Health has given us a great opportunity for a magnificent natural greenway. I thank these folks for the opportunity to support their Alternative No. 6 tonight and participate in a really democratic plan. Thank you.

MR. KIRLEY: Comments from William Kebe.

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127

WILLIAM KEBE: I'm the past president of the Butte Local Development Corporation, Chamber of Commerce, and present member of the Board of Directors of the Local Development Corporation.

I'm sure if Sid was here he'd make sure that George and Sid continued in the paper their debate, so I'll be sure to report to Sid. He's got a rebuttal coming.

I'm basically here in support of the greenway proposal because I think the most important thing we have to deal with here, hearing what we've heard today, is the end use that we're going to end up with here on this particular project. Everyone kind of thinks that, gee, the Proposal No. 6 would clean up 80 percent of the tailings. But frankly, we're going to end up with something that is totally unuseful. If you want to see an artist's rendition of what it's going to look like after No. 6, you've got to look at the fence because that's what's going to be there. We're not going to have any use.

We have an opportunity here with ARCO willing to sign on with, the way I view it, no further litigation and we could get something as a usable project here. The 80 percent removal will be too long. There is no guarantee that you're not going to

128

stir up, so to speak, a bucket of crap there and agitate something that settled down by Mother Nature a long time ago. There's no guarantee of that. There is no local usage of the end product guaranteed by it, whereas the greenway proposal locks that in for us.

We're going to have a loss of future economic benefit by not having this greenway proposal available to us. I think the situation with the Jack Nicholas golf course in Anaconda is a tremendous end use. We're going to have something there that we could utilize in the future, that we're not going to have just by cleaning it up. Because it's one of those things: Sure, there might be fish there; I might not even be able to go on it.

I think since ARCO would be obligated, provided there is no change in the law -- that's one reality everyone has to look at, we could have an entire change in the law that could negate what the State is requiring ARCO to do. But should they remain responsible, then if there is a problem with the greenway solution, using STARS and all the other acronyms I've heard tonight, they are still on the hook for it and they'll come in and remediate it.

There is not going to be any guarantee that the groundwater is going to seep up after the

129

State removes 80 percent of it. I think we have an entity here in ARCO that's willing to come in and spend a sizable chunk of dough here that's going to give us an end usable product, and we should take them up on it and get it over and done with, without all the attorneys getting their cut of the action because they're not going to roll over for years nice and easy. That's it.

MR. KIRLEY: Comments from Tom Weitz.

TOM WEITZ: Thank you. For the record, my name is Tom Weitz. I'm general manager of Pegasus Gold - Beal Mountain Mine, and my comments will be brief.

Pegasus owns property along Silver Bow Creek. I appreciate the opportunity to comment on the State's proposed remediation plan for the streamside tailings. Overall, the State's proposal lacks two things: Foresight and logic.

The idea of moving such massive amounts of material by either truck or rail is not a reasonable one. Also, while the plan does not seem to rule out future productive land uses like those put forth in MERDI's Project Green, it does little to cultivate such uses.

130

Further, I question the State's weighing of long-term risk versus short-term risk. Regardless of whether the materials were transported by rail or truck, the State would be sanctioning substantial risks to area residents and visitors. The plan's risk and costs assumptions regarding rail transport seem particularly underestimated.

Another point which quickly arises is the adage of: How clean is clean? The science-based approach ARCO has taken with STARS and the other aspects of its plan take a more reasonable approach and one which effectively and substantially reduces realistic risks from metals which would remain.

The State's plan fails to adequately recognize the downside of such things as removing massive amounts of topsoil from other locations to replace material which the plan proposes to be moved. Has the State determined where the topsoil will be found?

Thank you for the opportunity to present my comments.

MR. KIRLEY: Comments from Peggy Trenk.

Okay, Peggy Trenk is not here.

Comments from Kathy Stroeher.

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131

KATHY STROEHER: I'm Kathy Stroeher. I'm chairman of the Ramsay School Board, but the school board has not taken a specific position. I'm speaking as a parent whose children attend Ramsay School and whose family lives in the area.

I'm not here to criticize or support either plan. A plan that begins cleanup soon I believe is important. A compromise of the plans and those ideas presented tonight will most likely involve both the removal and transportation of contaminated materials and the neutralizing and containment of contaminated materials. Whatever techniques are used, my concern is that the final state plan give a great deal of attention to the impacts of the actual cleanup work on the school children at Ramsay and the people living in the corridor.

The contaminated material and air pollution must be monitored and steps must be taken to protect people during the short-term work period. The short-term risks of excavating and hauling waste materials to disposal sites is a significant concern. We can't sacrifice the health of people living in the corridor and attending Ramsay School now for the long-term end-use goals. When the State develops the final plan, please include very strict monitoring and

132

actions to minimize the added pollution and danger to the people living in the area.

Another question that you asked us to address is the feelings on the use of Ramsay Flats as a relocation or regional repository. I am very concerned about that because of the proximity of the school. The health of the children and staff there must be a major consideration in whatever plan is adopted. If you're going to keep ore concentrate in repositories, contaminated materials at Ramsay Flats, decide what you're going to do to safeguard the Ramsay School students and staff and the nearby residents.

I support any plan that includes frequent active testing of all of the appropriate indicators of ongoing pollution to provide a safe and efficient cleanup while working towards future goals of a clean Silver Bow Creek.

MR. KIRLEY: Kim Krueger.

KIM KRUEGER: Hello, I'm Kim Krueger. I work for Senator Max Baucus in Butte. Senator Baucus is very concerned about this issue. I know that he's talked with some of you who are here this evening and he's very anxious to hear my report of what is being said here tonight. Thank you.

MR. KIRLEY: Comments from Bert Freer.

Bert Freer, I think I'm saying that right. Is there anybody that's even close to that? He's gone, okay.

Joe Seymour.

JOE SEYMOUR: My name is Joe Seymour and I have been concerned about these things as a Ramsay landowner, streamside tailings for sometime. I've attended almost as many meetings as Kathy or Mary Kay has.

I have some concerns about the State plan and the ARCO plan. I was invited to take a look at some of the STARS projects down in Opportunity Ponds and I can see it's not perfect. It didn't take the flood too good. It washed out the tailings on the bank, left the cocoa mat sticking a foot in the air. I was impressed on some of the grasses holding and native soil not in tailings and had a lot of water pass over them. So there is good and bad in everything.

The State plan I would recommend because it removes more of the tailings out of the flood plain. I think in the Ramsay area, if things go favorably, will bring beaver into that valley and they'll build dams and raise the water table, and then you'll get a flood like we've had this year and it

will hit those beaver dams and it will cut around them and I think you'll wash tailings out unless you take them all out to start with. Whether you deposit locally or not depends on how you handle them.

I understand that the land that I own is scheduled to get a deposition of tailings removal. I'd like to get one consideration: Has anybody thought about putting a grid, sort of like a septic tank field in reverse, so it can drain the groundwater out of that system and won't have contact over a long period of time? And it will give you a good sample, too.

But I can just see the beaver causing this stream to meander all over the place. He was in Brown's Creek within 15 feet of Silver Bow Creek where the tailings are for many years until my neighbor, Don, shut the stream off for two years in the dry season and they left. But they'll be back. Nature heals.

I don't know what else to say except I do have concerns for the schools and I hope you don't pile those tailings up so high that the wind blows them. You've lost two feet of tailings in the last 40 years. The wind has blown it away. And this year you've lost more tailings and tonnage than I can shake

a stick at between the Silver Bow bridge and that railroad bridge that's just a few -- a half-mile away.

But I'll bet you there's 75,000 tons gone, washed off two feet of the fine stuff and that's supposed to be what's the most dangerous. It's where your zinc's at according to the analysis that I have.

I guess that's about all I've got to say, Jim, but I would like to commend you on your plan on trying to remove as much as possible. And if you want to make a regional repository, do it right and cap it and make it grow grass on it so it doesn't all blow down in the school yard again.

MR. KIRLEY: Comments from J. Ray Haffey.

J. RAY HAFFEY: I sign everything officially J. Ray Haffey. My name is Ray Haffey and I work at Anaconda High School. This last quarter of school I had the pleasure of kind of helping to coordinate some students to look at the Project Green concept. They were excited about it, totally excited about some of the concepts, some of the things that were on the table and some of the things that they would like to propose. I'm not here to talk about that but I wanted to kind of share that with you. And if you wanted to know some about that, I would like to

tell you some of their input, but it's very positive.

I'm here to testify in support of a compromise plan for reclamation of the Silver Bow Creek Drainage. If a compromise effort is not promoted, this important project may be lost in further expensive studies, delayed by court litigation, or affected by future changes in legislation. It's time to start the job that needs to be done.

There have been many excellent suggestions over the past several months to be considered. The Project Green concept has gathered community input aimed at promoting both short and long-term solutions. Safe, long-term protection of human health and the environment have been suggested rather than fence off unusable resource. Historical preservation and economic development have also been reviewed and promoted in the greenway concept plan.

There's been other interesting concepts that have been suggested recently in the paper. One advocated a wetland area west of Butte. Such a proposal would provide multiple-use situations as well as a holding and monitoring station. If you think about it, the wetland, a wetland area wherever it would be, as well as the Warm Springs Ponds, could be

a valuable checkpoint for the drainage system.

It's time for a compromise and implementation. ARCO's proposal utilizing the STAR technology appears to be a workable solution for most of the corridor. In identified hot spots such as the Colorado tailings, removal of contaminants to a drier, safer areas would be necessary. In thinking about the Colorado tailings and being from Anaconda, my wife being from Butte, that area might be white but it's a black eye to Butte. Every time I drive by there, I think about: Wouldn't it be nice to see that taken care of?

There's other pockets of high contaminants that could be carefully removed away from the flood plain. Less contaminated areas could be treated using the STARS technology. There's a problem. If you look at massive hauling, large scale usage of trucks, you're going to increase a health risk and/or death. Therefore, careful removal using limited trucks or rail hauling whenever possible may be a more reasonable option.

Again, a blended compromise of the Montana State plan, the recommendations, and ARCO's proposal utilizing STARS technology appears to be a workable solution if something is done and you work

together. Other proposals have complemented both sides. It's important to do the job and not let it be lost or diverted in legislation, litigation, or extended studies.

In writing this this morning, I couldn't help but think of a little conversation I had in one of my classes involving an individual who was very popular a couple centuries ago by the name of Benjamin Franklin. Benjamin Franklin once said that if you have a large table - and in this case we have two major parties sitting at the opposite end of the table - to reach a solution, you don't chop off one side and give more to one side than the other; take a little from each in the middle and a solution will work itself out. Thank you.

MR. KIRLEY: Comments from Jon Sesso.

JON SESSO: My name is Jon Sesso. I'm the planning director for Butte-Silver Bow.

I want to thank the State for holding this public hearing. I wish there were more of them. I think that this has been the healthiest debate that I have been a part of in my time of working on behalf of the local government, both as its planning director and its coordinator of Superfund activities.

I want to express the regrets of the Butte-Silver Bow Council of Commissioners this evening and the Chief Executive. They had to schedule a special meeting of their council, and consequently could not come. I don't think they realized that we would still be going on. I don't think their meeting is still going on. In any event, they are not here and they express their regrets.

Myself and my colleague, Steve Blodgett, have been here listening to everything that has been stated because my third point is that we are going to initiate our process starting Wednesday night as we have done with mixed reviews. Each time there is a specific decision to be made by the EPA or the Department of Health and Environmental Sciences and now the Department of Environmental Quality, we believe that a public forum in front of our Council of Commissioners is a prudent and necessary part of the process.

So I'd like to announce that Butte-Silver Bow will be releasing its position on the State's plan Wednesday night at the regularly scheduled committee of the whole meeting of the Butte-Silver Bow Council of Commissioners. The Council has also scheduled a public hearing for July 26th to invite members of the

public to comment both on the County's position as well as any other element in the State's plan. And we will pass a resolution by vote of the Council on August 2nd so we can meet the August 7th deadline of submitting comments.

As I indicated previously, this has been a great debate over the last month and a half and I believe it's been very, very healthy. I do have one concern, however, and that is that we have failed in some senses to focus the debate on the critical issues that we face. I think it's time and we need to use the next month as we submit our comments to the State to focus on those critical issues.

Now, I can't speak for the Council of Commissioners or the Chief Executive this evening, but I can point out a few of the critical issues that we will be addressing in our comments for the public record.

One is clearly this debate over the repository or the relocation areas, I think it's clear both from the testimony this evening and the previous comments that have been made that neither solution is perfect. Both have strong advantages and both have some limitations that simply must be addressed. From my point of view, it is probably most prudent to do

what costs less and use the money or at least some of the money saved by using the relocation areas to make sure that the other aspects of the cleanup are addressed properly and effectively.

Nobody likes this not-in-my-backyard acronym, this NIMBY thing, but I think Anaconda and Opportunity have had enough. Commitments have been made not to continue to dump our wastes in their back yard. I think that we have to respect that, particularly those wastes in Butte-Silver Bow. Likewise, it's ridiculous to contaminate an area that's not contaminated presently. So those are just some of the disadvantages of the repository.

There are certainly disadvantages of these relocation areas, but I believe that those disadvantages are more manageable and are fairer in the overall scheme of things than these repositories and these repository locations.

The second critical issue then becomes the amount of tailings to relocate out of the flood plain. I think I would like again, in terms of trying to focus the debate, I have heard a lot of consensus both from ARCO and the State on where there already is agreement on how much of those tailings to move out, particularly those tailings, as I say, currently in

142

waters way, and that is with respect to surface water as well as groundwater.

Nobody said to us at the county level, anyway, that anybody has an issue with taking the tailings out of waters way presently, which shifts the debate away from a consensus point and I think towards this point of how much of the tailings are we going to take out of the 100-year flood plain that is not currently in waters way or couldn't be predicted to be in waters way after a rain like we had at four o'clock or the one we had last month which could easily be construed as a 10- or 25-year storm event?

If the tailings are in the way of the water as Joe seems to point out, then I think they've got to be moved also. But whether's it's 20 percent of the total, 40 percent of the total, 45 percent or 70 percent, I don't think this is the numbers game that we should play with. I think we should get out there, get all the tailings out of waters way immediately, and leave it to a fair compromise as to how much of the additional tailings have to be moved.

Clearly, if you take 800,000 or a million cubic yards of tailings out of waters way, you're going to be left with a stream and a stream channel that's different than it is now. So to use the

143

current 100-year flood plain as the barometer of how much of the tailings to take out does not appear in our view to be a prudent measure at this time. Instead there's a compromise somewhere in between.

The third issue is instream sediments. There does not appear to be any consensus on this issue whatsoever. I'm not going to make any comments on what the county's position is going to be except to say that some of these ideas about wet closure appear to have some merit. Likewise, this thing about the one centimeter size does not appear to be technically feasible, but more comments are necessary on that particular point.

Lastly, this business of integrated solutions is not a new concept. We have been working long and hard to make sure that what happens on the Butte Hill with the priority soils as well as our stormwater running into the creek and polluting it every day, particularly today, and the nutrients problem that we're going to continue to face long into the future as the Department of Environmental Quality continues to press on us to clean up our sewage treatment.

And lastly, the land uses, and last but not least, the land use concept, both embodied

144

particularly now in the Project Green, which is a wholly supportable concept, but in our view, Project Green starts on the Hill in Butte, starts up there where the Mountain Con, the deepest mine, began and all the way down to make sure that the water that runs across abandoned mines does not continue to pollute the creek now and forever.

We believe the golf course, Project Green, the regional historic preservation plan are all examples of how to blend ultimate land uses and end uses into a concept of environmental cleanup.

So Butte-Silver Bow's position which will be released will advocate a compromise. It will advocate a compromise on the issues that I presented tonight and a way to achieve the goals of protection and development. That compromise is going to be largely a function or I should say a byproduct of what the State has presented because I don't want you to kid themselves, there's a lot of good in that plan; what ARCO has presented, because they have good concepts on how they can clean and protect and develop at one time; and most particularly the input from Project Green and all of the citizens this evening and all of the public debate that we have enjoyed on this issue for the last month and a half. Thank you.

145

MR. KIRLEY: Comments from Jim Davison.

MR. DAVISON: For the record, I'm Jim Davison. I'm manager of Anaconda Local Development. It's nearly eleven o'clock and I'm tired. I'm tired also of a process that has gone on for 13 years that has held our communities hostage while we try and clean up the pollution. We have to get out there and fight pollution and clean it up so our communities can go on.

I also have questions of how clean is clean, how safe is safe, and how healthy is healthy, and what is the end use of what we want to see cleaned up? And taking that end use in, how holistic is the solution? How does the total remediation work affect the residents and the interlocking Superfund areas? And have we taken a look at all that and have we seen the effects on all the other areas?

I find it absolutely incredible that we would clean up one small part of God's green earth only to contaminate or degradate another part, whether it be dumping stuff in Brown's Gulch, which is crazy;

or in the Opportunity Ponds, which I haven't found anybody in favor of; or taking some other clean area and dumping it in.

146

I think any solution needs to take a look at a risk, an economic and a use analysis. I think if we take a look at the State's desirable alternative, it wouldn't pass that test. I think there is an alternative out there that will and I don't think it should be ignored. Thank you.

MR. KIRLEY: Comments from Evan Barrett.

EVAN BARRETT: My name is Evan Barrett. I'm the Executive Director of the Butte Local Development Corporation, also a member of the Project Green Board of Directors.

This hearing is about democracy at work, as this whole process has been. We're in an age when people are very dislocated from the government and feel like and often question whether the government listens to them. What we're doing here is a real test of that. The community's voice is very clear in this. The only question is whether or not the State's ears are open, whether or not the State hears that voice.

I'm here as a proponent of Project Green's approach, not as an advocate of the ARCO approach, and not even as a strong opponent of the State's approach. There are some things about what the State recommends that are worthy of consideration;

147

likewise, some things that ARCO's talked about. We've tried to bring about a focus on this thing through Project Green that addresses the true concerns of the citizens.

There are places in which the Project Green recommendations are similar to some of the things that ARCO wants. That is a coincidence based upon some shared values and that is a common sense approach to cleaning up Silver Bow Creek.

This is all kind of like skinning a cat. There is an old saying that says there's a lot of ways to skin a cat, but ultimately, the cat is skinned. We all want Silver Bow Creek cleaned up. We're talking about skinning that cat in the particular way that lets us put the pelt to some use to the benefit of this community.

There's a lot of ways to clean up this creek. And we think the end use of the land around here is very, very important. People are talking about looking a hundred years down the line. The problem we're dealing with today is we're dealing with solving the problem of the last hundred years.

When people are looking back 50 years from now back at what we're doing, we don't want them to say we made mistakes. Now, some people think

148

that's to be interpreted as to say: Dig it all out and move it and put it in some pile somewhere. I think the mistake that we would make would be to spend hundreds of millions of dollars in environmental cleanup here in this area and not take into consideration appropriate end uses, because that money doesn't come back and it is not going to be paid for again.

The State's recommendation for essentially total removal and placement in repositories is a pure solution, it's a simple solution, and it's a wrong solution. In some cases, total removal makes some sense; in others, it does not. You can't have a monolithic solution to a problem that's full of diversity. You need to have those solutions fit the problem.

So let's talk about what makes sense. Where should the waste go? Well, Jon mentions the NIMBY thing. You get tired of that acronym a little: Not in my back yard. Well, I can't fault the folks in Opportunity and Brown's Gulch in saying, "Not in my back yard." But the interesting thing here is we're saying "yes" to where it should go. We're saying "yes," put it up above the flood plain and put it to some use and treat it. So this isn't all about "not

149

in my back yard"; we're inviting it into many backyards, many locations.

What should we do with it? There's a couple quick examples I like to use to give some focus on this for you. We've got to move this earth. Now, we can move it, put it in a pile somewhere, pay those costs, or we could move it, say, just out of the flood plain and treat it and turn it into a parking lot for some commercial activity. There's not a thing wrong with that.

We're trying to promote tourism. Why wouldn't we move this earth, place it, treat it, and create the base of a tourist information center or a rest stop? There doesn't seem to be anything wrong with that if it's placed in the right location.

When we're talking about cleaning out the creek, why wouldn't we, if we're down and looking at the Rocker area where we've got sewer and water problems for the future, now, we clean that creek out, we've got to be smart and put a conduit under that creek so that in the future we can put water and sewer lines under the creek so they can connect up to the main water and sewer connections to Butte-Silver Bow so when we have growth in Rocker, we're not hamstrung by the presence of a clean, Superfund clean creek

150

coming across. We've got to be smart when we're doing this kind of a thing.

What makes sense when it comes to sequence? This is important. It's tough for us to say, "Slow down." This is a process, as Jim said, we're all frustrated with. We've been saying, "Do it, do it, do it," and we want to see something done after all these years. On the other hand, we may want to suggest that we slow down some of the solutions or at least the sequencing of exactly what we do so that we can take care of the upstream area that Jon was talking about. All you've got to do is go around the Butte Hill and see the last two rainstorms and understand that we have to settle the primary soils issues and the Local Area 1 issues to have something meaningful to Silver Bow Creek. So we may want to suggest that at least the process of cleanup be sequenced right, what makes sense on that.

What makes sense on wetlands and in-place treatment? Butte-Silver Bow doesn't have $30 million, the citizens don't, to invest in a waste treatment facility that will deal with waste treatment in a chemical way. It does make sense to use the natural treatment of wetlands. We have some real opportunities on that and it's a real treatment

151

possibility. It makes economic sense.

What does make sense on cost? If Silver Bow Creek is going to be cleaned out for $68 million but it can also be equally cleaned to our satisfaction for 40 million, then it kind of makes sense to take that $28 million difference - and I'm just pulling that number out of the air - and do something with it that benefits the long-term economic viability and the quality of life for the community.

What we're talking about is good habitat, yes, doing some things to create good habitat in that creek; historic preservation and tourism where they're advantageous; economic development; recreation; educational opportunities; and the diverse land use. Those are the kind of things that we're talking about getting done.

It's clear what the community voice is here. Folks want Silver Bow Creek cleaned and they want it done with appropriate end land use to be taken into consideration. Folks want it clean, but they want the specifics of Project Green worked into the plan.

There's a difference here of two things. One is the product. I think it's very clear the product that the people want. They want the Project

152

Green integrated into the solutions and they don't want the monolithics list of any kind. They want diverse solutions here.

The process, on the other hand, is very important. It would be very inappropriate for the State of Montana to take all this into consideration, then go back into splendid isolation to make these decisions for us. The process we go on from here must take the voice of the people back, take the folks who can articulate that, the Project Green folks who I think have done a marvelous job with this, and get them involved in the process of decision-making with the State in this process so that the result, when we finally come to the final decision document, it would be one that we don't have to argue about; we know the voice of the people has been heard and it's been implemented. Thank you.

MR. KIRLEY: Those are the comments from the people who have had the opportunity to sign in already. Is there anybody else who has not yet had the opportunity to present comments who wishes to do so?

(No response.)

MR. KIRLEY: No, okay. Thank you very much for coming. The handouts that were given have

153

the address that anyone can use to submit written comments if they wish and you have until August 7th to do that. Thank you.

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154

CERTIFICATE

STATE OF MONTANA)
: ss.
County of Silver Bow)

I, Candi Nordhagen, Registered Professional Reporter - Notary Public in and for the County of Silver Bow, State of Montana, do hereby certify:

That the hearing was taken before me at the time and place herein named; that the hearing was reported by me in machine shorthand and later transcribed by computer, and that the foregoing one fifty-three (153) pages contain a true record of the testimony of the witness, all done to the best of my skill and ability.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my notarial seal this _____ day of __________, 1993.

Notary Public for the State of Montana residing at Butte, Montana. My commission expires September 15, 1995.

(NOTARIAL SEAL)

APPENDIX D-3
ARCO's Proposed Plan Comments

ARCO Comments on Proposed Plan - August 7, 1995

A I. INTRODUCTION - Atlantic Richfield Company ("ARCO") submits the following comments on the Proposed Plan: Streamside Tailings Operable Unit (June 1995)(the "Proposed Plan") issued by the Montana Department of Health and Environmental Sciences (now "MDEQ") and the United States Environmental Protection Agency ("EPA").

ARCO strongly opposes the Preferred Alternative No. 6 identified in the Proposed Plan (the "Preferred Alternative"). A decision to select the Preferred Alternative as the remedy for the Streamside Tailings Operable Unit ("SSTOU") would be arbitrary and capricious, not in accordance with law, inconsistent with the National Contingency Plan (the "NCP") and contrary to CERCLA. The Preferred Alternative would have serious adverse impacts on the established and improving ecosystem in Silver Bow Creek, and potentially downstream in the Warm Springs Pond and the Clark Fork River.

Response

A MDEQ and EPA recognize ARCO's opposition to the Proposed Plan, as noted in this and other comments provided by ARCO. The remedy selected in this Record of Decision differs from the alternative proposed in the Proposed Plan in many respects, Many of the changes made, for example, the change in the location of repositories for mining wastes to be excavated from the floodplain, respond directly to objections raised by ARCO. Various aspects of ARCO's objections are addressed in more detail throughout this document.

The Proposed Plan's preferred alternative would not manifest adverse impacts to a Silver Bow Creek ecosystem which is nearly devoid of aquatic life and riparian vegetation.

B If anything, the Preferred Alternative is an ill-conceived and unsupported natural resources restoration action thinly cloaked in the guise of a CERCLA remedial action. As the State well knows, natural resource damages are currently the subject of litigation in Montana v. ARCO, No. CV-83-317-HLN-PGH (D. Mont.). ARCO is vigorously contesting the State's natural resource damages restoration alternative for Silver Bow Creek in the Montana v. ARCO litigation forum. The State cannot circumvent the Montana v. ARCO Natural Resource Damages litigation by characterizing the Preferred Alternative as a remedial action.

Response

B ARCO's criticisms address the preferred alternative identified in the Proposed Plan, which, as noted above, is not the remedy selected here. However, MDEQ strongly disagrees with ARCO's characterization of either the preferred alternative or this remedial action plan as a natural resource restoration action cloaked in the guise of a remedial action. In proposing and selecting a remedy, MDEQ and EPA have followed the standards and criteria set forth in CERCLA and the NCP for selection of remedial actions. The goals to be attained by this action all relate to protection of human health and the environment, attainment of applicable or relevant and appropriate legal requirements, cost effectiveness and the other criteria specified in CERCLA and the NCP for <u>remedial actions.</u> The consideration and use of these criteria should be clear from the analysis presented in the Record of Decision. This decision is not driven by or based upon the objectives of a natural resource damage action, which is a separate action currently being prosecuted by a separate program in a separate department of state government.

C By these comments, ARCO also is submitting "ARCO's Proposed Remedy" to EPA and MDEQ. ARCO's Proposed Remedy is fully protective of public health and the environment and consistent with

Response

C ARCO's proposed remedy is vaguely identified in this document, but to the extent possible, MDEQ and EPA have given it full consideration. It includes elements that have been evaluated by the

the NCP. Unlike the Preferred Alternative, ARCO's Proposed Remedy meets the statutory requirements for remedial actions set forth in CERCLA.

ARCO respectfully requests that MDEQ and EPA give careful and complete consideration to these comments and ARCO's Proposed Remedy and select ARCO's Proposed Remedy as the remedial action for the SSTOU. ARCO also requests that a full response to each of the comments contained herein and all documents incorporated herein by reference be provided in the Responsiveness Summary.

Response: agencies in the context of the Feasibility Study, and thus in that sense has been fully evaluated before. The agencies' direct response to the various elements of ARCO's proposed plan are set out in those areas where the elements are identified by ARCO. In addition, as requested by ARCO, the agencies have again reviewed and, to the fullest extent possible, presented direct responses to all the documents ARCO incorporates by reference in these comments.

D II. SUMMARY OF COMMENTS - A. The Preferred Alternative Ignores CERCLA's Statutory Bias Against Off-Site Disposal Without Treatment. Section 121 of CERCLA establishes specific remedy selection criteria. Under these remedy selection criteria, the Preferred Alternative should be the least preferred remedy. Section 121(b)(1) of CERCLA clearly states that,

> The offsite transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available.

42 U.S.C. § 9621(b) (1) (emphasis added.) ARCO's Proposed Remedy incorporates a proven and practicable treatment technology, STARS. In direct contravention of CERCLA and the NCP, the Proposed Plan and the Preferred Alternative simply ignore the statutory "bias against offsite land disposal of untreated wastes." NCP, 40 C.F.R. § 300.430(f)(1)(ii)(E). Secondly, if removal of tailings is required, these tailings could be relocated and treated in adjacent "higher and drier" areas and would be equivalently protective to removal to a remote offsite repository.

Response: D The final remedial action plan incorporates changes from the Proposed Plan which directly respond to the concern raised by ARCO here. The plan will allow use of numerous nearby repositories along the Silver Bow Creek corridor rather than centralized off-site repositories, as long as adequate space for the nearby repositories can be acquired and an adequate and appropriate institutional controls/maintenance plan can be established to ensure the long-term monitoring and maintenance of the repositories.

E B. The Preferred Alternative Disregards CERCLA's Statutory Preference for Treatment. Under Section 121(b)(1) of CERCLA, remedial actions involving treatment "are to be preferred over remedial actions not involving such treatment." The Preferred

Response: E As noted in the prior response, changes have been made in the final remedial actin plan. This plan will use STARS treatment in situ in certain areas and will also use treatment of the several nearby repositories, thus utilizing treatment to the maximum extent

Alternative only employs STARS treatment to a very limited degree for a small percentage of SSTOU waste materials. ARCO's Proposed Alternative, on the other hand, uses treatment technologies to the maximum extent practicable to reduce the toxicity and mobility of waste materials at the SSTOU, while being fully protective of human health and environment.

practicable, as suggested by ARCO. All OU hazardous materials will be treated with STARS, in the appropriate location, during implementation of this remedial action.

The remedial action plan will in many areas move the materials to locations where such treated materials can be expected to remain in place thus permanently reducing the toxicity and mobility of the contaminants. In reciting CERCLA's preference for treatment, ARCO's comment omits significant language set out in the statute. CERCLA section 121(b)(1) provides "Remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principle element are to be preferred over remedial actions not involving such treatment." (Emphasis added.) As noted in the technical discussion, the agencies have obvious concerns about whether ARCO's plan would permanently reduce toxicity and mobility. Where treated areas wash out and the tailings are re-entrained into the stream, the reduction in mobility, for example, would not be permanent.

F C. The Preferred Alternative is not a Cost-Effective Alternative. Section 121 of CERCLA mandates the selection of cost-effective remedies. A remedy is "cost-effective" if its "costs are proportional to its overall effectiveness." NCP, 40 C.F.R. § 300.430(f)(1)(ii)(D). The costs of the Preferred Alternative clearly are far out of proportion to its questionable effectiveness. Moreover, the Proposed Plan substantially underestimates the costs of the Preferred Alternative and overestimates the costs of the components of ARCO's Proposed Remedy. ARCO's Proposed Remedy, in comparison: 1) meets CERCLA's requirements of protection of public health and the environment and attainment of applicable or relevant and appropriate requirements ("ARARs"); 2) far outweighs the Preferred Alternative under the NCP's "balancing criteria" of reduction of toxicity, mobility or volume through treatment, implementability, short-term effectiveness and cost; and 3) satisfies CERCLA's and the NCP's requirements for selection of cost-effective remedies.

F Because ARCO did not submit the details of their remedial plan for the SST OU in their Proposed Plan comments (see Comment M below) it is difficult to judge its potential cost-effectiveness. MDEQ's remedy as stated in this ROD is cost-effective. The remedial alternative benefits are clearly in proportion to its effectiveness. MDEQ utilized the form, content, and method submitted by ARCO in Revision 1 of the Draft Feasibility Study (FS) to estimate costs for the revised Site-Wide Alternatives. Only a few of the hundreds of line-item costs were adjusted by MDEQ; in fact, some of the effects of these changes were to increase the costs of certain line-items. Most of the cost assumptions originally proposed by ARCO were left unchanged in the FS as MDEQ believed these assumptions contained a suitable amount of conservatism in light of the scope of a remedial action implemented at the SST OU. MDEQ's changes in cost, as described in Revision 2 of the Draft FS are listed below. The changes which increased costs are marked with a (+).

- *General* - As discussed during our April 26, 1995 teleconference, costs were adjusted in the detailed analysis to recognize that both the sediment and railroad alternatives would be implemented in conjunction with the tailings/soils alternatives. Therefore, the additional cost to construct 23 to 184 miles of road that ARCO had included in their cost estimates for sediments and railroads (and consequently ARCO's proposed combined-media alternative cost estimates) was reduced to zero under the assumption that the 23 to 46 miles of road built to implement the tailings/impacted soils alternative would be used for sediments and railroad remedial actions. Also, duplicative costs to implement ICs for sediments and railroads were reduced to zero under the assumption that the same level of ICs provided for tailings/impacted soils would govern the combined remedial action for the site.

- *Tailings/impacted Soils Quantities* - Quantities of tailings/impacted soils calculated by NRIS were used in all spreadsheets. The quantities for removal of saturated tailings include both the saturated tailings and the tailings that overlie the saturated tailings. This quantity was calculated by NRIS.

- \+ *Clean Fill Streambank Replacement* - The quantity of clean fill used for streambank replacement was increased to account for a four-inch lift of coversoil placed over the partial removal areas. This material is expected to be used in selected areas to provide an adequate seedbed for germination. For total removal, the quantity of clean fill was calculated at 30% of the removed materials in all subareas. Cost associated with truck haulage was used to estimates costs to transport this material from local sources.

- *Roadbuilding* - Roadbuilding was broken into two categories, internal and external, along with the minimum and maximum costs developed from the demonstration projects for each category. For each of the alternatives except TS3, one times the stream length was used for internal roads and one times the stream length was used for external roads.

- *Truck Haul* - Truck haul costs were not altered from those presented in the original cost estimate. While MDEQ believes that ARCO's bulking factor used in the unit cost calculation is high and the travel speeds used are low, the combination of these two factors provide some conservatism to the quantity estimates and allow for overage that might be expected during tailings removal.

- \+ *Revegetation (relocation areas)* - The costs associated with STARS treatment in the relocation areas were increased to reflect the cost of applying STARS to multiple lifts of relocated tailings. ARCO's original estimate provided only for soil capping and treating one 12-inch lift without treatment of the remaining 14 lifts of tailings placed in the relocation areas. Unit costs for this item were changed to the STARS unit cost amount and acreage of the relocation areas adjusted to reflect applying STARS in seven, 2-foot lifts.

- *Institutional Controls* - Costs included for this item were reduced to those identified only for public ICs ($300,000 to $1,000,000) as there was not adequate justification for the costs associated with private ICs as submitted by ARCO.

- \+ *Operations and Maintenance* - These costs were recalculated to reflect a percent failure expected for each alternative rather than the man hour and equipment hour method used in the original cost estimate. These costs were also discounted to net present value at a discount rate of 7% in accordance with EPA guidance.

- \+ *In-Stream Sediments* - Costs were included to replace the streambank in addition to the backfill placed for the tailings/soils alternatives. Streambank replacement costs were based on linear foot of streambank replaced using a minimum and maximum of $16 to $40 per foot, respectively.

G D. The Preferred Alternative Does Not Use Alternative Treatment Technologies to the Maximum Extent Practicable. CERCLA and the NCP require that the selected remedy use alternative treatment technologies to the maximum extent practicable. See 42 U.S.C. S 9621(b) (1); NCP, 40 C.F.R. § 300.430(f)(1) (ii) (E). This is not a preference under CERCLA and the NCP; it is a mandate. Contrary to the unsupported and conclusory assertion in the Proposed Plan, the Preferred Alternative ignores this requirement by its minimal utilization of STARS. ARCO's Proposed Remedy clearly meets this requirement by appropriate use of STARS.

G As noted in Response E (above), the final remedial action plan incorporates changes which will provide for the use of STARS, an alternative treatment technology, to the maximum extent practicable. In addition, that plan will comply with all of the other selection criteria as well. ARCO's proposed remedy would not, as noted in the agencies' responses to ARCO's assertions about their proposed remedy.

H E. The Preferred Alternative Will Seriously Disrupt the Community and Will Create Significant Risks for Workers and the Public. The Preferred Alternative would involve the excavation and transport of between 1.2 to 2.4 million cubic yards of tailings, requiring from 86,000 and 172,000 truckloads of materials or 2,200-4,500 trainloads of material and would cover a period of up to 10 years. Excavation, transport and disposal of this enormous volume of material for this length of time presents significant worker and community safety issues and will generate substantial noise, traffic and dust problems. The Proposed Plan recognizes (but fails to discuss) the fact that short term risk will occur during implementation of the Preferred Alternative, "primarily related to potential accidents associated with transport of wastes." The Plan requests comments on "how significant is the short-term risk of excavating and hauling waste materials to disposal sites in comparison with the long term risks of creek contamination." Notably, the Agency downplays the extent of "short-term risk" in its rewrite of the Feasibility Study.

The question in the Proposed Plan is fundamentally flawed based upon its erroneous assumption of "long term risks of creek contamination." ARCO's Proposed Remedy would address this purported "long-term risk". The more appropriate question is whether the recognized risks to people posed by the Preferred Alternative can be justified, when ARCO's Proposed Remedy will clean up Silver Bow Creek to CERCLA's standards and will not entail significant risk to workers or the community. The obvious answer to the question in the

H The agencies recognize the short-term risks that would be posed to workers and communities from the hauling of materials to a centralized repository, especially if such transportation were to be accomplished by truck haulage rather than rail. The agencies do dispute ARCO's estimates for the number of trucks or trains needed to move the volume of tailings indicated in Comment H as they appear to be inflated based on ARCO's own assumptions for basic unit capacity. However, reducing the amount of construction traffic in the selecting the remedy for the SST OU was a factor in the agencies' decision in the final remedial action plan to allow numerous local repositories rather than a centralized repository.

As described in the responses to ARCO's proposed plan, MDEQ does not feel ARCO's remedy will "clean-up Silver Bow Creek".

Proposed Plan is that the speculative and unsupported assumption of continued creek contamination cannot override the recognized risk to people from excavation, transport and disposal of the enormous volume of materials under the Preferred Alternative.

I F. The Preferred Alternative for Sediments Will Have Significant Adverse Impacts on the Improving Silver Bow Creek Environment. Silver Bow Creek has recovered significantly over the past decade. Given the fact that all major sources of metal bearing sediments would be effectively controlled by ARCO's Proposed Remedy, Silver Bow Creek's natural recovery would certainly accelerate in coming years, subject to control of sewage discharges. The vague, impractical and unsupported removal criteria in the State's Preferred Alternative would likely require the majority of the stream's sediments to be removed. The Preferred Alternative could actually set back this recovery and significantly impair the existing benthic macroinvertebrate and riparian vegetation community on Silver Bow Creek by requiring the unnecessary removal of stable and armored sediment areas.

I Silver Bow Creek has not recovered to any great degree in the past decade. The stream is devoid of fish and most other aquatic biologic communities and is severely impaired because of the presence of metal contamination.

A portion of the tailings/impacted soil eventually becomes incorporated with in-stream sediments at the bottom of Silver Bow Creek. These sediments are highly contaminated. Concentrations are between 10 and 65 times higher for arsenic, cadmium, lead, zinc, and 400 times higher for copper than are found in other area streams which drain highly mineralized geologic areas. Like tailings themselves, the majority of contaminated sediments vary in size from a coarse sand (1 mm) to a very fine silt or clay. While in the stream, these sediments severely limit the number and types of benthic macroinvertebrates which live in the stream sediments, and these sediments could act as a source of contamination to future cleaner surface water.

To meet the remedial objectives for the SST OU, MDEQ and EPA have determined that all contaminated fine-grained sediments will be removed. All fine-grained (<1 mm) in-stream sediments located in all depositional areas will be removed and placed in repositories with the tailings/impacted soils and railroad materials. This size fraction was identified because it corresponds with the size of the tailings/impacted soils and contains the bulk of in-stream contamination. If this size criteria does not appear to meet RAOs, then a contingency has been delineated to formulate concentration based criteria for determining which materials will be removed. Specific volumes and locations to be excavated will be determined during remedial design/remedial action.

The remedial action described in this ROD will allow recovery of the benthic macroinvertebrate and riparian vegetation community on

Silver Bow Creek. The major sources of contamination (the tailings/impacted soil and in-stream sediments) would remain uncontrolled if ARCO's Proposed Remedy were implemented.

J G. The Preferred Alternative Fails to Meet the NCP's Requirement of Implementability. Implementability involves the "ease or difficulty of implementing alternatives." NCP, 40 C.F.R. section 300.430(e)(9)(iii)(F). As one primary example, the Proposed Plan does not adequately consider the fact that appropriate, publicly acceptable off-site disposal locations have yet to be approved for the enormous volumes of materials that would be removed under the Preferred Alternative. Nor does the Proposed Plan evaluate the severe strain on local transportation resources that would result from moving so much materials. Secondly, the State's proposed action for sediment is extremely impractical in requiring removal of all sediments of less than I millimeter (coarse sand) in size. Taken literally, it would be impossible to remove just the sand size and below without removing all the alluvial material. In contrast, ARCO's Proposed Remedy is readily implementable with available resources.

J The remedial action described in this ROD meets the NCP's requirement of implementability. This ROD addresses the issues associated with transportation to off-site disposal by requiring near-site relocation repositories.

MDEQ is unaware of any ARCO proposal for remedial action to in-stream sediments other than allowing natural flushing to clean the streambed of contaminants over time. As expressed in the Record of Decision, MDEQ feels the remedial action for in-stream sediments is practicable. The use of the <1mm grain size standard is intended as an indicator that will allow for ease of field implementation, enabling reasonably reliable visual identification of the material to be removed in the field without the need for constant sampling and expensive, slow, chemical analysis of in-stream sediments. MDEQ and EPA believe that this particle size fraction will reasonably identify the tailings/impacted soils located in the active streambed of Silver Bow Creek, particularly that fraction of the tailings/impacted soils that pose the greatest threat as a contaminant source, and therefore will serve as a reliable indicator for implementation in the field.

However, if it is demonstrated from design studies or initial field work that this size fraction standard is not a reliable indicator of the contaminated tailings/impacted soils that must be removed in order to eliminate the threat to aquatic life in the stream, sampling and chemical analysis may be used to identify the materials that must be excavated. In any event, sampling and analysis may be used in coordination with the use of this indicator, for example, to establish that a specific deposit of sediments within this particle size are in fact natural sands or silts and not tailings/impacted soils or contaminated materials that require removal. Demonstration that specific materials contain concentrations similar to in-stream sediment concentrations found in like Montana streams located in similar geologic/hydrologic environments, relatively unimpacted by mining activity, and contain a reproducing trout fishery will clearly establish that such in-stream sediments need not be removed.

K H. The Community Opposes the Preferred Alternative. Based upon testimony presented at the July 10, 1995 public hearing on the Proposed Plan, local citizens overwhelmingly disapprove of the Preferred Alternative.

K Public comment from 584 commenters overwhelming supported the Proposed Plan (see tables and graphs in the introduction to this appendix). The agencies feel that there will also be strong support for this ROD.

L I. The State's Natural Resources Damages Litigation Should Not and Cannot Drive Selection of the CERCLA Remedy for the SSTOU. Under CERCLA, natural resource damages are residual to remedial action. CERCLA creates a clear distinction between remedial action and natural resources restoration. Remedial actions must: 1) protect public health and the environment; 2) meet the requirements of section 121 of CERCLA; and 3) be consistent with the NCP. Natural resources restoration, on the other hand, involves restoration or replacement of, or acquisition of the equivalent, natural resources. Restoration is not evaluated under the NCP criteria or section 121 of CERCLA. Restoration is accomplished through restoration of the services provided by the resource, not of the physical, chemical or biological properties of the resource. While remedial action may result in the restoration of resource services to baseline conditions, neither the State nor EPA have the authority to use remedial action to attain the State's restoration objectives. As discussed above, ARCO is vigorously contesting the State's restoration alternative for Silver Bow Creek in the appropriate forum of the Montana v. ARCO litigation.

Notwithstanding recommendations by Montana State University and other scientists, the successful use of STARS-type technology at other mining sites, and the proven success of STARS technology in demonstration projects and treatability studies, i.e., the Governor's Clark Fork River Demonstration Project, the Silver Bow Creek Demonstration Projects I, II and III, the Resource Indemnity Trust Clark Fork Demonstration Project and the Anaconda Revegetation Technology Study, the State's Natural Resources Damages Program (NRDP) has opposed the use of STARS. The Administrative Record is replete with the NRDP's efforts to persuade MDEQ to oppose the

L MDEQ agrees with ARCO that the goals and objectives of remedial action and of natural resource damage actions are and must be kept separate and distinct. It is true that the State's Natural Resource Damages Litigation Program has continuously questioned the long-term viability of STARS treatment, just as ARCO has taken the opposite position.

The role of MDEQ and EPA in this instance has been to make an objective determination, based on sound technical judgment and the best available information, regarding the appropriate use of the STARS technology. As might be expected, the agencies have made a determination somewhere between the positions advocated by ARCO and the State Natural Resource Damage Litigation Program.

As outlined in the description of the remedy, the agencies have determined that STARS may be used in those locations in the floodplain that can reliably be protected from adverse flood impacts and stream channel meander over the long-term. Even ARCO acknowledges that STARS is not effective treatment for those tailings that are saturated by groundwater (approximately 700,000 cubic yards). After the removal of those tailings impacted by groundwater, together with the overlying tailings that must be removed in order to get to the saturated tailings, the estimated volume of tailings subject to erosion by normal flow or flood events, stream meander, and similar processes is approximately 850,000 cubic yards.

Approximately 950,000 cubic yards of tailings/impacted soils will be treated in situ, on the condition that a program will be established to monitor and maintain those areas to ensure that they remain intact use of STARS technology. Efforts by the NRDP to maximize restoration damages in the Montana v. ARCO litigation should be left to the litigation forum; such efforts clearly cannot serve as the basis for, nor should they drive, the selection of CERCLA remedial action at the SSTOU.

M J. ARCO's Proposed Remedy Incorporates Tested, Technically Sound, and Scientifically Defensible STARS Technology and Is Consistent With CERCLA and the NCP. ARCO has proposed a remedy which is a long-term, effective and permanent solution to the tailings impacts on Silver Bow Creek. ARCO's remedy proposes to utilize a combination of partial relocation and STARS treatment in Subareas 1-3 of the SSTOU and STARS treatment only in Subarea 4. STARS is an effective measure that neutralizes and fixes metal contaminants in place by amending the tailing/soil with lime and revegetating the amended area. This treatment permanently binds metal to soil and adjusts soil pH to allow revegetation. By permanently binding metals to soil, the mobility of metal contaminants is eliminated or substantially reduced, thereby preventing further metal migration to Silver Bow Creek. Revegetation reduces surface water runoff, erosion and reduces or eliminates infiltration of metals to groundwater. Finally, STARS treatment allows for a variety of land uses which are appropriate to the SSTOU, including agricultural (grazing) recreational (fishing, hiking, hunting), and rural residential. Partial relocation contemplates the removal of tailings located close to groundwater (within 2 feet of the groundwater table). Excavated tailings are relocated adjacent to the site. Remaining tailings and the relocated tailings are STARS treated and revegetated. Partial relocation enhances STARS by relocating tailings from areas near groundwater and most near stream areas.

ARCO's remedy will address SSTOU sediments through natural attenuation. Railroad materials will be relocated or otherwise remediated in specific areas where ore concentrate spills have

and do not cause further pollution as a result of flood flows or stream channel meander.

The agencies' decision represents a reasonable balance between the need for protectiveness and the costs to be incurred in attaining that protectiveness, as well as consideration of the other remedy selection criteria under CERCLA. Again, this decision is based on CERCLA's remedy selection criteria, not on NRD considerations.

M ARCO's remedy proposes relocation of all seasonally saturated tailings in Subareas 1-3 with STARS treatment for all remaining tailings/impacted soils and STARS treatment for all of Subarea 4. In-stream sediments would receive no remedial action.

The SST OU remedy as described in this ROD incorporates many aspects which are common to ARCO's conceptual remedial plan. MDEQ agrees that relocation of waste materials to near-site repositories will alleviate: (1) public concerns with short-term risks associated with transport; and, (2) concerns ARCO has raised on estimated costs to complete the remedy because of reduced waste material transport distances. MDEQ also agrees with ARCO that tailings/impacted soils saturated by ground water, even seasonally, will continue to contaminate ground water which in turn contaminates Silver Bow Creek's in-stream sediments and surface water. A point of contention with this criteria is that ARCO considers it valid for only three of the four OU subareas while MDEQ regards this criteria applicable for the entire OU. Subarea 4 contains the largest volume of saturated tailings/impacted soils of all the subareas (321,000 cy is saturated by ground water or overlying this material). By not applying this criteria to Subarea 4, ARCO, in essence, is willing to sacrifice ground water by continued contamination from saturated tailings/impacted soils. By sacrificing ground water, ARCO, under their conceptual remedial plan, would also allow for the continuing degradation of in-stream sediments and surface water of Silver Bow Creek.

Under the right physical and geochemical conditions, STARS is a potentially effective measure that attempts to immobilize most metal occurred or where the railroad material is in direct contact of Silver Bow Creek.

ARCO's remedy will provide significant benefits to the community and the environment with much less adverse effects than the preferred alternative in the Proposed Plan. First, ARCO's remedy will allow for various post-remediation land uses within the SSTOU. Second, ARCO's remedy will not require the movement of thousands of tons of untreated tailings/soil through the local communities to a selected repository. As a result, local communities will be spared the noise, dust, traffic and general inconvenience associated with the Proposed Plan.

Finally, ARCO disagrees with the State's approach of assuming that ARCO's remedy will fail where the State has no defensible evidence to support its position. As noted below, the available information to date indicates that STARS will provide permanent in situ treatment for tailings located within the SSTOU. Given the uneven evidence on this issue, the State should not rush to judgment concerning ARCO's remedy. Furthermore, CERCLA's 5-year review provision provides an adequate safeguard under which the success of ARCO's remedy can be evaluated and appropriate additional measures taken, if necessary, in the event that ARCO's remedy does not meet appropriate performance standards.

contaminants in place by amending the tailings/impacted soils with lime and revegetating the amended area. One point of clarification is that STARS treatment does not "binds metal to soil" it binds metals to tailings. This treatment works by immobilizing metals through pH adjustment which also allows revegetation with salt tolerant vegetation. At this point of technology development the ability to revegetate with woody species, such as willows, is uncertain. By reducing the solubility of metals and allowing revegetation, STARS can reduce runoff (overland flow) and erosion and theoretically decreases infiltration to groundwater. STARS treatment does not change metal concentrations, only mobility and solubility, therefore certain land uses will be restricted on STARS treated areas. Land uses which most likely would be restricted are grazing, certain types of destructive recreational, and agricultural. Because of the high tailings/impacted soil concentrations, residential development will not be allowed on any STARS treated tailings/impacted soils.

A second criteria MDEQ determined to be a critical component to this remedy, and will enable the agencies to meet the SST OU remedial objectives, is that the tailings/impacted soils will not be located where they may be eroded and re-entrained back into the stream system through normal stream erosive process or high flow events. The STARS technology only changes the solubility of the contaminants by amendment additions; if these amendments are separated from the tailings/impacted soils by normal stream erosive process or high flow events, then these contaminants will revert back to their original geochemical condition.

In-stream sediments (i.e. sediment within the active channel of Silver Bow Creek) are severely contaminated with metals. In-stream sediments contain contaminants of concern extending throughout the entire length of the SST OU stream channel. Their concentrations are similar to the concentrations found in the tailings/impacted soils, so, for conceptual purposes, they can be considered "tailings in the stream". While in the stream, these sediments serve as a source of metals contamination to the surface water system and impact aquatic life in the stream substrate. ARCO's remedy would not address instream sediments which would continue to impact any future fishery and limit macroinvertibrate abundance and diversity.

As indicated above, ARCO's proposed remedy does not satisfy the threshold requirements as required by CERCLA. The final remedial action plan, as described in this ROD, does satisfy these requirements.

ARCO has proposed a conceptual remedy which will continue to impact Silver Bow Creek in both the short and long-term and is inconsistent in the application of their own criteria. ARCO has not submitted any credible scientific evidence which would support: (1) applying the saturated tailings/impacted soils criteria to Subareas 1 - 3 but not Subarea 4; and, (2) that erosion of tailings back into the stream would not limit the agencies ability in meeting SST OU remedial action objectives and goals.

CERCLA's 5-year review provision will allow a safeguard under which the success of the remedy and specifically STARS can be evaluated and appropriate additional measures taken, if necessary, in the event that STARS or other aspects of the remedy does not meet the performance standards or remedial action objectives or goals.

N III. DETAILED COMMENTS - A. The Selection of the Preferred Alternative Would Be Arbitrary and Capricious, Not in Accordance With Law, and Inconsistent With CERCLA and the NCP.

1. The Selection of the Preferred Alternative Would Be Inconsistent With the Remedy Selection Criteria Specified in CERCLA s 121.

a. Off-Site Disposal is the Least Preferred Alternative Under CERCLA. - Section 121 of CERCLA and the NCP establish specific remedy evaluation and selection criteria that are mandatory or create preferences among alternatives. The Preferred Alternative is not consistent with and often ignores these criteria. As will be discussed further below, the Preferred Alternative does not use alternative treatment technology to the maximum extent practicable and is not cost-effective, violating the clear statutory dictates of CERCLA.

N The final remedial action plan incorporates changes from the Proposed Plan which directly respond to the concerns raised by ARCO here. The plan will allow use of numerous nearby repositories along the Silver Bow Creek corridor rather than centralized off-site repositories, as long as adequate space for the nearby repositories can be acquired and an adequate and appropriate institutional controls/maintenance plan can be established to ensure the long-term monitoring and maintenance of the repositories. In addition the local repositories as well as any tailings left in place will be treated with the STARS technology, thus utilizing this alternative treatment technology to the maximum extent practicable.

EPA and the State do not agree that selection of the alternative identified in the Proposed Plan would have been arbitrary and capricious. There were legitimate grounds for proposing the

Off-site disposal is selected for the vast majority of the SSTOU waste materials despite the statutory and regulatory bias against this alternative.

Section 121(b)(1) of CERCLA unambiguously expresses the strong Congressional bias against off-site disposal of untreated hazardous materials, providing in pertinent part:

> The offsite transport and disposal of hazardous substances or contaminated materials without . . . treatment should be the least favored alternative remedial action where practicable treatment technologies are available.

42 U.S.C. § 9621(b)(1). The NCP likewise provides that, in selecting a remedial action, EPA must "consider the . . . the bias against off-site land disposal of untreated waste." 40 C.F.R. § 300.430(f)(1)(ii)(E) (emphasis added). If a remedial action is selected which does not incorporate this preference, Section 121 requires the President to explain why the statutorily preferred remedy was not selected. 42 U.S.C. § 9621(b)(1).

The courts have applied this preference on several occasions. For example, in United States v. Hardage, 750 F. Supp. 1460 (W.D. Okl. 1990), the court reviewed two alternative remedies, one calling for excavation and offsite disposal of contaminated soil, and one proposing onsite containment. After trial, the court determined that the defendant's proposed containment remedy was superior to EPA's proposed excavation remedy. Indeed, the court held that if necessary, it would have found that the EPA's selected remedy was "arbitrary, capricious, and an abuse of discretion," because the excavation remedy did not satisfy the "threshold requirements of section 121(b)," and because onsite treatment of the soil better satisfied the standards under Section 121. 750 F. Supp. at 1489.

The Preferred Alternative clearly disregards the strong statutory bias against off-site disposal by requiring the off-site disposal of approximately 70% of tailings/impacted soils from the floodplain. This

alternative identified in the Proposed Plan. However, the changes made in the final remedial action plan obviate the need to discuss those at length here.

disregard is particularly inappropriate in this case where there is a high degree of understanding and certainty about the effectiveness of STARS treatment technology. The Proposed Plan recognizes the preference for treatment and recites that "offsite transport and disposal of hazardous substances should be the least favored alternative where practicable treatment alternatives are available". The Proposed Plan states without support that the Preferred Alternative uses STARS "to the maximum extent practicable" in a thinly veiled attempt to satisfy the treatment preference and to address the bias against off-site disposal.

CERCLA section 121(b)(1) further requires selection of a remedy that "utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable." Id. See also 40 C.F.R. § 300.430(f)(1)(ii)(E) ("Each remedial alternative selected shall utilize permanent solutions and alternative treatment technologies . . . to the maximum extent practicable." Again, the Proposed Plan gives lip service to this statutory mandate without explanation.

The Proposed Plan fails to adequately explain why the least preferred alternative under CERCLA is necessary for the SSTOU, or why "partial STARS treatment" in limited areas of Subareas 2 and 4 is all that is practicable. The excessive tailings and sediment excavation, untreated off-site disposal and the minimal use of STARS treatment in the Preferred Alternative fail to satisfy the criteria in CERCLA section 121(b) and the NCP. As in Hardage, the Preferred Alternative would be arbitrary and capricious if selected as the remedy for the SSTOU.

O b. The Preferred Alternative Fails to Satisfy CERCLA's Mandate for Selection of a Cost-Effective Remedy.

Section 121(a) of CERCLA requires the selection of remedial actions "which provide for cost-effective response." 42 U.S.C. § 9621(a). Section 121(b)(1) of CERCLA reiterates that EPA "shall select a remedial action . . . that is cost effective . . . ." 42 U.S.C. § 9621(b)(1). The NCP requires that "each remedial action selected shall be

O ARCO correctly cites these authorities on cost-effectiveness, with one significant omission. ARCO quotes almost the entirety of 40 CFR § 300.430(f)(1)(ii)(D), but omits the following, essential requirement, "Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in § 300.430(f)(1)(ii)(A) and (B) [emphasis added]." The threshold criteria referred to are (1) overall protection of human health and the environment and (2) compliance with ARARs. As indicated in the evaluation of alternatives cost-effective . . ." 40 C.F.R. § 300.430(f)(1)(ii)(D). Cost effectiveness is determined by evaluating long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." Id.

performed in the Feasibility Study and as set out in the technical evaluation of ARCO's proposed remedy below, the elements of ARCO's proposed remedy do not satisfy these threshold requirements. The final remedial action plan does satisfy these requirements.

P The Preferred Alternative is not a cost-effective remedy. Moreover, the costs of the Preferred Alternative clearly are excessive when compared to ARCO's Proposed Remedy. Under CERCLA, if several remedies are protective and compliant with ARARs, cost is a legitimate factor for choosing among such alternatives. Preamble to NCP, 55 Fed. Reg. 8666, 8727 (Mar. 8, 1990). As discussed further below, ARCO's Proposed Remedy is at least as protective as the Preferred Alternative and complies with ARARs.

P The cost of this remedial action, as described in the ROD, is cost-effective and are within the same cost range as ARCO has stated as "reasonable" in many public forums. Cost was one of the five "primary balancing" criteria used in the SST OU FS to compare remedial options.

Q In selecting the Preferred Alternative presented in the Proposed Plan, the State has clearly violated CERCLA's cost-effectiveness requirement by relying on highly questionable cost estimates in its rewrite of the SSTOU FS (attached as Exhibit 1). As ARCO pointed out in its June 7, 1995 disclaimer letter to the SSTOU FS, MDEQ made several unilateral and arbitrary revisions to the alternatives cost discussion in its rewrite of the SSTOU FS. The net effect of the changes is to reduce the costs of the removal-based alternatives and to increase the costs of the other alternatives, including the alternatives comprising ARCO's Proposed Remedy. This questionable adjustment to the total costs of the remedial alternatives has been made to reduce the range of costs between the removal-based alternatives and the other alternatives so that the projected cost of the removal-based alternatives would not be considered prohibitive. For example, on Page 57, Paragraph 3, Line 2 of its rewrite of the SSTOU FS, MDEQ states: "cost criteria are based upon the findings of the Draft RI Report (ARCO, 1995) and on the results of treatability studies, including STARS (RR and Schafer, 1993), Demonstration Projects I, II and III, and the Governor's Demonstration Project (Schafer, 1994)." However, in several instances, the MDEQ has replaced site-specific unit costs that ARCO derived from the

Q Please refer to Response F, above. With regard to MDEQ's revision of unit cost line items, the unit cost for dozer/loader/trackhoe was only reduced in the revised cost estimates for placing tailings at the regional repository. In ARCO's original cost estimate, the same unit cost was used to both excavate/load tailings and unload/place tailings. Since unloading and spreading tailings requires much less equipment time and horsepower, MDEQ used a lower unit cost for the latter operation. The Mill-Willow Bypass unit cost to remove tailings included excavation, transport from ½ to 1 mile, and unloading. In the SST Revision 2 cost estimate, the total cost used for excavation/loading and unloading/spreading was $4.15 to $6.90 per cubic yard. Transport of tailings was calculated as a separate cost based on distance.

demonstration projects with lower unit costs from generic engineering references based upon worldwide sites. An example of this is MDEQ's use of dozer/loader/track hoe unloading costs ($1.25-$2.70 per cubic yard) from the Means Building Construction Cost Data, 1995 rather than actual cost data from the Mill-Willow Bypass ($2.90-$4.20 per cubic yard). The deletion of actual cost data for projects completed at the Upper Clark Fork Sites in favor of generic cost data from a nationwide database is a questionable use of discretion. The inconsistency is obvious and highlights the questionable manner in which the State has estimated costs for the Preferred Alternative to suit its purposes in the administrative record.

R Two examples are telling. First, as discussed in ARCO's disclaimer to MDEQ's rewrite of the SSTOU FS, when it revised the SSTOU FS, MDEQ unilaterally modified several remedial alternatives definitions from those that had been used throughout the RI/FS process. These revised alternatives are key components of the Proposed Plan. The potential change in the delineation of tailings/impacted soils for Removal, Disposal and ICs (TS7) and the change in delineation of sediments to be removed for both Limited Sediment Removal (SD2) and total Sediment Removal (SD3) significantly increase the cost of these revised remedial alternatives. Costs for the newly defined sediment alternatives could easily double or triple given the uncertainty of the new ill-defined criteria utilized by MDEQ to delineate sediments to be removed. However, the changes in definitions were not incorporated in the cost estimations made by MDEQ in the Proposed Plan, thereby significantly underestimating the costs of these revised alternatives and ultimately compressing the cost difference between removal alternatives and STARS/relocation alternatives.

R ARCO's comment with regard to changing the definition of Total Removal (TS7) is confusing. The definition of this alternative has always meant total removal, meaning removal of all tailings/impacted soils as defined in the Draft RI.

MDEQ defined Alternative SD2 to include all fine-grained material that would be moved in a bankfull flow event primarily because the sediment survey completed by ARCO during August 1994 was only qualitative, using only a few direct observations to conclude that most of the fine-grained sediment within the stream was confined to the pools. MDEQ never agreed that pools were the primary depositional areas of concern. In ARCO's most recent attempt to quantify the locations and quantities of sediment, runs contained the greatest volume of sediment in Silver Bow Creek (Sept. 15, 1995 letter from ARCO to Jim Ford/MDEQ). Concentrations of metals that exceed aquatic effects criteria are found in the 1 millimeter size fraction and less. Because the results of the more detailed sediment survey were to be used to define the nature and extent of fine-grained sediment in the stream, MDEQ did not believe the definition of limited sediment removal should be confined to a vaguely defined stream form.

MDEQ contends that the revised standard is well-defined, not ill-defined as suggested by ARCO because, since it is based on the velocity of flow, a particular size criteria is defined (e.g. a grain size of less than 1 millimeter). In MDEQ's view, this more refined definition is essentially the same as the grain size definition used by ARCO in Revision 1.

Costs for the sediment alternatives could be somewhat greater given the uncertainty surrounding the location and volume of sediments, not because of the "ill-defined criteria" but because ARCO has been unwilling to delineate the location and volumes of the contaminated sediments which need to be removed. Changes were incorporated in the cost estimations made by MDEQ for the SST OU FS and the Proposed Plan as discussed in Response F, above.

S Second, MDEQ retained the potential for rail transport with removal alternatives in Subareas 1 and 2, without increasing the relevant factors in the FS cost estimates used in the Proposed Plan. In Jim Ford's May 8, 1995 letter to Chuck Stilwell concerning "Draft Feasibility Study Comments/Revision-Streamside Tailings Operable Unit," the MDEQ states: "MDHES [MDEQ] will retain rail transport for further consideration, although the cost estimates presented in Appendix D [Appendix F of MDEQ's rewrite] have not been changed at this time to include an item for rail haul." The net result of retaining rail haul in Subareas 1 and 2 is increased cost for these removal alternatives. This increased cost is not presented in the Proposed Plan.

Furthermore, MDEQ's analysis of rail haul costs is incorrect. ARCO has direct experience, based upon an actual contract for rail transport of materials from Lower Area One to the Opportunity Ponds, that rail costs will range from $8.23 to $11.23 per bank cubic yard to load and haul with an additional $400,000 per mile to construct sidings. MDEQ's analysis used unsubstantiated unit costs of $4.00 to $5.50 per bank cubic yard and neglected to include the costs of siding construction. [Footnote: Again, it is instructive to look at the cost estimates which the State NRDP published to support its claim for monetary restoration damages. A unit cost of $7.50 per cubic yard for hauling and disposal of sediments and tailings at the Opportunity Ponds is estimated in the Restoration Determination Plan for Alternative 4A. Although ARCO has many serious criticisms of the State's Restoration Determination Plan, the fact that the unit costs are

S MDEQ believes that rail transport is a viable option for transport of tailings/soils removed from Subareas 1 and 2 if the Opportunity Ponds were used as a central repository. MDEQ also understands the cost implications and, using the cost information transmitted to MDEQ by ARCO, conducted its own cost analysis supplemented by information supplied by other outside transportation authorities. Using both ARCO's and MDEQ's analyses, rail transportation compares very favorably from a cost standpoint for transport of tailings from Subarea 1. While ARCO's analysis indicates that it is approximately 25% more expensive to haul by rail than by truck from Subarea 2, there are other trade-offs in terms of the public and worker safety that make rail transportation attractive.

Contrary to ARCO's comment, MDEQ did include in its cost analysis construction of siding in each subarea at the same cost of $400,000 per mile that ARCO used. MDEQ included this cost so that its analysis was conservative even though there are several sidings present in the operable unit, namely at Rocker, Ramsay, and Browns Gulch, that could be used to offset this cost.

Also contrary to the comment, MDEQ's total unit cost range for excavation, loading, rail transport, unloading, and truck transport to the repository site at Opportunity is $8.70 to $12.40 not $4.00 to $5.50. MDEQ is puzzled why ARCO was reticent to thoroughly analyze potential rail alternatives when the benefit to the public and worker safety may have greatly exceeded any cost considerations.

so disparate in the two reports illustrates the arbitrary approach used by the State.]

In contrast, ARCO prepared its cost estimates with actual cost data from CERCLA sites in Montana and demonstration or treatability studies specifically designed to provide appropriate cost information for the remedial alternatives considered in the SSTOU. ARCO's cost estimates in the draft RI were also prepared by experienced construction and cost-estimating personnel to be as accurate as possible and represent the range of conditions and contingencies represented by the alternatives.

The result of the State's deceptive cost estimation is to compress the cost differences between the Preferred Alternative ($33M-83M) and the other alternatives that resemble ARCO's Proposed Remedy. As the preceding discussion illustrates, MDEQ's cost estimates are erroneous or misleading and certainly underestimate the true cost of the Preferred Alternative. When compared to the cost of ARCO's Proposed Remedy ($16M-33M), it is clear that the State's Preferred Alternative is significantly more expensive without being more protective. Thus, the Proposed Plan does not satisfy CERCLA's cost-effectiveness requirement and should not be selected for the SSTOU. Rather, ARCO's Proposed Remedy will meet CERCLA's threshold criteria of protection of human health and the environment and attainment of ARARs at substantially less cost than the Preferred Alternative and thereby satisfy CERCLA's prescription for cost-effective remedies.

MDEQ strongly disagrees with the statement that the cost estimates presented in Revision 2 are "erroneous or misleading and certainly underestimate the true cost of the Preferred Alternative." By using ARCO's unit costs in Revision 2 with few exceptions (as explained in Response F), MDEQ's cost estimates are comparable to those that ARCO claims in their proposed remedy. The estimated total cost to implement the remedy described in the ROD ranges from $23.9 million to 45.9 million.

T 2. The Preferred Alternative Fails to Satisfy the NCP Remedy Evaluation and Selection Criteria. - The Preferred Alternative presented in the Proposed Plan does not satisfy the remedy evaluation and selection criteria set forth in the NCP. Specifically, the NCP requires the assessment of remedial alternatives against each of the remedy evaluation criteria and a comparative analysis of alternatives that identifies the key tradeoffs (relative advantages and disadvantages) among alternatives with respect to the criteria. See 40 C.F.R. § 300.430(e)(9) and (f); Preamble to Final NCP, 55 Fed.

T As noted above, certain changes to the Proposed Plan were made in response to specific concerns raised by ARCO in its comments. Some of those changes address the concerns set out in this section and are noted below. MDEQ recognizes, however, that the changes made do not go so far as to accept ARCO's proposed remedy as the final remedial action plan. After full consideration of comments received and evaluation of the alternatives, including a renewed look at ARCO's proposed remedy, the agencies believe that the final remedial action plan presented in the Record of Decision is the

Reg. 8719. Under such an evaluation, ARCO's Proposed Remedy is superior to the Preferred Alternative identified in the Proposed Plan. Specific NCP criteria are discussed below.

alternative which best satisfies the remedy selection criteria under CERCLA and the NCP.

U a. MDEQ's and EPA's Cursory Consideration of the NCP's Implementability Criterion in Identifying the Preferred Alternative Under the Proposed Plan is Inadequate. - Implementability assesses the technical and administrative feasibility of a remedy. The Preferred Alternative exhibits several significant implementability problems which are glossed over in the Proposed Plan. First, the State has not identified any appropriate, publicly acceptable, off-site disposal locations to receive the materials removed from the SSTOU. Under the Proposed Plan, unaffected land (Brown's Gulch) could become impacted by construction of a repository. The other disposal location identified in the Proposed Plan (Opportunity Ponds) is a significant distance from large portions of the SSTOU.

U A different approach to repositories has been identified in the final remedial action plan. This approach resolves the concerns expressed regarding the proposed Opportunity Ponds and Browns Gulch repositories. The use of numerous local repositories will have some disadvantages, including the use of uncontaminated land and the need for permanent land use controls on these locations. However, considering the objections expressed regarding the other proposed repositories, the agencies have determined that, if adequate land in appropriate locations can be acquired and an adequate institutional controls/maintenance program can be established, local repositories will be implementable.

V Second, the excavation and transport of 70% of the tailings and sediments and railroad materials in the SSTOU would involve an enormous number of truckloads (86,200 - 172,500) full of tailings or train loads (2,200 - 4,500) over a period of up to ten years. This effort would severely strain local transportation resources at all levels by adding a staggering number of large haul trucks in a continuous stream to the highways, community roads/streets or rail lines. Apart from safety considerations discussed below, the Proposed Plan fails to consider the obvious difficulty or impact of implementing such an extreme Alternative. Normal traffic patterns will inevitably be disrupted; streets and highways will be damaged; and most importantly, peoples' everyday lives will be unnecessarily disturbed for many years.

V Again, the change in the repositories to be used will significantly reduce the strain on local transportation resources, as well as the risk of accidents to local communities. The remedial plan requires that approximately 62% of all floodplain tailings/impacted soils be transported to the near site repositories while 38% will be treated in place.

W Third, the Proposed Plan erroneously assumes available rail capacity. The capacity of rail haul in the SSTOU is limited due to both rail company equipment and the shared use of rail lines in the SSTOU with other companies. The maximum capacity of the RARUS Railroad to haul materials from the SSTOU is 3 unit trains per day. Each unit train includes 17 rail cars, each with 50 cubic yard capacity (Paul McCarthy, RARUS Railroad, personal communication, June 5, 1995).

W The change in the type of repositories to be used will void the need for rail haulage, eliminating this concern. However, based on information received from RARUS, transport of waste material from Subareas 1 and 2 by rail would not require shared use of another railway. Also, using the existing 17 rail car train available currently, approximately 2,300 cubic yards of material could be hauled per day (assuming three trains per day). To remove the approximately

It would conservatively require approximately 10 years to transport by rail all of the tailings/impacted soils from the SSTOU to Opportunity Ponds. Therefore, use of rail haul would extend the duration of remediation. The use of rail haul would also increase the costs associated with engineering and construction overhead and oversight. These additional costs would result from additional design and construction of rail loading and unloading facilities and the increased supervision required for the longer duration of activities associated with rail transport. (See also <l mm sediment issue.) Additionally, the Proposed Plan neglects to consider rail spur construction that would be required for loading unit trains without disrupting existing rail service on the rail lines. In addition to underestimating capital construction costs, this would further increase the duration of construction activity within the site and associated costs, and the related disruption to the surrounding community.

750,000 cubic yards of material in Subareas 1 and 2, approximately 326 days would be needed, not the 10 years as proclaimed by ARCO. As described in Response S above, unloading facilities were constructed at the Opportunity Ponds for the Colorado Tailings removal, availing them for use during removal from the SST OU, and loading facilities were included in MDEQ's analysis of rail costs.

X In contrast, ARCO's Proposed Remedy faces no comparable implementability difficulties. The equipment and materials necessary for implementing ARCO's remedy are readily available. Standard excavation and soil amendment techniques would be utilized for the actual relocation and STARS application in each sub-area of the SSTOU. ARCO's Proposed Remedy would not be tied to existing rail schedules, thereby increasing the speed with which the remedy could be completed. ARCO's Proposed Remedy would not involve the tremendous strain on transportation resources and the community inherent in the Preferred Alternative.

X The agencies acknowledge that ARCO's plan, although not clearly defined here, would include elements that are clearly implementable. One element that ARCO has not clarified is how saturated tailings in Subarea 4 would be treated, since the physical process of adding amendments to and plowing through saturated materials has not been demonstrated or proven. The agencies also have determined that the elements of the final remedial action plan are implementable, and that they have the added advantage of complying with the other remedy selection criteria, including the threshold requirements of protectiveness of human health and the environment and compliance with ARARs.

Y The removal of all sediment particles less than 1 millimeter in size raises serious implementability concerns. First, removal of these materials will not accomplish the effects desired by the Agencies. One millimeter diameter particles are not "fines" but are medium coarse sands and do not correspond with the fraction of sediments with the highest metals concentrations. Removal of all particles less than 1 mm in size would result in 19 to 92 percent of the sediments in the stream. Additionally, the alluvial materials on which the stream is bedded has a large fraction of materials of the size the Agencies

Y Removal of all sediment particles less than 1 mm in depositional areas will accomplish the effects desired by the agencies. If, for some reason, this size delineation will not achieve the desired effect, a contingency for delineation of concentration based criteria is described in the ROD. For the purposes of this remedial action, particles less than 1 mm in diameter were defined as "fines" and correlate to a grain size less than medium sands which are, coincidentally, the size fractions of the tailings themselves.

would remove. For example, in the Ramsey Flats area, the native uncontaminated soils, underneath the stream include an expansive and deep indurated silt layer. Direct application of the Agencies' 1 mm criteria would result in excavation of this silt layer to depths possibly over 100 feet deep.

MDEQ recognizes that the highest concentrations of metals reside in the silt/clay fraction. Examples of concentrations found in Silver Bow Creek in-stream sediment sand fraction versus the clay fraction can be seen in the table below which lists maximum values. MDEQ has determined that the concentrations in the sand fraction, although not as high as the silts or clays, are at unacceptable levels. When these values are compared to regional background values (Essig & Moore, 1992), it's easy to comprehend potential environmental impacts.

Silver Bow Creek
Average In-Stream Sediment Concentrations
(mg/kg)

	Background (Essig & Moore 1992)	**Sand Fraction** (MDEQ 1995)	**Clay Fraction** (MDEQ 1995)
Arsenic	7	92	378
Cadmium	0.2	3.8	76
Copper	20	694	10,459
Lead	15	225	6,702
Mercury	Not Studied	0.8	--
Zinc	57	1,357	12,782

This size range corresponds well with sediments containing the highest metals concentrations. Every in-stream sediment sample from this size fraction (<1 mm) ever collected from Silver Bow Creek has contained concentrations of contaminants in excess of every known biologic effects level. ARCO's contention that this would mean excavating to depths over 100 feet deep in the Ramsay Flats area clearly misconstrues the intent of in-stream sediment removal since the whole point of in-stream sediment removal is based on removing the active sediment in the active channel.

Z b. The Preferred Alternative Presents Serious Short-Term Effectiveness Problems Particularly With Respect to Worker and Community Safety and Environmental Impacts. - Short-term effectiveness addresses the period of time necessary to complete a remedy and any adverse impacts on human health and the

Z Short-term effectiveness was addressed. The short-term risks associated with the remedial plan are modest because of the limited hauling that will be required using relocation areas. This remedial action, if implemented and aggressively conducted, should require a construction period of no more than 4 to 6 years to complete.

environment that may be posed during the construction and implementation period. The Proposed Plan recognizes that the Preferred Alternative poses greater short-term risks than other alternatives because the waste materials would have to be transported greater distances. Proposed Plan, p. 15. The Preferred Alternative would take significantly longer to complete than ARCO's Proposed Remedy. The Proposed Plan estimates that the Preferred Alternative would take between 4-6 years to complete. As described above, ARCO believes that the Proposed Plan seriously underestimates the amount of time necessary to complete the Preferred Alternative. A more realistic time period to complete the Preferred Alternative would be as much as ten years depending on whether truck or rail haul is utilized to transport tailings. In contrast, ARCO's Proposed Remedy would take approximately 2-3 years to complete.

Aa Moreover, the Preferred Alternative creates far more risks to workers and the local communities than does ARCO's Proposed Remedy. ARCO has estimated that the chances of a fatality occurring during the implementation of the Proposed Plan is approximately three times greater than the chances of a fatality under ARCO's remedy. This estimate is based on the typical risks associated with similar construction activities (Mine Safety and Health Administration, Risks for Sand and Gravel Operations, 1994) and the estimated number of man hours per employee required to implement each remedy. Additional information concerning this estimate is presented in Exhibit 2. Thus, the Preferred Alternative creates significantly greater risk without additional benefit when compared to ARCO's remedy.

Response Aa: ARCO's supposition of risk, although greatly overstated, is dramatically reduced with the remedial action as delineated under this ROD.

Ab Furthermore, the local communities would be significantly affected by the passage of up to 172,500 truck loads or up to 4,500 train loads during the implementation of the Proposed Plan. (Note that these figures are based on estimated tailings volumes and average truck/train car size and do not include return trips.) Noise, dust and traffic would all be far greater under the Preferred Alternative than under ARCO's Proposed Remedy.

Response Ab: As noted in Response H above, where this same concern was raised before, the change in the type of repositories used will substantially alleviate this concern. MDEQ must point out that ARCO's maximum number of trucks and trains suggested in the comment are for removals of twice the volumes currently identified in the selected remedy.

Ac c. The Cost of the Preferred Alternative is Grossly Underestimated in the Proposed Plan. - Cost evaluates the estimated capital costs and operation and maintenance costs for 30 years. ARCO's projection of the cost of the Preferred Alternative ($33M-83M) is significantly greater than the cost of ARCO's remedy ($16M-32M). As described above, the Proposed Plan significantly underestimates the cost associated with implementing the Preferred Alternative, thus minimizing the differences in costs between the Preferred Alternative and ARCO's Proposed Remedy. If realistic cost estimates had been used, the Preferred Alternative clearly would not meet CERCLA's mandate for selection of the cost-effective remedy.

Ac Please refer to Responses F, O, and P, above.

Ad d. EPA and MDEQ's Position on ARARs is Arbitrary and Capricious, Inconsistent with CERCLA and the NCP,Not in Accordance with Law and Inconsistent with the Application of ARARs at Other Sites. - The ARARs criterion assesses whether a remedy is capable of meeting ARARs identified for the operable unit. ARCO's position on ARARs has been set forth in several letters to EPA and MDEQ, including ARCO's September 1993 ARARs Scoping Document for the SSTOU, ARCO's March 29, 1993 letter to Neil Marsh regarding solid waste and floodplain ARARs, ARCO's June 5, 1995 letter to Bob Robinson regarding SSTOU ARARs issues and ARCO's June 7, 1995 SSTOU FS disclaimer letter, which are incorporated herein by reference.

Ad The specific ARARs comments raised in this document are addressed below in response to each specific comment. ARCO's full June 7, 1995, FS disclaimer letter and direct responses to each comment raised in that letter are set forth in Appendix D-7. Letters that include only comments that are also stated in some other document are not separately addressed in this responsiveness summary.

ARCO's September 1993 ARARs Scoping Document sets out ARCO's positions on ARARs issues as of that date. ARCO's comments in the ARARs Scoping Document and related correspondence were considered by EPA and MDEQ in their detailed ARARs analysis which was developed for the Feasibility Study and which was finalized in Appendix A of this Record of Decision.

Many of ARCO's comments have been discussed at meetings between ARCO, MDEQ, and EPA. The agencies have attempted to refine the identification and description of ARARs in Appendix A to indicate how specific requirements apply to the SST OU. By clarifying just how the ARARs apply, for example, by specifying which portions of the requirements are substantive, rather than administrative, the agencies have responded, in the ARARS Appendix itself, to many of ARCO's comments.

While the Scoping Document's "Overview" of the role and scope of ARARs is accurate in many respects, ARCO is overly zealous in imposing restrictions on the scope of requirements that can be identified as ARARs. For example, ARCO notes, "Requirements must contain a 'level or standard of control' to be an ARAR." Scoping Document, page 5. Actually CERCLA § 121(d)(2) provides that the remedial action shall require "a level or standard of control for such hazardous substance ... which at least attains" the ARAR. Imposing "a level or standard of control" is thus a requirement for the remedial action, not a limitation on the type of requirement identified as an ARAR.

Similarly, ARCO asserts that several requirements cannot be considered ARARs because they are general statements of policy. MDEQ agrees that a general goal that merely expresses legislative intent about desired outcomes but is non-binding is not an ARAR. However, a provision that articulates an enforceable legal standard, requirement, or goal can be an ARAR, even if it is a statement of "policy." ARCO's view of what is "enforceable" is unnecessarily narrow. Nevertheless, certain statutes have been omitted from the ARARs identification because they are non-binding statements of policy rather than enforceable standards.

ARCO and the agencies are generally in agreement on the air quality requirements discussed in section IV.A of ARCO's Scoping Document. However, ARCO asserts on page 21 that "Ambient air monitoring is not currently planned and will not be implemented so long as the fugitive dust control measures described above are employed." It is the agencies who must determine, in approving the design of the remedial action, whether there are activities or areas where air quality must be monitored.

The water quality requirements discussed in section IV.B of ARCO's Scoping Document have been significantly revised in both the 1993 and 1995 legislative sessions, as well as through amendments to the Montana Water Quality Regulations. While much of ARCO's analysis of the water quality requirements was inaccurate, certain of the requirements to which ARCO objected have been deleted from the identification of ARARs as a result of the changes in the law. Where MDEQ has retained water quality requirements, it has attempted to clarify the application of the requirement in the ARARs document itself. (See Appendix A, Section IV.A).

Some of the other specific comments appearing in the Scoping Document are raised by ARCO and addressed by the agencies below.

Ae ARCO has previously expressed its serious concern regarding the State's interpretation of floodplain ARARs for the SSTOU and believes that MDEQ's position reflects undue NRDP influence. See, e.q., ARCO's FS Disclaimer Statement, p. 5. Throughout the SSTOU RI/FS process, MDEQ and ARCO met to discuss site characterization and the evaluation of potential remedial alternatives, including STARS. MDEQ's recent about face in its position on floodplain ARARs issues, i.e., that in situ treatment of tailings constitutes prohibited disposal in a floodplain, is specious at best and completely contradicts the discussions which have occurred and the agreements that have been reached over the prior 4 years of discussion between the Agencies and ARCO. ARCO believes that the current MDEQ's position on the floodplain ARAR is incorrect and that this change in position by MDEQ has been dictated by the State's natural resource damage litigation rather than CERCLA and the NCP.

Ae The analysis which addresses ARCO's substantive comments regarding the floodplain ARARs is set out in the agencies' Identification and Description of ARARs, attached as Appendix A to the ROD (see Appendix A, footnote 36 and footnote 37).

With respect to ARCO's allegations of undue NRDP influence, MDEQ notes that its actions and decisions with respect to this remedial action have been based on MDEQ's best professional judgment and objective determinations regarding the criteria and requirements for the selection of CERCLA remedies. While the State NRDP program has had the opportunity to present information and participate in the development of the administrative record, as has ARCO, the NRDP has not had "undue" influence on the decisions of MDEQ. The remedy identified in the ROD is based on CERCLA's remedy selection criteria, not on natural resource damage considerations or NRDP pressure.

In addition, ARCO is not correct in attempting to characterize MDEQ's position on floodplain ARARs as an "about face," and MDEQ denies ARCO's claim that "agreements ... have been reached over the prior 4 years of discussion between the agencies and ARCO." ARCO chose for the entire RI/FS period to disregard MDEQ's identification of those ARARs with which ARCO did not wish to comply, including the floodplain ARARs. ARCO cannot, however, feign surprise at MDEQ's application of those ARARs in its evaluation of the alternatives. Application of these ARARs was expressly raised by MDEQ in its evaluation of ARCO's proposal for Demonstration Project I at Rocker. These were discussed in meetings on Demonstration Project I and in the 1992 annual meeting between ARCO and MDEQ. In allowing ARCO to proceed with the demonstration, which involved removing near-stream tailings and relocating them in a nearby repository within the floodplain, MDEQ reiterated its concern regarding compliance with the floodplain ARARs in correspondence dated July 13, 1992, and correspondence dated January 22, 1993. In the January 1993 correspondence, MDEQ stated:

> We'd also like to reiterate our concern, expressed in my letter of July 13, 1992, that the placement of removed materials within or at the edge of the 100-year floodplain may require an ARARs waiver, and that such a waiver may not be justifiable in accordance with National Contingency Plan conditions for waivers. ... ARCO should bear in mind that MDHES may well determine that a waiver of the floodplain disposal requirement is not appropriate for all or parts of the site, or that it is simply more protective to remove those materials to an off-site repository. Our position on this issue for Demonstration Project I [allowing the project to be completed on an interim basis] should not be considered a precedent for our ultimate decision with respect to the application of the Solid Waste Disposal Act or floodplain ARARs.

Thus both the floodplain management regulation and the solid waste regulation prohibiting the storage or disposal of solid waste in the floodplain were identified as ARARs by the state throughout the RI/FS process. ARCO has, throughout this period, noted its legal position that these requirements are not applicable, and the state, while giving full consideration to ARCO's legal position, has never concurred in that position.

MDEQ acknowledges that there was little or no discussion during this period regarding how the floodplain ARARs applied specifically to the STARS alternative. The evaluation of whether each alternative complies with ARARs is performed as part of the evaluation of alternatives in the Feasibility Study. ARCO did not evaluate STARS for compliance with these ARARs because ARCO refused to acknowledge the applicability of these requirements. In its draft Feasibility Study, ARCO used an ARARs "Clarification" document prepared by its own attorneys rather than the State's and EPA's identification of ARARs. ARCO's "Clarification" document omitted all the prohibitions on storage or disposal of solid wastes or toxic or hazardous materials within the floodplain.

Thus the State's actual evaluation of the compliance of the various alternatives with ARARs in its response to ARCO's Draft Feasibility Study was the first formal discussion of STARS' compliance with the floodplain ARARs. This did not, however, constitute an "about face" or contradict any "agreement" with ARCO regarding the application of these ARARs.

Af ARCO is very concerned that MDEQ has taken a position and may make a remedy selection decision that is clearly inconsistent with existing EPA guidance on the application of waste disposal requirements in the context of in situ remedial action. Specifically, EPA has clearly stated that in situ treatment of wastes by a process such as STARS treatment does not constitute "disposal." Given that EPA and MDEQ define "disposal" virtually identically, ARCO believes that the floodplain requirements cannot be interpreted as prohibiting the use of STARS in the floodplain.

Af The agencies' selection of the remedy is consistent with existing EPA guidance. ARCO's assertion regarding EPA guidance on the definition of disposal, as it relates to in situ treatment of solid wastes, is not correct. ARCO fails to acknowledge the distinction between RCRA's very broad definition of "disposal" and RCRA Subtitle C's more narrow definition of "land disposal." The guidance upon which ARCO relies relates only more narrowly to the application of certain Subtitle C (hazardous waste) requirements, not to other aspects of RCRA which involve the full scope of the definition of "disposal." The definition of "disposal" appearing in the Montana Solid Waste Management Act, § 75-10-203(3), MCA, is virtually identical to the broader RCRA definition. Thus the scope of the Act and corresponding regulations is broader than ARCO asserts.

The applicability of the solid waste management regulations to the STARS technology is described in the State and EPA's Identification and Description of ARARs (see Appendix A, footnote 37). In addition to the solid waste regulation prohibiting the storage or disposal of solid wastes in the floodplain, the Montana Floodplain and Floodway Management Regulations prohibit solid waste disposal and the storage of toxic or hazardous materials within the floodway or floodplain. See ARM 36.15.602(5); ARM 36.15.605(2); and 36.15.703).

Ag STARS clearly does not violate floodplain disposal requirements. Interestingly, the Proposed Plan notes that the Preferred Alternative "complies with all ARARs except location-specific solid waste and floodplain ARARs, which may be waived where technically supportable." Proposed Plan, p. 15. ARCO was surprised to learn that the State was willing to waive location-specific ARARs for its use of STARS in Subarea 4 (based on equivalent protection) as an element of the Preferred Alternative while arbitrarily asserting that waivers of the same ARARs were unavailable for ARCO's Proposed Remedy. Assuming for argument's sake only that an ARARs waiver is necessary, an ARARs waiver (based on equivalent protection) to the floodplain disposal requirements is equally applicable to the use of STARS in all Subareas in both the Preferred Alternative and ARCO's Proposed Remedy. Furthermore, an ARARs waiver is unnecessary, because variances, waivers or exemptions contained within a requirement must be considered in determining whether a requirement should be an ARAR. Preamble to the NCP, 55 Fed. Reg. 8744. The variance provisions specified in the State's regulations provide a basis for MDEQ approval of remedial actions that would permanently manage STARS-treated materials within the Silver Bow Creek floodplain without having to invoke any ARARs waiver. Assuming arguendo that such STARS-treated areas should be regulated as artificial obstructions or nonconforming uses pursuant to the State floodplain requirements, reclamation of these areas may occur within the floodplain where the criteria set forth in the floodplain regulations are satisfied. Therefore, ARCO's position is that an ARARs waiver for State floodplain and solid waste disposal requirements is unnecessary.

Ag The ARAR waiver invoked to allow the limited use of STARS treatment in the floodplain is based upon a demonstration that the treatment, when coupled with an adequate monitoring and maintenance program to ensure the continued integrity of the treated wastes within the floodplain, will attain a standard of performance that would be equivalent to that attained by removing the materials from the floodplain. See 42 USC § 9621(d)(4)(D). This determination is based on the assumption that, in certain areas within the floodplain, the treated tailings can be protected from floods adequately to prevent the further release of metals and arsenic into the stream. The considerations that form the basis for this determination are described in detail in the decision summary portion of the ROD. ARCO's assertion that such protection can be provided everywhere ARCO would use in situ treatment is not credible and contrary to the best professional judgement of the agencies. The technical bases for these decisions are discussed in the Record of Decision. Equivalent protection cannot be provided everywhere within the floodplain. However, EPA and MDEQ have determined that there are limited areas where it can be provided in a reliable fashion.

ARCO also suggests that the State should use variances within the regulations themselves, rather than rely on an ARAR waiver for the floodplain ARARs. The variances to which ARCO refers do not apply to the prohibitions at issue.

As ARCO correctly notes, the Floodway and Floodplain Management Act does include a variance provision, § 76-5-405, and this variance provision does provide for the granting of permits that allow certain otherwise prohibited obstructions or nonconforming uses. Similarly, the Floodplain and Floodway Management regulations include a provision for the granting of variances through the permit system. See ARM 36.15.218. However, the regulations also specify certain prohibitions that are not allowed even through the permit system, and these include the prohibitions on solid and hazardous waste disposal and storage of toxic or hazardous materials.

ARM 36.15.605 includes a section which defines those "artificial obstructions that are prohibited within the designated floodway except as allowed by permit," and another section defining artificial obstructions that are simply prohibited, including the solid waste disposal and toxic or hazardous material storage prohibitions. The section that defines the uses that require a permit within the floodway, ARM 36.15.602, indicates that storage of materials and equipment may be allowed under certain conditions, but states, "[s]torage of flammable, toxic, or explosive materials shall not be permitted." Similarly, ARM 36.15.701 specifies the structures that may be allowed by permit within the flood fringe, but ARM 36.15.703 flatly prohibits, within the flood fringe, "solid and hazardous waste disposal ... and storage of toxic, flammable, hazardous, or explosive materials." Thus, while the permit system can be used to obtain certain variances from the minimum standards specified in the floodplain regulations, the variance provisions are not available for the restrictions at issue here.

The Montana Department of Natural Resources and Conservation, the agency which promulgated and administers the floodplain regulations at issue here, has confirmed that the variance provisions discussed by ARCO do not apply to these prohibitions. (Memorandum from Donald D. MacIntyre, Chief Legal Counsel, DNRC, to Bill Kirley, Legal Counsel, Environmental Remediation Division, MDEQ, dated September 21, 1995). While the variance provisions are created by statute, it is permissible and appropriate for the responsible agency, in crafting the implementing regulations, to designate specific regulatory requirements as either subject to or outside the scope of the variance provisions, as DNRC has done here.

Ah CERCLA requires states to apply ARARs consistently. If MDEQ improperly insists that an ARARs waiver is necessary in order for STARS treatment to be used within the Silver Bow Creek floodplain, ARCO believes that a waiver based on inconsistent application of State requirements is appropriate based upon the application of these State requirements to actions at the Old Works/East Anaconda Development Area OU of the Anaconda Smelter NPL Site. As a

Ah MDEQ believes that it has applied this ARAR consistently. The Solid Waste ARARs and the Floodplain ARARs were included in the identification and description of ARARs for that action. See Old Works/East Anaconda Development Area Operable Unit, Anaconda Smelter NPL Site Record of Decision, March 8, 1994, Appendix A, pages 29 and 37-40. The action at the Old Works/East Anaconda Development Area OU of the Anaconda Smelter Site complied with component of that remedial action, tailings were adequately protected and remain in the Warm Springs Creek floodplain. Under CERCLA and the NCP, an ARARs waiver is available to prevent "application to Superfund sites of State requirements that have not been consistently applied elsewhere in the State." 42 U.S.C. § 9621(d) (4)(E), 40 C.F.R. § 300.430(f) (1) (ii) (C) (5).

this ARAR by requiring the upgrade or repair of levees adjacent to Warm Springs Creek and replacement of culverts as necessary to safely pass the 100-year flood event without washout of waste materials. Repair of the channel levees and culvert replacement is intended to keep Warm Springs Creek within the existing stream channel during the 100-year flood and prevent the inundation of wastes located within the historic floodplain.

In any event, the use of applicable ARAR waivers under CERCLA and the NCP is discretionary. The agencies have determined that in this situation the "equivalent standard of performance waiver" is appropriate and that the use of this ARAR waiver here allows a close coordination between the two threshold requirements, protection of human health and the environment and attainment of ARARs, which brings both the technical and legal analysis of this remedial action to a very sound and compatible conclusion.

Ai e. The Community Does Not Support the Preferred Alternative. - The community acceptance criterion assesses whether community concerns are addressed by a proposed remedy and whether or not the community has a preference for a remedy. Based on testimony presented at the July 10, 1995 public hearing on the Agencies' Proposed Plan, the local citizens overwhelmingly disapprove (by a 2 to 1 margin) the Agencies' proposed remedy. Of the 49 persons giving testimony, 31 people spoke in opposition to the Proposed Plan. Those speaking against the Proposed Plan included a diverse cross-section of the local community including state and local government officials, a university professor, urban residents, rural/agricultural residents, an engineer, a medical doctor and representatives from local advocacy or community groups. Comments by these individuals identified the following issues with the Proposed Plan:

- The overestimation of risk by the Agencies in developing the Proposed Plan,
- The lack of balance between short-and long-term risk in the Proposed Plan,

Ai Public opinion was summarized at the beginning of Appendix D under the heading "Summary of Public Opinion". That summary shows that a majority of the local community supports the Preferred Alternative and that very few individuals expressed direct support for ARCO's proposed alternative (18 out of 321). The community acceptance criterion was assessed as overwhelming support for the Proposed Plan.

The Proposed Plan is not "overkill", or punitive and is economical. It is clear from the public comments that there is support for responsible and long-term effective remedial action. The remedy reduces risk, is practical, cost-effective and beneficial.

- The lack of end land use consideration or a realistic, practicable or cost-effective remedy by the Agencies,

- The lack of consideration of the coordination with remedial activities at upstream sites, and

- Unrealistic estimates of the length of time of implementation and public disruption.

Numerous individuals stated that the Proposed Plan was "overkill," was not economical or practical or was "punitive." It is clear from the public hearing that there is little, if any, support among the local community for the disposal of excavated tailings at either a Brown's Gulch repository or at Opportunity Ponds. A number of individuals stated that a remedy with 100 percent certainty or zero risk is not practical, and that a practical, cost-effective and beneficial remedy be selected and implemented as soon as possible.

Aj In particular, concern was expressed about the impact of the Preferred Alternative on the grass-roots proposal entitled "Project Green" to establish a "Greenway" recreational corridor from Butte to Anaconda. The conceptual proposal would include recreational areas along Silver Bow Creek and bike paths/hiking trails running the length of the Silver Bow Creek corridor. This proposal has widespread public support and ARCO's support so long as a reasonable remedy is selected. The Preferred Alternative does not specifically support or facilitate the development of the Greenway proposal. In contrast, ARCO's Proposed Remedy supports the Project Green proposal as an institutional control which would limit future land use within the SSTOU. Furthermore, the Project Green proposal incorporates as a component maintenance of the cleanup, including STARS treated/revegetated areas. As the July 10, 1995 public hearing made clear, the public supports the selection of a cost-effective remedy that is consistent with a realistic post-remedy land use/recreational use. By supporting the Project Green proposal which enjoys strong public support, ARCO's Proposed Remedy would ensure protective, publicly supported and realistic land Uses.

Aj The remedy as delineated in this ROD supports a recreational corridor such as the Project Green proposal as an institutional control which would limit future land use within the SST OU. The ROD requires ICs such as the Project Green proposal to be incorporated as a component for monitoring and maintenance of the remedial action.

Ak f. The Proposed Plan Disregards the Extensive Studies and Demonstration Projects Undertaken to Date Which Prove the Long-Term Effectiveness of STARS, and Arbitrarily and Capriciously Disparages STARS Long-Term Effectiveness in Favor of Removal/Excavation Technology. - The long-term effectiveness criterion assesses the ability of a remedy to maintain reliable protection of human health and the environment over time. The State has attacked the use of STARS on grounds that during high flow conditions, channel migration and streambank erosion may cause the discharge of treated and untreated materials into Silver Bow Creek. The Proposed Plan references no technical support for this assertion. ARCO hereby submits the report of Dr. Daryl Simons, attached hereto as Exhibit 3 which directly counters the State's unfounded concerns. Among other things, Dr. Simon's analysis shows that:

1) Silver Bow Creek has adjusted geomorphically to improved conditions and, at present, performs as alluvial channels in similar geomorphic settings not subject to mining activities;

2) The analysis of the geomorphic nature of a major portion of Silver Bow Creek and its flood plain verifies that the channel system has achieved a high degree of natural stability showing little lateral channel migration over time; and

3) The majority of the present sediment load in Silver Bow Creek is from natural sources. This indicates that the channel is stable and that the qualify of sediments in the stream bed will continue to improve over time.

Additionally, information ARCO developed during the FS and supporting documentation for these comments demonstrate that channel migration and erosion, to the extent it may occur in the future, would not materially compromise the permanence and effectiveness of the ARCO remedy. Establishment of vegetation and other erosion control measures will reduce erosion of tailings/impacted soils to a level that will not significantly impact the environment. ARCO has presented detailed calculations of erosion and sediment transport rates to demonstrate the potential effects of

Ak As part of its comments on the Proposed Plan, ARCO submitted an analysis of Silver Bow Creek by Daryl Simons. Simons reviewed limited upstream and downstream total suspended solids and flow data from 1993-1995, reviewed aerial photography from 1947 and 1988, and performed several flood modeling analyses. Simon's primary conclusions were that (1) SBC was overloaded with sediments historically, but in recent decades had become a geomorphically stable alluvial system, (2) lateral migration estimated from aerial photography is about a few tenths of a foot per year, (3) the majority of the sediment load in SBC is from watershed erosion from natural, nonmining sources, and (4) that implementing the State's proposed remedy would cause irreparable adverse effects on the alluvial system.

Simon's conclusions are not supported by the analysis he presents. He first utilizes Hooke's equation to estimate average lateral migration based on drainage area, deriving estimates of 1.57 feet per year for the entire stream and 1.33 feet per year for the stream upstream of Browns Gulch. The use of these equations to evaluate a system often constrained by dikes or railroad embankments is not appropriate. He then reviews aerial photography of the Butte to Browns Gulch reach and concludes that average migration during the period from 1947 to 1988 is about 0.13 feet per year. ARCO's other contractor, R2 Resources, evaluated the same reach of SBC based on 1954/56 and 1991 aerial photography and concluded that average migration was between 0.82 and 0.56 feet per year. The R2 measured erosion rate is approximately 4 to 6 times higher than the Simons measured rate for the same period. Without using aerial photography, Simons then calculates an average erosion rate of 0.061 feet per year for Subarea 4 by modifying the "measured" upstream rate according to drainage area. The channelized half of Subarea 4 and the braided section of Silver Bow Creek inside the Warm Springs Ponds operable unit are included in the calculation of the Subarea 4 average erosion rate. ARCO's other contractor, R2 Resources, measured erosion rates in a relatively straight channelized section of Subarea 4 from the aerial photographs and estimated a rate of 1.06 feet per year, or 17 times higher than the erosion. (R2 Resources 1995) These calculations support ARCO's belief that amendment and revegetation of tailings will limit the rate of erosion and input of metals to Silver Bow Creek to protective levels. Even assuming arguendo that such erosion will occur under the reclaimed condition, stream water quality will not be impaired and sediment quality will continue to improve over time. These calculations were made by evaluation of historical erosion rates over the last approximately 40 years, and are based upon sound, accepted scientific principles and reasonable assumptions regarding future conditions. In fact, this analysis was conservative given that the erosion estimated from the last 40 years should be significantly greater than future erosion under fully vegetated conditions. MDEQ removed these calculations from its rewrite of the SSTOU FS, stating that there was no basis for them. However, the MDEQ evaluation of erosion and sediment transport is purely qualitative and speculative and appears biased by NRDP considerations.

Simons calculation. MDEQ has concluded that Simons' calculation of average Silver Bow Creek erosion rates was without merit.

Simons concluded that for decades Silver Bow Creek has been stable and that its sediment load is from natural sources. The conclusion appears to be based on review of Silver Bow Creek flow rates and suspended sediment data from the last three years, as well as his review of overall stream geomorphology. MDEQ believes there is overwhelming data to support a conclusion that, although Silver Bow Creek may recently exhibit somewhat improved stability, sediment loading over recent decades has been large and has been related to mining sources. Both the in-stream sediments in the creek and the pond sediments in Warm Springs Pond 3 are highly contaminated with metals associated with mining wastes. Pond 3 contains approximately 12 million cubic yards of contaminated sediments deposited over the last 35 years. If natural sediments dominated the system, as Simons supposes, then both in-stream sediments and pond sediments would not exhibit the observed levels of contamination.

Simons last primary conclusion, that the State's remedy would impair the alluvial system, is presented with no supporting analysis. ARCO's proposed remedy is mentioned at several locations in the report, but the State's plan is neither mentioned nor analyzed anywhere in the body of the Simon's analysis. There is no basis for his conclusion.

R2 Resources evaluated the impact of erosion of contaminated streambank sediments from average channel migration on an assumed clean stream channel. R2 set up a differential equation to represent inputs and outputs of sediment to the stream and solved the equation using numerical integration. The differential equation was based on a control volume of incremental stream length and integrated over the stream length. No attempt was made to evaluate the stream conditions over time. R2 concluded that long-term concentrations would remain near background concentrations for all reaches of Silver Bow Creek.

R2's conclusion is not unexpected if one examines closely the input parameters to the equation used to model the system. R2 did not consider present stream sediment quality conditions. An implicit assumption is that all in-stream sediments are at background conditions, i.e., clean of contaminants, before the analysis is conducted. In addition, R2 assumes that all sediment inputs from upstream, tributary, and overland sources are also clean. The only contaminants considered in the analysis are those associated with erosion from streambanks during channel migration. Annual sediment load is assumed to be reduced to 13 percent of historic measured values (based on stabilization of the watershed) and erosion from channel migration is assumed to be 50 percent of historical values (based on SST OU channel revegetation).

MDEQ determined that R2's analysis was significantly flawed because the input assumptions were invalid and therefore rejected R2's conclusion that in the long-term, concentrations of metals in Silver Bow Creek sediments would approach background conditions. The following points summarize MDEQ's analysis of the combined Simons, R2 Resources, and Titan studies.

ARCO has submitted several studies (R2 Resource Consultants, Inc., 1995; Titan Environmental, 1995; Simons, 1995) in support of its claim that long-term erosion of amended tailings/impacted soils into Silver Bow Creek would not cause a significant adverse impact on the stream. These studies assume that historically measured bank erosion rate as determined from aerial photos will be reduced by revegetation of banks. According to ARCO, this reduction in bank erosion will reduce tailings volumes and metals entering Silver Bow Creek, and this reduction in tailings entering the stream, combined with reduction in all other sources of metals to background levels, will allow recovery of aquatic communities in Silver Bow Creek. MDEQ has considerable remaining concerns about the validity and applicability of these studies. These concerns are:

1. ***ARCO's historical bank erosion rate estimates are not consistent.*** - ARCO has provided two documents which calculate bank erosion migration rates. The first (R2 Resource Consultants, Inc., 1995)

compared positions for selected reaches of Silver Bow Creek on 1954-56 aerial photos to that on 1991 aerial photos and calculated average bank erosion rates of 0.56 to 0.82 feet per year in Subareas 1 and 2, respectively, and 1.06 feet per year in Subarea 4. The second (Simons, 1995), using a comparison of 1947 and 1988 aerial photos, found an average bank erosion rate of 0.13 feet per year above Durant Canyon (Subareas 1 and 2) and 0.061 feet per year below Durant Canyon (Subarea 4). The fact that two measurements using similar methods and overlapping periods by ARCO's own contractors have produced significantly different results in estimated stream migration rate indicates that there is a high level of uncertainty in the analyses that are based on these measurements. Until these conflicting results are reconciled, the accuracy of this method of calculating the bank erosion rate remains in doubt.

2. ***The assumption of halving erosion rate under STARS treatment has not been demonstrated.*** - The assumption that the erosion rate will be halved under STARS treatment (R2 Resource Consultants, Inc., 1995) has not been demonstrated through local measurements. This assumption is based on a comparison of the change in bank erosion rate of the Genesee River in New York State from farm land to forested land (Beck et al, 1983). It is questionable that the same conditions apply to Silver Bow Creek. Nanson and Kickson (1986), in a study of 18 rivers in western Canada, found that vegetation on the outer bank of these rivers had little significant effect in controlling channel migration. They attributed this finding to the undermining of trees through erosion of sediments below the root zone. It is not known which of these two conditions applies to Silver Bow Creek without local studies. Actual stream migration and erosion rates of treated areas may be significantly higher than the ARCO studies assume.

3. ***The assumption of reduction of all sources of sediment besides bank erosion has not been justified by quantifying other sources.*** - ARCO has performed two calculations (R2 Resources, 1995, and Titan, 1995) that are purported to calculate the improvement in the quality of Silver Bow Creek sediments due to the anticipated reduction of

tailings input from bank erosion anticipated by ARCO. These calculations are both flawed by the assumption that all other sources of contaminated sediment will be eliminated and that large amounts of clean sediments will replace them. To adequately evaluate long-term sediment conditions, it would be necessary to quantify and characterize the level of contamination in the sources of sediment that enter Silver Bow Creek now and would be projected in the future under various remedy scenarios.

There are unexplained differences in the assumptions used in the two ARCO calculations. The R2 Resource Consultants calculation uses an average annual sediment transport volume for Silver Bow Creek of 50,000 cubic yards. The Titan calculation uses 91,520 cubic yards per year. Titan eliminates the wash load from the calculation without explanation; R2 does not. The Titan calculation assumes that about 10% of the annual sediment load is tailings material from stream bank erosion; the R2 figure is closer to 5%. This is the reason the R2 calculation predicts a higher degree of long-term cleansing than the Titan calculation. Without more supportable assumptions for these types of calculations, the accuracy of the calculated values is highly speculative.

For example, the calculation performed by Titan Environmental (1995) concludes that impacted sediments in Silver Bow Creek will be reduced from 201,700 cubic yards to 19,700 cubic yards over a 100 year period, a 90% reduction in volume. This calculation assumed an average bank erosion rate of 0.4 feet per year and replacement of all other sources of contaminated sediment with clean sediments beginning with the first year of remediation. If the same calculation is performed with the historic bank erosion rate determined by R2 Resource Consultants (0.8 feet per year), an 80% reduction in contaminated sediment would be achieved over the same period. This shows that 80% of the calculated improvement in Silver Bow Creek sediments is attributable to the assumed remediation of other sediment sources and only 10% is due to possible effects of STARS on bank erosion.

To demonstrate further the importance of the assumption about the degree of contamination of the other sediment sources, the Titan calculation can be run with the assumption that all sediment sources are not remediated and these other sources are contaminated to the same degree as existing channel sediments. This would be a reasonable assumption if there had been no reduction in contaminated sediment sources in the last 30 to 40 years and the in-stream sediments had equilibrated with the sediment sources. Although it is likely that contaminated sediment sources have been reduced in this time period, ARCO has not quantified the degree of reduction and this calculation serves to set the other possible endpoint of eventual in-stream sediment cleansing.

Under this alternate scenario, the Titan model predicts 10% eventual reduction in in-stream sediment contamination if no action is taken and only 5% reduction in in-stream sediment contamination if STARS is implemented. Since this is the antithesis of the conclusion obtained by Titan, with the assumption that all sediment sources except bank erosion will be remediated, it is very important that the other sources of sediment and the effects of remediation of these sources be quantified.

Another concern with the Titan model is the assumption that the in-stream sediments are initially as contaminated as the tailings impacted streambank material. Although this may be true in a gross sense, it does not hold in all areas. According to RI data, Subareas 1 and 2 have greater metals concentrations in tailings than in-stream sediments. In these areas, cleansing of in-stream sediments will occur at a slower rate than the calculation predicts.

4. *Avulsion has not been adequately considered in calculation of the erosion rate.* - The calculations performed by ARCO's consultants on bank erosion do not directly address another significant erosional process, avulsion, which is defined as a sudden change in channel alignment. Avulsion can be caused by such events as large floods or ice damming. Because entire stream cross-sections are created during avulsion events, sediment erosion and loading associated with these events is often orders of magnitude higher than that associated with stream meander. Ayres Associates (1995), in a geomorphic inspection of Silver Bow Creek, found meanders to be a minor source of erosion in most reaches of Silver Bow Creek but found evidence of avulsion in all reaches. Although the R2 Resource Consultants' method of measuring stream meandering also accounts for avulsion in the period 1955 to 1991, this period did not include many extreme flood events which are the major causes of avulsion.

With respect to high-flow sediment loading, the Silver Bow Creek Flood Modeling Study by CH2M HILL estimated that Silver Bow Creek would move 100,000 cubic yards of sediments into the Warm Springs Ponds during a single 100-year flood event, 50,000 cubic yards during a single 25-year flood, and 25,000 cubic yards during a single 10-year flood.

5. *Measured suspended load versus estimated wash load.* - "Suspended load" is that portion of the in-stream sediment load borne by upward movement or flux of momentum in turbulent eddies in the flow. "Wash load" is distinguished as the load, because of it's fine size, has a settling velocity that would be held in suspension as colloidal particles (Leopold et al, 1964). Thus wash load is a sub-category of suspended load comprised of exceedingly fine particles.

R2 estimated total in-stream sediment load of 47,000 tons/yr. Titan suggested a yearly sediment transport, including wash load, equaled 81,485 tons/yr. When Titan eliminated the wash load, the bed-material load was estimated at 25,413 tons/yr. This would make wash load 56,072 tons/yr. The USGS measured suspended load at the Opportunity station from March 1993 to September 1994 averaged approximately 1,300 tons/yr for Silver Bow Creek (USGS Open File Reports 95-429 and 94-375).

6. *Median vs. mean concentrations of in-stream sediments*. - It is MDEQ's opinion that mean in-stream sediment metals concentrations better represent potential metals loading to Silver Bow Creek from streambank erosion then median concentrations used in the R2 or Titan analysis. The analysis underestimates the true loading that potentially would impact in-stream sediments. As shown in the table below, mean concentrations are approximately two to three times higher than the medium value used by Titan.

Silver Bow Creek
Mean vs. Median In-Stream Sediment Concentrations
(mg/Kg)

	Mean (MDEQ, Oct 31, 1995)	Median (Titan, Sept 5, 1995)
Arsenic	291	140
Cadmium	17	8
Copper	4230	1,470
Lead	769	381
Zinc	4,423	2,308

AI Additionally, by careful design specifications, the STARS' amendment particle size may be chosen so that the amendment particles are predominantly of a size that will remain the hydraulic equivalent of the tailings particles. Therefore, any amended tailings/impacted soil particles potentially entering the stream system would not be specifically separated from the amendment particles by physical processes. The eroded and redeposited tailings and amendment particles are likely to be mixed with native materials, as streambed sediments have been, so that they will not significantly impact the areas (eventually Warm Springs Ponds) in which they might be redeposited. Amendment particle sizes in the demonstration projects to date have been predominantly in the fine to medium sand particle size to reduce fugitive dust emissions from the amendments. Although originally specified for another purpose, this design specification also facilitates amendment mixing and should reduce the separation of amendments from the tailings where erosion may occur.

AI In order to adequately neutralize the tailings with lime, the proper amount of lime must be applied and applied in a manner that places the amendment in intimate contact with the tailings material that is to be neutralized. Since the lime application rate accounts for all potential acidity, as sulfur compounds oxidize over time to produce acid, the lime amendment that is in intimate contact with the tailings is available to buffer the acid reaction.

In consideration of the foregoing, MDEQ believes that during erosion and transport of amended tailings, there is a high likelihood that the tailings and the amendments will be separated. MDEQ believes that it is more likely that the tailings will be redeposited in both amendment-rich and amendment-poor deposits rather than a well mixed homogeneous mass due to the complex nature of sediment deposition processes. Because redeposited amendment-poor tailings will not be adequately buffered, they are likely to produce acid, subsequently mobilizing contaminants of concern. The uncertainty associated with translocating the tailings and the amendments through erosion is the basis of MDEQ's conservatism in limiting the conditions under which STARS amendments can be applied. MDEQ uses this approach with respect to STARS in the interest of fostering a remedial alternative that is effective in the long-term.

Am Further, in the Silver Bow Creek and Clark Fork River demonstration projects it has been demonstrated that deposition of even totally untreated upstream sediments does not cause vegetation failure in STARS treated areas. Specific evidence of this is currently available due to a number of small flood events occurring during the spring of 1995. These events (1-5 years flood events) showed that STARS-based field demonstrations held up well to floods events. Further evidence of the efficacy of the Governor's Project is that a self-sustaining trout population thrives adjacent to in situ amended tailings.

Am ARCO's apparent lack of geochemical understanding is readily apparent in this comment. There is a time delay between deposition of acid generating material and the visual effects that the acid mobilized metals will have on vegetation. If there is new data on the mineralogical composition of these bank-full flow event depositional materials, MDEQ would appreciate a copy.

With regard to the upper Clark Fork River trout population, this population existed prior to the in situ amendment of tailings. To imply that the STARS amended streambank tailings are connected in some way to the success of this classic example of a tailwater fishery is misleading and a perversion of the facts. Also, streambank erosion was evident at one of the treated fenced macroplots at the Governor's Project where approximately ¼ of the fenced area was missing and the corner fence post was hanging in the river.

An In addition, the State has expressed concern over leaching of amendments from saturated tailings/impacted soils that these amendments are intended to stabilize. An examination of the geochemistry of the amended tailings/impacted soils indicates that this concern is unfounded. Humidity cell test studies performed by Dr. Davis replicate infiltration of precipitation on treated soils over an extended time period. The results of these tests show that the soil amendments maintain neutral pH conditions over time. See Report of Dr. Andy Davis (July 14, 1995) provided to Jim Ford by Titan Environmental as part of the transmittal of supplementary information and data developed by ARCO. Dr. Davis' Report is incorporated by reference herein.

An In MDEQ's analysis of the STARS treatment in saturated tailings conditions, two critical factors concerning STARS implementation indicate that STARS will not be effective: 1) The equipment designed to mix lime amendments into tailings is not likely able to adequately mix below the water table; and, 2) Because the highly soluble calcium oxide or calcium hydroxide is used to make up 40% of the STARS amendment, it is likely to be removed from the amended profile in ground water in those amended tailings that are seasonally saturated, primarily during the first year after amendment.

To expand on the first critical factor, mixing STARS amendments below the water table was not demonstrated at any of the ARCO demonstration projects (Demonstration Projects I, II, and III), nor was lime mixed below the water table during Phase II of the STARS investigation at the Manganese Stockpile. MDEQ maintains that adequate mixing of lime amendments in ground water would not occur due to the inherent problems of plowing saturated materials and the physical process used to deliver the lime to the tailings to be mixed. Whether saturated tailings were amended during implementation of the Governor's Project could not be confirmed in the published documentation of the project.

The second critical factor is based on the solubility of calcium oxide or calcium hydroxide amendment. When mixed with soil, the pH generally rapidly rises to 9 to 10 standard units after mixing and tends to elevate soil pH for several months. As ground water rises into recently amended tailings, some quantity of the soluble calcium amendments are likely to be solubilized and removed from the soil as the water table lowers, even where ground water has a near neutral pH or is slightly alkaline. While no data is available to quantify the amount of amendment that could be removed, MDEQ believes that the uncertainty associated with this issue limits the application of STARS to tailings located greater than two feet above the October 1992 low water table elevation.

Finally, with regard to ARCO's comment on the geochemistry of the basic reaction of STARS treated tailings in ground water, the STARS technology was never evaluated for its effectiveness in saturated tailings/impacted soils. MDEQ has made their concerns regarding the appropriate application of the STARS technology apparent. These concerns are based on the condition that very shallow ground water (i.e. groundwater with the highest probability to contact amended tailings/impacted soils) can be extremely acidic (pH 1.0 - 4.5) with high sulfate (1,500 to 1,800 mg/l)(Benner et al, 1995). This water would not be considered "slightly alkaline". ARCO has not investigated the effects that both uncontaminated and contaminated ground water have on the STARS tailings amendments and has never submitted any technical information or an interpretation from any of ARCO's "experts" on this subject.

Dr. Ann Maest (1995) reviewed the humidity cell tests of Davis and found that Davis' conclusions were "highly suspect." Maest identified numerous problems in analytical methods used, data interpretation, and sampling design. Davis' own unreported data show that "a substantial amount of copper is leaching from the 12-15 inch depth and from the buried A horizon sample (15-20 inches)" (Maest, 1995). Although the pH conditions are questionable, Davis' data undoubtedly demonstrate that copper continued to leach in his humidity cell test.

Ao All potential acid generating capacity of the tailings/impacted soils is considered in calculating the amount of amendment to be added to the tailings/impacted soils. The amendment rate applied then is increased significantly to provide an additional safety factor. Moreover, because tailings would be removed from all areas where groundwater (which is slightly alkaline anyway) is found within two feet of the tailings, groundwater will not leach amendments from the tailing/impacted soils. (See Exhibit 5 for further discussion of groundwater issues.)

Ao MDEQ does not dispute the fact that all the acid generating potential of sampled tailings/impacted soil is taken into account in the lime requirement calculation. MDEQ also does not dispute the fact that an additional factor of 25% is added to the calculated lime requirement as a design safety factor to account for inadequate mixing and soil variability. However, as stated before, the neutralizing amendment must be in intimate contact with the acid material if it is to effectively neutralize acid produced. The criteria for removal of saturated tailings (within 2 feet of the October 1992 water table elevation) does eliminate the potential for ground water to leach amendments from the tailings.

It appears ARCO is confusing its proposed remedy with the agencies. The last sentence of this comment ("Moreover, because tailings would be removed ... from the tailings/impacted soils." would not apply to ARCO's remedy since 54% (the 321,400 cy of saturated tailings in Subarea 4) of all OU saturated tailings/impacted soils would be left in place and treated in situ with STARS.

With regard to Exhibit 5, MDEQ presented the data supporting the definition of saturated tailings in Appendix D-6, Response S. This response states that the two-foot to ground water criteria for removal of tailings/impacted soils is somewhat conservative but more representative of site conditions than a one-foot fluctuation. MDEQ believes that the one-foot fluctuation only represents conditions in the very near-stream areas, since 73% of the wells used in determining ground water fluctuation are within 70 feet of the stream channel. All wells located greater than 70 feet from the stream exhibited fluctuations in ground water greater than one foot.

The record of monthly water level observations for most of the monitoring wells in the OU was 11 months, although a few wells were monitored monthly for a 21-month time period. Using these data, the maximum observed groundwater fluctuation in each of the four subareas is: Subarea 1 - 1.98 feet; Subarea 2 - 2.09 feet; Subarea 3 - 1.68 feet; and, Subarea 4 - 3.06 feet. Thus, by considering all the preceeding information, a water table fluctuation of two feet is more representative of actual conditions in the OU.

Ap The State has also expressed its concerns about the long-term effectiveness of STARS treatment. For example, on page 95 of its rewrite of the SSTOU FS, MDEQ states:

> the adequacy and reliability of existing and future ICs and monitoring to maintain the STARS treatment are unknown. . . . Field studies have shown the STARS treatments to be effective over a period of approximately 5 years. Longer-term effectiveness and permanence evaluations are not available. However, based on the scientific principles involved, in situ amendment is expected to be effective at controlling the acidity of the tailings and the phytotoxicity of the amended soils. Issues of concern for long-term effectiveness and permanence include the potential for wide-spread vegetation failure, excessive erosion during bankfull and high flow events and leaching of amendments. Also, no components are included in the approach that could be implemented as a safeguard in the event floods separate the amendment from the source materials.

The MDEQ statement that field studies showing STARS treatments to be effective for approximately 5 years is technically correct. The STARS test plots and Governor's project were constructed in 1989 and 1990, providing approximately 5 years of demonstration of the treatment. However, the MDEQ is ignoring the common application of similar amendment and revegetation technology to reclaim mine tailings and mine waste at other sites. [Footnote: "Kinetic " or "humidity cell tests" were also performed by Andy Davis, Ph.D. on amended tailings/impacted soils from the SSTOU area. These tests are designed to conservatively replicate long-term conditions in the laboratory in a relatively short period of time. The results of this analysis, provided by Titan to Jim Ford under the July 14, 1995 submittal, further support the conclusion that amendments will not be exhausted or leached-out over time.] For example, at a mine site near Cooke City, Montana, revegetation of amended tailings has been established and thriving for over seventeen years. Revegetation of amended acid-generating phytotoxic mine wastes has likewise been demonstrated for long periods of time in the coal mining

Ap With respect to the reference made to Cooke City, Montana, revegetation studies have been conducted by the U.S. Forest Service since the late 1970s. However, it is MDEQ's understanding that vegetation failures occurred on many of the plots amended in the early years of the study due to re-acidification and that the successful duration of lime amended acid materials is much shorter than 17 years.

Regarding neutralization of acid mine wastes in the eastern U.S., there are prominent geochemical and physical differences between coal mine wastes in Appalachia and hard rock mining wastes in Montana. Some of these differences include the type and concentrations of heavy metals, the amounts and types of organic materials present, and the differences in geology and hydrology.

Lastly, our research indicates that the Whitewood Creek, S.D. Superfund site, while containing higher concentrations of arsenic (1,250 mg/kg) and similar concentrations of cadmium (9.4 mg/kg) on average, concentrations of copper, lead, mercury, and zinc (the more critical elements in effects to aquatic systems) are not elevated to the magnitude of Silver Bow Creeks tailings/impacted soils (Hester and Harrison, 1994). In fact, zinc and copper concentrations at Whitewood Creek are within the range considered background. Also, the acid producing potential of the Whitewood Creek wastes is much lower than the acid producing wastes present in the SST OU.

districts of Appalachia. At a Superfund mine tailings site along Whitewood Creek, South Dakota, 20 to 30 million cubic yards of tailings (ten times the volume in the SSTOU) containing concentrations of arsenic, cadmium, mercury, lead, chromium, manganese and iron at levels similar to those in the SSTOU have naturally become revegetated.

Aq At other sites presenting similar geomorphic settings, remedies have been selected favoring in-situ treatment in lieu of costly removals. For example, remediation of all tailings piles at the Idarado Superfund Side in Colorado, including the Society Turn Tailings, a riparian tailings deposit adjacent to the San Miguel River, will be accomplished through direct revegetation utilizing lime and other amendments. At the Bunker Hill site in Idaho, direct revegetation of jig tailings adjacent to the South Fork of the Coeur d'Alene River is the selected remedy in the Smelterville Flats subarea.

Aq Comment noted, although ARCO must recognize that the remedies selected at other Superfund sites, even those with similar contaminants, are chosen in consideration of site specific characteristics and risks associated with the contaminants and the physical and sociological setting of the site.

There are numerous sites with similar contaminant conditions where total removal is taking place. Two such OUs are in the California Gulch Superfund Site (Leadville, Colorado) where the lower California (OU-8) and the Oregon (OU-10) Gulches are removing all waste materials, including all in-stream sediments, within the 500-year floodplain. Preliminary findings from California Gulch aquatic risk assessment (Weston, 1994) indicate that the primary risk and impact to the aquatic ecosystem in these systems result from the presence and transport of soluble inorganic metals and contaminated in-stream sediments during spring runoff and runoff from storm events. A secondary exposure pathway is the leaching of contaminated in-stream sediments and transport of that leachate through surface and ground water. Preliminary conclusions of the Oregon Gulch Ecological Risk Assessment (Weston, 1995) indicate that the in-stream sediments in Oregon Gulch are a source of risk to the aquatic system.

Ar Finally, as noted below, CERCLA's five year review provision establishes a mechanism under which long term effectiveness concerns can be addressed.

g. ARCO's Proposed Remedy Provides Overall Protection of Human Health and Environment. - The overall protection of human health

Ar CERCLA's five year review provision is a primary mechanism with which long-term effectiveness concerns will be addressed. Once again, ARCO's proposed remedy would, unquestionably, not meet the threshold criteria (see response M) and would not sustain a reproducing fishery for trout species.

and the environment criteria assesses how a remedy, as a whole, provides and maintains protection of human health and the environment. This threshold criteria, which uses evaluations from other criteria, must be met by a selected remedy. ARCO's Proposed Remedy clearly meets this threshold criteria.

ARCO's Proposed Remedy will directly address and reduce human and environmental risks posed by the contaminants at the SSTOU by relocation and treatment of tailings near the ground water table in the first three subareas, and by STARS treatment of relocated tailings in the relocation areas and of the other tailings in situ. Relocated tailings (those within 2 feet of the average ground water table) include a significant portion of the tailings near the streambanks. Therefore, the relocation of those tailings and revegetation of the excavated areas in conjunction with the treatment and revegetation of the remaining tailings in situ will reduce input of metals to both ground and surface water acceptable levels. In fact, with ARCO's Proposed Remedy, a restoration goal such as reestablishment of a sustainable, reproducing trout fishery will likely be attained. Additionally, the institutional controls being placed on the lands within the Silver Bow Creek corridor via deed transactions by ARCO will eliminate residential exposures and maintain appropriate land uses required to maintain and preserve the remedy. These measures will result in protection of both human health and the environment.

As h. <u>The Preferred Alternative Does Not Result in the Reduction of Toxicity, Mobility and Volume of the Vast Majority of SSTOU Waste Materials.</u> - The reduction of toxicity, mobility and volume criterion assesses the degree to which a remedy reduces the toxicity, mobility and volume of contamination. As discussed above, assessment under this criterion establishes a key difference between the Preferred Alternative and ARCO's Proposed Remedy. STARS treatment proposed in ARCO's remedy will significantly reduce mobility and phytotoxicity of metal contaminants in the tailings by chemically binding metal contaminants to soil and tailings particles. In contrast, the Proposed Plan merely moves material from its current location in the SSTOU to an off-site repository. No reduction in

Response:

As The remedial action described in this ROD results in the reduction of toxicity, mobility and volume of the SST OU waste materials through treatment of all know OU waste sources.

toxicity, mobility or volume is accomplished by the Preferred Alternative.

At i. The Preferred Alternative Fails to Fulfill the NCP Remedy Selection Criteria. - As noted above, the NCP requires that each remedial action selected must be cost effective, provided that it satisfies threshold criteria (protective of human health and the environment and compliance with ARARs). Cost-effectiveness is determined by evaluating three balancing criteria: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short term effectiveness. This evaluation allows for an assessment of the overall effectiveness of the proposed remedy. Overall effectiveness is then compared to cost to ensure that the remedy is cost effective. Under the NCP, a remedy shall be cost effective if its costs are proportional to its overall effectiveness. 40 C.F.R. § 300.430(f) (1) (ii) (D).

At The agencies agree that cost effectiveness is determined as described here. Cost-effectiveness is to be considered in the manner specified in CERCLA and the NCP. The remedy plan as outlined in the ROD is cost effective.

Au ARCO believes that the Preferred Alternative provides less overall effectiveness than ARCO's Proposed Remedy. ARCO's Proposed Remedy is superior in its ability to reduce the toxicity and mobility of the metals contamination through treatment and because the short-term risks posed by ARCO's Proposed Remedy are far less than those associated with the Proposed Plan. As noted above, the Preferred Alternative will take longer to implement and will put local communities at greater risk and inconvenience due to the substantial earth moving and transportation activities associated with the Preferred Alternative. Moreover, the Preferred Alternative will significantly and negatively impact the improving Silver Bow Creek environment. Removal of a large volume of instream sediments and large volumes of streambank and floodplain soils will eliminate large portions of the existing channel and floodplain, remove existing vegetation and result in release of significant quantities of sediment and erosion during construction and during the period of stream adjustment to the imposed changes. These measures would extend the recovery of the near-stream ecosystem significantly. Thus, ARCO believes that the overall effectiveness of the Preferred Alternative is less than that of ARCO's Proposed Remedy. Given the lack of effectiveness of the Preferred Alternative and that the Preferred

Au The agencies differ with ARCO in its analysis of ARCO's proposed remedy as compared to the Preferred Alternative as set out in the Proposed Plan. However, the final remedial action plan changes certain elements of the remedy, and these changes address some of the concerns raised by ARCO. For example, the final remedial action plan will use treatment as extensively as ARCO's proposed remedy would. Moreover, the final plan will move exposed materials to locations where that treatment will permanently and significantly reduce the toxicity and mobility of the hazardous substances in the tailings, which is the type of treatment that is preferred under CERCLA § 121(b)(1). Since ARCO's estimate of the time frame needed for the preferred alternative was based upon the restraints imposed by transportation resources, the changes in the final remedial action plan which eliminate the need for most of that transportation will reduce the time required for implementation, as well as reduce the risk posed to transportation workers and the affected communities. These changes enhance the short-term effectiveness of the plan.

While the construction of the remedy in the Silver Bow Creek channel will create a significant disturbance of the stream environment, the

Alternative is at least twice the cost of ARCO's Proposed Remedy, the Preferred Alternative cannot be selected as the cost-effective remedy.

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stream currently contains very few receptors that will be adversely affected, and the benefit over the long-term of removing the hazardous materials from the stream environment will greatly exceed the short-term impact. Finally, as noted in the analysis of cost issues, the difference between the costs of the final remedial action plan and ARCO's proposed remedy are completely justified considering that the plan will meet the threshold requirements of CERCLA and the NCP (protectiveness and compliance with ARARs) as well as provide additional benefits in terms of other criteria such as long-term effectiveness and permanence.

Av 3. EPA and the State Are Without Authority to Select an NRD Restoration Action as the Remedial Action for the SSTOU. - CERCLA only provides authority for EPA to select remedial action that is protective of human health and the environment, not that restores natural resources. Restoration, which is residual to remedial action, can only be addressed in a natural resource damages action. Congress carefully distinguished between restoration and remediation. Even if evaluated as a NRD restoration measure, the Preferred Alternative is unnecessary and excessive.

Av Remedial action and restoration under CERCLA do have different goals and objectives, they serve distinct purposes under the statute, and the standards, procedures and criteria applicable to remedial actions differ from those for restoration actions. The final remedial action plan identified in this ROD is based upon the standards and criteria for remedial actions under CERCLA and the NCP using the procedures specified for selection of remedial actions in the NCP. Contrary to ARCO's allegations in these comments, this plan does not overreach the goals and objectives for remedial actions.

In this paragraph and throughout this section, ARCO makes several comments that relate to aspects of the NRD litigation between the state and ARCO or to NRD actions generally. NRD actions are not relevant to the selection of a remedial action here. Consequently, MDEQ is not responding here to the NRD aspect of such comments. For example, in response to the comment, "Even if evaluated as a NRD restoration measure, the Preferred Alternative is unnecessary and excessive," MDEQ is not addressing the evaluation of the preferred alternative as an NRD restoration measure. The lack of such a response is not to be construed in any manner as an admission of such allegations by the State of Montana. The NRD aspect of such comments is simply not relevant to the selection of the final remedial action plan, and a response would serve no purpose here.

Aw a. CERCLA's Definitions of "Environment," "Natural Resources," "Remedial Action," and"Restoration" Clearly Distinguish Remedial

Aw MDEQ agrees that "improvement in water quality such that a fishery would be supported" is an appropriate remedial action objective, and

Actions from Restoration Actions. - Under CERCLA, an action to recover damages for "injury to, destruction of, or loss of natural resources," may only be pursued by a trustee as a natural resource damage action under CERCLA Sections 107(a)(4)(C) and III(b). 42 U.S.C. §§ 9607(A)(4)(C), 9611(b)(2)(B). "Natural resources" are defined to include "land, fish, wildlife, biota, air, water, ground water, drinking water supplies and other such resources" which a government generally owns, controls or manages. 42 U.S.C. § 9601(16).

Natural resource damage assessment regulations promulgated by the Department of the Interior, 43 C.F.R. Part 11 (the "DOI Regulations") define "injury" to include, among other things, any release of concentrations of hazardous substances sufficient to cause wildlife to suffer "death, disease, [or] behavioral abnormalities." 43 C.F.R. § 11.14(v). Thus, an action to recover damages related to rehabilitation of stream habitat and a damaged fishery is a natural resource damages action. See Idaho v. Southern Refrigerated Transport Inc., 1991 WL 22479, *4 (D. Idaho 1991) (damages to be used to improve stream habitat and increase populations of steelhead trout constituted natural resource damages action). Damages can only be recovered for restoration of the services provided by the resource, not the physical, chemical or biological properties of the resource. The Proposed Plan states that "one of the primary objectives for the SSTOU is to support a self-reproducing fishery for trout species." Proposed Plan, p. 5. This clearly is a potential NRD restoration objective which should be addressed in the Montana v. ARCO litigation. The appropriate remedial action objective for the SSTOU is improvement in water quality such that a fishery would be supported. [Footnote: Achievement of this objective is dependent upon improved sewage treatment practices as well as abatement of metals loading to Silver Bow Creek.]

that is one of the objectives of this remedial action. The full statement of the remedial action objective appears in the Proposed Plan and states, "Improve Silver Bow Creek over time to a condition that supports a self-reproducing fishery for trout species." See Proposed Plan, page 7. This objective relates to the quality of the water in the stream and the other hazardous substances in the stream as a result of release of mine tailings and other mining wastes into the stream, including the tailings and metals-contaminated materials that form part of the sediments in the stream. It is a legitimate objective for remedial action. It is appropriate to use trout species as a goal here because tributaries of Silver Bow Creek include trout species, and these species can be considered likely environmental receptors of the hazardous substances in the stream. In addition, tailings and metals in the in-stream sediments pose a threat to other environmental receptors in the stream including the biota that live in the sediments. Thus, this objective necessarily relates not only to the quality of the water in the stream, but also to the other environmental media that pose a threat to environmental receptors.

The sewage treatment discharge to Silver Bow Creek is a point source upstream of the SST OU, and that point source is to be addressed under other authorities, although this plan expressly allows coordination with actions that will address the quality of that discharge.

Ax In contrast to natural resource damages restoration, section 121(b) of CERCLA authorizes EPA to select a "remedial action" which "is protective of human health and the environment." 42 U.S.C. § 9621(b). The objective of the Superfund remedial program as characterized by EPA guidance is to select remedies that provide

Ax The definition of "remedial action" goes on beyond that portion quoted by ARCO to provide, "The term includes, but is not limited to, such actions at the location of the release as ... cleanup of released hazardous substances and associated contaminated materials," and specifies "dredging or excavation" as among the activities included reliable, effective protection over the long term. Indeed, CERCLA defines "remedial action" as an action "to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment." This objective is accomplished through selection of a remedy which protects the public and environmental receptors by reducing risk posed by exposure to hazardous substances to acceptable levels. 40 C.F.R. § 300.430(e)(2).

within the scope of the term. "Cleanup of the released hazardous substances and associated contaminated materials," including "excavation" of some of these materials, is precisely what is specified in this remedial action plan. It is just such "cleanup," specifically, removing the contaminated materials from the stream (contaminated in-stream sediments) and from locations where they will continue to contaminate the stream (removal of tailings from the floodplain) to which ARCO objects. However, such actions cannot, as ARCO suggests, be considered beyond the scope of "remedial action," when they are expressly included in the definition.

Ay In assessing the reach of EPA's remedial authorities under CERCLA, the definition of "environment" is critical. "Environment" is defined as the media in which a natural resource exists, including "surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air" within the jurisdiction of the United States. 42 U.S.C. § 9601(8). Significantly, "environment" does not encompass the natural resources themselves, but merely the surrounding media. A host of actions may be employed to reduce risk to acceptable levels under the rubric of "remedial action." Such actions may include "confinement," "perimeter protection," and "neutralization." 42 U.S.C. § 9601(24). Furthermore, the NCP explicitly authorizes and sets forth the expectation that institutional controls may supplement engineering controls as a management tool to prevent or limit exposure to site contaminants. 40 C.F.R. § 300.430(a)(1)(iii)(D). Nowhere does CERCLA include within the definitions of "environment" or "remedial action" an action to enhance or restore natural resources.

Ay ARCO cannot isolate the environmental receptors, the various forms of life that are harmed by the contamination, from the environment in this fashion. "Protection of the environment" must be considered to include protection of the condition of the "surface water, ground water, ... surface or subsurface strata or ambient air" such that the wildlife, fish, biota and other receptors that are dependent on that water, strata, or air are also protected. The evaluation of environmental risk under EPA guidance properly includes such considerations. Finally, this action is not one to enhance or restore resources, but simply to clean up the hazardous substances that were released into the environment by ARCO and its predecessors.

Az The inclusion of a specific cause of action for recovery of natural resource damages by a trustee ensures that a potentially responsible party shall have the opportunity to defend a claim for monetary damages. The State and EPA's decision to seek restoration of natural resources for the SSTOU through the remedial action authorities provided under Section 121(b) is a blatant attempt to circumvent the jurisdiction of the federal courts to hear a trustee's claim for damages. The Agencies' election to pursue what the State perceives is necessary to restore natural resources at the SSTOU in the guise

Az Neither MDEQ nor EPA is seeking "monetary damages" in connection with the issuance of this remedial action plan. The agencies' selection of the remedy here is not to "restore natural resources," but rather to protect human health and the environment and to meet the other criteria for selection of a remedial action under CERCLA and the NCP.

of remedial action is arbitrary and capricious, and contrary to the requirements of CERCLA.

Aaa b. Case Law - The federal courts have carefully distinguished between an action to recover natural resource damages and the scope of permissible remedial action. See, e.g., Ohio v. Department of the Interior, 880 F.2d 432, 439 (D.C. Cir. 1989) (actions to restore natural resources "go beyond the mere removal or remedying of spills."). Indeed, the courts have consistently rejected attempts by plaintiffs to circumvent the limitations of a natural resource action by characterizing restoration as mere "remedial action." For instance, in Artesian Water Co. v. New Castle County, 643 (3rd Cir. 1988), a release of hazardous substances from a county-run landfill threatened to contaminate an aquifer used by the plaintiff. Although the county contained the contamination by pumping the contaminated groundwater, the plaintiff sued the county, alleging that the pumping lowered the aquifer, thereby causing the plaintiff to lose a potential future water source. According to the plaintiff, restoring the aquifer to its previous levels or locating an alternative water supply constituted a "remedial action" under CERCLA, for which the county was liable under CERCLA section 107(a)(4)(B). The district court rejected the plaintiff's argument and dismissed the plaintiff's claim, holding that an action to restore the aquifer's prior levels was a claim for natural resource damages, not a "remedial action." Artesian Water Co., 659 F. Supp. 1269, 1288 (D. Del 1987). On appeal, the Third Circuit affirmed the lower court. Artesian Water Co., 851 F.2d at 651. The Third Circuit acknowledged that "it may be true" that remedial and restoration actions "occasionally may overlap," if restoration of a natural resource is somehow necessary to prevent an imminent threat to human health. However, the court held that since the contamination from the landfill was not found to threaten human health, restoring the aquifer was not a "remedial action," but a natural resource damages action. 851 F.2d at 650.

Aaa In the Artesian Water case, the Third Circuit Court of Appeals did find that the claim being asserted by the plaintiff water company was a natural resource damage claim, not a remedial action. This follows simply from the fact that the plaintiff was seeking compensation for lost use of a resource. The plaintiff had no remedial action costs to assert in that case, because the remedial action had been performed entirely by someone else. Moreover, the court denied the plaintiff's claim because it held that only the state, and not the plaintiff, could assert a claim for natural resource damages in that case. The case did not address any type of limitation on the scope of remedial action, and the case does not establish the proposition ARCO claims. In the next to last sentence in this paragraph, ARCO's qualification "if restoration of a natural resource is somehow necessary to prevent an imminent threat to human health," is ARCO's embellishment on the holding, and is not in the court's analysis. ARCO tries to create an argument here that does not exist under the statute.

ARCO's argument that, because the state can recover damages for the lost use of the resource, the state cannot require the cleanup of the resource under CERCLA, stands CERCLA on its head. CERCLA provides for the selection and implementation of remedial actions that meet the cleanup criteria specified in CERCLA and the NCP. The damages to be collected for the loss of use of the damaged resources are residual. They begin where the remedial action leaves off. However, they do not define or control the selection of the remedial action. A responsible party is not prejudiced by this statutory scheme under CERCLA. To the extent the remedial action "restores" the resource, the damages for restoration of the resource are reduced. The additional right to collect damages in order to fully restore the resource cannot be regarded, as ARCO suggests, as a limitation on the primary right to require remedial action which effectively addresses the contamination.

Aab The court further noted that Congress intended natural resource actions to have important limitations, such as very limited retroactive

Aab There are certain limitations that apply to natural resource damage actions under the statute, which it must be noted do not apply to application, to limit the potential for creating "staggering claims" against defendants. 851 F.2d at 651. Permitting an action for natural resource damages to be brought as a"remedial action" would frustrate this express Congressional intent. [Footnote: Similarly, in Lutz v. Chromotex Inc., 718 F. Supp. 413, 419 (M.D. Penn. 1989), the court rejected a private party's attempt to characterize lost use of certain contaminated wells as "remedial damages," instead finding that the wells were a natural resource and thus claims to recover for their loss may only be brought by a government trustee as a natural resources action.]

remedial actions. ARCO attempts here to have these limitations applied to the selection of the remedial action for the site.

Aac These cases interpreting CERCLA's distinction between restoration and remediation clearly demonstrate that the courts have rejected attempts to disguise restoration actions as remedial actions as being contrary to the explicit separation between remedial and restoration actions established in CERCLA. As described below, given this explicit statutory bifurcation of restoration and remediation, ARCO believes that the State's attempt to disguise SSTOU restoration as remediation clearly violates CERCLA.

Aac The cases cited demonstrate only that a private party cannot assert a claim for natural resource damages. They have nothing to do with the limitations on the scope of legitimate remedial actions by the government. CERCLA itself establishes those limitations by specifying the criteria that are to be used in selecting a remedial action. The agencies' selection of the remedial action here complies with CERCLA and the NCP. The analysis on which it is based is fully set out in this ROD, and it has been arrived at through an open public process. It does not "disguise" anything.

Aad As noted above, the State and EPA admit that one of their "primary objectives" in selecting the Preferred Alternative was "to support a self-reproducing fishery for trout species." Proposed Plan, pp. 5, 7 (June 1995). Indeed, the State and EPA rejected alternatives which left in-stream sediment in place because it "would prevent attainment of the goal of establishing a self reproducing trout fishery for decades, until natural processes could flush all contaminated sediments from the OU and into the Warm Springs Ponds." Proposed Plan, p. 12.

Aad As noted above, the full statement of the remedial action objective appears in the Proposed Plan and states, "Improve Silver Bow Creek over time to a condition that supports a self-reproducing fishery for trout species." See Proposed Plan, page 7. The Baseline Ecological Risk Assessment demonstrated that the in-stream contaminated sediment posed a risk to aquatic life.

ARCO is being somewhat disingenuous in objecting in this fashion to the identification of this objective for Silver Bow Creek. ARCO has previously acknowledged such objectives as legitimate remedial action objectives. For example, in its September 1993 ARARs Scoping Document, ARCO noted, "Response actions for the SSTOU must be consistent with the objective of achieving the surface water goals, including the recovery of aquatic life, for Silver Bow Creek." (Scoping Document, Executive Summary, p. 1). Later in the document ARCO again observed, "The response actions implemented at SSTOU must also promote the reestablishment of aquatic resources in Silver Bow Creek." (Scoping Document, Executive Summary, p. 2).

Aae The goal of establishing a self-reproducing trout fishery clearly is a restoration objective, not a remedial action objective. Remedial actions are intended to abate an existing or potential risk associated with the release of a hazardous substance. In contrast, restoration actions rehabilitate or improve habitat and other resource services. Remedial actions may, as a practical matter, accomplish many or all of the goals of restoration but EPA and the State may not purposefully ignore the NCP criteria and select a remedial alternative in order to attain these restoration goals.

Aae ARCO cannot defeat the selection of a legitimate remedial action simply by labelling it something it is not. The objectives identified for the remedial action are legitimate, and the action was selected in accordance with the procedures and criteria for selection of remedial actions under CERCLA and the NCP.

Aaf Despite this statutory distinction, the State and EPA make a futile attempt to characterize this proposed fishery restoration as a remedial action. While admitting that the objectives of the Preferred Alternative "are similar" to those of its restoration plan, they argue that the Preferred Alternative "is not intended to and will not restore natural resources in and along Silver Bow Creek." Proposed Plan at 22. ARCO believes that the State's and EPA's position on this matter is totally specious and without merit. The Preferred Alternative presented in the Proposed Plan is remarkably similar to Alternative 4A described in the Restoration Determination Plan published by the Natural Resource Damage Program.

Aaf As was noted in the Proposed Plan (page 22), the restoration plan identified by the State's Natural Resource Damage Litigation Program was significantly more extensive than the Proposed Plan. The restoration plan will seek to restore fish and wildlife habitat and populations to baseline conditions. The remedial action plan only seeks to remediate the environmental contamination to a protective level that will not pose a threat to the expected human and environmental receptors. Moreover, since this remedial action plan will leave more contaminated areas within the operable unit than the Proposed Plan would have, residuals associated with the final remedy will leave even more to be addressed in the restoration plan.

Aag As the pertinent statutory language, legislative history, regulations and case law plainly demonstrate, whether an action is a "remedial action" or a plan to "restore" a "natural resource" depends on the nature and purpose of the action. Any action designed to restore or support wildlife is a natural resource action. [Footnote: Moreover, contrary to the State's and EPA's suggestion, full "restoration" of a natural resource is not required for a selected action to be considered a natural resources action. See Ohio v. Department of the Interior, 880 F.2d 432, 444 (in deciding measure of natural resource damages, "[s]cholars agree that recovery of full restoration cost in every case . . . is not required by CERCLA.")] Only if the action is designed to protect "human health or the environment" from existing or potential risk will it be deemed a "remedial action." Here, the

Aag The "nature and purpose" of the remedial action plan is to protect human health and the environment, that is, to remediate the contamination to a level of protectiveness that will not pose a threat to human or environmental receptors. It is not to restore natural resources in the area to baseline conditions, which is the nature and purpose of a restoration action.

In discussing risks here, ARCO discusses only the risks to humans. CERCLA also provides for protection of "the environment." ARCO's attempt to characterize any efforts to address environmental risks, as opposed to human risks, as a natural resource damage action is misguided and ignores CERCLA's provisions for protecting "human health and the environment." In connection with the Remedial express purpose of the Preferred Alternative in requiring substantial soil and sediment removal and disposal is to rehabilitate a fishery, not to protect human health or the environment. As the SSTOU baseline risk assessment makes clear, the risks associated with the SSTOU have been conservatively calculated and are limited. Risks exceed the acceptable range only in the event of long-term residential exposure to tailings and for recreational exposures to railroad materials consisting of concentrate spills. ARCO has and continues to purchase significant property areas along Silver Bow Creek and will, through permanent deed restrictions (institutional controls), prevent the residential use of the floodplain and other near-stream areas. Additionally, the calculation of recreational risk due to exposure to railroad materials is very conservative in that it assumes that the concentration of metals in railroad materials includes significant quantities of ore concentrate materials. In fact, only 1.4 cubic yards of ore concentrate materials were identified in the Remedial Investigation through extensive mapping and site reconnaissance. These materials do not constitute a significant risk to individuals recreating in the Silver Bow Creek corridor. Thus, the Preferred Alternative identified in the Proposed Plan is, if anything, an inappropriate natural resources restoration alternative, not a remedial action necessary to reduce potential risk to human health and the environment.

In short, like the plaintiffs in Artesian Water Co. and Lutz, the State and EPA cannot simply circumvent the limitations inherent in a natural resources action merely by characterizing it as a "remedial action." The proper forum for resolution of such a claim for natural resource damages is in Montana v. ARCO.

Investigation/Feasibility Study the agencies also conducted an ecological risk assessment. This assessment, although more qualitative than the human health risk assessment, clearly identified the adverse impacts from mining wastes along and in Silver Bow Creek as a threat to environmental receptors. The ecological risk assessment is discussed more fully in Section VI of the ROD.

ARCO has repeatedly stated the intent of purchasing land adjacent to the OU but fails to recognize that there are a significant number of people who reside adjacent to the OU.

Aah The State's attempt to circumvent CERCLA is most clearly illustrated by the role which the State Natural Resources Damages Program ("NRDP") has played in the development of the "remediation" strategy presented in the Proposed Plan. As described in the Restoration Determination Plan (January 1995) published by the NRDP, it is the State's position for purposes of the NRD litigation that restoration to baseline in the Silver Bow Creek riparian corridor requires wholesale removal of tailings from the environment. Through its ridicule of

Aah ARCO was involved in the development and evaluation of alternatives for this remedial action through the conduct of an RI/FS under an administrative order on consent issued by the State. This process was provided in accordance with the provisions of CERCLA and the NCP. Similarly, CERCLA and the NCP provide a role for and a measure of coordination and consultation with the trustees for natural resources, including both federal and state trustees. The NCP provides for cooperation between the trustees and the lead agency

STARS and, ultimately, selection of a remedy which implements its restoration position, the State is attempting to ignore or circumvent the statutory and NCP requirements relevant to remedy selection. In so doing, the State also hopes to insulate its flawed evaluation of baseline and restoration opinions from judicial review in the NRD litigation.

"in coordinating assessments, investigations and planning," and also allows trustees to, among other things, request "that the lead agency remove, or arrange for the removal of, or provide for remedial action with respect to, any hazardous substances from a contaminated medium pursuant to section 104 of CERCLA." 40 CFR § 300.615(c)(2) and (e)(2). Consultation with the State's Natural Resource Damage Program, on behalf of the state trustee, including allowing them to present their views on the effectiveness of proposed alternatives, which they had independently evaluated, was thus not only proper, but expressly provided for in the NCP.

Aai The NRDP initiated efforts to undermine the credibility of the STARS program no later than January 1994. Documents obtained by ARCO through discovery and administrative record review reveal a concerted effort directed toward selection of a remedy for the SSTOU which mirrors the State's restoration Alternative 4A for Silver Bow Creek. Furthermore, it is evident from review of the documents that the NRDP sought to and did exclude ARCO and the public from participation in the "debate" concerning STARS which it precipitated. These documents are described in these comments and collectively submitted as Exhibit 4 to these comments for inclusion in the SSTOU administrative record.

Aai The agencies made an independent determination of the efficacy of STARS, but in so doing, it was appropriate to listen to evaluations of the technology from all parties which had expertise to offer. ARCO certainly had input into this process, through its development of the RI/FS. It cannot begrudge the agencies giving other parties the opportunity to present their views.

Aaj In January 1994, NRDP requested RCG/Haigler Bailly, its litigation consultant, to review available data from the STARS program. The consultant responded that the data were inconclusive and that kinetic tests were appropriate to evaluate the long term effectiveness of liming on both pore water chemistry and the long term acid generation potential of the tailings. [Footnote: Memorandum from Ann Maest, RCG/Haigler Bailly, Inc. to Mark Kerr, NRDP dated January 21, 1994. When ARCO became aware of this recommendation, kinetic tests (humidity cells) were performed on amended tailings. The results of these tests support ARCO's belief that neutralizing effects of the lime treatment is permanent. <u>See</u> Section III.A.2.f. of these Comments.]

Aaj With regard to the humidity cell tests referenced in the comment, Dr. Ann Maest (1995) reviewed the humidity cell tests of Davis and found that Davis' conclusions were "highly suspect." Maest identified numerous problems in analytical methods used, data interpretation, and sampling design. Davis' own unreported data show that "a substantial amount of copper is leaching from the 12-15 inch depth and from the buried A horizon sample (15-20 inches)" (Maest, 1995). Although the ability of STARS to permanently neutralize SST OU tailings is suspect, Davis' data undoubtedly demonstrate that copper continued to leach in his humidity cell test.

Regarding ARCO's insinuations that the NRD Program unduely influenced MDEQ's analysis and interpretation of the effectiveness of STARS or the selection of the Preferred Alternative or the final

Thereafter, NRDP with the support of its consultants developed a STARS Issues Paper which was the focal point of further discussion with MDEQ and the Reclamation Research Unit from MSU. Various drafts of the issues paper were produced, culminating in the distribution of a final document in October 1994. [Footnote: Correspondence between NRDP and its consultants, including drafts of the STARs Issues Paper, are contained in the following documents: Memorandum to Ann Maest, RCG Haigler/Bailly, Inc. from Mark Kerr and Greg Mullen, dated July 25, 1994, re: STARs discussion issues; Memorandum to Mark Kerr and Greg Mullen from Ann Maest, dated August 15, 1994, re: Comments on STARs Discussion Issues; Memorandum to Jim Gannon, University of Montana, Larry Kapustka, SP&T, Ann Maest RCG Haigler Bailly, Inc., Johnnie Moore, University of Montana and Kirk Nordstrom, USGS, dated September 22, 1994 from Mark Kerr and Greg Mullen, re: STARs discussion issues; Memorandum to Jim Gannon, University of Montana, Larry Kapustka, SP&T, Ann Maest RCG Haigler Bailly, Inc., Johnnie Moore, University of Montana and Kirk Nordstrom, USGS, dated October 3, 1994 from Mark Kerr and Greg Mullen, re: STARs discussion issues.] In providing the NRDP position paper to MDEQ, Charles McGraw, Assistant Attorney General and a member of the NRDP, admonished Neil Marsh:

> [T]his document should receive limited distribution, targeted to specific consultants and federal and State regulatory personnel. A public debate on STARS at this point in time would not, we believe, be productive. [Footnote: Letter to Neil Marsh, Superfund, from Charles McGraw dated October 7, 1995, transmitting the STARs Issues Paper, State of Montana Department of Justice Natural Resource Damage Litigation Program, dated October 1994.]

The State's decision to carry on a internal debate outside the purview of the public regarding the merits of a remedial action technology under review as part of the SSTOU Feasibility Study was contrary to the intent and express requirements of the NCP and relevant RI/FS guidance. In any event, the responses to NRDP criticisms from MDEQ and, in particular, MSU faculty members from the Reclamation

remedy, please refer to Responses Aai, Aah, Av, and L above. With regard to MDEQ's position on the use of STARS technologies in the floodplain, please refer to Responses An and Al. With regard to Dr. Daryl Simons and other analyses concerning the geomorphic stability of Silver Bow Creek, please refer to Response Ak.

Research Unit, dismissed the NRDP arguments related to the permanence and effectiveness of STARS. [Footnote: Additional technical work undertaken by ARCO has been provided to the State which further supports the permanence and effectiveness of STARS. This work includes the examination of nitrogen recycling and microbial development on revegetated soils reported by Professor Edward Redente, Ph.D. Andy Davis, Ph.D prepared an analysis of the geochemical processes inhibiting the availability of metals to plants and infiltration to groundwater. These materials were transmitted to Jim Ford of MDEQ by letter dated July 14, 1995 by Titan. These materials are incorporated by reference and made part of ARCO s comments on the Proposed Plan for inclusion in the administrative record.]

It is apparent that the NRDP efforts over the past year were not intended to spur an open and frank debate of the technical merits of the STARS program or its practical application, revegetation of tailings surfaces along Silver Bow Creek and most significantly, the Governor's Project area. NRDP has instead lobbied MDEQ to reject STARS and support a remedy which mirrors its litigation position on restoration. MDEQ apparently was not initially convinced by the NRDP arguments as evidenced by Mark Kerr's summary of Neil Marsh's reaction to the STARS Issues Paper. [Footnote: Memorandum to Jim Gannon, et al., from Mark Kerr dated November 2, 1994 regarding Superfund Response to STARS Issues Paper.] The fact that NRDP carried this preconceived position and agenda regarding the merits of the STARS program into its meetings with the MSU Reclamation Research Unit is further evident in the comments of MSU which were relayed to Neil Marsh by letter dated February 15, 1995. Referring to the meeting to which NRDP, MSU faculty and regulatory personnel were invited (and ARCO and the public were not), the Reclamation Research Unit Staff noted:

> We feel the meeting failed in its purpose of providing a free and open discussion of the STARS remedial alternative because it was agenda driven by, and restricted to issues exclusively put forth by the Natural Resource Damage Program. . . . Perhaps

the meeting was doomed to failure because of the NRDP's historical attempts to discredit the STARS study as demonstrated in their documents including their STARS Issues Paper and their Restoration Determination Plan.

NRDP's efforts to influence remedy selection continue. Just prior to release of the Proposed Plan in June 1995, NRDP provided copies of the expert reports prepared for the NRD litigation to Don Peoples of MERDI. [Footnote: Letter from Mark Kerr, NRDP to Don Peoples, MERDI, dated May 31, 1995.] The correspondence is replete with references to the State' s litigation position that application of STARS treatment in floodplain soils is inconsistent with and contrary to the restoration concepts for the Silver Bow Creek riparian corridor described in the Restoration Determination Plan formulated by the State.

Together these documents reveal a concerted effort by the NRDP to discredit STARS and mold the SSTOU proposed remedy to fit the State's restoration position in the NRD litigation. The NRDP coerced MDEQ to reject broader application of STARS treatment in the floodplain despite its demonstrated success in the Governor's Project area and along Silver Bow Creek. While the Proposed Plan purports to evaluate the FS alternatives under the NCP criteria for selection of a remedial action, in-situ treatment within the 100 year floodplain is limited to a portion of Subarea 4 where less than 50% of the tailings would be treated in place. (Proposed Plan, p. 14-15.)

In addition to criticisms regarding the permanence and effectiveness of STARS treatment, the Preferred Alternative also limits use of STARS in the floodplain based upon the undemonstrated concern that treated tailings may be eroded and re-entrained into Silver Bow Creek through normal stream processes or major flood events. The extent to which normal stream processes or major flood events will cause erosion and the effects of re-entrained tailings upon water quality and biota have never been quantified by the State. As discussed in the attached report prepared by Dr. Daryl Simons (Exhibit 3) and other analyses prepared during the FS, the Silver Bow

Creek system is a stable system and broad modification of the present stream configuration as a result of flood events having a 100 year occurrence interval or less is not probable.

Aak 4. <u>The Evolving Preference for Containment Remedies Supports ARCO's Remedy Which Contains and Treats Tailings in Place.</u> - Recent Congressional attempts to amend CERCLA and Administration attempts to change CERCLA evince an evolving preference for remedies that contain or treat on-site. For example, Senate Bill 1834 removed the general preference for treatment in favor of even greater preference for onsite containment of hazardous substances. A Senate Report concerning the Senate bill provided:

> Also problematic is CERCLA's statutory preference for treating, as opposed to containing, contaminated material. In some cases this approach may be overly conservative, requiring remedial actions beyond what is necessary to ensure the protection of human health and the environment over the long term.

S. Rep. NG. 349. As a result, EPA itself proposed several changes to the legislative language of CERCLA's remedy selection process, including eliminating the preference for treatment over containment in all areas but "hot spots":

> Section 502 of the bill amends CERCLA section 121(b) with respect to the general rules and procedures applicable to remedy selection. This section makes several major changes to the remedy selection process. First, it narrows the preference for treatment to only "hot spot"

<u>Id.</u> (Title V, Introduction); "EPA Proposed Legislative Language on Reform of CERCLA Remedy Selection," 24 Env't Rep. (BNA) 1407 (May 11, 1994). Moreover, proposed amendments to section 121 provided that containment may even be used for hot spots if the site is a "mining site":

Aak ARCO counsel certainly understand that proposed legislation does not constitute the law of the land until it is enacted into law. The legislation referred to by ARCO here died in the last few days of the last Congress without being enacted into law. The selection of the remedy here must be based on <u>current</u>, <u>existing</u> law, and the selection of this remedy is based on the criteria set out in CERCLA and the NCP.

The danger of relying on proposed legislation is that every advocate can find some proposal that supports their position. Even in this case ARCO notes only those portions of SB 1834 that support its position, and ARCO carefully omits those sentences in the same section of the bill that would support the remedy selected here. As ARCO notes, the high volume or large area hot spots referred to in Section 502(iv)(II) of the bill were intended to include the type of tailings deposits found along Silver Bow Creek. ARCO's quote of section (iv) on "Final Containment Remedy" stops one sentence short of the provision specifically addressing this remedy. The rest of that section in Senate Bill 1834, as set out in the referenced committee report, provided:

> With respect to a hot spot described in subclause (II), the President may require, pursuant to subparagraph (A), the <u>removal of the hot spot to an appropriate location where necessary to ensure reliable containment of the hot spot, including the removal of the hot spot from a flood plain.</u> (Emphasis added.)

Thus the very next sentence in the bill recognized the need to ensure that a containment remedy for mining wastes such as those involved here must be in an appropriate location, and where the mining waste is in the floodplain it is appropriate to move that material to an appropriate location outside the floodplain to ensure reliable

(iv) Final containment remedy.-The President may select a final containment remedy for a hot spot at a landfill, mining site, or similar facility under each of the following circumstances:

(I) Small hot spots.-The hot spot is small relative to the overall volume of waste or contamination being addressed, the hot spots is not readily identifiable and accessible, and without the presence of the hot spot containment would have been selected as the appropriate remedy under subparagraph (A) for the larger body of waste or area of contamination in which the hot spot is located.

(II) High volume or large area hot spots.-The volume and areal extent of the hot spot is extraordinary compared to other facilities listed on the National Priorities List, and it is highly unlikely due to the size and other characteristics of the hot spot that any treatment technology will be developed that could be implemented at reasonable cost.

Id. at § 502.

containment. Similarly, the committee report from which ARCO quotes (Senate Report No. 103-349, p. 87) provides:

> Containment could consist of engineering or other controls to contain contamination in place where it is located. The bill makes it clear, however, that in some cases, containment could consist of relocation of all or part of the material in an appropriate repository. Consideration of containment as a final remedy is not limited to containment in place. There may be a significant enhancement of protectiveness by relocating the hot spot to an appropriate repository. For example, if the hot spot is located in a floodplain of a stream or river, or where the hot spot may pose a threat to groundwater, the appropriate containment remedy may involve the movement of such hot spot to a secure repository in another location. (Emphasis added.)

Of course, this draft legislation does not serve to justify the selection of the remedy here, since it is not law. This analysis is provided solely to explain that ARCO's argument here relies on taking portions of the legislation out of context rather than providing a fair view of the bill as a whole.

Aal Additionally, the proposed amendments to section 121 require explicit consideration of land use in remedy selection. This requires the Administrator to consider the future potential uses of the site, thereby lowering the required level of clean-up for all but proposed residential areas. Id. As noted above, the SSTOU is unlikely to receive residential use in the future.

Aal The remedial action plan identified by the agencies here will rely on institutional controls, if they can be appropriately implemented, to establish a land use plan consisting primarily of recreational land use. The agencies have made a reasonable determination that recreational use is the likely future land use in the area because there are numerous people who presently reside adjacent to the OU.

Aam Finally, recent hearings held by the 104th Congress support this preference for containment. For instance, at a hearing convened on April 5, 1995, by the Senate Subcommittee on Superfund, the subcommittee's chair, Sen. Robert Smith (R-N.H.) was reported to state that "[c]ontainment should be used at Superfund sites that do not pose immediate risks to human health so funds can be diverted

Aam Statements made at Congressional hearings do not constitute the law of the land, and the agencies are bound to make their remedy selection decisions based on the law, as EPA and the State have done here.

to sites posing the highest risks." See "Superfund: Containment Eyed to Allow Shift of Resources to High-Risk Sites," Hazardous Waste News, Vol. 17 (April 10, 1995). In response, EPA's Assistant Administrator for Solid Waste and Emergency Response, Elliott Laws, was reported to state that "EPA would support removing the preference for treatment, making cleanup remedies and standards more flexible and moving containment higher up on the list of cleanup options." Id.

Aan IV. Prior Comments - The following documents have previously been submitted to MDEQ and EPA and supplement these comments. These documents are part of the SSTOU Administrative Record and are incorporated herein by reference:

ARCO's "Institutional Controls Planning Document for the Streamside Tailings Operable Unit," June 18, 1992;

ARCO's "Streamside Tailings Operable Unit Remedial Investigation/Feasibility Study (RI/FS) Scoping Document Applicable or relevant and Appropriate Requirements Under Section 121(d) of CERCLA (ARARs)," September 1993;

Letter from Charles T. Stilwell to Neil Marsh submitting attached statement of disclaimer to Final Preliminary Remedial Action Objectives/Treatment Technology Scoping Document, July 20, 1993;

"Attachment A, Summary of Issues for Disclaimer Draft Remedial Investigation Report Streamside Tailings Operable Unit," January 6, 1995;

Letter from Charles T. Stilwell to Neil Marsh discussing goals of Silver Bow Creek/Streamside Tailings Demonstration Projects I and II and transmitting summaries of each, July 18, 1992;

Aan To the extent certain of these documents have been incorporated by reference in the substantive comments provided by ARCO, they have been considered by the agencies and addressed along with those comments. Those not referenced in the substantive comments are viewed by the agencies as being incorporated by ARCO for purposes of establishing a record. These documents have been considered by the agencies throughout the RI/FS process and have generally been discussed with ARCO or responded to as they were submitted, but are not separately addressed here.

Letter from Charles T. Stilwell to Neil Marsh transmitting second draft of monitoring plans and responding to MDHES comments on general issues relating to SBC demonstration projects, March 11, 1993;

Letter from Charles T. Stilwell to Neil Marsh transmitting and commenting on Demonstration Project I Streamside Tailings Treatability Study Monitoring Plan, September 29, 1993;

ARCO's "Response to MDHES Comments on the Silver Bow Creek Remediation Demonstration Project I Monitoring Plan," September 29, 1993;

Letter from Charles T. Stilwell to Neil Marsh transmitting ARCO's comments on STARS Phase III Draft Final Report, June 9, 1993;

Letter from Charles T. Stilwell to Neil Marsh transmitting ARCO's review comments on STARS Phase III Draft Final Report, June 16, 1993.

ARCO's "Comments on the Streamside Tailings Operable Unit Draft Ecological Risk Assessment," April 10, 1995:

ARCO's "Preliminary Comments on the Streamside Tailings Operable Unit Human Health Draft Baseline Risk Assessment," April 10, 1995: and

ARCO's "RI Data Issues Common Between Ecological Risk and Health Risk Assessment," April 10, 1995.

Aao V. - Conclusion - The preceding discussion demonstrates that selection of the State's Preferred Alternative as the remedy for the SSTOU would be arbitrary and capricious, not in accordance with

Aao The responses set out here, together with the analysis contained in this Record of Decision, demonstrate why ARCO's proposed remedy would not meet the criteria for selection of remedies under CERCLA law, inconsistent with the NCP and contrary to CERCLA. The Preferred Alternative would have serious adverse impacts on the established and improving ecosystem in Silver Bow Creek. In contrast, ARCO's Proposed Remedy is better suited as a remedy for the SSTOU, satisfies the statutory and regulatory requirements for remedial actions specified in CERCLA and the NCP and is supported by the public. For these reasons, the State and EPA should withdraw the Preferred Alternative set forth in the Proposed Plan and select ARCO's Proposed Remedy for the SSTOU.

and the NCP and why the remedial action plan specified by MDEQ and EPA does meet those criteria. ARCO's characterization of the ecosystem in Silver Bow Creek as "established and improving" is an example of ARCO's consistent denial of the need for effective remedial action in this operable unit. Such a characterization cannot be taken seriously when the stream is so adversely affected by metals contamination that it is absolutely devoid of fish and most other aquatic life. The actions identified by the agencies will remediate the contamination to reduce the threat to human health and the environment posed by the metals contamination caused by years of disposal of mining wastes in and near the stream by ARCO and its predecessors.

After consideration of these and all the other comments submitted, the agencies have determined that certain changes in the remedial action plan could make the remedy more cost effective and still provide an acceptable level of protection. Changes incorporated include several that were proposed by ARCO in these comments. With these changes, the agencies have determined that the remedial action plan identified in this Record of Decision is the appropriate plan for this operable unit.

APPENDIX D-4
Comments Received on the Preliminary Remedial Action Objectives Report

On July 16,1993, ARCO submitted the Remedial Action Objectives Report/Treatment Technology Scoping Document (RAOR/TTSD) with the revisions that were required by the Montana Department of Health and Environmental Sciences' (MDHES) as presented in a letter from Mr. Neil Marsh to Mr. Charles Stilwell of ARCO dated June 11, 1993. These revisions to the RAOR/TTSD were made at the direction of the MDHES and as required by the Administrative Order on Consent (AOC), Docket No. SF-91-0001. ARCO does not agree and has significant concerns with some of the required changes. As provided for in the AOC, this text presents the changes in which ARCO disagrees and the basis of ARCO's concerns.

GENERAL CONCERNS

The MDHES wrote Section 2.0 of the text to be inserted verbatim in the text. ARCO has several general concerns with the entire section.

A 1. Inappropriately Restrictive Language - Throughout the text, and particularly in Section 2.0 as re-written by the MDHES, overly restrictive, categorical language is employed in contexts where it may not be appropriate. Examples of this are listed here, with the language that ARCO finds acceptable for comparison.

Restrictive	Realistic
Will	Is intended to
Must	Should
Prevent	Limit to the extent possible
Will be	May occur
Eliminate	Limit to the extent possible

40 CFR Part 300.430(a)(1)(i) states that "The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste." In accord with this stated national program goal, the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA, 1988) defines RAOs as "goals for protecting human health and the environment." The overly restrictive, categorical language used by the

A MDEQ disagrees that it has used overly restrictive, categorical language. We believe strongly that the cleanup goals at this site should be definite, specific goals that can be numerically defined if possible. We want a clearly identified yardstick by which to measure and evaluate the various cleanup options. To lower our cleanup goals by stating them too vaguely at the outset would have made it difficult to conduct the feasibility study, and would have allowed for not considering thoroughly full cleanup options. MDEQ notes that the NCP requires that EPA select remedies that are protective of human health and the environment, not ones that "are intended to" or "may" be protective, which is the language that ARCO suggests be used.

In Sections 2.2, 2.3, and 2.4 ARCO recommends replacing language that says exposure to contaminants is through pathways with language stating that exposure "may occur" through pathways. MDEQ believes that, for the most part, the exposures listed are well documented. MDEQ does not assume that risk from those exposures is significant; that determination is made in the Draft Baseline Risk Assessment. For many exposures, such as exposure of aquatic organisms to contaminants in surface water and bed

MDHES in drafting the revisions to the document, such as "prevent" and "eliminate", are absolutes and represent objectives in excess of that which is required by the NCP and/or obtainable at the SST OU.

Examples of the language that this disclaimer pertains to include, but are not limited to Section 2.2.3 paragraph 3, Section 2.2.4 paragraph 2, Section 2.2.3 paragraph 3, Section 2.3.4 paragraph 2, Section 2.4.3 paragraph 3, Section 2.5.4 paragraph 1, and Tables 2.1, 2.2, 2.3 and 2.4.

Response: sediments, the evidence of exposure is overwhelming and it would be totally inappropriate to alter the language as ARCO recommends.

ARCO also recommends that MDEQ replace language stating that the goal is prevent or eliminate exposure to contaminants in excess of legal or risk-based concentrations with language stating that the goal is to "limit to the extent possible" such exposure. MDEQ has maintained throughout the Streamside Tailings OU investigation that the goal should be to prevent and eliminate unacceptable exposure. If the investigation had shown this was not possible, then the goal would be revised in the Record of Decision. Although we do not believe that all exposure can be eliminated, we do believe that exposure to unacceptable levels can be.

B 2. Short-term Risk Not Given Proper Consideration - ARCO agrees that risk issues should be factored into the evaluation of technologies, process options and remedial alternatives, and that the appropriate consideration is not necessarily direct comparison of short term risk versus long term effectiveness, as stated by the MDHES in Section 2.1.1 paragraph 4. However, an appropriate evaluation should include comparison of the same criteria across alternatives with consideration of the incremental, long-term benefits derived by implementation of actions with higher short term risk. ARCO believes this to be a logical approach based on regulatory criteria. For instance, when comparing two remedial alternatives with similar long-term effectiveness, it would not be appropriate to implement one with a higher short-term risk.

In comparing the various criteria, as in any scientific evaluation, the uncertainty related to the variables must influence the weighing of each factor (Superfund Exposure Assessment Manual, EPA, 1 988; Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, EPA, 1988). Long-term effectiveness and risk associated with any active remedial alternative is more speculative in nature. As a result, evaluations of future conditions resulting from a remedial action tend to be very conservative. This must also be considered doing the evaluation of criteria.

Response:

B The comment does not identify why ARCO believes that short-term risk is not given proper consideration. Section 2.1.1 clearly states that short-term risks are weighed along with the other eight remedy selection criteria spelled out in the NCP.

C 3. Compliance - ARCO objects to use of the word "compliance" in PRAOs and PRGs as required by MDHES. This word implies monitoring and proof of compliance regardless of land use, land ownership, existence of receptors, existence of exposure pathways, or existence of risk. ARCO believes that less restrictive language should be used that allows evaluation of the factors listed above. PRAOs and PRGs should be attainable goals and objectives stated in terms of risk that are directly related to the operable unit in question. For instance, ARCO would suggest PRAO phrasing such as "Limit exposure to inorganic constituents in groundwater above risk-based levels".

Additionally, use of the word "compliance" is usually associated with an RAO requiring compliance with ARARS. Compliance with ARARS is inherent in the process, and having such RAOs are simply redundant. RAOs should focus on setting scientific- and risk-based objectives for the project. This disclaimer pertains primarily but is not limited to Section 2.3.4 paragraph 2, Section 2.4.3 paragraph 3, Section 2.5.4, paragraph 1, and Tables 2.2, 2.3 and 2.4.

Response C: MDEQ believes that it is appropriate to specify compliance with applicable or relevant and appropriate requirements (ARARs) as remedial action objectives and preliminary remediation goals. The NCP [40 CFR 300.430(e)(2)(i)] states that "preliminary remediation goals are developed based on readily available information, such as chemical-specific ARARs or other reliable information." That section further identifies ARARs, maximum contaminant levels (MCLs), nonzero maximum contaminant level goals (MCLGs), water quality criteria (WQC), and other risk-based levels as possible remediation goals. In addition, the preamble to the NCP notes that "preliminary remediation goals are the more specific statements of the desired endpoint concentrations or risk levels. Initially, they are based on readily available information, such as chemical-specific ARARs (e.g., MCLs, WQCs) or concentrations associated with the reference doses or cancer potency factors."

D 4. Focusing the RI/FS Process - ARCO believes that inclusion of the focussed PRAOs would allow all parties to perform their portions of the RI/FS more effectively. The original tables submitted by ARCO to the state for review, including Table 2.1, outlined general and focussed PRAOs. The focussed PRAOs were designed to facilitate the RI/FS process, but were eliminated during MDHES review. The RI/FS process is designed to be interactive and iterative. The RI and FS are to be conducted concurrently, in a phased approach. A phased approach is used so that the determinations of each step can be used as feedback to direct the next steps of the process. This requires that minor decisions are made by the oversight agency throughout the process. It has been ARCO's position throughout the RI/FS that focussing on key RAOs and early screening of inappropriate technologies and alternatives will allow other FS tasks to be focussed and more effective. This position is supported in the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA, 1988).

Response D: The "focused" remedial action objectives proposed by ARCO in the original RAOR/TTSD were non-specific "goals", consistent with ARCO Comments A and C above, that would have been useless tools by which to evaluate and compare alternatives. Any alternative, including no action, would have been able to meet ARCO's proposed "focused" goals. The agencies replaced them with specific compliance-related objectives that would be meaningful measures by which to evaluate alternatives and specific cleanup requirements.

MDHES revisions to the RAOR/TTSD have removed several of the portions of the document (including the determination of focussed RAOs and RAGs) that had been designed to facilitate remediation of the SST OU. Based on this, ARCO assumes MDHES does not recognize the value of focussed RAOs, even though the changes requests several revisions on highlighting in the tables. ARCO urges the MDHES to reconsider its position on this issue.

This disclaimer pertains primarily but is not limited to Tables 2.1, 2.2, 2.3, and 2.4.

E **SURFACE WATER/SEDIMENT CONCERNS** - In Section 2.2 of the text, numerous surface water and sediment issues are discussed. ARCO has a significant difference of opinion with the MDHES on several of these, as is presented below.

1. Inappropriate Application of Drinking Water Standards to Silver Bow Creek - Silver Bow Creek is not currently a source of drinking water, and it is not anticipated that Silver Bow Creek will ever be used as a drinking water source. In addition, Silver Bow Creek does not contribute significantly to the recharge of any drinking water aquifers. Therefore, comparison of Silver Bow Creek water quality to drinking water standards, in the first paragraph of Section 2.2.1, is inappropriate.

Response E: As noted in Section 2.2.1 of the RAOR, the ARAR for surface water is defined by the I-classification of Silver Bow Creek contained in ARM 16.20.604 and ARM 16.20.623. The stated goal of the State of Montana is to have I-class streams fully support a number of beneficial uses, including drinking, swimming, growth and propagation of fishes and other aquatic species, and agricultural and industrial water supply. The beneficial uses are considered supported when the applicable standards for ambient water quality, contained in department Circular WQB-7, are met. MDEQ recognizes that Silver Bow Creek, like other I-class streams, is not used for drinking water because it is presently severely degraded. However, the standard promulgated in the regulation is to improve the quality of Silver Bow Creek water, over time, so that it could support use for drinking. The remedial action objective appropriately incorporates the I-classification requirements.

F 2. Applicability of I-Classification - In Section 2.2.1 paragraph 1, the MDHES text states I-classification of Silver Bow Creek as a potential Applicable and Relevant or Appropriate Requirement (ARAR). Further discussion ARCO's position concerning the identification of the I-classification as an ARAR will be presented in the ARARs Scoping Document being prepared by ARCO.

Response F: The response to Surface Water/Sediment Concern No. 1 above explains the rationale for identifying I-Classification standards as applicable to this action. For more detail, see Appendix A of the Record of Decision (Identification and Decription of ARARs).

G 3. Elimination of Organic Constituents of Concern - In Section 2.2.1 paragraph 1 of the MDHES-revised text identifies that organic constituents of concern derived from the Montana Pole site will be "eliminated as part of the Montana Pole remedial action". ARCO

Response G: MDEQ disagrees with ARCO's statement. The clear evidence in the remedial investigation indicates that pentachlorophenol (PCP) is in surface water in Silver Bow Creek and that PCP and polynuclear aromatic hydrocarbons (PAH) are in sediments in Silver Bow Creek.

believes that this statement should be qualified to indicate that organic constituents of concern from Montana Pole no longer result in impacts to the SST OU.

Response: Impacts to the Streamside Tailings OU remain. The statement in the RAOR was that the "primary off-site source" of these contaminants, the oil seeps at Montana Pole, would be eliminated with the Montana Pole remediation. Impacts to Silver Bow Creek will remain over time until dilution and degradation eliminate the known organic contaminants in the creek.

H 4. Reference to Off-Site Sources in SST PRAOs and PRGs - Since the source of organic constituents to Silver Bow Creek is not on the Streamside Tailings Operable Unit, ARCO does not believe it appropriate for surface water PRAOs and PRGs to address organic constituents as presented in the MDHES modified Section 2.2.4. RI data reveals that there are sources of constituents of concern upstream and off-site of the SST OU (1992 Draft Data Summary Reports, ARCO, 1993). PRAOs and PRGs for surface water will be inherently limited and may be unobtainable due to these off-site sources. PRAOs should only focus on what the SST OU can accomplish.

H ARCO appears to have misinterpreted the RAOs for surface water and in-stream sediments. Surface water RAOs do not include organic contaminants of concern. However, since organic contaminants of concern have been identified in stream sediments, these sediments are considered a potential source of contaminants in the Streamside Tailings OU. It was appropriate to retain RAOs and PRGs to address the sediment sources, although the investigation concluded that the levels of organic contaminants in sediments did not drive remedial action.

I 4. Assumed Presence of Mercury in Sediments - In Section 2.2.1, paragraph 3, the MDHES states that because there is no data for mercury in sediments but mercury does appear in some soil/tailings samples, that it is reasonable to expect that it would also be present in streambed sediment samples. ARCO believes this assumption is insupportable in light of the current RI data.

I ARCO does not identify the "current RI data" that supports its apparent contention that mercury is not in sediments. Subsequent RI sampling has confirmed MDEQ's assumption that mercury would be found in stream sediments. Mercury was found not only in "some soil/tailings samples," but rather in nearly every sample for which it was analyzed. In addition, RI data collected in 1994 has shown mercury in all stream sediment samples analyzed for mercury.

J 5. Impact of Alternative Sources Not Quantified - As the MDHES states in Section 2.2.2 paragraph 1, there are alternative sources of sediments and dissolved constituents of concern to Silver Bow Creek. Although the impact of these alternative sources has never been thoroughly examined or quantified, the MDHES asserts that the impact of these sources is relatively minor relative to the impacts from mining-related sources. ARCO believes this statement is currently insupportable. Sources outside the SST OU include publicly owned treatment works, agricultural run-off, urban run-off, and mining-related impacts that are not related to fluvially-deposited tailings. ARCO also wishes to point out that mining-related sources

J MDEQ believes that there is overwhelming evidence to support the statement that mining-related sources of contaminants are the primary causes of the past and present degradation of Silver Bow Creek. While we acknowledge that there are other parameters of concern, they will continue to be relatively minor factors until cleanup of the metals contamination is complete. This situation was evaluated semi-quantitatively and documented in the Draft Baseline Ecological Risk Assessment.

upstream of the site can not be addressed from the SST OU and should not be reflected in SST OU RAOs and RAGs. (See also Comment No. 8 below.)

K 6. Significance of Human Exposure - As previously stated in No. 1 above, it is not expected that Silver Bow Creek will be a source of drinking water. Therefore, potential human exposure will only occur through incidental ingestion and dermal contact. Although this pathway is direct, the exposure is not expected to be common or significant. This disclaimer pertains to Section 2.2.3 paragraph 1 and Table 2.1.

K Table 1 of the RAOR clearly states that the primary route of human exposure will be through incidental ingestion and dermal contact. Although this exposure pathway is considered, MDEQ has never determined it to be a primary or significant pathway. Table 1 notes that aquatic species, not humans, are the primary potential receptors of concern with respect to surface water and sediments.

L 7. Unrealistic Future Land Use Scenario - As previously stated, determination of future land use for risk evaluations is speculative, at best, and results in overly conservative assumptions. It is ARCO's understanding that EPA has recognized this and is in the process of implementing a new initiative for Superfund actions which will "Produce a (future) land use policy ... that could relax the conservative assumptions that have led to too-strict cleanups, perhaps installing the assumption that current land use will continue" (Superfund Week, 1993, "EPA to ease study, design and cleanup," v.7, no. 25, June 25). Therefore, ARCO believes that, in light of EPA's developing policy for defining future land use scenarios, it is inappropriate to assume residential land use for the SST OU as required by the MDHES. Residential use is currently adjacent to the OU. Institutional controls will be incorporated into a development of future land use scenarios and remedial actions. It is likely that current and future institutional controls and physical restrictions will preclude future placement of residences within the OU. Therefore, land use categories for determining exposure and risk assessment should be recreational or trespass.

This disclaimer pertains primarily but is not limited to Section 2.2.3 paragraph 3, Section 2.3.2 paragraph 4, Section 2.4.3 paragraph 2, Section 2.5.3 paragraph 1, and Tables 2.1, 2.2, 2.3, and 2.4.

L MDEQ has considered future potential land uses very carefully in the evaluation and development of the remedy for Streamside Tailings. We agree with ARCO that all present and most future residential development will occur adjacent to, but not within, the operable unit. In fact, Tables 1 through 4 of the RAOR each note that consideration. MDEQ also recognizes that there are portions of the Streamside Tailings operable unit, particularly near Ramsay, that are located out of the 100-year floodplain and that are not zoned. As a result, there is presently no mechanism that can absolutely prevent residential development on those portions of the site. We therefore prudently considered the possibility of some residential development, in limited locations on the site and adjacent to the site, in conducting exposure analyses for the Baseline Risk Assessment and in evaluating remediation alternatives.

Development in the past six months of the Project Green conceptual plan for future Silver Bow Creek corridor land use, and its ongoing adoption as part of the Butte-Silver Bow County Master Plan, has created the possibility of a more certain mechanism for ensuring that residential development does not occur on the operable unit. These developments occurred after the Streamside Tailings investigation was essentially complete, so they could not be considered in any degree of detail in the feasibility study or Proposed Plan.

M 8. Unrealistic Goal for SST OU of Self-supporting Reproducing Trout Fishery - In Section 2.2.4 paragraph 2 and Table 2.1 the MDHES sets

M MDEQ does not believe that improving Silver Bow Creek, over time, to a condition that supports a self-reproducing trout fishery is an an objective for the SST OU of establishing a self-supporting trout fishery. This goal is inappropriate and unobtainable by the SST OU remedial action. There are numerous factors un-related to the SST OU that will limit or prevent the ability of Silver Bow Creek to support a self-sustaining trout fishery. These factors include, but are not limited to, continued metals input from upstream sources, discharge from publicly owned treatment works (POTW), agricultural run-off, thermal impacts, and limited habitat, cover or spawning grounds related to the local geology and ecology. ARCO believes that establishment of a put-and-take fishery would be a more appropriate PRAO for the SST OU.

unattainable goal. We agree that there are other factors that will have to be addressed, also over time, in order to reach the goal. These factors are primarily related to the control of metals contamination from the upstream operable units and control of nutrient loading from the Butte Wastewater Treatment Plant. However, we are confident that timely upstream actions will be successful and ultimately will not be limiting factors in the productivity of Silver Bow Creek. MDEQ's identification of this remedial action objective is also supported by the I-classification of Silver Bow Creek. The I-class goal is to support certain beneficial uses, including a "growth and propagation of fishes." The Montana Department of Fish, Wildlife and Parks has notified MDEQ that its preference is to maintain all stream fisheries as self-sustaining, noting that replacement fisheries are generally less productive and less desirable.

N 9. Surface Water/Ground Water Interaction - Ground and surface water quality data, ground and surface water elevation data, and seepage run data obtained in 1991 and 1992 (1991 and 1992 Draft Data Summary Reports, ARCO, 1992 and 1993) show that there is very little gradient and very little interaction between ground and surface water within the SST OU. Discussions in the ARARs Scoping Document being prepared by ARCO will provide further technical evidence of the nature and results of ground water/surface water interaction. Constituents of concern in ground water are not a significant impact to surface water, and the constituents of concern in surface water are not a significant impact to ground water.

This disclaimer pertains primarily but is not limited to Section 2.2.4 paragraph 2, Section 2.3.1 paragraph 3, Section 2.3.2 paragraph 5, and Tables 2.1 and 2.2.

N MDEQ believes that there are ample low-flow surface water quality data and groundwater data, particularly in Subareas 1 and 2, to support a conclusion that groundwater and surface water are interacting. In addition, there are data that indicate that bank storage of extended-duration high flow events has a potentially significant impact on groundwater and surface water quality. For these reasons, groundwater and surface water interactions are included as potential remedial action objectives for this site.

O 10. Inappropriate ARARs - In Section 2.2.4 paragraph 3, the MDHES lists proposed ARARs for surface water. Numerous references are made by the MDHES to water quality standards and criteria that are not applicable, appropriate or relevant within the SST OU. For example, for drinking water standards and criteria to be applicable to surface water, it is a jurisdictional prerequisite that surface water

O Please refer to Responses E and F. The surface water ARARs are applicable because they are based on the I-class designation of Silver Bow Creek in ARM 16.20.604. The goal of streams identified with I-class designation is to improve water quality, over time, so that the stream could support uses as drinking water, fishery, etc. MDEQ must be a source of drinking water. Silver Bow Creek is not currently a source of drinking water and it is not anticipated to be a source of drinking water in the future. Further discussion of ARCO's position on ARARs will be provided in the ARARs Scoping Document being prepared by ARCO.

This disclaimer pertains primarily but is not limited to Section 2.2.4, paragraph 3, Section 2.3.2 paragraph 4, Section 2.3.4 paragraph 3, and Tables 2.1, 2.2, 2.3, and 2.4.

P **GROUND WATER** - In Section 2.3, MDHES develops ground water PRAOs and PRGs. Many of the points upon which ARCO disagrees with the MDHES concerning ground water are parallel or analogous to those points upon which ARCO disagrees with the MDHES concerning surface water issues. These analogous issues and issues unique to ground water are listed below.

1. Surface Water/Ground Water Interaction - In Section 2.3.1, paragraph 3, the MDHES suggests that ground water may be a source of dissolved metal constituents of concern to surface water. In Section 2.3.2, the MDHES suggests that surface water may be a source of dissolved metal constituents of concern to ground water. As discussed in the Item No. 9 of the surface water section above, the ARCO 1991 and 1992 RI data (1991 and 1992 Draft Data Summary Reports, ARCO, 1992 and 1993) identifies little interaction between surface and ground water.

Q 2. Unrealistic Future Land Use Scenario -In Section 2.3.3, paragraph 3, the MDHES proposes a speculative and unrealistic future land use scenario. As discussed in Item No. 7 above in the surface water section, the EPA has recognized the need to develop realistic land use scenarios and is presently considering using current land use for risk assessments.

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does not agree that there is a "jurisdictional prerequisite" that the surface water be used as a drinking water source.

P MDEQ disagrees with the ARCO conclusion that there is little interaction between groundwater and surface water. Although there is no area with marked discharge of groundwater to surface water, surface water quality data clearly indicate degradation along certain reaches of Silver Bow Creek during low flow conditions. Since these reaches also exhibit shallow, near-stream groundwater contamination from the limited sampling conducted during the RI/FS, MDEQ concludes that it is probable that groundwater contamination is contributing to surface water loading in those reaches. Other studies by the University of Montana in the Miles Crossing area, which utilized more extensive monitoring of the shallow groundwater on a greater frequency than the quarterly RI/FS monitoring, demonstrated considerable loading to the creek in an area with prevalent saturated tailings.

Q MDEQ believes that the Draft Baseline Risk Assessment and the remedy selection process considered future land use in an appropriate manner. MDEQ did not assume that the SST OU would generally be residentially developed, but realistically assumed that modest residential development might occur adjacent to the site or on parts of the site outside of the 100-year floodplain. The risk assessment exposure assumptions considered that private ownership might extend to and include the creek and that use of the creek might include either recreational use or use as part of contiguous residential property. After the risk assessment analysis was completed, the concept of a recreational greenway corridor was proposed by local groups and has been considered in development of and selection of the final remedy.

R 3. Unrealistic Supposition of Future Shallow Groundwater Use - Shallow ground water is not currently being used as a source of drinking water within the site. There are numerous hydrogeological constraints that make the completion of shallow wells infeasible. However, in Section 2.3.2 paragraph 4 and in Table 2.2 the MDHES suggests that future residential development may develop the shallow aquifer for drinking water. ARCO believes that the suggestion that shallow ground water within the site will be used as a source of drinking water in the future is speculative and unlikely. Even if shallow alluvial ground water resources adjacent to the site are used for residential purposes, it is unlikely that on-site ground water would impact those resources since ground water flows in the valley typically follow the topography and flow toward the lowest point. This is consistently within, rather than adjacent to, the SST OU.

R As discussed in Section 2.3.3 of the RAOR, MDEQ is not aware of any hydrogeological conditions that separate the shallow alluvial aquifer under the tailings from that portion of the alluvial aquifer that is used for water supply by nearby residents, or may be used by future residents. There is no restriction in Montana on the depth of a residential well that is not within the floodplain or part of a subdivision development. Some interaction between the deeper and shallow portions of the alluvial aquifer has been demonstrated in the Rocker vicinity.

S 4. Surface Water/Ground Water Interaction - In Section 2.3.3 paragraph 4, the MDHES suggests that ground water may be a source of dissolved metal constituents of concern to surface water. As discussed in Item No. 9 of the surface water section above, the ARCO 1991 and 1992 RI data (1991 and 1992 Draft Data Summary Reports, ARCO, 1992 and 1993) indicates little interaction between surface and ground water. Potential impacts to aquatic species resulting from ground water discharge to surface water are speculative and unsubstantiated.

S Please refer to Response P above.

T 5. Surface Water/Ground Water Interaction - In Section 2.3.4 paragraph 1 and in Table 2.2, the MDHES refers to surface/ground water interaction. ARCO disclaims these statements as in points No. 1 and 4 above.

T Please refer to Response P above.

U 6. Inappropriate ARARs - In Section 2.3.4 paragraph 2 and in Table 2.2, the MDHES list proposed ARARs for ground water. Numerous references are made by the MDHES to water quality standards and criteria that are not applicable, appropriate or relevant within the SST OU. In this instance, MCLs are suggested as ARARs for ground

U There is no basis for ARCO's contention that Montana groundwater quality standards are not applicable to the Streamside Tailings OU. The ARARs identified in the Record of Decision specify that the Montana groundwater quality standards contained within MDEQ Circular WQB-7 are applicable requirements. In addition, water. However, there is no clear definition of background ground water quality data, and therefore application of standards that may be exceeded by native pristine water is not warranted. In addition, shallow ground water is not currently a source of drinking water and it is not anticipated to be a source of drinking water in the future. Further discussion of ARCO's position on ARARs will be provided in the ARARs Scoping Document being prepared by ARCO.

nondegradation standards are also applicable. Although no background groundwater quality data was collected during the SST OU RI/FS, general groundwater data from other sites that have investigated Butte, Rocker, and Anaconda area groundwater conditions, including the natural resource damage assessments, support the interpretation that background groundwater quality conditions do not exceed the applicable State standards in WQB-7. ARCO's conjecture that the "standards ... may be exceeded by native pristine water" does not appear to be supportable.

V **TAILINGS AND IMPACTED SOILS** - In Section 2.4 the MDHES develops PRAOs and PRGs for tailings and impacted soils. As previously stated for surface and ground water, ARCO disclaims several of the MDHES required revisions. These points are identified below.

1. Significance of Streamside Tailings Impacts to Surface Water Quality - ARCO agrees that, as stated by MDHES in Section 2.4.3 paragraph 1, that *near-stream tailings potentially impact surface* water quality. However, the significance of that impact in comparison with upstream sources must be put into perspective. Data collected during the RI suggest that with the possible exception of short-term transient conditions, up-stream sources appear to be of more significance than on-site sources.

V MDEQ does not disagree that upstream sources may be more significant at certain times than on-site sources in causing the present degradation of Silver Bow Creek. However, certain conditions on site, such as localized precipitation runoff events and streambank erosion, are thought to contribute very significantly to contaminant loading to Silver Bow Creek and therefore to its overall environmental degradation. In addition, as upstream sources are eliminated over time, the relative loading contribution from on-site sources will undoubtedly increase. Since the scope of the Streamside Tailings remedial action deals only with on-site conditions, the focus of this RI/FS has been to assume that improvements to upstream loadings will occur and identify contributions from on-site sources that can be addressed under this action.

W 2. Migration of Inorganic Constituents Up the Food Chain - In Section 2.4.3 paragraph 3, MDHES identifies the migration of inorganic constituents up the food chain as a significant exposure scenario. Information regarding the migration of inorganics up the food chain is not available and the significance of any such migration is questioned by ARCO. Migration of inorganics up the food chain would not be significant unless it results in risk to the organisms in the food chain.

W In Section 2.4.3, MDEQ identified the primary receptors as aquatic species within the creek exposed to acute and chronic toxicity from direct exposure to surface water and sediments contaminated by erosion and runoff. The historic fish kills in the upper Clark Fork River support this pathway, as do the presently depressed macroinvertebrate and nonexistent fish populations in Silver Bow Creek. Since the population and diversity of those species are so degraded by the present conditions of Silver Bow Creek, it is difficult to directly track migration of contaminants up the food chain. Relevant data from the Clark Fork River support the conclusion that food chain impacts are of concern where the conditions seen at Silver Bow Creek are prevalent.

X 3. Speculative Future Land Use Assumptions - As previously stated, ARCO considers the assumption of residential activities by the MDHES in Section 2.4.3 too speculative.

X MDEQ has taken a very reasonable approach in assuming potential land use development along the Silver Bow Creek corridor. Refer to Response Q above.

Y 4. Solid Waste - ARCO objects to the general term "solid waste" used in the MDHES revisions to Table 2.3. The more appropriate phrase would be "fluvially deposited tailings."

Y MDEQ has determined that fluvially-deposited tailings and impacted soils within the operable unit are properly identified as solid wastes and are subject to the applicable standards promulgated under the Montana Solid Waste Disposal Act. See the discussion of ARARs in Appendix A of this Record of Decision.

Z **AIR RESOURCES** - In Section 2.5 the MDHES develops PRAOs and PRGs for air resources. As previously stated for surface, ground water and tailings/soils, ARCO disclaims several of the MDHES required revisions. These points are identified below.

1. Off-Site Exposure via the Air Pathway - MDHES states in Section 2.5.3 that predicted exposure scenarios include off-site agricultural, commercial/industrial and residential activities. ARCO objects to the establishment of PRAOs and PRGs based on off-site exposure. ARCO believes that PRAOs and PRGs must be limited the site boundary as defined in the Administrative Order for the Streamside Tailings Operable Unit. Air quality within, rather than adjacent to, the site is the concern. ARCO assumes that if a PRAO for air has been met on-site, air-quality objectives related to constituents from the SST OU will be comparably attained offsite. This disclaimer pertains primarily but is not limited to Section 2.5.4 paragraph 2.

Z MDEQ disagrees with ARCO's contention that the agencies are to be concerned only with air quality on site. Where there is the potential for exposure to adjacent off-site residents, workers, or recreationists from air-transported site contaminants, it is entirely appropriate to establish PRAOs and PRGs to address that potential exposure. The site boundary is not defined as final in the Administrative Order on Consent, but rather is defined after the full extent of contamination is known.

Aa **TECHNOLOGY SCREENING** - 1. Modern Mining Techniques - ARCO does not agree with retaining the category "Modern Mining Techniques" in Section 3.0 (the Treatment Technology Scoping Document). As cited in the MDHES letter from Mr. Neil Marsh to Mr. Chuck Stilwell, dated June 11, 1993, evidence exists that these techniques should not be applied to the SST OU. Bench or pilot scale tests have shown that these techniques are not effective for metals removal from tailings within the SST OU. Therefore, retaining this process option even at this stage is contrary to the screening process. This disclaimer pertains primarily but is not limited to Section 3.5.3 final paragraph and Figure 8.

Aa The modern mining techniques were retained at this level of the screening to be consistent with the ARCO *Remedial Technology Guidance Document for Solid Media* (January 1993), in which those technologies were retained. In addition, the referenced MDEQ comment letter noted that MDEQ had received results of the bench testing of SST OU tailings only verbally, but not in writing. MDEQ did not believe it appropriate to formally reject an alternative technology until written confirmation of test results was available. This alternative was not considered further after confirmation of the bench scale testing.

APPENDIX D-5
Comments Received on the Draft Baseline Risk Assessment Report

ARCO Comments - April 10, 1995		Response	
A	**Lead Assessment** - MDHES acknowledges that there are substantial uncertainties inherent in applying EPA's lead model to the intermittent exposure conditions assumed for the recreational scenario at the SST OU. As a result, MDHES urges that the lead risk analyses for this scenario presented in the human health DBRA be considered only as screening level analyses and "that such estimates not be the sole support for any remedial actions taken at the site." There are questions regarding the validity of the lead model results for the residential scenario (exposures at this site are more intermittent than EPA typically assumes).	A	As indicated in the risk assessment, MDEQ acknowledges the large uncertainty in applying the IEUBK model to situations where exposure is intermittent. MDEQ has considered these uncertainties in decisions on remediation involving lead-containing wastes.
B	**Monitoring wells used to calculate risk from ground water** - The DBRA used data from samples of ground water from monitoring wells in the Rocker area that are inconsistent with the data determined to be appropriate for the SST OU and used in the SST RI. Data from wells RH-3 and RH-4 and drive point DP-5 were not used and samples from RH-29 and RH-30 (which could be impacted from the Rocker Timber Framing and Treatment Facility) were used. Samples from wells RH-8 and RH-1 are also in the DBRA database, but data from these wells likely reflects impacts by COPCs from railroad materials (from Rocker area) rather than floodplain tailings.	B	MDEQ believes that the wells selected are appropriate for the analyses presented, and that wells RH-29 and RH-30 are not likely to be impacted by the Rocker facility. Moreover, MDEQ believes that RH-3 and RH-4 are downgradient of the Rocker site and may be impacted despite the fact that the wells are completed in areas where tailings deposits are obvious. DP-5 is entirely inappropriate for inclusion, since the sample results are probably artifactual due to sampling and/ or well development problems. Readers of the risk assessment should recognize that risk estimates calculated are to be applied using Figures 4-27 through 4-30. These figures indicate how the site-wide exposure point concentrations compares to actual well data in different areas of the site. As an example, Figure 4-27 indicates that high concentrations of arsenic (above exposure point concentrations) occur in only two wells – one in the Rocker area and another in the Ramsay area. Exposure potential thus varies considerably over the site, and only limited areas within the SST OU may have groundwater arsenic and metals concentrations associated with risks as high as those estimated in the risk assessment. Finally, the SST OU (i.e., RH-1, RH-8) includes many sections of railroad beds which run adjacent to Silver Bow Creek and it is appropriate to include wells where groundwater has been impacted by arsenic and metals leaching from these wastes. The source of the contamination will be important in this case for decisions concerning remedy.

C **Ground water database** - Ground water sample concentrations for each individual well from the DBRA database are presented as averages of all samples collected from that well. Ground water data were also presented this way in the RI, however, the averaged values from the DBRA do not match those in the RI. Were the averages in the DBRA based upon a different data set? Differences in average concentrations were greatest for ground water in the Opportunity area, specifically for arsenic, cadmium, lead and mercury. Individual well data presented in the DBRA for these chemicals was consistently higher than average values presented in the DRIR.

C Not all data collected during the field investigation is used for risk assessment purposes. MDEQ has not determined the source of the above referenced differences in average concentrations in groundwater, but believes that the differences lie in choices made for data to include in the quantitative estimates. Generally only the most recent groundwater samples are chosen for use in risk assessment, since groundwater quality can change dramatically from year-to-year in certain situations. Moreover, some data from individual wells was excluded as unrepresentative prior to averaging. For example, a number of non-detect results with very high detection limits were eliminated. MDEQ believes that the data selected for use in the risk assessment is representative, and that the calculations based on these data are accurate.

D **Consideration of Hydrogeology** - The concentrations of COPCs from ground water samples from monitoring wells on-site are used to calculate risk in off-site locations without regard to hydrogeology. As stated in the Draft RI Report, buffering reactions between ground water and the alluvial aquifer will likely immobilize COPCs before they travel off-site. Samples from the shallow aquifer should not be used to calculate risk because concentrations of anions and cations are higher and state regulations prohibit screening a ground water well for domestic use shallower than 25 feet below the ground surface. No evidence is available to show that shallow ground water from the OU is drawn directly outside of the OU.

D MDEQ does not understand the comment concerning onsite and offsite risks. As stated in the risk assessment (Section 3, page 3-6), "It is assumed that future residential development will only take place outside of the 100-year floodplain, but that future wells could draw water from areas including those within the floodplain. Moreover, some areas affected by tailings, such as portions of Ramsay Flats, are outside the presently-defined 100-year floodplain." The risk assessment thus assumes that future wells could be placed within the OU (as defined by the extent of tailings impact) and could draw currently contaminated water directly. No assumptions were made concerning migration of shallow groundwater either horizontally offsite or vertically into separate underlying aquifers. From the results of the risk assessment, it would be reasonable to conclude that restriction of well installation within the area of historical tailings impact would eliminate site-related risks from the groundwater ingestion pathway.

MDEQ believes that the risk assessment is correct in averaging groundwater from shallow (<25 feet below ground surface) and deeper well installations. Well screens are prohibited above 25 ft bgs only within the 100-year floodplain. There is no state regulation that prohibits shallow wells outside of or adjacent to the floodplain. In addition, pumping a well screened at greater than 25 feet would most likely draw water from shallower depths. Thus an integrated estimate of groundwater concentrations with depth seems appropriate. The risk assessment was careful to fully explain assumptions concerning the groundwater pathway and to present groundwater arsenic and metals concentrations with depth (see Figures 4-31 to 4-34).

E **Risk from Use of Railroad Bed** - Exposure and risk estimates calculated for the railroad bed materials are in error because exposure concentrations used in the risk calculations incorrectly combine data from several categories of materials within the railroad beds. Specifically:

- Ore concentrate spills should be evaluated separately because they are limited in extent and contain higher levels of metals and arsenic.
- Data for abandoned railroad should be evaluated separately for recreational use.
- The exposure times and frequency for recreational use of railroads is unrealistic.
- The concentrations of copper in railroad materials used for the DBRA were incorrect by a factor of ten for three of the 21 samples used (RBB14, RBB11, and RBB12).

E MDEQ disagrees with ARCO on all points made in this Comment. Ore concentrate spills should not be evaluated separately, except when considering acute exposures. If a rails-to-trails conversion is implemented in the future, exposures would occur along lengths of the former railroad bed and would potentially involve contact with all types of wastes, including concentrate. In addition, data are insufficient to determine the extent and location of historical concentrate spills. Concentrate spills in areas that could receive heavy use in the future might not be of "limited" extent from an exposure standpoint.

Data for specific rail lines are insufficient for quantitative assessment. MDEQ elected to take all data on railroad bed materials to present a general picture of the types of wastes, arsenic and metals concentrations, and exposures that could occur within the OU. Actual exposure conditions will vary, not only between lines, but along any single line. It is likely that considerable sampling would be necessary to support conversion of any segment of rail line into a trail.

MDEQ believes its exposure assumptions are reasonable. There is no basis for an objective determination of appropriate parameters for this pathway. For example, MDEQ is aware of hiking/biking/running trails in other states that are used by some individuals on a daily basis, and it would not be inappropriate for exposure frequency to be considerable in such cases. Thus, a reasonable maximum of 56 days per year may even be an underestimate for many users if a trail became popular.

Recreational scenarios are always subject to considerable uncertainty and MDEQ attempted to generate a combination of exposure parameters that would present one conservative scenario for trail-related exposures. This effort was successful in identifying specific "hot spots" along some current lines that may have to be addressed if railroad beds are considered for trail conversions. MDEQ has considered conservative assumptions in developing a remedy.

Finally, errors in the database used for the SST risk assessment were corrected after all calculations were completed. Fortunately, most of these errors were caught beforehand and appropriate values used in the DBRA. In a few cases, minor errors were not noted and some exposure point concentrations used are slightly different than those that would be calculated using the current corrected database. These slight differences do not, however, have any significant impact on risk estimates presented. A comparison of calculations based on the CDM SST database (January 1995) and the Revised Clark Fork Database (November 1994) is presented in the risk assessment at the beginning of Appendix A.

F **Risk from inhalation of soils and railroad material** - The DBRA uses PM10 data from the Montana Pole site, with no regard to actual grain size distribution of materials in the SST OU. Railroad materials, particularly, have a low percentage of grain size distribution within the range of respirable dust.

F The risk estimates for inhalation of contaminants resuspended from soils and railroad beds are subject to considerable uncertainty in the absence of site-specific air data. However, even very conservative estimates of inhalation exposures are at least an order of magnitude less than those for other pathways. Moreover, as discussed under uncertainties (Section 4, page 4-127), inhalation risks are considered conservative and may "not be important for risk management at the site. More detailed analysis of this pathway would be unproductive.

G **List of Issues with RA Procedures and Assumptions Identified by Titan Environmental Corporation (TEC)(page 2# 2)** - The fraction of contaminated materials (soil and sediment) used for screening purposes was 1 for both the residential and occupational scenarios. This fraction is inappropriate for either the portion of a yard or the portion of a field that may run into areas with tailings/impacted soils.

G The assumption for fraction of contaminated materials is appropriate for screening purposes. In the body of the risk assessment, MDEQ was careful to separately calculate and average time spent inside and outside the 100-year floodplain. This approach takes into account that exposures will likely occur in areas both inside and outside areas most heavily impacted by historical tailings deposits.

H **Highly Conservative Assumptions** - *Several conservative exposure* assumptions were applied in the human health DBRA that lead to overestimates of the risk potential of this site:

H
1. MDEQ has taken the likelihood of residential development in different areas within the SST OU into consideration in any risk management decisions.
2. The comment expresses ARCO's judgement on exposure frequencies. MDEQ does not concur. Especially as the

1. The low likelihood of residential development should be considered when interpreting the risk assessment results and making remedial decisions for the site.

2. Although no homes can be built within the 100-yr floodplain, exposure assumptions for the residential scenario assume a substantial degree of exposure to materials within the flood plain. Particularly, the exposure frequency (210 days) is unrealistic for most members of the population. These assumptions are most likely to be overestimated for residential exposures for children younger than 6 years of age.

3. The DBRA states that the "potential for consumption of shallow ground water is limited." However, calculations of risks associated with consumption of ground water as a drinking water supply use shallow ground water aquifer data. Higher concentrations have only been found in the shallow aquifer, not in the deeper aquifer that would be used for any drinking water wells in the area. Therefore, the estimates presented in the DBRA overstate any potential exposures or risks via this route.

4. There are several conservative elements related to recreational exposure that contribute to overestimated risk, they are: The assumed exposure frequency (particularly for young children); Exposure duration; The extent of skin surface area exposed to surface water (surface area unrealistically large); The use of total daily soil digestion rates as the assumed RME sediment or rail bed material intake rate for a given recreational visit to the site.

5. Conservative assumptions used in assessing arsenic toxicity (current EPA data, 80 to 100 percent bioavailability of arsenic from soil) may contribute to conservative estimates of the overall risks posed by the site, because all the cancer risk estimates and most of the noncancer risk estimates calculated for the site are attributed to arsenic exposure.

creek environment improves, either naturally as upstream sources are controlled or through remediation, many areas of the creek may become more attractive for residential development. The 100-year floodplain is narrow in many areas, and homes could reasonably be constructed fairly near the streambed (homes are presently located within the 100-year floodplain). In such cases, homeowners could make considerable use of their "yards" inside the floodplain. Very frequent use of these areas by children and others is not "unrealistic."

3. MDEQ believes that the risk assessment is correct in averaging groundwater from shallow (<25 feet) and deeper well installations. Although well screens are prohibited above 25 ft bgs, pumping a well screened at this depth would most likely draw water from shallower depths. Thus an integrated estimate of groundwater concentrations with depth seems appropriate. The risk assessment was careful to fully explain assumptions concerning the groundwater pathway and to present groundwater arsenic and metals concentrations with depth (see Figures 4-31 to 4-34). Subarea #4 does have MCL exceedances at depth.

4. Risks associated with visitors to Silver Bow Creek are low, especially for dermal contact with and ingestion of surface water. Since both MDEQ and ARCO can accept that exposure assumptions for these pathways are conservative, it appears that, overall, recreational exposures within the OU fall into (or below) EPA's acceptable range. Therefore, it does not seem productive to enter into a discussion of exposure parameters that are based totally on professional judgement. High risks are estimated from exposures to railroad bed materials. Exposure assumptions for this pathway are thus important for risk management decisions. MDEQ believes its exposure parameters are reasonable (see Response E).

6. Dust concentrations used for worker exposure seem unrealistically high.

7. The hypothesized swimming season of May through September for human health exposure calculations is extremely unlikely.

8. Agricultural exposure rates and ingestion seem unreasonably high, considering that agricultural use of the site is either grazing, with minimal worker exposure, or planted fields, in which case the establishment of vegetation will considerably reduce exposure.

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5. Arsenic bioavailability may be reduced in soils/sediments within the SST OU. Studies of soils from nearby Anaconda suggest that bioavailability in soils may be about 18 percent. This value is being used in the risk assessment for the Community Soils OU. However, bioavailability of arsenic is dependent on several factors, including the chemical forms of arsenic in soil. It is not readily apparent that the forms of arsenic in saturated sediments, concentrate spills, dry tailings, smelter emissions, etc. are similar and have similar bioavailability. It was, therefore, deemed appropriate to use a higher bioavailability assumption.

6. Mechanical disturbances can lead to considerable dust generation, even when wind speeds are too low to themselves cause significant resuspension. It is common to see a plume of dust behind a tractor in a field when there is no visible dust being resuspended from other areas. MDEQ believes that dust loads in air for field workers should be fairly high to address the potential for mechanical dust resuspension.

7. MDEQ disagrees and refers the commenter to Section 4.1.5.1.1, page 4-43. The risk assessment only assumes that the number of exposure days per year will occur sometime between May and September. There is no requirement that people visit the creek each year in May and September. There may be years when the weather warms quickly and some use occurs and others where cool weather persists and little or no visits occur. It is not possible to determine how exposures would vary on such a short time scale and MDEQ chose a yearly average, expressed as visits per week or month to provide a frame of reference.

   It should also be noted that incidental ingestion of surface water and/or sediment does not require "swimming." Children wading and splashing in the creek would also be expected to ingest small amounts of water and sediment. It is reasonable to assume that children might wade in the creek during times of the year less conducive to immersion.

8. Exposure parameters for agricultural workers are based on work in planted fields and assume that much or all of this work will involve the use of machinery (plowing, fertilizing, weeding, harvesting, etc.). As discussed above, machinery is expected to generate considerable amounts of dust even in instances where wind resuspension would be minimal. This could lead to greater exposures than implied in the comment.

I **Arsenic Bioavailability** - Replace the rabbit study with study utilizing monkeys (Freeman 1994) to assess the bioavailability of arsenic in humans. The monkey study yielded lower absolute bioavailability values (13.4% for arsenic in Anaconda soil and 19.2% for arsenic dust) than the rabbit study (28%).

I See Response H, Number 5.

J **Arsenic Toxicity** - Recent studies have been conducted which suggest that EPA's toxicity factors for ingested arsenic inaccurately reflect the carcinogenicity of this substance. The new results were not used in the DBRA because they had not been published in peer-reviewed literature. A paper has recently been submitted for publication and states that the current reference dose for arsenic be increased by a factor of 2.5 and the current carcinogenic slope factor should be reduced by a factor of 2.3.

J EPA will likely evaluate any new published information that might influence the arsenic oral slope factor. MDEQ believes that any such evaluation will take into account not only the conclusions of the paper's authors, but also its own interpretation, evidence and research results from other papers (especially those linking arsenic exposure to cancers other than skin cancer), and remaining uncertainties.

It should be noted that new results were not left out simply because they had not been published. They were not incorporated because, since they have not been published, they have not undergone the review and critical evaluation necessary for them to be appropriately incorporated into the body of knowledge on arsenic carcinogenicity.

K **Dermal absorption of arsenic from water** - Results of cancer and noncancer risks demonstrate the insignificance of exposures via this route and support its exclusion from risk analyses.

K MDEQ agrees that for this assessment dermal risks are insignificant and can be ignored in any remedial decision making.

L **Errors in risk assessment tables** - Numerous typographical errors are present in the tables summarizing the algorithms and

L MDEQ finds few, if any, errors of the types listed above in Tables 4-1 through 4-10. These are the tables that summarize the algorithms assumptions used in the human health risk assessment calculations (i.e. incorrect units, undefined parameters, listing parameters that are not relevant to the exposure calculation described in the table).

and assumptions used in the quantitative estimation of potential exposures.

M **List of Issues with RA Procedures and Assumptions Identified by TEC (page 2, #1)** - Barren soils are all considered to be due to tailings/impacted soil, with no consideration of the naturally occurring rocky, gravelly soils (page 5-7) or overgrazing. Also, all stream siltation is considered to be related to mining impacts, without mention of other causes, such as livestock.

M Barren soils and stressed vegetation are both mentioned in the ERA as observations used to support the characterization of terrestrial habitats. In the absence of chemical stresses, rocky or gravelly soils can generally support at least limited numbers of plant species that are adapted to such soil types. There are very few locations within the SST OU where barren soils are not associated with mine wastes or tailings. Tailings-impacted soils are considered a primary stressor on terrestrial vegetation. Other stressors such as overgrazing are also likely to affect the diversity and abundance of terrestrial plants. Overgrazing alone is not, however, likely to result in completely barren soil.

Most but not all stream siltation is considered to be related to mining impacts. Also mentioned in the ERA, for example, are the effects of uncontrolled cattle grazing (page 5-91) along streambanks.

N **List of Issues with RA Assessment Procedures and Assumptions Identified by TEC page 2 #9** - The statements of terrestrial fauna use of tailings/impacted soil areas appear to be worded too strongly. Aquatic macroinvertebrate species diversity "fluctuates over time" inappropriately implying that decreases (other than seasonal) in diversity have been observed rather than identifying recently documented increases in macroinvertebrates.

N There is no evidence that statements regarding the use of tailings/impacted soils by terrestrial fauna are too strong. There are no terrestrial species documented as being commonly or even occasionally observed in tailings/ impacted soils.

Data are insufficient for quantitatively evaluating recent (after 1993) trends in macroinvertebrate abundance and diversity. Qualitative, recent (1994) site investigations reveal little diversity in macroinvertebrate populations throughout Silver Bow Creek. Silver Bow Creek supports an abundance of only a few tolerant species such as *Hydropsychid* caddis flies and dipterans. It would be misleading to emphasize possible increases in macroinvertebrate abundance when diversity remains so low.

O **Site-specific risk equations** - Calculations of potential risk use statistics are based upon a log-normal distribution, however, the distribution of COPCs is more appropriately represented by a gamma distribution. Gamma distribution presents the median which is

O The distribution of data collected within the SST OU can reasonably be represented by a log-normal distribution. More importantly, exposure is not solely related to the distribution of contaminants within an exposure area. Given random contacts with contaminated consistently lower than the arithmetic mean used in the DBRA. Methods for the appropriate data distributions should be used (see Tables 1a through d).

media, the average media concentration is a better indicator of exposure *regardless of the underlying distribution of contamination.* EPA guidance (EPA, 1992, *Supplemental Guidance to RAGS: Calculating the Concentration Term,* Publication 9285.7-081) clearly explains this concept and the use of average concentrations is both reasonable and in compliance with this guidance.

P **Inclusion of screening quality and rejected data** - "Rejected" data in the database should be removed and replaced with the mercury data obtained from additional surface water and sediment sampling that was performed in August of 1994. Use of this data will result in a calculation of lower risk.

P No rejected data were used in the calculations of exposure point concentrations for mercury. Only values for *total* mercury in surface and sediment were used. All data for dissolved mercury were rejected. Some of the data used are J qualified. J qualified data were included, in accordance with EPA guidance, to help ensure adequate numbers of samples for small data sets. Data from samples collected in August of 1994 were not available at the time the risk assessment was completed and therefore could not be included.

Q How were non-detected (ND) data handled in calculations of risk? The procedure used for including ND data in calculations for the RI was to use one half of the reported MDL.

Q Samples in which arsenic and/or metals were not detected were included in exposure point concentrations according to EPA guidance. COPCs were considered present in samples reporting non-detects at a concentration of one-half the detection limit. However, data were eliminated from calculations if one-half the detection limit was greater than the maximum positive detection.

R In the conceptual model for the Streamside Tailings Operable Unit, the selection of receptor species is very general and does not identify important receptors or critical pathways.

R See Response Aax, below.

S There are systematic differences in the concentrations of a number of COPCs between surveys that are strongly suggestive of differences in field and/or analytical techniques. Although this fact is recognized in the text, it is a subject worth further exploration because it suggests that there may be systematic basis in some of the reported values.

S See Response Abd, below.

T Uncertainty is dealt with in only a very qualitative sense. A more quantitative treatment would be far more helpful. In particular, there

T See Response Aba, below.

is little mention made of how few measurements have been made of the COPCs in the various media. Table 5-10 should include a column indicating the number of observations for each COPC and each medium. For several of the COPCs and media, the number of data points is very limited (e.g., for dissolved mercury in surface water, there was only a single detected value out of nine observations). The discussion of uncertainty should then emphasize the point that the conclusions drawn are based on very small data sets, this fact should be specifically mentioned and recognized as a serious limitation.

ARCO Comments	Response
U The restoration of self-reproducing trout fishery is still included as a remedial action objective for Silver Bow Creek. ARCO has previously (see June 18, 1993 letter to Neil Marsh) disagreed strongly with this being a long term goal for Silver Bow Creek. Factors such as organic enrichment, low dissolved oxygen concentrations, ammonia, and habitat modification that result from activities entirely unrelated to ARCO may limit growth, survival and reproduction of fish in Silver Bow Creek.	U See Response Aaw, below. See also Responses Aw and Aad in Appendix D-3 and Response M in Appendix D-4.
V Too little attention is paid to factors (e.g., ammonia, dissolved oxygen, stream channelization, effects of grazing cattle) other than COPCs associated with mining that may also have adverse effects on aquatic biota. Though the DBRA recognizes these confounding factors, the analysis of their effect should be given full weight, particularly when it is likely one or several would not allow the above remedial goal to be achieved, even without metals.	V See Response Aaz, below.
W Available data on benthic macroinvertebrates and periphyton in Silver Bow Creek are presented on pages 5-86 through 5-91, but there is little interpretation of the macroinvertebrate data and no discussion at all of the periphyton data in the text. These benthic macroinvertebrate and periphyton data should be discussed in the risk characterization. In addition, other pertinent data not mentioned in the document include site-specific surface water quality criteria for copper that ARCO has been developing, based on water-effects ratio. This represents an analysis which was overseen by the State and EPA, following well-tested scientific procedures recommended in an	W See Responses Aaq, Aat, and Aav, below.

consistent with EPA guidance. such site-specific criteria are far more relevant than comparisons with criteria, thresholds, and background values developed for other purposes and for other areas.

X The surface water database used for the DBRA included the MSE highflow sampling event from May 1991 and numerous additional MultiTech sampling events from December of 1984 through June of 1985 that were not selected for evaluation in the DRIR. The DBRA database also includes samples from several surface water stations that are outside of the SST OU, SS-19, SS-23, and SS-24. However, the concentrations of COPCs in the dominance of the additional data are lower than the average of the concentrations of COPCs for the events chosen as representative of site conditions for the RI.

X This comment is somewhat unclear. All available databases used to characterize surface water quality are clearly presented in summary form in Section 3 of the Risk Assessment. All data were evaluated for adequacy and representativeness, and data that met minimum data quality and quantity requirements were used in the Risk Assessment. Appendix A includes all data evaluated. SST OU media quality was characterized using only data collected within SST OU boundaries.

Y In general, ARCO believes the most appropriate information available should be used for the sediment assessment. For the exposure assessment, this includes both qualitative and quantitative data for Silver Bow Creek itself, plus indirect information available for the Clark Fork River. For the toxicity assessment, this primarily includes information available for the Clark Fork River from the Milltown Endangerment Assessment (USFWS, 1992). Though ARCO appreciates the evolution of the sediment risk assessment from the first opportunity we had to comment to the stage represented in the DBRA, there remains serious technical flaws in the use of available data. The comments below are directed at the most serious problems, and also recommends the best approach for CDM and MDHES to take in comment #5 below - given the available sediment information.

Y See Response H-5 above, and Responses, Z, Aav, and Abc, below.

Z The exposure characterization for sediments in the DBRA needs to be as representative of the Silver Bow Creek sediment as the data allows. First, the data available from the August 1994 sampling of mercury should be included in the database used to calculate average sediment concentrations of mercury. These data reflect a substantially lower average and maximum concentration than indicated in the DBRA for mercury in sediments (see the attached Table 3 for this data). Also, by only considering average concentrations in sediments, the fact that the higher metals

Z All validated and evaluated sediment data available at the time the ERA was produced is included in the ERA. If the ERA is revised, any additional data that meets data quality objectives will be included in the revision.

MDEQ agrees that fine sediments are generally associated with higher metals concentrations. Fine sediments are found primarily in depositional areas, but also occur in interstitial spaces between and below coarser surface sediments within Silver Bow Creek.

concentrations associated with the fine sediments is not considered. This is important because fine sediments are mostly found in depositional or pool areas, which make up a small percentage of the stream.

Aa See comments on Data Issues below, which may apply for the sediment data.

Aa This comment does not warrant a response - it only suggests that other comments be considered. MDEQ has read and addressed all comments provided by ARCO.

Ab Though ARCO agrees with CDM and MDHES in weighing information from the Milltown Endangerment Assessment (USFWS, 1992) higher in drawing its conclusions for potential risk associated with sediments, the use of that data to develop effects concentrations remain highly flawed. Table 5-17 and Table ES-10 include measurement endpoint concentrations for arsenic, cadmium, copper, lead, and zinc in sediments that were based on sediment toxicity tests conducted as part of the USFWS 1992 assessment. The sediment toxicity tests used reductions in length and sexual maturation in amphipods (Hyalella azteca) as chronic endpoints. The measurement endpoint concentrations suggested for use in screening Silver Bow Creek sediment data were the no-effects concentrations (NECs) developed by USFWS (1992). However, those NECs were based on simultaneously extracted metals (SEMs), rather than on total metals concentrations. NECs developed on an SEM basis should not be compared with total metals concentrations in sediments, just as dissolved surface water values should not be compared directly to total recoverable values. Comparing site exposure data, reported in total metals, with NECs in the USFWS, 1992, reported as SEM metals, overestimate the potential risks.

Because of the serious concerns with the approach taken by to develop sediment effect levels in the DBRA, ARCO would like to provide - by example - a more appropriate use of the USFWS, 199 2 information. <u>We do not propose this example as an alternative to the effects concentrations presented in the DBRA, but only to illustrate how the use of the same study information in a more rigorous approach can result in a much wider, and likely realistic, range of values.</u> The data from the USFWS, 1992 study were

Ab MDEQ disagrees that the use of data from the Milltown Endangerment Assessment is highly flawed. It is agreed that there are uncertainties associated with the NECs used that are based on *Hyalella* tests. These uncertainties include the relationship between total metals concentrations in sediments and other sediment parameters, such as SEM, AVS, organic carbon, etc. Data are inconsistent regarding the ability of SEM, AVS, or organic carbon to predict sediment toxicity. The degree that these parameters can predict toxicity appears to depend on the metal in question and on other unknown factors associated with specific sediment characteristics.

MDEQ agrees that comparing NECs derived from SEMs to total metals in sediments may overestimate sediment toxicity in some cases or to some degree. This potential for risk overestimation is accepted, and this acceptance is considered appropriate, for several reasons, discussed below.

First, as discussed above, SEMs do not consistently predict sediment toxicity, and for some metals the relationship between total metals and SEMs is not as strong as for other metals.

Second, site-specific or regional sediment toxicity data are limited to NECs based on SEMs for only one amphipod species (*Hyalella azteca*). There is therefore no evidence that *Hyalella* is more or less sensitive than other non-tested species that may be ecologically important in Silver Bow Creek. In fact, toxicity data based on EPA water quality documents for metals reveal that *Hyalella* and other freshwater amphipods are not consistently among the most sensitive of tested reevaluated by ARCO and NECs were developed for arsenic, cadmium, copper, lead, and zinc on a total metal basis. Although Table 5-17 included NECs for both the amphipod length and maturation endpoints, there was relatively little difference in the resulting NECs, and because of technical problems with the maturation endpoint, only the length endpoint was used by ARCO in deriving NECs on a total metals basis. In addition to NECs, lowest-observed-effects levels (LOELs) were also developed by ARCO from the USFWS, 1992 data (the LOEL was defined as the next highest sediment metal concentration above the NEC at which a statistically significant toxic effect was found). The derivation of the NECs and LOELs is illustrated in Figures 1-5.

The NECs, because they represent sediment metals concentrations at which no statistically significant chronic effect was found, may be useful for a screening-level assessment but are overly protective for an assessment of true ecological risk. The metal concentration at which significant toxic effects attributable to that metal begin to occur may actually be much higher than the NEC.

It would be preferable to compare the total concentrations of arsenic, cadmium, copper, lead, and zinc in the sediments from silver Bow Creek with both the NECs and LOELs developed on a total metals basis. The concentration range between the NECs and the LOELs could be considered a range of uncertainty, because the point within that range where significant chronic effects might begin to occur is poorly defined, given the relatively small number of available data points from the Milltown endangerment assessment (USFWS 1992). The NECs and LOELs developed for this purpose are shown below:

organisms. For example, *Hyalella* ranks 15th of 44 genera tested with cadmium (i.e., 14 other genera, including several salmonids, are more sensitive, and in some cases much more sensitive, than *Hyalella*). EPA ambient water quality criteria documents for copper and zinc do not include *Hyalella* results, but other tested freshwater amphipods ranked 4th of 41 genera with copper (amphipods were quite sensitive) and 25th of 35 genera for zinc (amphipods were relatively insensitive). These inconsistent results indicate that amphipods do not necessarily represent sensitive aquatic biota. This is especially significant where salmonids are much more sensitive to metals than amphipods (e.g., cadmium exposure). Protection of amphipods therefore does not necessarily provide protection for other more sensitive organisms for which protection is desirable. MDEQ would be more in agreement with ARCO's comment if the goal of remediation were to protect a small group of aquatic organisms such as amphipods, represented by *Hyalella azteca*. However, there is considerable uncertainty associated with the representativeness of *Hyalella* with regard to all other aquatic organisms that are likely to comprise a healthy and diverse aquatic community in Silver Bow Creek.

MDEQ believes that the LOELs suggested by ARCO can not be accurately derived from reported NECs because the slope of the toxicity curve used to derive the NECs is unknown. That is, there are no exposure-response data for metals concentrations between the reported NECs and LOELs. ARCO admits that the concentrations range between the reported NECs and the estimated LOELs are "a range of uncertainty". Therefore, the true LOEL could be only slightly in excess of the reported NEC. There is no evidence that the LOEL is at the level suggested by ARCO, and in fact the highest possible or upper limit of potentially actual LOELs is what ARCO has suggested to represent the LOEL. Because the true LOEL could be only slightly above the reported NEC, it is considered appropriate to use the NEC as a conservative estimate of the sediment metals concentration that, if exceeded, can result in adverse effects to exposed organisms.

NECs and LOELs Developed by ARCO from the Milltown Endangerment Assessment (USFWS 1992) Data on Chronic Toxicity to Hyalella Azteca

Metal	NECs (mg/kg)	LOELs (mg/kg)
Arsenic	102	404
Cadmium	6.68	13.3
Copper	583	878
Lead	113	679
Zinc	1,300	4,200

Note: Concentrations reported on a total metal basis.

Finally, recently available data (Ingersoll et al. 1995) on sediment metals toxicity to *Hyalella azteca* and *Chironomus riparius* (midge larvae) support the use of the effects concentrations, including the *Hyalella* NECs, used in the Streamside Tailings ERA. NECs derived with the Milltown studies, and used in the Streamside Tailings ERA are presented below, along with a series of recently derived freshwater sediment effects concentrations based on *Hyalella* testing. These concentrations include Effects Range Low (ERL), Effects Range Median (ERM), Threshold Effects Level (TEL), Probable Effects Level (PEL), and No Effects Concentrations (NECs). Each of these values are based on actual toxicity testing conducted with freshwater sediments collected at a variety of sites, including the Clark Fork River. These values are not the same as other values derived in a less rigorous manner from other data sets (e.g., Long and Morgan). The derivation and use of these sediment effects concentrations are presented in the referenced article. Neither the Milltown NECs nor the recently derived sediment effects concentrations are intended to serve as "cleanup" values. Instead, these values are most useful for characterizing sediments as toxic or nontoxic. In general, the authors conclude that ERMs and ERLs are as reliable as paired TELs and PELs for classifying both toxic and nontoxic sediment samples. ERLs are considered useful for classifying sediments as nontoxic. Toxicity is rarely observed at concentrations below ERLs. Concentrations above ERLs are potentially toxic. All values presented below are based on mg/kg total metals, dry weight, except for the site-specific NECs which are based on SEMs. Sublethal effects to *Hyalella* (growth and/or maturation) are the endpoints for all presented values.

	As	**Cd**	**Cu**	**Pb**	**Zn**
Site NEC	23.8	3.9	325	NT	1,064
ERL	13	0.7	41	55	110
ERM	50	3.9	190	99	550
TEL	11	0.58	28	37	98
PEL	48	3.2	100	82	540
NEC	100	8.0	580	130	1,300

NT: not tested

Site-specific NECs consistently fall within the range of ERLs and NECs derived and presented by Ingersoll et al. (1995). These comparisons suggest that the site-specific NECs used in the Streamside Tailings ERA are appropriate for assessing sediment toxicity based on whole metals concentrations.

In summary, the limited amount of site or regional sediment toxicity data, the inconsistent sensitivity of *Hyalella* and other amphipods to sediment metals, and the support provided by recently available data indicate that it is prudent, and consistent with EPA guidance, to assess potential risks using an appropriate yet conservative approach. The preponderance of available toxicity data and the reasoning presented above strongly support the inclusion of site-specific NECs based on SEMs as potentially useful measurement endpoints in this ERA.

Ac Even using the available sediment toxicity data more appropriately, as discussed in comment 4 above, sediment effects could be severely overestimated. The most appropriate means of estimating sediment effects considers both lab and field information, sediment lab toxicity tests, benthic community analysis, and in-situ chemistry under a sediment triad analysis. Also, a range effects levels should be developed based on both chronic and acute effects results. This can be done using the data available for the Clark Fork River from the USFWS, 1992 assessment, and will be done for the Clark Fork River scoping process in the next few months. ARCO strongly recommends the DBRA's sediment assessment be revised to allow this valuable analysis to be considered. In the absence of direct sediment effects studies on Silver Bow Creek sediments, this is clearly the best approach to estimating potential risks from silver Bow Creek sediments.

Ac The Streamside Tailings ERA includes data on in situ sediment chemistry, laboratory toxicity tests (regional and outside the region), field community data (periphyton and macroinvertebrate abundance and diversity), and recent and historical field observations (e.g., absence of fish in Silver Bow Creek, visibly stressed vegetation, absence of vegetation).

Ad For evaluation of the concentrations of chemicals of potential concern (COPCs) in various media, a wide range of criteria, thresholds, and background values is identified for each COPC and each media. The relevance of some of these values is questionable (e.g., various soil background values and criteria for Ontario; the "A," "B," and "C" concentrations of Siegrist [1989]), while flaws in the

Ad As discussed in the text of the ERA, all effects concentrations and other concentrations used to assess potential toxicity are associated with uncertainties. For this very reason the ERA uses a weight-of-evidence approach that considers a variety of potentially useful data. No single data point is given so much weight that other points are ignored or eliminated, and any data value that has potential to be technical basis for others (e.g., Long and Morgan [1990] sediment quality values) are largely ignored. ARCO strongly recommends against the use of such highly questionable values in the ecological risk assessment. Their limited applicability and technical flaws should also be explicitly recognized. In addition, references to various values throughout the document are ambiguous or potentially confusing (e.g., Figures 5-14 through 5-19 include reference to "phytotoxic A" and "phytotoxic B" values, which, as explained on page 5-101, are separate and distinct from Siegrist's [1989] "A" and "B" concentrations). The individual values should be referred to consistently throughout the document. The list of criteria, thresholds, and background values used in the risk characterization should be greatly reduced, with a much greater reliance on site-specific or regional values.

Ae The Regional Ecorisk Field Investigation (REFI) report (ARCO 1994) contains site-specific metals concentrations in soil samples as well as in tissue samples from terrestrial vegetation and invertebrates (i.e., spiders, grasshoppers, and beetles) and small mammals (Peromyscus maniculatis). This report is available and should be used to fill data gaps identified in the ecological risk assessment. The main results of the REFI that should be discussed in the ecological risk assessment were:

- The development of site-specific plant community effects levels (PCELs).
- The demonstration of minimal food-chain transfer of metals.
- The demonstration of an absence of adverse effects on wildlife based on food-web models.

useful is included in the ERA. It is inappropriate to eliminate a value simply because it may be uncertain. It may just as well be highly accurate but lacking in supporting data. Supporting data is provided in many cases by the weight-of-evidence approach used in the ERA. For example, the inclusion of a particular effects concentration, although highly uncertain in itself, is often supported by the fact that this concentration is similar to or within the range of other more certain data points. There is therefore no argument that some data points used in the ERA are more certain than others. In all cases, data with the least uncertainty are preferred and used to the extent possible. For certain chemicals and certain media, highly certain data are not readily available, and the ERA necessarily relies on less certain data in these cases. Unless more certain data are available, EPA guidance clearly states that a conservative approach be taken where uncertainties are substantial. This ERA uses a conservative, weight-of-evidence approach that is unlikely to underestimate risks to ecological receptors. In some cases (e.g., soil phytotoxicity), risks may be overestimated to an unknown degree, but overestimation is preferred where uncertainty is high so that protection of ecological receptors is not compromised.

Ae See Response Abb, below.

Af At a minimum, the DBRA should provide risk managers with additional contextual information regarding the chemical risks related to terrestrial habitat at the site. For example, there should be a recognition that metals-related risks would be substantially reduced with higher soil pH and better nutrient condition.

Af The physical and chemical risks to terrestrial habitats are discussed in the ERA. In addition, the ERA includes a discussion of the role of pH on surface soils and potential toxicity. Nutrient conditions of surface soils related to pH and metals are not discussed in the ERA, and MDEQ is not aware of sufficient or adequate ecological data to support such a discussion.

Ag In the fourth complete paragraph on page 5-5, the particle size range for silt should be 0.004-0.06 mm instead of 0.004-0.6 mm.

Ag MDEQ agrees. This will be corrected if the document is revised.

Ah Figure 5-1 (Conceptual Model) includes redundancies that could be overcome by reorganization and simplification (see attached copy with suggested changes). The abbreviated exposure routes (e.g., DC,I) in the far right column should be defined.

Ah Figure 5-1 does not require reorganization to eliminate redundancies because each potential exposure pathway included warrants a separate and complete description. While this approach results in apparent redundancies, especially in receptors and exposure routes, it provides the reader with a clear understanding of each exposure pathway.

MDEQ agrees that the abbreviated exposure routes should be defined on the Figure. In fact, definitions appear on all but the final figure because of a formatting error. This will be corrected if the document is revised.

Ai It is difficult to follow the logic of Table 5-8. It is not set up so that the taxonomic order is obvious. There are no bullets for orders and families after Rodentia.

Ai Table 5-8 is not intended to be anything more than a list of potential receptors. The elimination of bullets from certain families and orders is a typographical error that will be corrected if the document is revised.

Aj In Table 5-9, abundance and diversity of wildlife are listed as major assessment endpoints, but there are no measurement endpoints identified to address these assessments endpoints. Also, abundance and diversity of periphyton are listed as measurement endpoints, but there are no corresponding assessment endpoints. This table should be restructured so that it is clear which measurement endpoint(s) applies to which assessment endpoint(s). There are no remediation goals or remedial action objectives identified for the terrestrial component of the investigation, although terrestrial receptors and habitats are discussed in the earlier sections of the report.

Aj It is expected that some assessment endpoints can not be subjected to direct or indirect measurement. Assessment endpoints identify ecological values to be protected, and are not necessarily matched to specific measurement endpoints in all cases. Table 5-9 therefore does not present matched measurement and assessment endpoints, but rather presents important ecological values to be protected and examples of measurement endpoints that can be used to assess potential risks.

The most critical remediation goals and remedial action objectives are presented in Table 5-9. MDEQ believes that these primarily include those associated with the aquatic system because risks there are potentially greater than those associated with the terrestrial system.

ARCO Comments - April 10, 1995		Response	
Ak	Table 5-10 includes no values for nitrogen, although it was supposedly detected in every sample. For dissolved mercury in surface water, the same value is reported as the minimum, mean, and maximum, although the text indicates that dissolved mercury was only detected in one sample. It is not apparent what is meant by the parenthetical expression within the footnote explaining the use of the geometric mean. A column should be added to this table indicating the total number of measurements for each variable.	Ak	Limited nitrogen data (100% frequency of detection) are included in the final draft of Table 5-10. Dissolved mercury was detected in only one surface water sample, at a concentration of 0.16 μg/L. The table has been corrected in its final draft version. The parenthetical expression indicates that the arithmetic mean for the referenced values exceeds the calculated U95 value. Therefore, the geometric mean is substituted and presented for the referenced parameters. The number of samples are presented in the Data Evaluation section of the draft BRA (Tables 3-1 through 3-4).
Al	Figures 5-2 through 5-19 should each indicate the source of the data plotted and the numbers of observations represented. Table 5-17, which provides the source of the various criteria, thresholds, or background values plotted in these figures, should also be cross-referenced. It is inappropriate in some of these figures to plot 95 percent confidence limits for individual stations when there are only two data points at a station.	Al	The sources for the data presented on these tables are provided both in the summary table 5-17 and individually for each graph on the page following the graph. The number of observations are easily viewed on each graph because each data point represents a single measurement.
Am	The right-hand column in Figure 5-3b includes the same descriptor for two different values in the left-hand column (i.e., 0.94 and 1.1 μg/L).	Am	MDEQ agrees. This is a typographical error that will be corrected if the document is revised.
An	In Figure 5-5a, the upper 95 percent confidence limit plotted for the station at approximately river mile 16 is lower than the mean value plotted for the same station. This is impossible.	An	MDEQ agrees. This is a typographical error that will be corrected if the document is revised.
Ao	The acute AWQC for mercury is not plotted in Figure 5-6a.	Ao	The value referenced in the comment exceeds the upper boundary of values allowed on the graph. However, this value should be included as a note or the range of values could be expanded to allow plotting of this value. This will be corrected if the document is revised.
Ap	In Figure 5-7a, the upper 95 percent confidence limit plotted for the	Ap	MDEQ agrees. This is a typographical error that will be corrected if the document is revised.

station at approximately river mile 25 is lower than the mean value plotted for the same station. This is impossible.

Aq In Figure 5-7b, the reference to "(USFWS & VW 1992)" should apparently be instead to "(FWS & US 1992)" as cited elsewhere in the document. Also, no citation is provided for the last effects concentration listed (277 μg/L); according to Table 5-17, the reference should be USEPA (1987).

Aq MDEQ agrees. This is a typographical error that will be corrected if the document is revised.

Ar In Figures 5-8b, 5-9b, and 5-10b, references to "Persaud 1993)" should apparently be to "(Persaud et al. 1993)."

Ar MDEQ agrees. This is a typographical error that will be corrected if the document is revised.

As In Figure 5-12b, three references to ranges of values from Long and Morgan (1990) should be to the "low range."

As MDEQ agrees. This is a typographical error that will be corrected if the document is revised.

At In Figure 5-13a, there is no indication of the meaning of the values in parentheses along the right-hand axis.

At The referenced values were to be deleted from the final graph. This is a typographical error that will be corrected if the document is revised.

Au In Figures 5-14 through 5-19, it is not apparent what is represented along the horizontal axis. Also, the meaning of the plotted criteria, thresholds, and background concentrations (e.g., "hazard," "phytotoxic A," "tolerable," "mean baseline," "phytotoxic B") should be clearly defined. Cross-referencing these values to Table 5-17 would be helpful, but the potential for confusion exists between the "A" and "phytotoxic B" values used in these figures and explained on page 5-101.

Au For these graphs, the horizontal axis does not represent any parameter, and the graphs are intended to only show ambient concentrations (squares) compared to effects or other relevant concentrations (horizontal lines). The values presented in these graphs are clearly defined in the text.

Av In the second complete paragraph on page 5-57, the last sentence states that "U95 values provide good estimates of the true average concentration of contaminants...". The U95 values should be interpreted to be upper-bound estimates of the true average concentrations, not "good estimates of the true average concentration."

Av MDEQ disagrees. EPA states that "Because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used for this variable. (Emphasis added).

Aw In the third complete paragraph on page 5-62, it is reported that few terrestrial animals have been reported onsite. However, results of the REFI (ARCO 1994) show that small mammals are present and using

Aw MDEQ stands by the statement that few terrestrial animals have been reported onsite. Data from the REFI was not available for inclusion in the draft baseline ERA. Even if data from the REFI were available, habitats within the Streamside Tailings Operable Unit. Apparently, there is sufficient cover and food production to satisfy the habitat requirements for deer mice. ARCO has also shown that adverse effects on reproduction are not occurring in deer mice as a result of exposure to elevated soil metals concentrations. These results can be attributed to the low bioavailability of mining-related metals (see ARCO 1994 for specific results).

the presence of deer mice or a few other terrestrial animals that have short life-spans and rapid reproductive rates does not change the overall observation and assumption that few terrestrial animals inhabit or regularly use the site.

Ax In the second complete paragraph on page 5-63, the second sentence states that "chemicals with BCFs less than 300 are considered to have low bioaccumulation potential." However, in the bullets following that paragraph, lead is said to have "low to moderate bioaccumulation potential" even though the geometric mean BCF for lead listed in Table 5-11 is 52. Similarly, zinc is said to have "low to moderate bioaccumulation potential" even though the geometric mean BCF for zinc listed in Table 5-11 is 162.

Ax Table 5-11 presents the geometric mean of available BCFs for invertebrates and fish that may occur in Silver Bow Creek. These values are therefore a subset of available BCFs for a larger variety of aquatic species, including those that do not or can not occur in Silver Bow Creek. The EPA reference to bioaccumulation potential (e.g., ...300...low bioaccumulation potential) is a general statement that is based on a much larger dataset. The interpretations given on Page 5-63 are based on EPA-recommended interpretations (second paragraph, Page 5-63) of bioaccumulation potential. These interpretations reflect overall bioaccumulation potential for all tested aquatic species, not just those that may occur in Silver Bow Creek.

Ay In Table 5-13, the discussion of uptake/ingestion pathways for terrestrial macrophytes should be revised based on site-specific vegetation tissue concentrations measured during the REFI (ARCO 1994). Bioaccumulation factors (BAFs) derived for local vegetation species along Silver Bow Creek should be used rather than literature BAFs derived from potentially sensitive crop species.

Ay Data from ARCO's REFI were not available in time to be included in the draft baseline ERA.

Az In Table 5-15, it would be helpful to show the percentage of dissolved oxygen measurements that fell below 4.0 mg/L at the first two locations.

Az These data have been added to the final draft of Table 5-15.

Aaa In Table 5-16, it is not apparent what is meant by "threshold value" in the heading of the third column, or what the tabled value (1.0 mg/L) represents.

Aaa A definition of "threshold value" is included in the final draft of Table 5-16. As indicated on the table, 1.0 mg/L represents the threshold value as defined in the table footnote.

Aab In the last paragraph on page 5-72, it is stated that measured concentrations of pentachlorophenol (PCP) in surface water (i.e., 5 to 12 μg/L) were "similar to national chronic criteria." It would be

Aab MDEQ agrees that the comment presents a more accurate statement. This comment will be considered if the document is revised.

more accurate to state that the measured concentrations were below the national chronic criterion (13 μg/L).

Aac In the last paragraph on page 5-74, it is stated that "The ingestion of contaminated surface water and sediment is likely to have lower potential to cause adverse effects than direct contact." The basis for this conclusion should be explained.

Aac MDEQ agrees that the referenced statement could be clarified and better supported. The intent is to present the generally accepted assumption that drinking water and incidental sediment ingestion offers a lower potential for adverse effects than direct contact for aquatic species. Also, it should be made more clear that, in this case, direct contact includes surface water that passes over gills and through filtering organs. This statement will be revised if the document undergoes revision.

Aad In the fifth line on page 5-84, the reference to "Persaud et al. 1991" should be to "Persaud et al. 1993."

Aad MDEQ agrees. This will be corrected if the document is revised.

Aae In the first several lines on page 5-100, it is inappropriate to compare measured polycyclic aromatic hydrocarbon (PAH) concentrations in sediments to effects levels for PAH in soils from Siegrist (1989).

Aae PAHs in sediments are first and primarily compared to sediment effects concentrations (from Table 5-17). They are also compared to Siegrist values for soils for two reasons: (1) sediment effects concentrations for individual PAHs are lacking, and (2) PAHs in surface soils are likely to bind strongly to particles that may erode into Silver Bow Creek, thereby becoming sediments.

Aaf The data reported in Table 5-20 for nitrogen in surface water are not reported in Table 5-10. Also, the value of 3.5 μg/L cited in Table 5-20 as the lower range of the effects concentrations for PCP does not appear in Table 5-17. Instead of selecting in Table 5-20 the NECs developed on an SEM basis for arsenic, cadmium, copper, lead, and zinc as the most appropriate effects concentrations, it would be preferable to report for each metal the range from the NEC to the LOEL, both developed on a total metals basis (see general comments above). These values are more appropriate for comparison with the total metals concentrations in the sediments of Silver Bow Creek. Because the NECs and LOELs on a total metals basis are considerably higher than the NECs on an SEM basis, the risk potentials listed in the last column of Table 5-20 for arsenic, cadmium, copper, lead, and zinc in sediments should be adjusted downward accordingly (from "high" to either "moderate" or even "low to moderate").

Aaf Some, but not all, of the data presented in Table 5-20 have been included in the final draft of Table 5-10. The 3.5 μg/L value presented in Table 5-20 should be included in Table 5-17. The 3.5 μg/L value represents the national chronic AWQC for PCP (pH 6.5). This a typographical error that will be corrected if the document is revised. Table 5-20 includes a variety of effects concentrations for comparison purposes, including NECs based on SEM basis for metals in sediments. The reasoning behind using and presenting these effects concentrations are discussed in Response Ab, above.

Aag The risk assessment approach should be consistent with available EPA guidance and the latest risk assessment methods (e.g., available human health risk assessment information for the Anaconda region and ARCO's 1992 *Framework for Ecological Risk Assessment, Upper Clark Fork River Basin*).

Aag A great variety of information and guidance, including that cited in the comment, was used in completing draft risk assessment. The basis for the approach used in provided in detail in the risk assessment.

Aah **Inclusion of dermal absorption of arsenic in surface water as an exposure pathway** - Evaluating dermal absorption of arsenic from surface water is unnecessary because dermal absorption of inorganic substances is widely recognized as being negligible compared to absorption from the gastrointestinal tract or lungs (e.g., ATSDR 1993). As a result, exposures via this pathway typically are not quantified in risk assessments for inorganic substances. Both EPA and MDHES recognized this pathway as insignificant, therefore, ARCO strongly recommends that this exposure pathway be omitted from the risk assessment prepared for the Streamside Tailings operable unit.

In addition, permeability constants should be used instead of absorption factors, however, a permeability constant is not available for arsenic. EPA therefore suggests using a default permeability constant, but this may substantially overestimate actual dermal absorption of arsenic in water. This coupled with other findings further supports exclusion of this exposure pathway from quantitative evaluation in this risk assessment.

Aah See Response K.

Aai **Identification of Likely Land Uses and Exposure Types** - CDM indicated that the Human Health Risk Assessment will identify and focus on areas within the OU where human health risks are potentially of concern but where ecological exposures are not significant (areas include Ramsay, Rocker, Miles Crossing, and Opportunity). Additional information should be provided regarding how the potential for human health risk and the insignificant potential for ecological risk will be judged. Complete delineation of the types of land uses and the actual types and degrees of exposure that could occur in different areas is necessary. Specifically, residences may not be as close to Silver Bow Creek due to flood plain restrictions, and therefore the exposure frequencies (for 1 to 6 year-

Aai MDEQ does not believe it necessary to delineate all possible used for all land parcels within the SST OU in order to adequately explore potential human health risks. In addition to estimating current risks to residents within the OU, a primary objective of the assessment is to provide information that can be used to assist risk management decisions as additional data become available and/or as land within the OU is developed in the future.

olds) assumed in MDHES' proposed residential or recreational exposure scenarios should be reduced. For some remote areas of the OU, MDHES' assumed exposure frequencies are likely to overestimate likely exposure potential for older age groups as well.

Aaj **Calculation of Exposure Point Concentrations** - CDM's proposed approach to calculate exposure point concentrations is statistically invalid because concentration and risk estimates derived from the complete data set will be compared with those derived from much smaller subsets of the complete data set. A better approach is to back-calculate benchmark concentrations corresponding to specified target risk levels using the exposure assumptions with ARCO's recommended modifications and pathways developed for use in the risk assessment. Ultimately, consideration of exposure point concentrations and exposure potential should be combined when assessing the risks associated with different subareas of the site.

Aaj The method proposed and used in the risk assessment is not statistically invalid and is, in fact, similar in concept with that proposed by in the comment.

Aak **Recreational Exposure Parameters** - Several aspects of CDM's assumptions for recreational exposure scenarios are unrealistic in light of site-specific conditions, specifically the exposure frequency for 1 to 12 year old visitors of Silver Bow Creek (two times a week for seven months/year for RME and two times a month for seven months/year for average exposure). Climatological data suggest that play activity in the creek involving surface water contact is realistic for only four months of the year. Exposure time and exposure skin surface area should also be reconsidered. Older children (7 to 12 years) should be the focus for the recreational scenario (higher activity level, unsupervised during weekday waking hrs during summer months, etc.).

Aak See Response H, Number 4.

Aal **Arsenic Toxicity Factors** - Numerous lines of evidence suggest that toxicity factors currently used by EPA to evaluate arsenic toxicity in risk assessments overestimate toxic effects likely to result from a given exposure level. There are several uncertainties related to the CSF and the RfD for arsenic and risk estimates associated with ingested inorganic arsenic could be modified downwards as much as an order of magnitude (some studies suggest it could be as much as 2 to 3 orders of magnitude higher).

Aal MDEQ's use of arsenic toxicity and bioavailability factors is fully explained in the risk assessment. Please refer to Sections 4.2.2.2 and 4.2.2.5 of the draft risk assessment.

The lower bioavailability of arsenic in soil relative to arsenic in water should be accounted for when evaluating exposures to arsenic in Streamside Tailings soils.

Aam **Ecological Risk Assessment - Chemicals of Potential Concern** - CDM should consider dissolved oxygen, ammonia, PAHs, and PCP in the ecological risk assessment. In addition, nitrate and other nutrients should be added to the list of COPCs. The Montana Department of Mines and Geology should be contacted for water quality data and if this data support conclusions beyond those already developed by CDM based on the available information, these additional data should be included in the risk assessment.

Aam Dissolved oxygen, ammonia, PAHs, PCP, and nitrate are fully evaluated in the ERA. Data for these evaluations were obtained from State summary databases, which include data from several sources.

Aan **Spatial Segmentation** - A risk characterization should be prepared for each area and for the entire Streamside Tailings OU. It is unclear how the areas will be delineated and how minimum data requirements for each area will be determined. ARCO would like to comment on the approach to spatial segmentation before finalization of the risk assessment.

Aan Only a site-wide risk characterization is presented in the ERA. To assign risks to specific areas of the site is inappropriate because that would suggest that exposure potential is based on discrete, well-defined locations. Most aquatic and terrestrial animals that now occur onsite or may occur following remediation are sufficiently mobile to move freely within and beyond the boundaries of the site. Risk estimates for specific sub-areas of the site therefore provide no useful information concerning potential exposure for these organisms. For plants and sedentary animal species, risks obviously differ from one area of the site to another. Finally, contaminants are currently transported in Silver Bow Creek from upstream to downstream areas, and erosion, spring runoff, and rain events contribute to contaminant movement within the aquatic/riparian areas of the site. It is therefore likely that risks estimated for any specific area of the site will change substantially over time.

Aao **Toxicity Thresholds** - CDM stated that all available toxicity thresholds and criteria will be used in the risk characterization for soils and sediments. This approach appears inconsistent with the surface water approach in which only the best available thresholds (USEPA water quality) are used. Should only used technically defensible and meaningful data in the risk characterization. Prior to the application of any generic criteria, ARCO requests that MDHES provide a full technical and regulatory justification of the underlying assumptions, reliability, and applicability of the numeric values.

Aao Toxicity data for sediment and especially surface soils are much more limited than what are available for surface water. It is therefore not surprising that surface water toxicity data are associated with less uncertainty than are data for sediment and surface soil. There are no universally accepted toxicity data for surface soil and sediment, and the ERA relies on regional and other data to provide a weight-of-evidence approach to estimate potential for toxic effects. The uncertainties of all toxicity data, along with their sources and intended uses, are fully discussed in the ERA.

Aap **Specific comments on Long and Morgan (1991)** - The Long and Morgan approach does not result in valid threshold levels that can be compared to concentrations of metals in streambed sediments for the purposes of indicating injury to macroinvertebrates. The ER-L, ER-M, and AET values derived by Long and Morgan (1991) for the COPCs in this risk assessment are technically flawed and should not be used in the risk characterization.

Aap Long and Morgan's data are used for comparative purposes because these data are commonly used as screening level data to assess potential for toxic effects. The uncertainties associated with Long and Morgan's data, and all other effects data, are presented clearly in the ERA. Again, Long and Morgan's data are used to support a weight-of-evidence approach, and are not used to classify sediments as toxic or nontoxic and are not used to derive or represent "cleanup" values.

Aaq Available information on water-effects ratio being developed by ARCO for Silver Bow Creek should be used to derive site-specific water quality criteria to be applied in the risk characterization. Any water quality criteria or toxicity thresholds that are based on toxicity to species not expected to occur in Silver Bow Creek (cladocerans), should be eliminated from the analysis.

Aaq Data obtained by ARCO concerning the water-effects ratio studies were not available in accepted form in time to be included in the ERA. Toxicity data based specifically on cladoceran studies were not included in the ERA. AWQC, which include cladoceran studies, are used in the ERA because these AWQC are derived to protect 95 percent of the aquatic species using a representative species approach. Cladocerans are sensitive water column species that may represent other, non-tested sensitive species. AWQC are there fore not adjusted by eliminating any particular species.

Aar Background (reference area) values and thresholds or criteria with low confidence levels should be "flagged" on the risk characterization graphics.

Aar There is no reason to "flag" any particular value in the graphics. Each value is clearly defined, and the sources and uncertainties associated with the values or the database from which the values are obtained are clearly discussed in the ERA.

Aas **Risk Characterization** - 1. To the extent possible, the risk characterization should be quantitative. When a quantitative analysis is not possible, a hazard quotient method should be used. 2. A qualitative weight-of-evidence approach is inadequate for the risk characterization for the Streamside Tailings OU. Where information is limited, alternative guidelines should be developed or data gaps should be documented. Because of the lack of site-specific sediment toxicity data and sediment criteria, the risk assessment should rely on field survey data for benthic macroinvertebrates and periphyton to characterize risk to benthic biota.

Aas 1. There is no evidence or guidance that suggests a ERA risk characterization should be quantitative or based on a hazard quotient method. Both purely quantitative approaches and hazard quotient methods, which are based on human health risk assessment approaches, rely on comparisons of one value to another. For the most part, this includes a comparison of a single exposure point concentration to a single effects concentration. There is concern that such a simplified approach would imply more confidence in a particular exposure point or effects concentration than is justified.

2. The weight-of-evidence approach used in the ERA is semi-quantitative and is neither inappropriate nor purely qualitative. Data gaps are identified in the ERA and elsewhere in the RA. Uncertainties associated with identified data gaps are clearly

presented in the ERA. Regional and site-specific data are preferred and are used in the ERA to the extent possible. Macroinvertebrate and periphyton data for Silver Bow Creek and the upper Clark Fork basin are included in the ERA. It is inappropriate to rely on community data without consideration of available sediment toxicity data, even if the sediment toxicity data are not site-specific. This ERA therefore uses available community data and available sediment toxicity data to provide a weight-of-evidence approach to estimate risk potential to benthic biota. The uncertainties associated with the non-site-specific sediment toxicity data (and the community data) are clearly discussed in the ERA.

Aat **Benthic Macroinvertebrate and Periphyton Data** - An analysis of available benthic macroinvertebrate and periphyton data for Silver Bow Creek should be included in the ecological risk assessment.

Aat Periphyton data are presented in the ERA, along with limited interpretation of these data. Macroinvertebrate data are presented and fully discussed in the ERA.

Aau **Terrestrial Ecological Risk** - CDM indicated and ARCO concurs that food web transfer of metals and effects on terrestrial wildlife is not an issue of concern in the Streamside Tailings OU. However, it is important to document that food chain effects are not occurring and to provide likely reasons for the lack of effects.

ARCO recommends using site-specific data to evaluate the effects of soil metals, if any, on plants. Soil pH must be considered in the evaluation of risks to plant communities and generic phytotoxicity thresholds (which do not consider pH) should not be used.

Aau The baseline ERA is not required to prove that certain effects are not occurring. Rather, the ERA should evaluate all relevant pathways, and focus on the critical pathways of concern. The elimination of a particular pathway needs to be discussed and supported by reasonable assumptions and conclusions. This ERA clearly presents reasons for not fully evaluating food chain transfer of metals in terrestrial systems.

At the time the phytotoxicity assessment was produced, no site-specific data were available, and regional data were used to support more general phytotoxicity data available in the literature. The ERA clearly indicates that the phytotoxicity thresholds are based on total metals concentrations and are most appropriately compared to measurements of total metals in site soils. The ERA also clearly states that these comparisons should be based on soils that have pH values within the range of natural soils. Finally, the ERA includes an extensive discussion of soil pH and its impact on metals bioavailability, potential toxicity, and risk estimates presented.

Aav **Comments on the SST OU Draft Ecological Risk Assessment (DERA) page 2 #6** - 2. Need more discussion on benthic macroinvertebrates and periphyton in Silver Bow Creek. Mention that macroinvertebrate communities have improved in abundance and diversity over recent years and diversity of species increases downstream, as the influence of the Butte POTW is likely to decrease. 3. Site-specific surface water criteria developed by ARCO should be used, instead of criteria, thresholds, and background values.

Aav 2. Macroinvertebrate abundance and diversity increase at the more downstream stations, but are not indicative of a healthy community anywhere in Silver Bow Creek within the SST OU. While distance from the Butte WWTP is a consideration, mining-related impacts are also likely to decrease downstream because the upper reaches of Silver Bow Creek are adjacent to Butte, where the most intensive mining took place. It is therefore inappropriate to single out the Butte WWTP as the sole source of stress with impacts that decrease downstream. It is likely that current macroinvertebrate numbers and types reflect mining-related stresses and, to a lesser extent, other sources of stress that include the Butte WWTP.

3. ARCO only developed site-specific surface water criteria for copper. These data are not available in acceptable form at the time the ERA was produced. This ERA is based on a weight-of-evidence approach that relies on multiple sources of criteria, effects concentrations, and recommended threshold values. Relying on only a single value, such as the site-specific copper criteria derived by ARCO, would weaken the ERA because of limitations associated with any single value. For example, site-specific criteria may be based on only a few species that may or may not represent the range of sensitivities of other non-tested species for which protection is desirable. On the other hand, national criteria may not reflect the composition of species that are likely to be resident at a particular site. Reliance on a single toxicity value or criterion is therefore considered inappropriate, and a weight-of-evidence approach is preferred and used in the ERA. Background values were not used for evaluating surface water risks, but are included in the ERA to provide a point of reference.

Aaw **Self Reproducing Fishery** - ARCO disagrees strongly with this remedial action objective for Silver Bow Creek and hopes that this objective and the significant non-metal factors which may likely hinder achieving it are appropriately conveyed to the public.

Aaw Remedial action objectives are determined by risk managers, and are not within the domain of risk assessment. Metals are considered the primary stressors affecting the health of Silver Bow Creek and adjacent environments. Throughout the ERA, potential sources of stress other than metals have been identified. These include, for example, discharges from the Butte WWTP (ammonia, nutrients), uncontrolled streambank cattle grazing (physical effects, nutrients), and dewatering. None of these, however, are considered to have the same potential for adverse effects as the metals derived from past mining/milling activities and present site conditions.

Aax **Receptors and Critical Pathways** - In the conceptual model for the SST OU, the selection of receptor species is very general and does not identify important receptors or critical pathways.

Aax Important receptors and pathways are clearly identified in the ERA. The SST OU ERA is unique because only very limited numbers and types of potential ecological receptors are currently present in Silver Bow Creek and adjacent areas. The types of potential receptors considered important, and worthy of protection, are clearly stated throughout the ERA. Rather than specific species, potential receptors are grouped into seven categories of organisms that include representative species expected to occur within the OU following remediation (page 5-21). Important pathways are not only clearly depicted, they provide the basis for the ERA (Tables 5-12 and 5-13), which is focused on the direct contact and ingestion of contaminants. Other less critical pathways are not fully evaluated in the ERA.

Aay **Chemicals of Potential Concern** - 1. The relevance of some of the values used for evaluation of COPCs is questionable. If these values are to be retained, their derivation should be explained, their intended use should be described in greater detail, and their limited applicability should be explicitly recognized.

2. References to various values throughout the document are ambiguous or potentially confusing (e.g., Figures 5-14 through 5-19 include reference to"phytotoxic A" and phytotoxic "B" values, which, as explained on page 5-101, are separate and distinct from Siegrist's [1989] "A" and "B" concentrations). The list of criteria, thresholds, and background values used in the risk characterization should be reduced or specifically quantified based on their limited relevance, with a much greater reliance on site-specific or regional values.

Aay 1. The comment is somewhat unclear, but it is assumed that "values" refers to effects concentrations of toxicants used to compare to ambient toxicant concentrations. The derivation and use, along with the limitations associated with each effects concentration, are clearly presented in the ERA (Table 5-17, pages 5-75 through 5-85).

2. The terms or "values" used in the ERA are clearly explained. For example, and as the comment correctly states, the origin and identification of the effects concentrations for surface soils are explained on page 5-101. It is agreed that regional or site-specific data are preferred, and, to the extent possible, the ERA relies heavily on regional and site-specific data. For example, Figures 5-14 through 5-19 include all available regional or near-site effects data, and do not include the more general Siegrist concentrations referred to in the comment.

Aaz Too little attention is paid to factors (e.g., ammonia, dissolved oxygen, stream channelization, effects of grazing cattle) other than COPCs attributable to ARCO that may also have adverse effects on aquatic biota.

Aaz It is recognized throughout the ERA that factors other than mining-related metals can contribute to adverse ecological effects. As stated in a previous response to comment, potential sources of stress other than metals have been identified. These include, for example, discharges from the Butte WWTP (ammonia, nutrients), uncontrolled streambank cattle grazing (physical effects, nutrients), and dewatering. None of these, however, are considered to have the same potential for adverse effects as the metals derived from past mining activities.

Aba The uncertainty analysis needs to be more quantitative. Specifically, Table 5-10 should include a column indicating the number of observations for each COPC and each medium. In cases where limited data were available (mercury) the uncertainty analysis should emphasize this. When means and upper 95 percent confidence limits are calculated on small data sets, this fact should be specifically mentioned and recognized as a serious limitation.

Aba Section 3 of the Risk Assessment (Data Evaluation) includes the number of samples taken for each COPC and media type. Small or otherwise limited data sets are specifically discussed on pages 5-2, 5-57, 5-74, 5-104, and elsewhere in the ERA.

Abb The following elements from The Regional Field Investigation Report (REFI) (ARCO November 1994) should be discussed in the Ecological Risk Assessment:

- The development of site-specific plant community effects levels (PCELs).
- The demonstration of minimal food-chain transfer of metals.
- The demonstration of an absence of adverse effects on wildlife based on food-web models.

Abb The results of the REFI were not available in time to be included in the ERA. The ERA qualitatively discusses, however, the relatively low likelihood of metals being transported through terrestrial food chains and also states that there is a low probability that terrestrial wildlife will be affected by metals moving through terrestrial food chains.

Abc Site-specific thresholds used in the ecological risk assessment (USFWS sediment values from the Milltown endangerment assessment) are not given enough weight. ARCO agrees that these thresholds have limits due to being from a reservoir, but are more relevant than other thresholds used in the assessment for sediments.

Abc As stated above, regional or site-specific data are preferred for use as effects concentrations. To the extent possible, the ERA relies heavily on regional and site-specific data. For example, Table 5-17 lists all available regional or near-site effects data, including USFWS sediment values from the Milltown Endangerment Assessment. In addition, Figures 5-4a through 5-19 include all available regional and site-specific effects data. The preference for regional and site-specific data is clearly indicated in the ERA, and other more generic data only supplement regional and site-specific data. These other data, cannot, however, simply be excluded because there are recognized limitations with all effects concentrations, including site-specific data.

ARCO Preliminary Comments on the Draft ERA - March 10, 1995

Abd There are systematic differences in the concentrations of a number of COPCs between surveys that are strongly suggestive of differences in field and/or analytical techniques. Although this fact is recognized in the text, it is a subject worth further exploration because it suggests that there may be systematic biases in some of the reported values.

Response

Abd As in any field investigation, there may be systematic differences in the concentrations of COPCs because of differences in field and/or analytical techniques. As stated in the comment, this fact is recognized in the text. This probably does not warrant further exploration, however, because all available data suggest that the primary COPCs are sufficiently elevated throughout the OU to be a major concern. Differences in some reported values are unlikely to change the overall magnitude of the COPCs in the SST OU or the conclusions based on the currently reported magnitudes.

A To what levels must (or should) the contaminants of concern (COCs) be reduced to eliminate the risk potential.

A The baseline ERA does not provide specific COC concentrations ("cleanup values") that would result in reduced risk potential. Instead, the baseline ERA provides a range of media-specific COC concentrations that are associated with risks to ecological receptors. It is the risk manager's decision, with input from risk assessors, to determine appropriate risk reduction measures that may consider COC concentration, sediment grain size, technical implementability, costs, and other issues outside the domain of risk assessment. For the most part, these issues are addressed in the feasibility study (FS) rather than in the baseline ERA.

B What is the risk potential, or conversely, the recovery potential of the affected ecosystems absent the COCs.

B Recovery potential is of course dependent on a number of factors. Of critical importance is reduction or elimination of bioavailable forms of chemical contaminants from exposure media. Other issues become important for recovery after risks from chemical contaminants have been substantially reduced or eliminated. For example, habitat quality, which includes parameters such as cover and prey availability, can greatly influence recovery. Habitat quality is currently influenced, for example, by past mining activities, cattle grazing, erosion, and stream channelization. Established plant and animal populations outside and in some cases within SST site boundaries provide a nearby source for recolonization of the site. These organisms are likely to become established in or utilize the SST area where and when chemical and physical risks have been sufficiently reduced.

C Will natural recovery occur, and if so, over what length of time.

C Natural recovery will follow remediation. There is, however, no way of knowing which species will recover first, the extent of short-term and long-term recovery, or how long complete recovery will take. Aquatic insects and other invertebrates have colonized other similar sites within a season following remediation. The establishment of most native plant communities, and certain animal populations as well, are likely to take several months to years, depending on species, residual risk potential, and the extent of remediation. In fact, remediation itself is likely to disrupt the potential for colonization for a period of time. Natural recovery rates will also differ for each area of the site and each media type (e.g., surface water, sediment, riparian soils, upland soils). It is unlikely that remediation will, at least

	Comment		Response
			in the short-term, be equally successful at all locations within the site. For example, removal of tailings from terrestrial areas is likely to be more easily and completely accomplished, and thus will be associated with less short-term residual risks, than removal of fine-grained sediments from the streambed.
D	Page 17 - Executive Summary. We suggest that risk potential be explicitly defined in the text as the potential for onsite media to preclude the existence of healthy and diverse aquatic and riparian ecosystems in, and adjacent to, Silver Bow Creek.	D	Although risk potential is not explicitly defined in the ERA as recommended, a similar definition is implied throughout the ERA. For example, the discussion of assessment endpoints includes examples of the types of endpoints or "results" desired (goals) if risks were reduced or eliminated.
E	Page 18 - Executive Summary. "Risk potentials are estimated by evaluating the difference or magnitude between average and U95 values and relevant effects concentrations." Risk potential is estimated to be high where average of U95 values "greatly exceed relevant effects concentrations." How is this "greatly exceed" determined, and to what extent must the relevant effects concentrations be exceeded for the chemical to pose a low, medium, or high risk potential.	E	There is no clear and universally accepted definition of low, moderate, or high risks. Such determinations are made using best professional judgement and comparisons to risks from all identified stressors. That is, risk estimates of "low," "moderate," and "high" in the ERA are best interpreted as relative risks based on comparisons of risks from all stressors.
F	Page 21 paragraph 6 (ES) - The sentence describing PAH detections should be corrected. Presumably the four samples ≤ 0.02 μg/L.	F	Agreed. The value referenced should be "<0.02 μg/L."
G	Page 22 paragraph 4 (ES) - The causes, if any, for the temporal increases in copper concentrations should be discussed more fully.	G	As discussed more fully in Section 5 of the risk assessment, the apparent temporal increases in copper concentrations in sediment may be "real" or may be the result of sampling bias or analytical variability. There is currently insufficient evidence for concluding that the apparent increase is real. If real, there are numerous currently unidentified potential causes for such increases, including increased erosion of copper-contaminated tailings, upstream inputs, etc.
H	Page 23 paragraph 1 and 4 (ES) - These paragraphs are confusing and should be rewritten. To maintain consistency, lead and mercury should be discussed in separate paragraphs.	H	Typographical errors contribute to the apparent confusion. These two paragraphs appear incomplete because portions of each are out of place in the current document.
I	Page 23 paragraph 5 (ES) - We would recommend that the State of Montana's injury assessment for terrestrial and riparian habitats and	I	These data sources were not available at the time phytotoxicity data were obtained.

CH2M Hill's Clark Fork River Screening Study also be utilized in developing phytotoxicity concentrations.

Comment		Response	
J	Page 25 paragraph 1 (ES) - A sentence should be added to this paragraph stating that the risk potential for zinc is high.	J	Although implied, the risk potential for zinc in surface soil is not included. It is agreed that the risk potential for zinc in surface soil is high.
K	Page 2-5 - McGuire (1995) is the most recent Silver Bow Creek aquatic macroinvertebrate study and identified only 14 species. The differences between this study and Canonie results should be discussed. In addition, the Montana Department of Fish, Wildlife and Parks (MDFWP) should be contacted concerning the fisheries surveys.	K	McGuire (1995) was not available in time for inclusion in the ERA. The ERA discusses the limited diversity and abundance of macroinvertebrates in Silver Bow Creek, using data up to and including 1993. During the time of the ERA production, there was no recent evidence that fish were present in Silver Bow Creek.
L	Page 5-1 - Problem Formulation. The hypothesis referred to on page 5-105 should be clearly and explicitly stated in the Problem Formulation section (5.2).	L	Presenting a hypothesis at the Problem Formulation stage of the ERA could be viewed as a pre-conceived bias before data were collected, evaluated, and interpreted. The results of these investigative efforts support the formulation of the hypothesis presented on Page 5-105.
M	Page 5-8 paragraph 4 - Portions of the SST OU are within the foraging radius of a peregrine falcon nesting site located outside of Butte.	M	It is recognized that portions of the SST OU are within the foraging radius of the nesting peregrine falcons. That is not the same, however, as suggesting that these or any peregrine falcons are likely to regularly or even occasionally forage within the SST OU boundaries. It is believed that the site provides limited habitat and prey for most predators compared to non-impacted locations adjacent to the site.
N	Page 5-20 - Invertebrates. McGuire's (1995) macroinvertebrate study should be referenced. See Comment K.	N	See Response K, U.S. Fish and Wildlife Service comments.
O	Page 5-20 - Fish. No reference is made to MDFWP. Were they contacted? See Comment K.	O	MDFWP was contacted during the early stages of the ERA production. MDEQ received at that time a verbal response that fish were not known to be present in Silver Bow Creek within the SST OU boundaries.
P	Page 5-15 - Column heading should read Mean (Range) D.O. Concentration, and the superscript in the box for the mean D.O. concentration at SBC near Ramsay should be deleted.	P	The comment apparently refers to Table 5-15 on Page 5-70. The first portion of the comment is correct, and the "D.C." currently presented

should read as "D.O." The second portion of the comment is incorrect. The superscript is correct as presented.

Q Page 5-74 paragraph 3 - The magnitude and distribution of mercury, PAHs and PCP are described based relatively few samples. We recommend additional samples, particularly for mercury, be collected and analyzed in order to reduce the uncertainty.

Q Additional surface water and sediment samples were collected in late summer 1994 and analyzed for total mercury. Although the results of these samples were not available in time to be included in the ERA, they supported the initial findings of mercury in sediment. Mercury was not detected in surface water. Additional samples have not been collected for analysis of PAHs and PCP. These contaminants are primarily from known, mostly upstream (PCP) or discrete onsite (PAHs) sources. Remediation of these contaminants will be addressed either independent of the SST remedial activities (PCP) or will be included in the SST remedial activities (PAHs).

R Page 5-74 paragraph 4 - The statement "The ingestion of contaminated surface water and sediment is likely to have lower potential to cause adverse effects than direct contact" should be substantiated. Feeding studies have shown that ingestion of contaminated feed and invertebrates is a major exposure route.

R The comment is correct for many types of contaminants, especially those that bioaccumulate or biomagnify. Contaminants for which ingestion and food chain transfer is of most concern include PCBs, many pesticides and herbicides, dioxins, and certain other organic compounds. Under certain conditions, mercury would be included here as well. In contrast, most metals, especially those of primary concern here (copper and zinc), do not bioaccumulate to a great degree, and do not biomagnify. In fact, both copper and zinc are essential nutrients for plants and animals, thereby confounding the role of ingestion. The ingestion of copper and zinc via drinking water and food ingestion is not a major exposure route for most aquatic biota. The direct contact of dissolved copper and, to a lesser extent zinc, on gills and other tissues is by far the most critical exposure route for fish and most aquatic invertebrates. Terrestrial exposures to copper and zinc via food chain transfer is also of comparatively little concern because of minimal trophic level transfer of these metals.

S Page 5-84 paragraph 2 - The State of Montana Natural Resource Damage (1995) injury reports and the CH2M Hill Clark Fork Screening Study (1991) should be referenced.

S These data were not available in time to be included in the baseline ERA.

T Page 5-93 5.4.1.1 Risk from Surface Water COPCs - Dissolved COPC concentrations were used to assess risks because the use of

T The vast majority of evidence based on aquatic toxicity studies indicates that the toxic effects of metals observed in aquatic biota are total metals concentrations may overestimate risks to aquatic receptors. Conversely, the use of dissolved metals concentrations may underestimate risks to those receptors. Total metal concentrations should be used to assess risk to be protective of the environment.

from elevated concentrations of dissolved metals. Dissolved metals, which for the most part measure the free ionic form, are therefore routinely used to assess toxicity. In fact, EPA now suggests using ambient water quality criteria (AWQC) adjusted for dissolved metals to compare to dissolved metals in site waters. EPA and nearly all aquatic toxicologists now recognize that the bioavailability and toxicity of surface water for which only total metals is measured is highly variable, and differs greatly from site to site depending on the specific characteristics of site water. It is unlikely that metals sorbed onto particulate matter (measured in total metals) adds substantially to the toxic effects due to dissolved metals. This is especially true for Silver Bow Creek, where dissolved metals are greatly elevated.

A Concern is expressed regarding the adequacy of the number of samples taken with regard to Mercury. With so few samples, is any conclusion viable? Will additional sampling continue?

B When not dissolved in water, does mercury not tend to adhere to other mercury, thereby causing it to be located in discrete areas, as opposed to being generally mixed into tailings? If this is true, how were the few sampling areas chosen, and how does it relate to the possibility that there could be a large mass of mercury undiscovered in the streamside tailings?

A As presented in the Draft RI Report, mercury appears to be ubiquitous in surface tailings/impacted soil within the operable unit. However, a very distinct relationship could be seen in the data between concentration and depth, that is, mercury concentrations decreased considerably with depth, and, although mercury was found in several borings at concentrations greater than 1 milligram per kilogram below a depth of three feet, the majority of samples exhibited concentrations below this level at depth.

Because of this, any remedial action taken that addresses the other five contaminants of concern should address mercury also, since they appear to be associated with similar materials. Therefore, even though only a limited number of samples were analyzed for mercury, there is an adequate number of analyses to support the analysis of alternatives in the feasibility study and additional sampling for mercury is not contemplated.

B Elemental mercury is very dense (heavy) and insoluble, making it difficult to transport downstream in stream water. It is possible that elemental mercury from a point source along the creek might collect in a "pool" beneath the sediments. Once oxidized to Hg(I) or Hg(II), mercury will probably not "pool" in the same fashion. Oxidized mercury will probably be more generally mixed with sediments/tailings. Some mercury can also be transformed by bacteria into methyl mercury. Methyl mercury is a serious concern because it is highly toxic, will bioconcentrate in living organisms, and can biomagnify through food webs, potentially affecting top level predators. However, methyl mercury is unlikely to form a discrete pool beneath sediments, and is more likely to be rather uniformly mixed in surface and shallow sediments.

Elemental mercury was used historically in an amalgamation process to extract gold from ores. Thus, it is theoretically possible that some elemental mercury is present in sediments in the form of large masses. Such masses would be extremely difficult to find. However, they may not represent a separate hazard unless disturbed (e.g., by a large flood). Mercury would have to be removed from the mass (by oxidation or methylation) in order to impact aquatic organisms or people. Such mercury would be released to water and sediments and should show up in sampling even when the mass itself has not been identified.

C A word of mouth report was made by a Butte-Silver Bow employee that he had interviewed a gentleman some years ago who said he had uncovered a large pool of mercury in the Lower Area One near the old asphalt plant. To your knowledge, is there anything to this report, and is there a possibility that some of that mercury has moved downstream?

C MDEQ has not been able to confirm this report. A "large pool of mercury" probably relates to an observation of mercury in its elemental (silver liquid) form. As stated previously, pools of elemental mercury could be located in Silver Bow Creek because of past uses of elemental mercury. However, such pools would be difficult to locate because of their discrete nature. Under the oxidizing conditions of flowing water, most elemental mercury is expected to be converted to other forms that are more soluble and unlikely to form discrete pools under sediments. These other forms should be more evenly distributed in creek sediments and, possibly, surface water. The more uniform distribution and greater solubility of these forms increases the likelihood that they will be detected by sediment and surface water sampling.

D What are the conditions under which mercury is dissolved in water vs. when it is in a visibly silver liquid form? Can it change back and forth depending on weather?

D Generally, elemental mercury (the silvery liquid form) is favored under neutral to high pH and reducing (low oxygen) conditions. If the pH drops (becomes more acid), mercuric sulfide (HgS) may precipitate. HgS is extremely insoluble and is fairly inert biologically. When oxidizing conditions exist, elemental mercury may be oxidized to HgO or to various chloride species. These forms can be soluble and are the forms expected when mercury is dissolved in water. Some interconversion is expected between forms, however, MDEQ has no information that would suggest that interconversion is weather dependent. Most often, transport of mercury into a different set of environmental conditions leads conversion to a different form. For example, transport of inorganic mercury into oxygen poor sediments in Minimata Bay in Japan led to the bacterial conversion to methyl mercury which then accumulated in estuarine organisms.

E Is cadmium from the smelter area more dangerous than the cadmium from the mines? Was it sampled separately?

E The relative impacts from cadmium from different sources have not been investigated, although it is possible that some forms of cadmium are less bioavailable (less able to be absorbed into the body) and therefore represent less hazard. For risk assessment purposes, toxicity criteria for cadmium are derived from experiences with soluble or dissolved cadmium, which is absorbed to the maximum extent and is thus most toxic. Therefore, if there are differences in hazard between cadmium in mine and smelter wastes, it is unlikely that risks due to cadmium exposure have been underestimated in either the human health or ecological risk assessments.

F Air transport of cadmium is said not to be a concern in the RA. How can that be when there were no air samples taken along the creekside in this OU?

F Possible exposures to cadmium via inhalation were "screened" using very conservative assumptions of both resuspension of cadmium-contaminated materials and human exposure (See Appendix B). Even under extreme conditions (i.e., heavy assumed dust loads, all dust derived from contaminated materials, constant exposure 24 hours per day for 30 years) potential risks from cadmium inhalation were very small. It does not seem at all likely that cadmium concentrations in air could be sufficient to pose a significant risk for long-term (chronic) exposure.

G Animal grazing has not been studied vs. treatability studies done. How can that risk be evaluated?

G The comment is somewhat unclear, but it is assumed that the question relates risks to herbivorous animals that might consume vegetation growing on treated soils. An evaluation of the risks potentially associated with such scenarios fall outside the scope of the baseline ERA. The baseline assessment seeks to evaluate current conditions, not those associated with specific remedial approaches. Such risks, which are likely to be rather minimal because of limited food chain transfer for most metals, are probably best evaluated, if warranted, in an independent study.

A Have the synergistic affects of any of the contaminants been studied or recognized?

A The synergistic effects of contaminant mixtures have not been well-investigated. Although antagonistic effects have been documented for some classes of toxicants, especially certain metals, toxicants are generally (and conservatively) considered to exhibit additive effects. This ERA assumes additivity, and the effects of copper, for example, are in addition to those from arsenic, cadmium, lead, and zinc.

B How may soil samples were taken from outside of the 100-year flood plain? Is there an appropriate number of samples to properly classify the risk of the area outside of this flood plain?

B Approximately 50 soil samples were taken outside the 100-year floodplain, and about 75 soil samples were taken inside the 100-year floodplain (Table 3-1). The Streamside Tailings Operable Unit (SST OU) is generally defined by the 100-year floodplain of Silver Bow Creek. There are, however, some contaminated areas that are outside this boundary. These areas are also considered part of the SST OU. This ERA is based on environmental samples taken from within the SST OU boundaries, which includes all of the current 100-year floodplain. Risks to ecological receptors outside the 100-year floodplain were not specifically addressed in the ERA, but are expected to be low because toxic materials are for the most part confined to well-defined areas. Exposure to these areas is likely to be minimal for most receptors because suitable habitat does not exist in these well-defined contaminated areas outside the 100-year floodplain. Discrete areas of contamination will therefore be avoided by nearly all potential receptors because of lack of suitable habitat.

C Was any soil sampling done lower than 6 inches (6-18 in.)? Sampling done at sites nearby Silver Bow Creek suggest that soil contamination extends lower than 6 inches in depth.

C Both shallow and deep soil samples have been taken over the years. In some areas, soils are contaminated at depths much greater than 6 inches. Surface and shallow subsurface soils (e.g., 0 to 6 inches) are most useful for evaluating potential risks to ecological receptors because the potential for exposure is much greater for most species. Exposure to deeper soils is limited to only a few types of ecological receptors, such as certain burrowing rodents and soil invertebrates. These types of organisms are unlikely to use tailings or highly contaminated soils. In fact, where contamination is high, avoidance is likely because insufficient cover (vegetation).

D Have all the chemicals of primary concern been precisely located? (chemicals may have been overlooked). For example, have you looked into the possible contamination from the old Butte Landfill

D MDEQ assumes that the commenter is referring to sources when using the term "precisely located." A significant database has been generated during many years of investigation within the Streamside located upgradient from the Montana Pole Treatment plant NPL site? or the location of mercury? If harmful organics (and possibly metals) migrate into the "system" who will be economically responsible for damages?

Tailings OU and particularly upstream in Butte (Priority Soils, Mine Filling and Lower Area One Operable Units of Silver Bow Creek NPL Site, Montana Pole NPL Site, and Butte Wastewater Treatment Plant). Major upstream sources of metals and organics have been identified and actions are planned or ongoing in many instances to reduce downstream releases. MDEQ believes that other potential contributors to contamination in Silver Bow Creek are minor. However, it is difficult to identify all contamination sources and it is possible that other contributors, such as the old Butte landfill, will be found in the future. MDEQ plans continued monitoring of stream conditions during remedial activities and such monitoring should help detect other inputs to the system.

Responsibility for damages is determined on a case-by-case basis. If a viable responsible party can be found, they may be held liable. If no responsible party can be identified, as may be the case for the old landfill, responsibility for cleanup may fall to the State of Montana. It should also be mentioned that Congress is currently debating liability under CERCLA (Superfund). Rules for determining economic responsibility may change dramatically in the near future.

APPENDIX D-6
Comments Received on the Draft Remedial Investigation Report

A 1. Volume of Tailings/Impacted Soils - The Coalition believes that ARCO may have underestimated the volume of tailings/impacted soils within the SST OU, and that these estimates should be revisited in light of the following information.

1. ARCO used the "order of magnitude" relationship to define the boundary between tailings/impacted soils and nonimpacted soils. They admit that this relationship in metal concentrations does not equal a specific value (reference/ background) for any metal, but say it provides a good "rule of thumb" to semi-quantitatively determine the base of tailings impacts for volume determinations.

We believe this "rule of thumb" underestimates the extent of soil contamination because it assumes that impacts end at "the interval where an order of magnitude decrease in concentration was measured for most metals." This method may identify the areas of grossest contamination, but it does not accurately represent the full extent of impacts, and more importantly, the volume of materials that must be considered in remedial alternatives evaluated in the Feasibility Study.

Consider the following two statements from the RI. Concentrations of the Contaminants of Concern (COCs) As, Cd, Cu, Pb, Hg. and Zn were generally an order of magnitude higher in the tailings/ impacted soils than in the underlying "nonimpacted" soils and <u>up to two orders of magnitude</u> higher than reference soil materials for most metals. Anomalously high metals and arsenic concentrations were sometimes measured in samples collected at depth. Zinc concentrations <u>did not</u> frequently drop an order of magnitude with depth and could often be measured at concentrations above 1,000 mg/kg in <u>nonimpacted</u> soils.(emphasis added)

These two passages clearly demonstrate that materials identified in the RI as "unimpacted" have in fact been severely impacted by contaminants percolating through the overlying tailings. While we concur that ARCO's statistical analysis did show a distinct difference between the materials in the two categories - "tailings/impacted materials" and "non-impacted materials"- we disagree that this order of magnitude relationship accurately quantifies impacted materials.

A During the course of the RI, approximately 800 soil samples used to delineate the lateral and vertical extent of tailings/impacted soils were collected, described, logged, and archived. Of these, approximately 410 natural soil samples were submitted to the laboratory for analysis of metals (specifically arsenic, cadmium, copper, lead, mercury, and zinc) including 125 that were collected by PTI in 1989 and reanalyzed with an XRF using EPA approved protocol. The results of these analyses showed that there was extreme variation in metals and arsenic concentrations both vertically and laterally but that, in general, metals concentrations decreased with increasing depth. As stated in the RI, at some depth, most metals and arsenic concentrations decreased an approximate "order of magnitude". In general, the majority of metals and arsenic concentrations at a certain depth were lower than action levels used by the EPA at other Montana Superfund sites or operable units (e.g. Butte Priority Soils, ASARCO/East Helena Smelter, and Warm Springs Ponds).

Considering the preceding information and the fact that the performance standard for removal of tailings/impacted soils presented in the Record of Decision (ROD) is not concentration-based, the "order of magnitude" quantification would provide a reasonable volume estimate of tailings/impacted soils for use in the Feasibility Study (FS). While MDEQ recognizes that the actual volume of tailings for treatment or removal may be different when a remedial action is implemented, MDEQ maintains that this estimate is adequate for the purposes of developing and evaluating remedial alternatives in the FS.

B We believe all soils with concentrations of COCs above reference (background) materials, i.e. Outside of the influence of flood deposited tailings, should be considered impacted. ARCO must provide a more realistic estimate of the volume of tailings and depth of impacted soils so that all parties-MDEQ, ARCO, and the public-will have a clearer understanding the volume of tailings to be remediated, the maximum depth of impact, and the potential for effects to groundwater.

B While the term "nonimpacted" was chosen in the RI to describe soil material lying below the "order of magnitude" decrease in metals concentrations, the term was chosen as a working phrase to indicate that soils, as a whole, have lower concentrations of contaminants of concern than tailings/impacted soils. The intent in the RI was not to characterize "nonimpacted" materials as being contaminant-free.

The concept that the volume of impacted materials should be based on all materials exhibiting concentrations of metals above "background" soil concentrations was considered during the development of the RI. However, since a true "background" is difficult to define in the highly impacted area through which Silver Bow Creek flows and since metals and arsenic concentrations based on risk to human health and the environment are the driving factors for treatment or removal of tailings/impacted soil, MDEQ feels that the volume data, the maximum depth of impact, and the potential for effects to groundwater as presented in the RI more closely resemble the volume of material that would be treated or removed under the selected remedial action.

C 2. ARCO's estimate of 1,270 acres, of tailings/impacted soils with a total volume of between 2.3 and 2.8 million cubic yards differs from the Montana Natural Resource Damage Program's estimate of 1304 impacted acres and 2.83 million cubic yards of tailings/impacted soils. Please explain the different methodologies used to generate these two estimates and the 34 acre difference in total impacted area.

C The primary differences between the NRIS calculations and the NRD calculations are the slight variations between the interpretation of the extent of contamination based on independent aerial photo review and the slightly different ways used to calculate volumes based on average thicknesses of tailings.

2. Volume of Saturated Tailings - MDEQ and ARCO recognize the fact that the fluctuating groundwater levels in the OU can mobilize and transport COCs to deeper groundwater systems and to Silver Bow Creek (SBC). The RI concludes that contaminant concentrations in the deeper interval indicate that pore water can impact groundwater quality substantially, especially in the portion of the aquifer near the water table surface. In addition, several shallow wells within the SST OU contain significantly elevated concentrations of copper, zinc, and manganese, indicating the probable source of

these constituents is the overlying sulfide and metal-rich tailings/impacted soil.

A total of 30 monitoring wells were installed within the operable unit to characterize groundwater occurrence and quality, the degree of tailings saturation, and potential for metals transport via groundwater movement. ARCO superimposed the groundwater elevation map, topographic elevations, and the tailings thickness map, and assumed that only tailings/impacted soils lying within two feet of the October 1992 water table would be saturated at some time of the year.

Using this methodology, ARCO estimates there are approximately 480,000 cubic yards of tailings/impacted soils that could be saturated by the fluctuating levels of the water table, with 33% of total located in Subarea 1 and 40% located in Subarea 4.

The Coalition believes ARCO has underestimated the total volume of potentially saturated tailings, and therefore true extent of contamination, for the following reasons.

D 1. We question the assumption that only tailings/impacted soils within two feet of the October 1992 groundwater are susceptible to inundation. ARCO correctly points out that this October 1992 data probably presents minimum groundwater levels. However, they did not provide the rationale for selecting two foot level to distinguish potentially saturated materials. The RI states that groundwater levels fluctuated anywhere from less than 0.5 feet to as much as 3.5 feet. We believe this 3.5 foot level (maximum observed fluctuation) should be used, or that the rationale for selecting a lesser value be explained and justified in the RI.

D The two foot fluctuation in ground water level was selected because the measured maximum ground water fluctuation in Subareas 1, 2, and 3 were all less than 2.1 feet. In Subarea 4, two out of 11 wells exhibited fluctuations greater than 2.1 feet. This occurred in monitoring wells C2 and C3 near the town of Stuart. Because the majority of wells in the four subareas exhibited less than 2.1 feet fluctuations, and the fact that the measured fluctuation in two other monitoring wells (C4 and C4S) near Stuart were less than 2.1 feet, the data indicate that a two foot fluctuation is more representative of ground water fluctuation than the maximum fluctuation measured at the site.

E 2. In addition, the short period of record for groundwater monitoring prevents an adequate characterization of the seasonal and annual fluctuations of groundwater levels within the SST OU. Appendix F of the RI shows that most of the vadose zone data collected during low flow months of low flow years. We recommend MDEQ require ARCO to collect more conclusive data on groundwater level fluctuations in

E It is true that there is a short period of record available to determine ground water fluctuations throughout the SST OU. During the Phase II RI, ground water level information was collected in the deeper wells from November 1991 to August 1993. Because both a "wet" and a "dry" year were monitored during this period, MDEQ feels that there is adequate feasibility study level data to estimate the volume of order to provide a better estimate of the volume of saturated tailings and the potential for mobilization and transport of COCs within and out of the SST OU.

tailings that would be saturated when ground water is near the seasonal high. The reference to Appendix F and historic vadose zone data does not apply to the analysis of ground water fluctuation.

F 3. Vadose Zone Discussion - Much of the RI's discussion of fate and transport of COCs particularly to groundwater, suggests that the vadose zone plays a major role in attenuating metals and arsenic in the subsurface environment. In fact, Page 100 of the RI states that "chemical reactions and hydrogeologic properties of the vadose zone may combine to effectively prevent transport of metals and arsenic to the saturated zone." We question this statement for several reasons.

1. The data presented indicates the vadose zone has limited, if any, effectiveness in attenuating contaminants that leach into groundwater from the overlying tailings. In coarse grained materials, metals and arsenic pass through the vadose zone quite easily, as evidenced by groundwater quality degradation in areas upstream of Rocker, near Miles Crossing, near Silver Bow, and in Crackerville. In finer grained sediments-like those found in Ramsay Flats-the increasing pH and decreasing concentration with depth indicate that some of the metals are buffered in the unsaturated zone or capillary fringe.

ARCO suggests this gradual decline with depth provides evidence that precipitation, coprecipitation, and/or adsorption are operative in immobilizing contaminants in the SST OU. While this statement may be true for copper, lead, and mercury, it does not hold true for other COCs. Studies show zinc, cadmium, arsenic, and manganese all move deeper into soils, indicating the vadose zone does not effectively prevent their the movement through the SST OU.

F MDEQ recognizes that chemical reactions and hydrogeologic properties of the vadose zone may prevent transport of metals and arsenic. The Draft RI also stated on page 100 that "Zinc, cadmium, and manganese are relatively more mobile and may still be present in relatively high concentrations even when pore water pH increases above 7.0 s.u."

MDEQ agrees with the contention outlined in (1.) as it is consistent with the information and discussion of vadose zone transport of contaminants of concern. The discussion in the Draft RI also recognizes that some contaminants, particularly zinc and manganese, do not decrease as much in pore water with depth as do contaminants such as copper and lead.

With regard to contaminants precipitating, coprecipitating, and adsorbing in the vadose zone, the Draft RI acknowledges that the geochemical mechanisms are dynamic processes that can inhibit movement of metals and arsenic in the vadose zone. The RI also recognizes that site specific conditions will determine the effectiveness of the vadose zone in inhibiting contaminant movement.

G 2. Metals attenuated in the vadose zone are only immobilized temporarily, always available for transport when geochemical conditions change. Shifts from oxidizing to reducing conditions, and vice versa, can occur naturally during the seasonal fluctuation of groundwater and its interaction with tailings/impacted soils. This is evidenced by data from the STARS Study that showed large seasonal variations in pH (2 to 6.5), soil moisture, and pore water chemistry.

G This point is acknowledged in the Draft RI in the subarea specific conceptual model discussions (Sections 4.3.7, 4.4.7, 4.5.7, and 4.6.7) and in the Summary.

These ever changing conditions suggest the vadose zone may just be a "rest stop" for COCs.

H 3. Finally, data from the three STARS sites is inadequate to characterize the behavior of COCs in the vadose zone across the 25 mile expanse of the SST OU. The data discussed above shows there were wide seasonal fluctuations at two of the three sites, yet no new data was collected. We recommend MDEQ require ARCO to collect representative data from each of the four distinct subareas in the SST OU. In addition, we believe a longer period of record is needed to estimate percolation and contaminant movement during "normal flow" years.

The data presented suggests that the vadose zone may be effective in slowing the movement of some metals, but it does not prevent it. The RI concurs, stating "the occurrence of relatively high concentrations of COCs in certain groundwater monitoring wells indicates that the buffering and/or adsorptive capacity in the vadose zone is not sufficient at all locations to prevent migration of metals into the shallow groundwater." In light of this statement, and our previous comments, we believe it is inaccurate to suggest that the vadose zone is "operative in immobilizing contaminants in the SST." Therefore, we request all references to vadose zone attenuation be closely scrutinized in the Feasibility Study and that conclusions based on mechanism be omitted.

H Pore water data collected during the STARS investigation was relied on heavily in the Draft RI primarily because of the three years of monitoring data that was available. The approach used by the STARS investigation with regard to vadose zone monitoring was to select representative sites that covered the range of conditions expected. The STARS evaluation of this range of conditions, from the coarse textured tailings lying near shallow ground water at Rocker, to the fine textured tailings lying several feet above the water table at Ramsay accomplished this objective. Thus, MDEQ believes that the vadose zone has been adequately characterized using the STARS data and that this information will be sufficient to analyze vadose zone issues in the FS.

I 4. Bed Sediments - As part of the RI, ARCO characterized the volume and toxicity of sediments within the SST OU because it is recognized that reentrainment of streambank and bottom sediments during high flow is a source of metals to surface waters and the aquatic environment of Silver Bow Creek.

ARCO estimates that approximately 78,000 cubic yards of sediment are present in the SST OU. They estimated this volume by multiplying the average thickness of sediment by the average stream length and width. Studies also determined that sediments were enriched over background conditions between 10 and 65- fold for arsenic, cadmium, lead, and zinc and between 40- and 70 fold for copper.

I The volume of bed sediments as presented in the Draft RI was calculated by using the average thickness of sediment in the runs and pools (the riffles were generally sediment-free) and multiplying by an average stream width and the estimated stream length for each respective geomorphic stream form. Further work to characterize the volume and location of bed sediment was requested by MDEQ in August 1994. MDEQ would agree that the original qualitative estimate is inadequate for determining in-stream sediment volume and wholly incapable for determining sediment locations.

A survey, utilizing MDEQ's original methodology, was initiated on August 28, 1995 by ARCO contractors. MDEQ believes that this

The Coalition believes ARCO did an inadequate job of estimating the volume of bed sediments and streambank material in the SST OU that are available for erosion, transport, and redeposition. We believe ARCO must consider the following information to recalculate the volume of contaminated bed sediments with the SST OU.

1. The methodology used to derive these estimates are questionable because it only provides a rough estimate of the total volume of bed sediments. Sediment volumes were estimated primarily based on general observations of riffle, run, and pool characteristics and frequency in each subarea. A few cross-sectional measurements were made in Subarea 1, and semiquantitative estimated were made in other areas.

We believe quantitative estimate of sediment volume should be made based on representative field sampling within Silver Bow Creek. We recommend that MDEQ require ARCO to complete the sediment volume survey mentioned in the RI in order to adequately characterize the volume and fate of COCs within the SST OU. The RI admits (p. 44) that a sediment volumé survey has not yet been completed.

survey will allow quantification of the volumes and locations of in-stream sediments and that this information will be used during remedial design.

J 2. We also believe ARCO may have underestimated toxicity of sediments within the SST OU. ARCO used local background concentrations of metals and arsenic found in tributary streams to provide the basis for comparing metal levels in sediments in the SST OU. The RI concluded that sediments are believed to be enriched over background conditions by between 10 and 65-fold of arsenic, cadmium, lead and zinc and between 40 and 70-fold. Yet Essig and Moore, 1992 concluded that sediments were enriched by as much as 400-fold compared to baseline conditions. We recommend ARCO and MDEQ explain why this order of magnitude discrepancy exists and what implications it has on determining the impacts of sediments within and beyond the boundaries of the SST OU.

J The background sediment metals and arsenic concentrations were obtained from Essig and Moore (1992) on page 24 (Table 7 - Local Sediment Baseline Elemental Abundances). These values were compared with the geometric mean of sediment metals and arsenic concentrations measured in samples collected from each of the individual subareas. The geometric means are reported in Tables 4-22, 4-44, 4-61, and 4-77. Geometric means represent the concentrations for the whole sample less than 2 millimeters in size (i.e. coarse sand, sand, silt and clay). The Essig and Moore reference to the 400-fold increase above background in copper concentrations in Silver Bow Creek is based on median element concentrations in the soil fraction containing silt and clay (less than .063 mm in size). The findings presented in the Draft RI are consistent with this data (pp 125 and 190, Draft RI).

K 3. Finally, we think ARCO did an inadequate job of evaluating the potential for erosion of streambank and bed materials, and their subsequent impacts to surface water quality in Silver Bow Creek. We recommend that MDEQ require ARCO to develop the sediment transport model that was discussed in the SAP, but not provided in the RI. Please see section 5 for an expanded discussion of this point.

We recognize that streambed sediments are dynamic by nature and thus difficult to quantify. However, we also recognize the fact that high flow conditions erode tailing/impacted soils streambed/banks materials that are a known source of metals to surface waters and the aquatic environment of Silver Bow Creek. We strongly believe that these contaminated stream sediments will have to be removed if the remedial goals are to be met at the site. Consequently, we urge ARCO to provide a more accurate estimate of the total volume of contaminated sediments within the SST OU, as well as a better discussion of how those sediments are transported and what their likely impacts will be downstream.

K MDEQ agrees that ARCO did an inadequate job of evaluating the potential for erosion during varying flow conditions as well as under different potential remedial actions. This was one of the factors in the decision to evaluate a more intensive near-stream removal as described in the Draft FS (ARCO, 1995b) and the Proposed Plan (MDEQ, 1995). MDEQ may require ARCO to develop a sediment transport or geomorphic stability model during remedial design to demonstrate the efficacy of the selected remedy.

L 5. Surface Water - Surface water quality and quantity data for Silver Bow Creek was collected from 1991-1993 as part of the RI. Eleven surface water stations within the SST OU were sampled during "representative" high and low flow events, and twelve staff gages were monitored monthly to determine surface water levels. Finally, continuous surface water measurements were taken at three stations in the SST OU.

The RI concludes that during non-runoff conditions, the quality of Silver Bow Creek improves downstream as the pH increases and metal precipitate out of solution and into the streambed. During runoff event-rainstorms and snowmelt-however, flows increase and water quality quickly deteriorates. This deterioration usually occurs when rain storms follow relatively dry antecedent conditions allowing metallic salts that have formed at the surface of the tailings deposits to flush into the stream.

The RI also concluded that erosion of streambed/bank materials is one of the most important transport mechanisms in the SST OU. In

L Surface water flow and quality data were collected from Silver Bow Creek under Superfund guidance in 1984, 1985, 1988, 1989, and the years 1991 through 1993. The data collected represent a range of flow and climatic conditions at the site. While this range of conditions does not cover the higher flood flow conditions that could occur within the SST OU, the characterization of low and high flows presented in the Draft RI adequately depict the mechanisms contributing to surface water quality degradation and form an adequate basis for evaluating remedial alternatives in the FS.

fact, much of the increase in total metals during high flow/runoff events is caused by the erosion of tailings/impacted soils and streambed/bank materials.

Although ARCO adequately characterized the mechanisms by which tailings degrade surface water quality, we do not believe ARCO did an adequate job of quantifying the volume of streambed/bank materials that are susceptible to erosion or their likely impacts on surface water quality. We believe this discussion was inadequate for the following reasons.

1. Surface water flows were monitored during low and high-flow events in 1985 and from 1991 to 1993, although continuous recorders were used at three locations within the SST OU. Because these years generally represent low flow/drought conditions, they do not adequately characterize historic flows through the OU. Consequently, we believe the period of record for surface water sampling is inadequate. We recommend ARCO collect more flow data or that more extensive modeling be performed to estimate the potential for erosion and transport, bed sediment scour, mass wasting and slumping of tailings/impacted bank material.

M 2. As previously mentioned, no sediment transport model for Silver Bow Creek was developed for the SST OU. The only real information presented in the RI to help quantify erosion potential was the flood modeling discussion on page 123. However, the HEC-1 and HEC-2 models that were used can only simulate laminar flow. Since the majority of sediment erosion occurs during turbulent flows during spring runoff, these models cannot adequately predict erosion and transport of streambed/bank material within the SST OU.

The data presented indicates that the primary impact on Silver Bow Creek water quality is erosion and runoff from tailings materials within the floodplain. This conclusion is supported by visual evidence observed in the field. Yet the degree to which bank erosion impacts the quality of water in SBC has not been quantified in the RI. Considering the fact that streambed/bank materials are a source of contaminants to surface waters, a repository for contaminants, and

M As part of the CH2M Hill Flood Modeling Study (1989), the sediment transport model FLUVIAL-12 was run to simulate the combined effects of flow hydraulics, sediment transport, and channel changes for a given series of flows. This model is capable of calculating bank erosion due to river widening during floods (CH2M Hill, 1989). The model predicted that approximately 100,000 cubic yards of sediment would reach the Warm Springs Ponds during the 100-year flood. Estimated changes in channel cross-section geometry were developed as an output of the model. While the degree to which bank erosion contributes to water quality degradation could not be quantified with this model or other information developed during the RI, bank erosion was identified as a pathway for surface water and sediment contamination and will be considered as such in the development of remedial alternatives in the FS.

a direct pathway for contaminants to enter the food chain of fish, and the fact that some bed materials were enriched with COCs by as much as 40-fold compared to local baseline conditions, we recommend that MDEQ require ARCO to create a sediment transport model for the SST OU.

N 6. Groundwater - Characterization of the alluvial aquifer was one of the primary focuses of the RI, primarily because of its shallow depth and its close relationship with Silver Bow Creek. During the RI investigations, a total of 154 samples were collected from 30 monitoring wells to characterize groundwater occurrence and quality in the SST OU. These studies found that the Silver Bow Creek valley alluvium and subjacent unconsolidated deposits vary in thickness from thirteen to several hundred feet, and that these deposits operate as a single aquifer.

The RI concludes that impacts to groundwater are probably limited to the upper portion of the alluvial aquifer and that chemical reactions and hydrogeologic properties of the vadose zone may combine to effectively prevent transport of metals and arsenic to the saturated zone. Yet the RI plainly states that the degree to which groundwater quality is affected by contact with tailings and by surface water /groundwater interactions is unknown and difficult to distinguish.

In light of this contradiction, we believe ARCO did an inadequate job of quantifying the potential impacts to groundwater in the SST OU. We believe the discussion of these impacts needs to be expanded for the following reasons.

1. ARCO failed to complete studies outlined in the 1991-1992 Sampling and Analysis Plan. Page 40 of the RI states that deviations from the SAP for the groundwater investigation include non-performance of the following activities: vadose zone monitoring of the capillary fringe, performance of aquifer tests, and, numerical 1-D or 2-D modeling to assess groundwater contaminant transport to SBC. Other modifications of these plans included changing borehole locations, changing SOPs, alternative data collection methods, and

N MDEQ recognizes that the ground water information collected during the Lower Area One Phase I and II RIs and the SST OU RI is limited, primarily due to the size of the operable unit and its linear nature. While the impact to the ground water system underlying the tailings could not be quantified, ground water data do show that MCL exceedances and higher concentrations of copper and zinc are generally restricted to the upper portion of the aquifer.

With regard to deviations from the SAP, MDEQ determined that none of the deviations would substantially contribute to altering conclusions in the Draft RI. Thus, ARCO will not be required to perform these incomplete tasks for the following reasons:

- With regard to vadose zone monitoring, MDEQ and ARCO jointly determined that data collected during the STARS study concerning the vadose zone would be adequate and more valuable then implementing additional vadose zone monitoring, primarily because of the three years of enforcement quality data collected at representative sites in the SST OU. Similarly, ample aquifer test data was also agreed to be available to characterize the shallow aquifer, supplemented by testing done on the deeper aquifer at the Rocker Town Pump. These data are presented in Appendix H of the Draft RI.

- Changes made to the SOPs, borehole locations, alternative data collection methods, and alternative well completion methods were all made during the RI with the concurrence of MDEQ with few exceptions. None of these changes affected the integrity or completeness of the data collected. While the collection of additional data would facilitate quantification of several aspects of the site where now there adjusted well completion methods. We recommend that MDEQ require ARCO to complete a more comprehensive groundwater investigation in order to better characterize the occurrence and quality of groundwater in the SST OU.

is only qualitative data, additional data is not expected to affect the conclusions of the Draft RI nor would additional data impact the selection of alternatives in the FS.

O 2. As mentioned earlier, the period of record for groundwater level and quality monitoring is inadequate to determine spatial and temporal variations within the SST OU. The RI reports that groundwater levels fluctuated anywhere from less than 0.5 feet to as much as 3.5 feet during the monitoring period, yet the average value of two feet was used to determine the volume of saturated tailings. We urge MDEQ to base groundwater fluctuation estimates and the potential for tailings saturation on the worst case scenario, not on the average conditions.

O See previous responses D and E.

P 3. Finally, ARCO based some conclusions regarding groundwater on unproven assumptions about the buffering capacity of the vadose zone and native soils. ARCO claims that "chemical reactions and hydrogeologic properties of the vadose zone may combine to effectively prevent transport of metals and arsenic to the saturated zone." Yet data presented in the RI concludes that "the occurrence of relatively high concentrations of COCs in certain groundwater monitoring wells indicates that the buffering and/or adsorptive capacity in the vadose zone is not sufficient at all locations to prevent migration of metals into the shallow groundwater.

ARCO also claims that the soils underlying the tailings have a buffering capacity that neutralizes the acidity of downward moving pore water. They claim this buffering capacity can result in the coprecipitation and adsorption of metals from pore water, particularly in Subarea 4 where calcareous materials are thought to neutralize low pH solutions, promoting precipitation and adsorption of metals. These conclusions are contradicted by the fact that arsenic, zinc, cadmium and manganese are more mobile and may still be present in relatively high concentrations even when pore water pH increases above pH 7. This point is particularly true in Crackerville, a portion of Subarea 4 that has MCL violations for cadmium, even though it is in the Subarea thought to have the most buffering capacity.

P See previous response F with regard to buffering capacity in the vadose zone. With regard to MCL exceedances of arsenic in the upper, and cadmium in the upper and lower alluvial aquifer in Subarea 4, ground water pH is generally less than 6.0 s.u. in the Stuart transect and generally greater than 6.5 s.u. in the Crackerville transect. Manganese and zinc concentrations in both areas are generally elevated with respect to other wells in Subarea 4 as well as iron and copper in certain shallow wells. This was explained in the Draft RI as potentially being related to changes in ground water elevations where the highest concentrations of copper and zinc in certain wells appeared to coincide with periods of relatively higher ground water elevation. This relationship is thought to be due to the saturation of tailings/impacted soils becoming inundated during periods of high water levels.

Metals and arsenic concentrations measured in borehole samples from the two to three-foot depth interval below ground surface do not necessarily support this hypothesis. However, metals and arsenic concentrations in wells screened deeper than 20 feet below ground surface generally are not elevated above MCLs, except for cadmium, which has been detected at concentrations above MCLs in the lower aquifer in Subarea 4.

In light of these contradictions, we recommend that ARCO complete the studies that were outlined in the SAP but not completed as part of the RI.

Q 7. STARS Discussion - Much of the discussion in the RI alluded to the fact that STARS treatment is a remedial alternative that will be considered during the Feasibility Study. As discussed earlier, we believe MDEQ and ARCO must develop specific criteria for determining when implementing STARS technology is appropriate. As this decision is made, we believe several questions regarding the STARS treatment technology must be addressed. These include:

1. Several COCs within the SST OU respond to pH changes in a similar manner, unfortunately arsenic is not one of them. Lime additions to increase pH, decrease acidity, and promote plant growth on tailings will mobilize arsenic in the tailings/ impacted soils and pore water. Please explain how arsenic mobility will be controlled if STARS technology is selected as a remedy

Q MDEQ recognizes the limitations of STARS as outlined in the STARS Phase III Monitoring Report. These limitations will be considered during the detailed and comparative analyses conducted during the FS. Increasing the mobility of arsenic is one of the limitations of STARS that will be considered during the analysis of alternatives. Site specific criteria will be evaluated in the FS during the analysis of STARS alternatives to determine whether STARS is an appropriate treatment for specific areas of the OU.

R 2. Maintaining "neutral" pH conditions in the amended tailings over time is critical in determining the potential success of STARS treatment technology. Percolation of rainfall and snowmelt through the tailings, whether vegetated or not, will transport some of the lime amendments to lower depths in the soil horizon. This situation must be addressed because as lime is leached form the upper soil profile, pH will decrease and metals will be more likely to wick up to the surface, possibly killing the STARS vegetation. Please discuss whether ARCO and MDEQ view this as a potential problem. If they do, please explain how additional lime amendments will be added to the tailings/impacted soils without damaging the vegetation that has already been planted.

R Using the STARS treatment approach, lime amendments are added to the tailings at a rate calculated on the portion of sulfides that could potentially produce acid over time plus an additional amount to account for incomplete mixing. Due to the relative insolubility of calcium carbonate (the primary buffering mineral that results from STARS amendment application) in soil where pH conditions are greater than 6.0 s.u., the majority of the lime applied is not expected to leach from the amended zone. This assertion is supported in the scientific literature by many investigators and was shown to be true for the STARS Phase III monitoring. Therefore, as the sulfides weather to form acid, the applied lime will be available to neutralize the acidity produced over the long term. Additional lime is not expected to be added to a STARS treated area unless the acid potential is incorrectly assessed during amendment design, if amendment application results in incomplete mixing, or if rising ground water or surface water runoff remove the soluble amendment components shortly after amendment application.

S 3. We're concerned that disturbing the tailings/ impacted soils to add lime amendments will make them more susceptible to erosion and transport. Once these materials are eroded, natural stream dynamics will separate the different grain size fractions and deposit them in different areas of the stream. The tailings that were amended with lime will no longer be in contact with the lime, and COCs will be released. In addition, excessive lime washed into the stream may cause unanticipated impacts on Silver Bow Creek itself. We urge ARCO and MDEQ to explain how will surface erosion from STARS plots will be controlled while vegetation is getting established.

Response

S Rill, gully, and sheet erosion affecting treated areas are expected to be short-term problems that will be managed with standard reclamation Best Management Practices (BMPs). MDEQ expects that erosion control measures will be included in remedial design between the time of disturbance and the actual establishment of vegetation. Reclamation and seeding of treated areas will be completed as soon as final grading is completed. Vegetative mulch will be applied and crimped into the surface of recently seeded areas, a standard form of erosion control. Nurse crops of annual wheat or rye will be used to provide quickly establishing, vegetative cover to protect the treated areas while the slower growing perennial cover becomes established. Other erosion control measures such as the use of erosion control mats will be considered during remedial design.

T 4. Finally, Superfund remedies are supposed to be permanent and effective, yet the long-term effectiveness of STARS has not been demonstrated. While initial results from the STARS plots are encouraging, they simply are not sufficient to suggest that STARS will permanently and effectively remediate tailings/ impacted soils within the SST OU. Please explain how using STARS meets the spirit and intent of the federal Superfund law.

Response

T The limitations of STARS are recognized by MDEQ and were included in the analysis of remedial alternatives during the FS. Limitations as well as strengths of all remedial alternatives is considered in the final selection of the remedy.

A 1. Issue: Land Use - The MDEQ description of current land uses should be clarified. The MDEQ states, in Section 3.7, Page 84, Paragraph 3, Line 1, "The majority of the land within the Silver Bow Creek watershed is rangeland. Some areas along Silver Bow Creek are used for irrigated agricultural and industrial purposes. Near-stream recreational use is also evident, including hiking, bird watching, hunting, and off-road vehicle use." It should be clarified that the near-stream recreational uses are largely trespass use and are therefore limited. Also, based on discussions with landowners, and direct observation of stock and fences, only a small percent is currently used for agricultural grazing.

ARCO disputes the MDEQ assumptions for future land uses within the SST OU. MDEQ states, "Future land use is expected to be agricultural, stock grazing, recreational, and residential." ARCO firmly believes that residential use of areas of the SST OU will not occur, just as it has not presently occurred, because all but a few areas in the SST OU are within the floodplain, because of the presence of riparian wetlands, and the presence of railroad right-of-ways for a large portion of the site.

B 2. Issue: Ground Water Use Identification and Assumptions - The current and future ground water and land use assumptions made by the MDEQ lack basis and are incorrect. For example, the MDEQ text states in Section 3.5.4, Page 66, Paragraph 1, Line 1, "Lower alluvial ground water is being used for potable and agricultural applications adjacent to the SST OU. Some of these adjacent wells draw water from beneath the OU as well. It is also reasonable to expect future ground water development adjacent to the OU boundaries for consumptive purposes. Domestic water supply wells may be permitted, even within the floodway, provided the well casing is water tight to a depth of 25 feet and the well meets certain conditions for floodproofing, sealing and positive drainage away from the well head [ARM 36.15.602(6)]."

There is no direct evidence that withdrawals from wells adjacent to the SST OU would draw shallow alluvial ground water from beneath

A MDEQ did not intend to quantify the types of use along the OU in the referenced statement but rather listed the uses that have been observed and are known to occur. Because most of the land along the OU is private, some of the use is trespass use, although this does not mean that the use does not occur. Also, in the near-stream areas, Montana's stream access law applies to those portions of the OU within the high water mark of the stream which is considered to be publicly accessed property.

With regard to residential use, at the time the Draft RI was prepared, MDEQ considered that, upon clean-up of the site, residential use would be as likely as any other future use for non-floodplain areas. Private properties can be sold, subdivided, and developed in the future and meeting the remedial action goals for the OU will likely make Silver Bow Creek attractive for development. MDEQ believes that, while residential use has not been developed to any extent to date, residential use cannot be precluded from future land use considerations. Recent efforts to dedicate the Silver Bow Creek corridor to recreational use are likely to preclude residential development on the site. This factor was considered during evaluation of the selected remedy.

B MDEQ believes the aquifer test of the Town Pump well was inconclusive in determining connection between the lower alluvial and the upper alluvial aquifer because of interference from precipitation events and Silver Bow Creek stage movement during the duration of the test. ARCO's delineation between the upper and lower alluvial aquifer was completely arbitrary and was solely based on depth from land surface. There is no hydrogeological base separating the upper and lower alluvium and MDEQ asserts that the two are, in fact, one aquifer system. This arbitrary delineation was only made for interpretation of impacts to ground water from SST OU tailings/impacted soils.

MDEQ disagrees with ARCO's interpretation of the aquifer test of the Town Pump well near Rocker. The statement ARCO quotes in Section 3.5.4 "<u>Lower alluvial</u> [emphasis added] ground water is being used for potable and agricultural applications adjacent to the SST the SST OU. The single, quantitative evaluation performed to measure the response of ground water within the SST OU from off-site pumping identified no movement or connection of shallow ground water off-site. The aquifer test of the Town Pump well at Rocker, performed by the MDEQ in 1994, involved pumping the Town Pump well (located outside the SST OU) and monitoring water levels in wells on-site. The test was performed for a period of one week with no evidence of shallow water movement from within to outside the SST OU. In fact, the test showed that the shallow ground water was not connected hydraulically to the deeper aquifer zone being tested. The volume of water pumped and continuous duration of the aquifer test exceeded expected future ground water use adjacent to the SST OU.

ARCO acknowledges that the physical setting of the Town Pump aquifer test is not representative of the entire site and that significant pumping of a well adjacent to the OU in an unconfined aquifer could potentially result in flow of ground water from within to outside the SST OU. However, as ARCO described in the Preliminary Draft RI Report submitted to the agency in October 1994, the geochemistry of the system will limit the movement of constituents of concern with the ground water. ARCO stated, "Constituents of concern that are carried by vadose zone transport to ground water are expected to move only a minor distance within the aquifer, before the geochemical system has changed to the point that these constituents of concern drop out of ground water..." Therefore, even if ground water movement from the SST OU to adjacent areas was induced by pumping, significant transport of constituents of concern would not occur.

OU. Some of these adjacent wells draw water from beneath the OU as well." is entirely correct. The Town Pump aquifer test clearly demonstrated a hydraulic connection between off-site lower alluvial ground water and onsite lower alluvial ground water while the Town Pump well is presently being utilized as a drinking water source.

ARCO's conjecture on the geochemical system attenuating contaminant movement to a "minor" distance before these contaminants "drop out of ground water..." is not supported by any scientifically derived data.

C 3. Issue: Background Soil and Sediment Concentrations - The MDEQ text identifies "background" soil and sediment concentrations that do not represent background conditions for the Silver Bow Creek drainage which are naturally mineralized. Specifically, the MDEQ text cites studies from the Montana Natural Resources Damage Program from other stream systems and literature values for background sediment and soil concentrations. Since the cited information was obtained outside the Butte area and not directly downstream from a

C As discussed in the Draft RI on page 110, reference soil samples were collected in drainages adjacent to the OU from sites with soil characteristics similar to soils in the Silver Bow Creek floodplain. This set of soil samples was used for comparative purposes and was defined as reference because of the difficulty of defining a true "background" for soil. This is explicitly stated in the Draft RI. MDEQ considers this a valid and informative comparison with the purpose highly mineralized area such as found in Butte, the use of the information for definition of local "background" is not appropriate. Use of inappropriate and unrepresentative background levels will result in a distortion of the impacts of streamside Tailings.

For instance, relative to background sediment concentrations, the MDEQ states in the summary, "Local background concentrations of metals and arsenic in sediment samples collected from tributary streams in the Clark Fork basin provide a basis for comparing to metals and arsenic concentrations in sediments sampled in the SST OU. In general, sediments in Silver Bow Creek within the operable unit were enriched over background conditions by between 10- and 65-fold for arsenic, cadmium, lead, and zinc and between 40- and 70-fold for copper." The "local background" conditions cited are based on the investigation of Essig and Moore (1992) in tributaries to the Clark Fork River. Those tributaries do not flow through areas with the elevated levels of economic and other minerals like those that resulted in the extensive mining, both past and present, in and near Butte. The location of locally extensive placer workings along Silver Bow Creek is additional evidence that elevated levels of economic and other minerals exist in the native soils adjacent to the stream. Therefore, both floodplain soils and sediments "background" to the area of the SST OU would be expected to have higher metals contents than other areas in the state.

of appraising the enrichment of metals in tailings/impacted soils within the OU.

With regard to sediment background concentrations, the work done by Essig and Moore (1992), who are respected researchers at the University of Montana, attempted to establish background conditions in bed sediments by selecting tributary drainages that were minimally affected by mining, although not necessarily outside of highly mineralized areas. Since mining activity has disturbed most of the drainages surrounding Butte, Essig and Moore went outside the Butte area for their study. Three streams were chosen to represent geochemical baselines (background), Ruby River, Gold Creek, and Rock Creek. Both Gold Creek and Rock Creek are tributaries to the Clark Fork River. The process used by Essig and Moore to define sediment metal concentrations that would be considered to represent pre-mining conditions was scientific and logical and provides a relative comparison for metals enrichment. MDEQ is not aware of any data showing that pre-mining, unimpacted, floodplain soils and sediments naturally have considerably higher concentrations of metals and arsenic than those presented as background or reference concentrations in the Draft RI.

D 4. Issue: Non-Mining Impacts on Aquatic and Terrestrial Resources within the SST OU - MDEQ presentation of the biologic health and impacts to biota are incomplete and do not present the whole picture. For example, the last bullet of the summary Aquatic and Terrestrial Resources section, page 14 of the Summary states, "Benthic macroinvertebrate population in the SST OU indicated that biological integrity was severely impaired by metals and organic pollution and that metals remained the primary cause of impacts to macroinvertebrates above Warm Springs Ponds." The MDEQ text does not fully explain that in addition to impacts related to mining urban and industrial pollution impact the aquatic biota in Silver Bow Creek and the surrounding habitat. As an example, levels of ammonia and other organic compounds discharged from the Butte

D Biointegrity samples were collected at two stations within the OU and at one station above the Warm Springs Ponds (McGuire, 1993). On page 13 of the McGuire report, Section 4.1.1 concluded "Silver Bow Creek (stations 00-03) continued to be seriously impacted by metals throughout the seven-year monitoring period." On page 14, Section 4.2.1 states "Metals remained the overwhelming cause of degradation above the Warm Springs Ponds." In this same section, on page 15, the report states "Metals pollution was generally so severe as to preclude biological responses to other forms of pollution in Silver Bow Creek. However, severe organic/nutrient pollution was sometimes indicated (Table 5), particularly below the Butte sewage outfall (station 01) and the Warm Springs Ponds (station 04). When metals were diminished, organic pollution prevented significant

Sewage Treatment Plant are sufficient to depress invertebrate populations for almost the entire length of Silver Bow Creek. These non-mining effects have been clearly documented in a report prepared by the Montana Water Quality Bureau, "Clark Fork River Macroinvertebrate Community Biointegrity- 1986-1992 (MDEQ, October 1993). The following conclusion was made in this report in Section 5, page 39:

"3. Silver Bow Creek was severely polluted by metals, nutrients and organic pollutants throughout the seven-year monitoring period. Metals toxicity depressed biological integrity and restricted the benthic biota to a few tolerant species. biological [sic] responses to nutrient and organic enrichment were usually limited in the prevailing toxic environment. When metals impacts diminished, organic pollution prevented significant improvement in biointegrity."

Additionally, the MDEQ text does not note the recent trends toward increased species diversity and biologic health in the SST OU that has been noted by recent investigations by the same recent investigations by the Montana Water Quality Bureau.

E Regarding terrestrial vegetation, the MDEQ removed a paragraph describing that vegetation outside of tailings/impacted soils is characteristic of disturbed sites. The MDEQ text assumes that all barren areas are contaminated (for example, Section 3.8.1, page 84, paragraph 1; Section 3.8.2, page 86, paragraph 4; and Section 3.8.4, page 89, paragraph 1), ignoring the percentage of area that may be naturally barren due to naturally rocky soils, arid climate, and active and historic gravel mining operations.

F 5. Issue: Misrepresentation of the Phase I RI Conclusions - The conclusions from the Phase I RI by MultiTech are misrepresented in

improvement in biointegrity." The last sentence in the previous quotation references the effects of organic pollution with respect to samples collected below the Warm Springs Ponds, not in Silver Bow Creek as ARCO suggests. McGuire (1993) also notes in Section 4.2.1 that temporal trends in biointegrity are not evident in Silver Bow Creek during the period 1986-1992. McGuire (1995) noted a "slight, but significant, trend of reduced metals impacts" during 1993, although the conclusion seems to be based more on Silver Bow Creek data from above and below the Streamside Tailings operable unit than the one station within the site at Opportunity. McGuire's report of his 1994 investigation is not complete yet, but observations by McGuire based on his 1994 and 1995 sampling suggest that the improvements seen in 1993 did not continue in the same magnitude in subsequent years and may have only been temporary or perhaps were primarily associated with the sustained high stream flows during 1993.

E The following paragraph was inadvertently removed from the document: "Upland portions of the study area included plant communities dominated by Great Basin Wildrye, rabbit brush, greasewood, and a variety of species characteristic of disturbed sites, such as spotted knapweed and Loesel tumblemustard."

MDEQ changed the wording referenced in its revision of ARCO's original text from "barren" to "barren/contaminated". The barren/contaminated was meant to mean barren and/or contaminated. MDEQ did not intend to ignore that a small percentage of land may be unvegetated due to gravel operations and rocky soils. As a percentage of the 1,270 acres, land that falls into this category is considered to be less than 5%, with the balance of barren land due to mining related impacts.

F MDEQ did not intend to misrepresent the conclusions drawn in the Phase I RI. Rather, MDEQ framed the conclusion presented in the

the MDEQ text. Words and phrases have been deleted that leave the implication that the Phase I RI found extensive impacts of tailings/impacted soils to ground water and of ground water to surface water. For example, MultiTech concluded in Table ES-2 of the Phase I RI that "ground water was only locally affected by contaminants." MDEQ deleted the words "only locally" from their summary of the Phase I RI conclusions. In addition, the MDEQ cites the MultiTech Phase I RI Report as finding that "non-point sources [of constituents of concern to surface water] included ground water inflows...". The Phase I RI specifically did not find significant impacts of ground water to surface water within the SST OU. The identified impacts were located upstream of the SST OU in the Colorado Tailings area.

Response: Phase I RI into terms more appropriate for the level of ground water data collected. The words "only locally" were not used because of the limited number of wells installed in the SST OU for the Phase I study. MDEQ did not believe the sampled universe was large enough to make a determination that the impact was local, as opposed to widespread.

G 6. Issue: Subarea Conceptual Model Figures - The conceptual model figures included by the MDEQ significantly misrepresent the physical and chemical nature of the site. While the figures are "cartoons" and for illustrative purposes, the figures should not be misleading. These misrepresentations include:

G The conceptual model figures for each subarea are meant to be illustrative and were never drawn or represented as scale drawings. The illustrations conceptually show the relationship between the sources, pathways and receptors. To do this, some aspects of the physical characteristics of the illustrations were exaggerated; however, MDEQ does not believe the drawings misrepresent site conditions.

H The relationship between tailings deposits, ground water and Silver Bow Creek is misrepresented. For example, Silver Bow Creek is shown flowing over tailings in the conceptual model figures. This does not occur anywhere within the SST OU. The appropriate relationship between tailings deposits, ground water and Silver Bow Creek are shown on the scaled cross-section figures for each subarea (Figures 4-13, 4-30, 4-31, 4-32, 4-45, 4-59 and 4-60);

H None of the conceptual model figures show tailings beneath the streambed. In the Subarea 4 model, tailings are shown in the overflow channels. This condition was documented by test pits excavated in an overflow channel in Subarea 4.

I The sinuosity of Silver Bow Creek in the figures (see especially the Subarea 4 conceptual model rifle) is not representative of stream conditions. As shown, the rifles portray overly sinuous and more erosive conditions than are present;

I See comment G.

J Vertical scale is inconsistently represented, so that the tailings thickness is represented as greater than the height of the railroad grades, and placer workings are unrealistically hummocky;

J See comment G. Vertical scale was not intended or represented on the drawing.

ARCO Statement of Disclaimer - January 6, 1995

K Geochemical mechanisms that mobilize constituents of concern are represented, whereas the equally prevalent geochemical mechanisms that immobilize constituents of concern in the soils are not represented;

Response

K The geochemical mechanisms precipitation, coprecipitation, complexation and adsorption that inhibit metals migration are represented on each of the conceptual model figures.

ARCO Statement of Disclaimer - January 6, 1995

L The figures imply that all railroad beds are made of mine wastes. This is inaccurate and misrepresents the extent and quantity of mine wastes in railroad embankments;

Response

L See comment G. Vertical scale was not intended or represented on the drawing.

ARCO Statement of Disclaimer - January 6, 1995

M The figure of Subarea 2 implies that the majority of the alluvial deposits and exposed bank at Ramsay Flats is tailings. In reality, only approximately the top two feet of the soil profile in the Ramsay Flats area along the stream cut are tailings;

Response

M See comment G. No scale was intended or represented on the drawing.

ARCO Statement of Disclaimer - January 6, 1995

N The conceptual model figure for Subarea 4 notes tailings deposited outside of irrigation ditches by irrigation flows. This is a minimal issue along Silver Bow Creek given that only two irrigation diversions have been identified and evidence of tailings deposits from irrigation diversions were not identified during the RI; and

Response

N Comment noted.

ARCO Statement of Disclaimer - January 6, 1995

O The relationship between ground water and surface water is misrepresented. For example, Subarea 3 is shown as gaining although surface water and ground water elevation data from this subarea show that the stream is losing throughout most of Subarea 3.

Response

O See comment G. Basic natural hydrogeological and hydraulic processes support the conclusion that the stream is not losing flow to groundwater in Subarea 3. The ground water seeps on the canyon walls in Subarea 3 are clear indicators that, in general, the ground water level is higher than the surface water level. The one well in the canyon that appears to indicate a lower ground water elevation then the adjacent surface water elevation would reasonably be not considered as representing the hydraulic conditions of the canyon as a whole. Because of the low primary and secondary conductivity typical of volcanic rocks that are similar to the volcanics present in the canyon, this recharge might not be measurable by the quantification evaluated by ARCO using the limited ground water level and stream stage information available in the canyon.

ARCO Statement of Disclaimer - January 6, 1995

P 7. Issue: Significance of Airborne Transport of Constituents of Concern - The MDEQ text is not consistent in its presentation of the significance of airborne transport as a pathway. In the MDEQ text, airborne transport is cited as a "primary" pathway. However, it is

Response

P ARCO did not collect SST OU specific air transport data and chose to rely on data collected at the Smelter Hill OU of the Anaconda Superfund Site. MDEQ accepted the adjustment to the RI/FS work plan requirements because it was clear that this pathway would be later determined to be insignificant. The inconsistency is confusing and misleading. Available data in the area shows that the air transport pathway is not significant and should not be identified as a primary pathway.

For example, the MDEQ text states, on Page 1, Paragraph 3, Line 2 of the Summary, "The primary pathways of contaminant movement in the operable unit include windborne transport, surface water runoff, infiltration of surface runoff into underlying groundwater systems, and groundwater movement to Silver Bow Creek or its tributaries." Additionally, the MDEQ states, in Section 4.4.7.2, Page 272, Paragraph 2, Line 1, "The relatively large expanse of unvegetated tailings at the Ramsay Flats and the fine grained nature of the tailings makes this area susceptible to wind erosion and entrainment of metals contaminated dust."

However, the MDEQ concludes, in Section 4.7, Page 389, Paragraph 3, Line 3, "Though this [airborne transport of constituents of concern] potential exists, evaluations of the extensive air data available from other operable units in the Clark Fork NPL site indicates that airborne emissions from the SST OU are unlikely to result in significant effects on air quality or contribute significantly to exposures or health risks."

eliminated or at a minimum severely reduced by any selected remedy that addressed surface runoff erosion to protect Silver Bow Creek. MDEQ acknowledges the comment.

Q 8. Issue: Impacts of Larger Tailings Areas - The MDEQ asserts that larger areas of tailings result in greater impact to Silver Bow Creek than other areas. The MDEQ states, "Because Subareas 2 and 4 host the most laterally extensive expanses of streamside tailings, it is probable that these portions of the SST OU exert a relatively greater impact on the quality of water in Silver Bow Creek than the other two subareas." This statement is speculative, has no basis from data collected and is inconsistent with the other findings in the report.

The mere presence of tailings in an area relatively distant from the stream is not an indication of "greater impact" on the stream. Only those tailings near stream would be anticipated to impact the stream. In those locations of relatively wider areas of tailings, the natural topography is flatter. The runoff and erosion pathways identified by the MDEQ as the most significant will be reduced. Therefore, tailings

Q This statement was made in the summary (page Sum-19) as part of the *Impact Analysis*. The sentences preceding the sentence quoted in the comment state "The relative impact of the various pathways of contaminant movement in the SST OU on Silver Bow Creek water quality is difficult to quantify accurately. Available data suggest that the primary impact on Silver Bow water quality, on an annual basis, is erosion of and runoff from the tailings within the floodplain." Further, the statement referred to in the comment used the qualifiers "probably" and "relatively greater".

MDEQ believes this statement is accurate within the context that it is presented. It refers to runoff and erosion as the primary impact to Silver Bow Creek, not ground water, and relies on the observation that samples of runoff collected from Ramsay Flats in July 1986 (Table 4-33, page 294, Draft RI) contained extremely high distant from the stream will not result in significantly "greater impact" to the stream.

Additionally, the MDEQ has stated that tailings which may be inundated by ground water is a potential concern to ground water and, subsequently, surface water. The areas with the least potential for this impact are Subareas 2 and 4 (the areas with the widest areal extent of tailings). MDEQ states on Page 20 of the Summary that, "in Subarea 4, where the largest percentage of the total tailings/impacted soils in this category (potentially saturated) are located, ground water only appears to be minimally affected." Relative to ground water quality in Subarea 2, the MDEQ states that ground water samples from "wells completed within Ramsay Flats, one of the larger tailings deposits in the operable unit, do not indicate widespread groundwater quality degradation." This supports the conclusion that the areas of wider extent of tailings are not anticipated to result in "greater impact" to the stream.

concentrations of metals and arsenic. From this, it is deductive to conclude that precipitation falling on larger areas of tailings may produce higher quantities of runoff and that this runoff contains metals and arsenic in relatively higher concentrations. During runoff events, near-stream tailings are not the only source of contaminated runoff to the stream; those tailings areas distal to the active stream channel can have a substantial impact on surface water quality during a runoff event.

R 9. Issue: Precipitation/Snowmelt Infiltration of Tailings/Impacted Soils - The MDEQ text describing the percolation of precipitation through tailings/soils is misleading and does not fully convey the overall picture of the anticipated quantity of percolating water. The values presented are maximum values for portions of the site for one investigation effort and do not present either the magnitude of error associated with the maximum results or other studies and models that identified significantly less infiltration. For example, in the Summary section, MDEQ states "During an average year, between three and 3.5 inches of percolation were expected to infiltrate through tailings/impacted soils. Vadose zone transport of pore water through finer grained materials will likely be somewhat less than that for coarser grained material." This characterization does not represent the actual data and studies that have been done on infiltration in the SST OU. Moreover, this characterization is wholly inconsistent with the MDEQ conclusion that ground water impacts are "scattered," "isolated" and limited to the upper portion of the upper alluvial aquifer.

R The conclusions drawn for the vadose zone study rely heavily on conclusions drawn from the STARS investigation. MDEQ believes that the information developed during the STARS investigation is the most comprehensive and complete because of the three years of vadose zone chemistry data and the extensive modeling effort completed. However, each of the other studies completed for the vadose zone in the SST OU, specifically the MultiTech, CH2M Hill and Canonie information was presented in the Draft RI in the original form received from ARCO in Revision 1 of the document (Table 4-6, page 144).

With regard to the empirical information available, the CH2M Hill report specifically states that the neutron probe data collected for that study show soil moisture was near field capacity, making it difficult to observe a wetting front (Table 4-6, page 144, Draft RI). The MultiTech data are inconclusive for the same reason. Empirical information collected at the Rocker site during the STARS investigation show "In coarse materials, ... that percolation of water through the vadose zone will occur." (page 146, Draft RI). The Draft RI acknowledges that "... a wide variation in flow through the vadose

The only empirical infiltration results from the SST OU suggest that little, if any infiltration occurred. In the two empirical infiltration studies, neutron probe and tensiometer data from Silver Bow and Ramsay (CH2M hill, 1987) and from Rocker, Silver Bow and Ramsay (MultiTech, 1987), no change in soil moisture content was seen over the duration of the infiltration tests, indicating no infiltration. Canonie performed applied numerical modeling techniques (the UNSAT model) to the CH2M Hill field data. It was determined that under constant flooded conditions water would require from between 15 days to several months to move through the soil column to ground water.

Interpretations from water balance calculations including runoff modelling (RRU and Schafer, 1993) indicated 3.25 inches of water would percolate through tailings/impacted soils to ground water yearly at Rocker, 0.93 inches at Ramsay, and 1.5 at Opportunity. These model results were derived from input parameters that included 140% of the average annual precipitation (which includes snow) at Rocker, 116% of the average annual precipitation at Ramsay, and 79% of the average annual precipitation at Opportunity. Additionally, modeling results were determined to have a potential error of "up to several inches," so that these results are potentially meaningless. In a second method employed in the same study to determine the quantity of infiltration, vadose zone modelling indicated that infiltration would range from 2.83 to 3.54 inches per year. In a third method to address the issue of infiltration, the same investigators performed a water balance analysis based on neutron probe measurements, precipitation amounts and estimated runoff quantities which estimated 0.7 inches of infiltration per year. As their final conclusion summarizing this work, these investigators identified infiltration as "fairly insignificant" and possibly within the range of error in the calculations.

zone can likely be expected." (page 146). This conclusion is based on both empirical and modeling data.

The preponderance of information collected during and previous to the RI on the vadose zone indicates that some water could be expected to percolate through some types of tailings. The amount of infiltration is difficult to quantify but this lack of quantification does not invalidate the concept that the vadose zone is a pathway of contaminant movement.

S 10. Issue: Expected Fluctuation of Ground Water in Tailings/Impacted Soil - The MDEQ assumptions that, "October 1992 (ground) water levels were considered to represent minimum groundwater levels" and "Tailings/impacted soils within two feet of October 1992 water levels were identified as susceptible to saturation

S MDEQ concurs with the comment that a two-foot fluctuation in water table is somewhat conservative. MDEQ has selected this conservative estimate for two reasons: 1) The relative short period during which monthly water level data was collected (10 to 22 during seasonal fluctuation of the water table" are overly conservative for most of the site. This assumption does not take into account the geometry of the ground water/stream recharge system that limits the near-stream ground water fluctuation. Near-stream ground water elevation fluctuations are less than that of the ground water elevation fluctuation further away from the stream due to the hydraulic control imposed by the surface water. This over-estimation of the amount of fluctuation of ground water elevation in the tailings/impacted soils significantly overestimates the volume of tailings/impacted soil that may be saturated.

For example, in Subarea 2, of the 13 wells within the SST OU that were monitored for water level fluctuation during the latest RI activities, the measured fluctuations for individual wells ranged from 0.38 feet to 1.02 feet for all but the two wells furthest from the stream. These two wells, Wells C-13 and C-13S, were the farthest from the stream and had measured ground water elevation fluctuations of 2.09 and 1.87 feet, respectively. This shows that assuming a two-foot ground water fluctuation to the entire floodplain, is overly conservative. In ARCO's version of the Draft RI Report, submitted to the MDEQ in October 1993, ARCO assumed an average ground water fluctuation of one foot, which more appropriately represents the fluctuation across the floodplain cross section. The overly conservative estimate by the MDEQ results in a 75 percent increase in the calculated volume of tailings/soils susceptible to saturation.

months) and, 2) Near-stream wells represent only a small portion of the operable unit with respect to ground water fluctuation.

Monthly water level data is available for 30 wells within the SST OU. Of those 30 wells, 22 wells (73%) are within approximately 70 feet of the streambank. The remaining 8 wells that were greater than 70 feet from the streambank all had ground water fluctuations greater than one foot for the period monitored, ranging from 1.01 to 2.07 feet. The average fluctuation for this group of 8 wells is 1.73 feet. Thus, while the average fluctuation for all wells is closer to 1.0 foot, this average only represents the near-stream areas (within approximately 70 feet of the stream). The maps presented in the Draft RI showing the extent of saturated tailings/impacted soils (Figures 4-21, 4-37, 4-50 and 4-66) indicate that not all tailings within two feet of the October 1992 ground water elevation are located near stream. The difference in volume of saturated tailings between one-foot and two-feet of the October 1992 ground water elevation is 234,000 cubic yards out of approximately 495,000 cubic yards.

T 11. General Issue: Shallow Ground Water Quality - The MDEQ text does not describe the natural differences between ground water in shallow alluvium and ground water in deeper alluvium that are present regardless of tailings impacts. This has the result of overemphasizing the impacts of tailings on shallow ground water. For example, on Page 12 of the Summary, the MDEQ states, "Sulfate concentrations were typically higher in the upper alluvial aquifer than in the lower alluvial aquifer in wells sampled within the operable unit. This difference is likely the result of oxidation of pyrite and other sulfide minerals from the overlying tailings since it is unlikely that bedrock is the source of these higher concentrations. With only few

T The quoted statement referenced in the summary was based on an objective analysis of sulfate data between wells within the operable unit and outside the operable unit. Sulfate analysis is only available for two samples in the upper alluvium outside the operable unit as presented in the Draft RI. Because this is a very limited data set, no reference was made to sulfate concentrations in the upper alluvial aquifer outside the operable unit; rather, the more ample data set for the lower alluvial aquifer was used in the comparison. However, the data from the two upper alluvial wells outside the operable unit (well DW215, 42 mg/L sulfate; well DW230, 148 mg/L sulfate) does not refute the conclusion presented in the Draft RI.

exceptions, sulfate concentrations in deeper domestic wells outside the operable unit are substantially lower than sulfate concentrations in wells within the operable unit." This statement leads readers to believe that only ground water from the upper alluvial aquifer inside the operable unit has elevated levels of ions, and that ground water from the upper alluvial aquifer outside the operable unit would not have elevated concentrations of anions and cations.

Site data, including that listed in analytical results presented in Tables 4-16 through 4-19, 4-38 through 4-44, 4-56 through 4-58 and 4-71 through 4-74 of the Draft RI Report, indicate that shallow wells outside of the operable unit also have elevated concentrations of cations and anions. The quality difference between shallow and deeper water in alluvial aquifers is common regardless of influence from tailings and is part of the reason that state subdivision regulations limit well depths in approved subdivisions to those screened deeper than 25 feet in depth.

Response: The reference made in the comment to differences in shallow and deeper water quality in alluvial aquifers and state subdivision regulations regarding well depths is impertinent.

U 12. Issue: Arsenic Solubility - The MDEQ states that "Arsenic becomes more soluble at a higher pH, particularly above a pH of 6.0 s.u. (RRU and Schafer, 1993), but this effect if (sic) buffered to some extend (sic) by the tendency for arsenic to be adsorped (sic) to the surface of iron oxide minerals." This is incorrect. Arsenic is not an amphoteric species (i.e., arsenic solubility does not increase at high pH). Iron hydroxide, which controls metals and arsenic concentrations by adsorption, is amphoteric. Therefore, dissolved arsenic concentrations in surface water may increase at higher pH as arsenic desorbes from amorphous iron hydroxide. This is a function of the chemistry of iron hydroxide, not of the solubility of arsenic.

Response: U Comment noted.

V 13. Issue: Comparison of Surface and Ground Water Quality to Standards - The MDEQ compares surface and ground water quality to standards for arsenic and mercury set forth in the Montana Water Quality Bureau (MWQB) Circular WQB-7. These standards are significantly less than the method detection limit for either of the methods prescribed by Circular WQB-7 or the CERCLA Contract Laboratory Protocol Contract Required Detection Limit (CLP CRDL). Additionally, the comparison made by the MDEQ of geometric means

Response: V This comment is not entirely true. Comparisons to standards for surface water were made with EPA Gold Book aquatic standards, which are listed in WQB Circular 7. For arsenic, the WQB Circular 7 concentration of 0.018 micrograms per liter (μg/L) was referenced as the arsenic health standard and text noted that all samples exceeded this standard; however, emphasis on comparisons presented in the text were made to aquatic standards. The chronic arsenic standard, which is lower than the acute standard, is or medians for surface or ground water concentrations of mercury and arsenic (for example, Summary Page 10) are not valid. Non-detect results for the prescribed methods are currently considered as "not non-compliance" (MWQB, December 1994). However, in calculation of the geometric means and medians, nondetect values were included for numerous samples at one-half the method detection limit, which is as much as two orders of magnitude greater than the standard. These values that are "not non-compliance" were included in the calculations of geometric means and medians that are then discussed by the MDEQ text as in exceedance (implying noncompliance) of standards.

Secondary parameters in ground water are useful for interpreting water geochemistry. However, the concentrations of these secondary parameters in ground and surface water from the SST OU should not be compared to Secondary MCLs, as the MDEQ Draft RI Report text does on Tables 4-20, 4-42, 4-59 and 4-75 and in text discussing these tables. Secondary MCLs are not related to health risk, but are developed for aesthetic qualities of ground water used as a drinking water source, such as taste, smell and color. By CERCLA regulations, these are not federally enforceable and comparison of SST OU surface and ground water to these standards is inappropriate.

approximately 2,000 times the method detection limit used for most of the data included in the geometric mean.

For surface water mercury data, a geometric mean was not calculated because of the lack of sufficient data. Mercury comparisons were made based on single sampling event data. While the detection limit (0.1 μg/L) was higher than the chronic standard of 0.012 μg/L, the acute standard was 20 times higher than the detection limit.

For ground water, geometric means were not calculated. Instead, exceedances were compared to individual sample events at specific wells. All exceedances were compared to MCL exceedances of 50 μg/L arsenic and 2 μg/L mercury. No mercury exceedances were reported in the Draft RI.

Neither the tables referenced in the comment nor the text in the Draft RI refers to Secondary Maximum Contaminant Levels. Water quality parameters that are included in this group of MCLs were only used in the Draft RI to aid in interpreting ground water geochemistry.

W 14. Issue: Impacts of Ground Water Influx upon Surface Water Quality - Three methods were employed during the Phase II RI to determine the impacts of ground water influx on surface water quality. Two of these methods were not included or discussed by the MDEQ. Only qualitative trend analysis, which indicates minor impacts of ground water influx to surface water quality was included in the MDEQ text.

A primary method of determining the impact of ground water impacts upon surface water quality used by ARCO was a geochemical approach, examining the significant variables controlling the concentration of dissolved constituents of concern in both ground and surface water, including temperature, oxidation potential (Eh) and acidity (pH). From these variables for surface water and inflowing ground water, the likely geochemical outcome of mixing of

W ARCO did attempt to quantify the impact of ground water on surface water, although the method employed by ARCO used average metals and arsenic concentrations from numerous data sets. This averaging mixed both upper and lower aquifer data sets and data collected during different times of the year to determine an average geochemical mixing zone. MDEQ considered this method inappropriate. Because of the simplistic nature of the analysis to determine impacts contaminated ground water are having on in-stream sediments and surface water, MDEQ looked to other sources for data.

Two sources of OU specific data were associated with on-going research conducted at Miles Crossing on Silver Bow Creek. The work is being performed by the Western Mine Land Reclamation Center and the University of Montana.

these two types of water was predicted. Data from SST OU ground water and surface water indicate that ground water mixing with surface water would favor the precipitation of oxides and hydroxides, particularly iron hydroxide, and adsorption and co-precipitation of constituents of concern with iron hydroxide. The only major exception to these conditions is in the lower portion of Subarea 4, where diurnal pH changes related to biologic activity in the stream are large enough in the summer that arsenic may desorb from amorphous ferric hydroxide. Detailed discussions and tables of these parameters prepared by ARCO were not presented in the MDEQ text.

At the request of the MDEQ, extensive amounts of work were done to assess the impacts of ground water influx upon surface water quality by mass balance calculations using both empirical field data and Darcy's Law calculations to approximate the contribution of ground water flow to stream discharge. Results of the mass balance approach, identified areas of potential impacts of ground water to Silver Bow Creek. Ground water impacts to surface water were not identified for all reaches of the stream. This calculation was conservative in that in did not consider the geochemical attenuating effects and used worst case ground water quality results. This work was ignored by the MDEQ text.

Two outcomes of the work that resulted from this research were Master's Theses published under the titles "Surface Water and Groundwater Interaction in a Shallow Unconfined Alluvial Aquifer and Small Mountain Stream, Silver Bow Creek, Montana" (Smart, 1995) and "Geochemical Processes in a Transition Zone Between Surface Water and Acidic, Metal-Rich Groundwater" (Benner, 1994). A summation of both studies was synthesized in an article published in Environmental Science & Technology (Benner et al., 1995).

The conclusions of Smart (1995) stated in the abstract that *"Shallow groundwater contains metals released from sulfide mining wastes distributed in the flood plain sediments."* Expansion of this idea was included in the conclusion as:

> *"There is extensive physical and chemical interaction between the surface and shallow ground water systems at the Silver Bow Creek site. This study documented a strong connection between the groundwater system and the stream stage of Silver Bow Creek. Metal contaminated groundwater was shown to enter the creek and form what are observed to be metal-oxide precipitates on the stream bank. Based on these observations and characterization of the interaction of the floodplain groundwater system and the creek, groundwater discharge may prove to be a larger source of metals to the stream system than previously described (Titan, 1995).".*

The conclusions of Benner's Environmental Science & Technology article (1995) states:

> *"The high levels of metal accumulation on the beads in this zone [in-stream sediment] suggest that the metal loading to the bed sediment of the creek may be significant. Despite the fact that the surface water has relatively low metal concentrations, riparian biota that are dependant of the hyporheic zone may be adversely impacted by the flux of acidic, metal-rich waters into this zone."*

The results of these two peer-reviewed studies were the basis of much of MDEQ's conceptual model for ground water-surface water interaction.

It was unfortunate that ARCO spent extensive amounts of time on quantitative work that was conceptually flawed. Appropriate data for this type of analysis were never collected. The primary data needs were: (1) ground water contaminant concentrations from a vertical profile starting at the top of the alluvial system directly adjacent to the creek and (2) a qualification of the contaminant loading to the in-stream sediments. The above referenced data supplied both needs.

MDEQ also reviewed the mass balance calculations used to determine ground water influx to surface water. This approach was also viewed as flawed. Because these two quantitative methods were flawed, MDEQ relied on the qualitative method presented in the Draft RI to characterize ground water influx to surface water. This analysis showed that ground water impacts the stream in only certain reaches, not all reaches as implied in the comment.

Letter from the Confererated Salish and Kootenai Tribes of the Flathead Nation - April 3 1995

We have reviewed the Streamside Tailings Draft Remedial Investigation Report, and provide these brief technical comments: The conceptual models presented for the sub-areas appear to be adequate syntheses of the geochemical, geohydrological, stratigraphic and water quality data provided in the Draft RI Report. The estimates of volumes of contaminated soils, sediments and tailings within the Silver Bow Creek riparian area provide graphic evidence of the sources of contaminants within the Operable Unit and underscore the potential for continuing contamination of downgradient areas by these sources.

While the descriptions of contaminant sources, pathways and fates are given much attention in the Draft RI Report (as they should be), the identification of specific source areas of surface water contamination within the Operable Unit is no contained in the Draft Report. Unless these specific source areas are delineated, it is not clear how remedial action alternatives which are intended to prevent releases to surface water can be effectively designed.

The potential for wastes in the Operable Unit to continue to contaminate downgradient areas and the evidence presented in the Draft Report of surface water transport of contaminants into the Operable Unit from upstream sources illustrates the need for the sequencing of response actions in the Clark Fork NPL complex. It is assumed that the recognition of the need for response sequencing will be emphasized in the Feasibility Study, and threat the alternatives offered for remedial action for Operable Unit contamination will emphasize components intended to alleviate transport of contaminants to downgradient operable units.

The opportunity to comment is appreciated. The Tribes look forward to issuance of the draft Feasibility Study for the Streamside Tailings Operable Unit, and alternatives which 1), recognize the need for sequencing of responses; 2), are designed to remedy specific site problems predictably; and 3), are designed to eliminate the potential

Comments noted. MDEQ believes that the Draft RI adequately identifies specific source areas in each subarea. As described in the Draft RI, streamside tailings, saturated tailings, and contaminated ground water are the primary sources.

for continuing contamination of downgradient operable units. The Tribes reserve the right to submit additional comments as the discussion of Operable Unit remedial alternatives develops.

Memorandum from CTEC - April 10, 1995

The following comments do not represent a CTEC position. They ar e technical concerns prepared by the technical assistants.

Placer deposits - The locations of historic placer deposits do not appear to be delineated in the remedial investigation. This is of concern since the placer deposits appear to be the primary source of mercury in the system.

If the placer deposits are within the floodplain, would a STARS approach demobilize the mercury? Mercury was not a parameter in the STARS research.

Placer deposits are shown on the subarea maps at the beginning of each subarea discussion as purple areas with the cultural numbering system beginning with the letters DG. The individual sites are keyed in Appendix B.

While the STARS investigation did not investigate the affects of amending tailings containing mercury, the current literature does not show that mercury is destabilized in the presence of alkaline conditions or high concentrations of calcium carbonate. In general, elemental mercury is the favored form in neutral to high pH and reducing conditions.

Letter from Mary Kay Craig - April 10, 1995

Please refer to Appendix D-5 of this Responsiveness Summary where the text of this letter and the responses are presented.

APPENDIX D-7
Comments Received on the Draft Feasibility Study Report

A 1. Issue: Redline of Revision 2 Provided by MDEQ is not a Good-Faith Redline Document - At ARCO's request, the MDEQ provided a redline document of Revision 2 of the DFSR on May 8, 1995. ARCO requested that a redline document be provided to facilitate review of the changes made to the DFSR Revision 1, as submitted by ARCO to the MDEQ on March 16, 1995. However, the redline text provided by MDEQ was not a good-faith document (i.e., it did not indicate all changes that were made). Although, ARCO did not perform a detailed comparison to assure that the redline document correctly identified all changes, it was noticed that several MDEQ changes were not identified in the redline document. For example, italicized phrases ("volumes to be calculated by NRIS" DFSR Revision 1, Page 85, Paragraph 3, Line 1) and the costs of the alternatives ("$1,792,000 to $3,803,000" DFSR Revision 1, page 96, paragraph 3, line 2) were removed and replaced in the DFSR Revision 2, but do not show cross-outs. Therefore, due to the size of the document and extent of the changes by MDEQ, ARCO is concerned that other changes made to the document by MDEQ were also not identified. It is for this reason that ARCO reserves the right to provide additional detailed comments at a later data on the DFSR.

A There were some changes that MDEQ made to Revision 1 of the Draft FS and inadvertently did not redline. The two examples provided in the comment are the primary changes that were not redlined. In the case of the NRIS change, both MDEQ and ARCO received the NRIS numbers prior to issuance of the Revision 2 of the Draft FS. Because of this, the italicized phrases in Revision 1 were deleted without redline.

With regard to cost figures provided in Revision 1 of the Draft FS, ARCO was aware of the changes made to the cost estimates; because the costs of each of the individual media alternatives, except for ground water, were modified and because ARCO was aware that modifications were made, MDEQ did not redline these changes. Other than these two instances, the only other changes made to the document that were not redlined were in the summary Tables 4-1a through 6-1. Changes made to these tables reflected the redlined changes in the text so the redline was not repeated. These changes were identified in the transmittal of Revision 2 from MDEQ to ARCO dated May 7, 1995.

B 2. Issue: MDEQ Bias due to Natural Resources Damage Lawsuit - ARCO has repeatedly expressed concern that there is a conflict of interest between the administration of the Upper Clark Fork Basin Superfund sites by the MDEQ and the State of Montana Natural Resources Damage (NRD) program. Put simply, at the eleventh hour in this feasibility study the MDEQ has changed its position to adopt its sister agency's (i.e. the Montana Natural Resources Litigation Program) position that restoration of the natural resources in the SST OU requires the massive removal of streamside tailings to an offsite repository. Much of the language written by the state in the DFSR Revision 2 reveals this conflict of interest or, at least, confusion of the cleanup goals of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and CERCLA's NRD provisions. This conflict or confusion results in inappropriate evaluation (and ultimately, selection) of alternatives in the DFSR. The purpose of actions taken under the CERCLA and the equivalent state statute, the Comprehensive Environmental Cleanup and

B MDEQ's actions and decisions with respect to this remedial action have been based on MDEQ's best professional judgment and objective determinations regarding the criteria and requirements for the selection of CERCLA remedies. MDEQ has been careful not to confuse the goals and criteria used by the Superfund Program in the Department of Environmental Quality for remedial actions with the goals and criteria used by the Natural Resource Damage Litigation (NRDL) Program in the Montana Department of Justice for restoration actions. MDEQ believes it has been quite successful in maintaining its objectivity in evaluating and applying the CERCLA remedy selection criteria in accordance with CERCLA and the NCP.

The State NRDL Program has had the opportunity to present information and participate in the development of the administrative record, and information provided by that program and included in the adminstrative record has been useful in analyzing the SST OU and in evaluating available alternatives. This information has been

Responsibility Action (CECRA), is to mitigate "imminent and substantial endangerment to the public health or welfare or the environment...caused by an actual or threatened release of a hazardous substance from a facility" (CERCLA Section 106(a)). The right to achieve compensation for damage to natural resources is preserved under CERCLA as a standalone program, or NRD. The purpose of actions taken under NRD by the State is to recover monetary damages for injured or lost natural resources. These damages, if any, must be used to restore, replace or acquire the equivalent of a lost or injured natural resource.

An example of this conflict of interest is on Page 6, Paragraph 1, line 1 of the DFSR. The MDEQ added text stating the legal opinion that "In 1977, the assets of AMC were purchased by ARCO which expressly assumed liability for AMC." (emphasis added) Similarly, in Paragraph 4 of the same page describing the flood distribution of tailings within the SST OU, the MDEQ added text stating, "As noted, upstream facilities discharged waste directly into or along Silver Bow Creek, and did not exercise due care (emphasis added) in anticipating flood events or storm events and taking precautions to avoid waste movement." These statements of legal opinion and many others like them in Revision 2 of the DFSR were added solely for adversarial legal purposes rather than constructive technical purposes and are but one example of the MDEQ's NRD bias.

This litigation-instilled bias is also evident in the MDEQ's evaluation of applicable or relevant and appropriate requirements (ARARs), in evaluation of in situ treatment technology, in evaluation of removal and relocation technologies and in unilateral modifications to the alternative costs. This is likely the motivation for conspicuous deletion of any references to successful field demonstrations of Streamside Tailings Amendment and Revegetation Study (STARS) technology, such as the Governor's Project, and the Silver Bow Creek Demonstration Projects. ARCO's concerns with these technical issues are further presented in the remaining items of this Statement of Disclaimer.

evaluated along with the information provided by ARCO in its development of the RI/FS, and has proved valuable in filling in gaps and identifying flaws in ARCO's analysis. However, MDEQ's use of all this information has been based on MDEQ's objective determination on the validity and reliability of the information provided and not on any bias in favor of a particular party. The NRDL Program has not had any control or improper influence on the decisions of MDEQ. The remedy identified in the ROD is based on CERCLA's remedy selection criteria and an objective evaluation of the information available, not on natural resource damage considerations or NRDL Program pressure. The same allegations of bias were made by ARCO in its Proposed Plan comments and are addressed more fully in the responses to those comments (see Appendix D-3, Comments B, L, and Av through Aal).

ARCO's assertion that MDEQ "changed its position" at the "eleventh hour" is simply incorrect. It may well be true that the decision proposed by the agencies was not the decision ARCO either desired or expected. However, this does not constitute a "change of position" on the part of the agencies. A similar claim was made in ARCO's comments on the Proposed Plan, and a detailed history of the issues involved is presented in the agencies' response to that comment on the proposed plan (see Appendix D-3, Response Ae).

With respect to the statements made in the text of the Draft FS, including the finding that ARCO "expressly assumed liability for AMC" and that "upstream facilities which discharged waste directly into or along Silver Bow Creek ... did not exercise due care ..." MDEQ acknowledges that such statements are included in the recitation of the history of the site, and that such statements regarding the history of activities at the site bear upon the liability of parties for the site. However, issues of liability are not only of concern to the State NRDL Program, but to the State Superfund Program and to the EPA as well. Thus these statements do not constitute evidence of improper influence by the NRDL Program, as suggested by ARCO. No improper influence exists.

As explained in the letter transmitting Revision 2 of the Draft FS from MDEQ to ARCO, all references to the Governor's Demonstration Project and ARCO's Demonstration Projects I, II and III were removed from the document because they have not yet been revised and approved by MDEQ. As stated in the May 7, 1995 transmittal letter, "By virtue of having been submitted by ARCO, they have been entered into the administrative record as separate draft documents. We will be providing comments on them this summer, either separately or as part of the Responsiveness Summary."

The statement made in the comment about the "*conspicuous deletion of any references to successful field demonstrations of Streamside Tailings Amendment and Revegetation Study (STARS) technology...*" [sic] is not true, as data collected during the three years of monitoring the Streamside Tailings and Revegetation Studies (STARS) was frequently drawn on in the text of the Draft FS.

C 3. Issue: Applicable or Relevant and Appropriate Requirements (ARARs) - In addition to the ongoing correspondence between ARCO and the MDEQ in the Administrative Record of the SST OU that documents ARCO's disagreement with MDEQ on the identification and application of ARARs, ARCO wishes to make specific points of disclaimer concerning the discussion of ARARs that is included in the DFSR Revision 2.

C The specific points raised by ARCO in this section are addressed below across from the subheadings raising the specific issues.

A. *MDEQ Last-Minute Change in Interpretation of Floodplain ARARs* -- Throughout the four years of the Phase II RI/FS, there have been a series of technical and legal meetings between the MDEQ and ARCO to discuss site characterization and evaluation of potential remedial alternatives. MDEQ's recent modification its position on floodplain ARARs issues, (i.e., that in situ treatment of the tailings constitutes disposal which is prohibited), completely contradicts the discussions which have occurred and the agreements that have been reached over the prior four years of discussion. ARCO does not agree with this interpretation of floodplain ARARs and believes that this position reversal by the MDEQ is a result of the NRD bias by MDEQ that will delay and complicate the Superfund process for the SST OU.

MDEQ's position on floodplain ARARs was not a last minute change, and there were no "agreements" reached on the application of the floodplain ARARs. In preparing the RI and FS, ARCO consistently disregarded MDEQ's position on floodplain ARARs and consequently did not evaluate the impact of these ARARs. MDEQ finally performed such an evaluation in revising the FS Report. ARCO makes this same comment in its comments on the Proposed Plan, and MDEQ's response is set out in detail in response to that comment (see Appendix D-3, Response Ae).

B. *MDEQ Incorrect Interpretation of Floodplain ARARs* -- ARCO is very concerned that MDEQ has taken a position and may make a remedy selection decision that is clearly inconsistent with existing EPA guidance on the application of waste disposal requirements in the context of in situ remedial action. Specifically, the EPA has clearly stated that the in situ treatment of wastes by a process such as STARS treatment does not constitute "disposal." Given that the EPA and MDEQ define "disposal" virtually identically, ARCO believes that the floodplain and solid waste disposal requirements should not serve as ARARs for the SST OU.

Similarly, MDEQ has asserted that tailings are "solid waste" subject to State of Montana solid waste management requirements. However, mining wastes are specifically excluded from the definition of "solid waste." As a result, ARCO believes that the solid waste management requirements identified by MDEQ should not constitute ARARs.

Response: ARCO's comment on the incorrect interpretation of floodplain ARARs is identical to the comment made in ARCO's comments on the Proposed Plan, and MDEQ's response is presented in response to that comment (see Appendix D-3, Responses Af and Ag). An explanation of the definition of the term "disposal" and the agencies' analysis of this issue is provided in the State's and EPA's Identification and Description of ARARs (see Appendix A to the ROD, footnote 36). With regard to the definition of "solid waste,", please refer to Appendix A of the ROD, footnote 35.

D C. *MDEQ Misrepresentation of the Appropriateness of a Waiver of Floodplain ARARS* --- Even if MDEQ insists on identifying the floodplain and solid waste disposal requirements as ARARs for the SST OU, ARCO believes that an ARARs waiver is unnecessary, because, under the Preamble to the Final NCP, variances, waivers or exemptions contained within a requirement must be considered in determining whether a requirement should be an ARAR. The variance provisions specified in the State of Montana regulations provide a basis for MDEQ approval of remedial actions that would permanently manage STARS-treated materials within the Silver Bow Creek floodplain without having to invoke any ARARs waiver. Assuming that the State concludes that such STARS-treated areas should be regulated as artificial obstructions or nonconforming uses pursuant to State floodplain requirements, reclamation of these areas may occur within the floodplain without meeting the relevant regulatory standards where the criteria set forth in the floodplain regulations are satisfied. Therefore, ARCO's position is that an ARARs waiver for State floodplain and solid waste disposal requirements is unnecessary.

Response: D ARCO made the same comments on the Proposed Plan. MDEQ's response, indicating why the options ARCO suggests here are not available, appears in response to those comments on the Proposed Plan (see Appendix D-3, Responses Ag and Ah).

If MDEQ insists that an ARARs waiver be necessary in order for STARS treatment to be used within the Silver Bow Creek floodplain ARCO believes that a waiver based on inconsistent application of State requirements is appropriate based on the application of these State requirements to the Old Works/East Anaconda Development Area OU of the Anaconda Smelter NPL Site where the remedy allowed tailings to be left in the floodplain. Under the NCP, an ARARs waiver is available to prevent "application to Superfund sites of State requirements that have not been consistently applied elsewhere in the State."

Moreover, even within the DFSR Revision 2 the MDEQ is inconsistent in its application of floodplain and solid waste disposal regulations within site subareas. On Page 189, Paragraph 3, Line 1 of the DFSR Revision 2, MDEQ states that: "This alternative [Site-Wide Alternative No. 5] would meet overall protectiveness standards and would comply with ARARs, except for the floodplain and solid waste management ARARs in certain locations of Subarea 4 equivalent standard of performance may be possible [sic]. In those particular locations, a waiver of ARARs, based on a technical consideration that STARS, when applied under certain conditions where it could meet equivalent standards of performance, may be possible." This position ignores available information which demonstrates STARS could meet equivalent standards of performance in the other subareas as well. This will be discussed in a later section.

E D. *MDEQ Misrepresentation of the Attainment of "I"-Class Standards* -- The MDEQ states on Page 66, Paragraph 1, Line 1 of the DFSR Revision 2 that: "Surface water "I" class standards, as explained in Section IV.A.1 of Appendix A, establish not only specific discharge standards for point sources, but also the ambient water quality standards which are ultimately to be attained in the stream. This alternative [TS1, No Action] cannot be expected to attain these standards." On Page 70, Paragraph 4, Line 1, the DFSR Revision 2 states: "Ambient water quality standards to be attained as designated in the state surface water "I" class standards would not consistently be met through implementation of TS2." Throughout the discussion of each alternative, the MDEQ states that "I" class standards are not currently

E As MDEQ has explained in the Identification and Description of ARARs (see Appendix A, Section IV.A.1), the I-class standards establish the goals that are ultimately to be attained by an I class stream. The "I" classification standards are contained in ARM 16.20.623 of the Montana water quality regulations. This section states:

> [T]he goal of the state of Montana is to have these waters fully support the following uses: drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and

met in Silver Bow Creek, and that they would not be met without remediation. This is incorrect. The "I" class standards require only that the water quality in these "impacted' streams be moving toward the achievement of the noted surface water quality standards. Silver Bow Creek which is improving and has been improving meets requirements of the classification today and will meet those requirements in the future through improvements of water quality related to natural recovery and remediation of the stream system regardless of which remedial alternative is selected.

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associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

As ARCO correctly noted in its ARARs Scoping Document, general goals that merely express legislative intent about desired outcomes or conditions but are non-binding are not ARARs. However, general goals can be ARARs if they are promulgated (legally enforceable) and if they are directive in intent (see Preamble to the final NCP, 55 Fed. Reg. 8746 [March 8, 1990]). The specific regulations that implement such a goal are key in identifying what compliance with the goal means. Id.

As provided in ARM 16.20.623(2)(h)(iii), the beneficial uses identified above for an I class stream are considered supported when the concentrations of toxic, carcinogenic, or harmful parameters in these waters do not exceed the applicable standards specified in department Circular WQB-7 when stream flows equal or exceed the stream flows specified in ARM 16.20.631(4)(10-year 7-day low flow). Alternatively, site-specific criteria may be developed using the procedures given in the Water Quality Standards Handbook (US EPA, Dec. 1983), provided that other routes of exposure to toxic parameters by aquatic life are addressed. In discussing the option of site-specific standards, the regulation provides, "The limits so developed shall be used as water quality standards for the affected waters and as the basis for permit limits instead of the applicable standards in department circular WQB-7." Thus the regulation clearly indicates that either the WQB-7 standards or site specific criteria, if they have been developed, are "water quality standards for the affected waters." Since no site-specific criteria have been properly developed here, the WQB-7 standards are the contaminant-specific ARAR for ambient water quality in the stream.

When MDEQ indicated that certain of the alternatives being considered would not attain the I class standards, it was indicating its determination that the specific alternative would not sufficiently address the contaminant sources to allow attainment of the WQB-7 water quality standards in the stream. MDEQ still believes that those conclusions are accurate. In contrast, MDEQ and EPA have determined that the remedial action identified in this Record of Decision, in coordination with actions at other operable units of the Silver Bow Creek/Butte Area NPL site, will allow eventual attainment of these standards in Silver Bow Creek.

F 4. Issue: MDEQ Removal of Text Explaining the Legitimate Use of an ARARs Waiver - The MDEQ removed text that ARCO had included in the DFSR Revision 1 that explained the conditions under which CERCLA suggests that a waiver of ARARs is possible and sometimes appropriate. The text removed from Page 59, Paragraph 2, Line 8, (DFSR Revision 1) stated: "ARARs waivers may be appropriate where site-specific data shows that there is no significant potential risk to human health or the environment." ARCO believes that this is a concise statement of what is specified in CERCLA and the NCP. The MDEQ replaced this text with the statement: "The specific grounds upon which ARARS may be waived are specified in CERCLA and the NCP." ARCO believes that the CERCLA and NCP may not be easily available for DFSR readers to refer to and that the majority of DFSR readers will not have the legal expertise to clearly understand the discussion of ARARs waivers included in those regulations. In order to facilitate community involvement and input as required by CERCLA and the NCP, it is more appropriate to clearly state in the DFSR that ARARs waivers are common and pertinent where there is no risk to human health and the environment.

F ARAR waivers may be granted only where one of the specific grounds for a waiver provided in CERCLA and the NCP are met. The description provided by ARCO here is not one of the grounds. Nor is it an accurate summary of the grounds for ARAR waivers. Since it is incorrect and misleading, MDEQ was reluctant to include it in the Draft FS. MDEQ replaced it with a correct statement of the law, believing that it is appropriate to provide the readers with accurate information, rather than incorrect but easy to understand information.

G 5. Issue: STARS Treatment - ARCO believes that the MDEQ revision of the DFSR misrepresents the effectiveness of STARS treatment. The primary points of contention are: (1) STARS effectiveness in saturated tailings/impacted soils; (2) potential impacts of erosion on STARS-treated tailings; (3) STARS long-term effectiveness; and (4) long-term operations and maintenance of STARS treated tailings/impacted soils.

A. *MDEQ Incorrect Interpretation of STARS Effectiveness in Saturated Tailings/Impacted Soils* -- In the DFSR Revision 2, Page 75, Paragraph 1, Line 3, the MDEQ states that "STARS technology is not effective in areas in which tailings are saturated or close to ground water." This is not correct. The basic chemical reactions between tailings and

G In MDEQ's analysis of the STARS treatment in saturated tailings conditions, two critical factors concerning STARS implementation indicate that STARS will not be effective: 1) The equipment designed to mix lime amendments into tailings is not likely able to adequately mix below the water table; and, 2) Because the highly soluble calcium oxide or calcium hydroxide is used to make up 40% of the STARS amendment, it is likely to be removed from the amended profile in ground water in those amended tailings that are seasonally saturated, primarily during the first year after amendment.

To expand on the first critical factor, mixing STARS amendments below the water table was not demonstrated at any of the ARCO demonstration projects (Demonstration Projects I, II, and III), nor was amendments that cause constituents of concern to become relatively immobilized by STARS treatments are not changed in the presence of ground water.

ARCO believes that the MDEQ position that STARS treatment is not effective for saturated tailings is based upon two technical errors. (ARCO is not certain because MDEQ has never made its concerns clear.) First, the authors of the STARS Final Report [Reclamation Research Unit (RRU) and Schafer, 1994] hypothesized that the vegetation at the Manganese Stockpile STARS site may have failed due to high ground water or from high salinity. ARCO's technical experts have examined the data from the manganese Stockpile site and find that an equally probable or more probable explanation for the failure of the STARS test plot to establish vegetation at the Manganese Stockpile is that upland plant species were improperly used in a wetland environment. This view is further buttressed by the fact that the Demonstration Project III, Resource Indemnity Trust and Governor's demonstration projects prove the effectiveness of STARS treatment in saturated tailings or within 2 feet of ground water when revegetation uses appropriate riparian species.

Secondly, ARCO believes that MDEQ is concerned about leaching of amendments from saturated tailings/impacted soils that these amendments are intended to stabilize. This concern is answered by examination of the geochemistry of the amended tailings/impacted soils. All potential acid-generating capacity of the tailings/impacted soils is considered in calculating the amount of amendment to add to the tailings/impacted soils. The amendment rate applied then is increased significantly to provide an additional safety factor. Moreover, ground water in the region of the SST OU is predominantly slightly alkaline, and will not leach amendments form the tailings/impacted soils.

lime mixed below the water table during Phase II of the STARS investigation at the Manganese Stockpile. MDEQ maintains that adequate mixing of lime amendments in ground water would not occur due to the inherent problems of plowing saturated materials and the physical process used to deliver the lime to the tailings to be mixed. Whether saturated tailings were amended during implementation of the Governor's Project could not be confirmed in the published documentation of the project.

The second critical factor is based on the solubility of calcium oxide or calcium hydroxide amendment. When mixed with soil, the pH generally rapidly rises to 9 to 10 standard units after mixing and tends to elevate soil pH for several months. As ground water rises into recently amended tailings, some quantity of the soluble calcium amendments are likely to be solubilized and removed from the soil as the water table lowers, even where ground water has a near neutral pH and is slightly alkaline. While no data are available to quantify the amount of amendment that could be removed, MDEQ believes that the uncertainty associated with this issue limits the application of STARS to tailings located greater than two feet above the 1992 low water table elevation.

Finally, with regard to ARCO's comment on the geochemistry of the basic reaction of STARS treated tailings in ground water, the STARS technology was never evaluated for its effectiveness in saturated tailings/impacted soils. MDEQ has made its concerns regarding the appropriate application of the STARS technology apparent. These concerns are based on the condition that very shallow ground water (i.e. groundwater with the highest probability to contact amended tailings/impacted soils) can be extremely acidic (pH 1.0 - 4.5) with high sulfate (1,500 to 1,800 mg/l)(Benner et al, 1995). This water would not be considered "slightly alkaline". ARCO has not investigated the effects that both uncontaminated and contaminated ground water have on the STARS tailings amendments and has never submitted any technical information or interpretation from one of ARCO's experts on this subject.

With regard to the Manganese stockpile, saturated tailings were not an issue with the vegetative failure. As stated in the Reclamation Research Unit's 1992 publication "Technical Memorandum. Mortality of Vegetation in STARS Field Plots at the Manganese Stockpile Site", mortality of seeded vegetation was caused by high salinity aggravated by drought and poor drainage.

H B. *MDEQ Exaggeration of the Impacts of Erosion of Amended Tailings/Impacted Soils* -In the DFSR Revision 2, Page 82, Paragraph 3, Line 6, the MDEQ states that "Implementing this alternative [TS4, STARS Treatment and ICs] may substantially meet RAOs for tailings/soils and surface water during all but high flow conditions when channel migration and streambank erosion are likely to cause input of treated and untreated materials into the stream." No data or other basis for these assertion is provided.

Conversely, ARCO provided significant basis for the conclusion that channel migration and erosion would not pose a compromise of the STARS technology. First, establishment of vegetation and other erosion control measures will reduce erosion of tailings/impacted soils to a level that will not significantly impact the environment. Second, erosion control measures including streambank regrading and the establishment of vegetation are included in the tailings/impacted soil remedial alternatives that employ STARS treatment, Alternatives TS3, TS4, TS5 and TS6. Thirdly, in Revision 1 of the DFSR, ARCO presented detailed calculations of erosion and sediment transport rates to demonstrate the potential effects of erosion. These calculations showed that amendment and revegetation of tailings will limit the rate of erosion and input of metals to Silver Bow Creek to protective levels. Even if such erosion occurs, the condition of the stream will continue to improve over time. These calculations were made by evaluation of historical erosion rates over the last approximately 40 years, and are based upon sound, accepted scientific principals and relationships and reasonable assumptions regarding future conditions. In fact, this analysis was likely conservative given that the erosion estimated from the last 40 years is significantly higher then in the future under fully vegetated conditions. MDEQ removed these calculations, stating that

H ARCO states that they have demonstrated that "establishment of vegetation and other control measures will reduce erosion of tailings/impacted soils to a level that will not significantly impact the environment." This demonstration appears to be largely an assumption as there is no site specific data that demonstrates erosion rates have decreased under revegetation of stream banks. In fact, at one revegetated plot on the Clark Fork River, it appeared that bank erosion had increased after revegetation due to 3:1 sloping of the stream bank. The 50% reduction in bank erosion rates after STARS treatment which is used in ARCO's modeling efforts is based on literature values, not on data collected on STARS plots. However, MDEQ does believe the assumption of a 50% reduction in bank erosion is attainable with proper bank revegetation and other control measures. What is at issue is whether this degree of erosion reduction will allow attainment of RAOs.

The calculations presented by ARCO in Revision 1 of the Draft FS are limited to determination of the existing bank erosion rate and projection of contaminated sediment concentrations in Silver Bow Creek. There is no calculation of the effects of revegetation on erosion rates; as stated above, the rate is assumed to decrease under revegetation based on literature values. Further, there is no calculation of future water quality due to amendment of tailings. The calculation of long-term predicted metals concentrations in sediment by R2 Resource Consultants, Inc. does not address whether these metals concentrations are sufficiently low to attain water quality objectives. It is therefore not logical to say that the calculations in Revision 1 of the Draft FS show that protective levels will be attained.

MDEQ's concern about the appropriateness of the R2 and Titan mass balance calculations remains. Many of these concerns were there was no basis for them. However, the MDEQ evaluation of erosion and sediment transport is purely qualitative and speculative, relies on a "gut feel" and appears biased by NRD considerations as previously stated.

I Additionally, by careful design specifications, the STARS amendment particle size may be chosen so that the amendment particles are predominantly of a size that will remain the hydraulic equivalent of the tailings particles. Therefore, even for the limited amount of tailings that will be eroded into the stream amended tailings/impacted soil particles would not be specifically separated from the amendment particles by physical processes. The eroded and redeposited tailings and amendment particles are likely to be mixed with native materials, as streambed sediments have been, so that they will not significantly impact the areas in which they are redeposited. Amendment particle sizes in the demonstration projects to date have been predominantly in the fine to medium sand particle size to reduce fugitive dust emissions from the amendments. Although originally specified for another purpose, this design specification also facilitates amendment mixing and should reduce the separation of amendments from the tailings if future erosion occurs.

expressed in previous MDEQ comments. However, the main concern with these models is that they do not demonstrate the effect of streambank revegetation alone. The models assume that all input of metals to Silver Bow Creek except stream bank eroded tailings will be at background levels at year zero. Therefore, the models show the effects of a complete remediation of the stream including upstream inputs, groundwater inputs, and other tailings erosion inputs, not just the effects of revegetating stream banks. Until these inputs are eliminated by remedial efforts or quantified in the absence of remediation, a mass balance model that compares the effects of STARS treatment to other scenarios is not meaningful.

To the extent there are data gaps and speculation on future performance, this is often a result of ARCO's refusal to conduct analyses requested by the agencies in the RI or FS. In addition, an estimate of likely performance in the future requires a measure of conjecture. MDEQ and EPA have attempted to use the best scientific information avalable and their best professional judgement to objectivily theorize future performance of the STARS technology.

I The rate at which lime amendment materials are applied to the tailings is based on the total acid generating potential of tailings, which is a function of sulfur content by weight of the in-place tailings. As seen in the lime amendment calculations for the demonstration projects, the lime needed to neutralize the tailings varies greatly from place to place, ranging from a low of 20 tons per acre to greater than 200 tons per acre.

In order to adequately neutralize the tailings with lime, the proper amount of lime must be applied and applied in a manner that places the amendment in intimate contact with the tailings material that is to be neutralized. Since the lime application rate accounts for all potential acidity, as sulfur compounds oxidize over time to produce acid, the lime amendment that is in intimate contact with the tailings is available to buffer the acid reaction.

In consideration of the foregoing, MDEQ believes that during erosion and transport of amended tailings, there is a high likelihood that the

Further, in the Silver Bow Creek and Clark Fork River demonstration projects it has been demonstrated that reasonably anticipated deposition of even totally untreated upstream sediments are not likely to cause vegetation failure in STARS treated areas. Specific evidence of this is currently available due to a number of small flood events occurring this spring. These events (1-5 years flood events which usually exhibit the most erosive conditions) showed that STARS-based field demonstrations held up well to floods and are available for direct observation by experts and the public alike.

J C. *MDEQ Misrepresentation of Ground Water Fluctuation* -- Based on concerns about the effectiveness of STARS treatment, the MDEQ required that the partial relocation and partial removal alternatives (TS5 and TS6) be calculated to include tailings/impacted soils that are within two feet of the level of ground water as defined in the DRIR. This requirement is extremely conservative and provides a significantly increased level of protectiveness that is not acknowledged in the text written by the MDEQ in the DFSR Revision 2.

The ground water elevation during the Phase II RI period of observation varied approximately one foot from the elevation on the ground water elevation map in the DRIR in the near-stream areas. In areas further from the stream, the ground water fluctuated slightly more. The period of record for the Phase II RI included the culmination of a decade-long drought (1992) followed by the wettest year on record (1993) for the area. Therefore, the MDEQ misrepresents the site characterization and is incorrect in defining "Saturated tailings ... [as] those that would become saturated at some time of the year based on a [sic] the observed two-foot fluctuation of groundwater." Rather, an approximately one-foot fluctuation in ground water will inundate tailings/impacted soils under the most extreme types of climates that have been observed in the SST OU. Since the MDEQ insists on using the two-foot zone that is, on the whole, greater than the amount of fluctuation seen under extreme climate changes rather than the true zone of fluctuation of ground water, the conservatism included in the use of the two-foot fluctuation

tailings and the amendments will be separated. MDEQ believes that it is more likely that the tailings will be redeposited in both amendment-rich and amendment-poor deposits rather than a well mixed homogeneous mass due to the complex nature of sediment deposition processes. Because redeposited amendment-poor tailings will not be adequately buffered, they are likely to produce acid, subsequently mobilizing contaminants of concern. The uncertainty associated with translocating the tailings and the amendments through erosion is the basis of MDEQ's assertion that RAOs for surface water may not be met during high flow.

J As explained in the MDEQ response to this issue presented in the ARCO Statement of Disclaimer for the Draft RI Report (see Appendix D-6, Comment S) the two-foot to ground water criteria for removal of tailings/impacted soils is somewhat conservative but more representative of site conditions than a one-foot fluctuation. MDEQ believes that the one-foot fluctuation only represents conditions in the very near-stream areas, since 73% of the wells used in determining ground water fluctuation are within 70 feet of the stream channel. All wells located greater than 70 feet from the stream exhibited fluctuations in ground water greater than one foot.

The record of monthly water level observations for most of the monitoring wells in the OU was 11 months, although a few wells were monitored monthly for a 21-month time period. Using these data, the maximum observed groundwater fluctuation in each of the four subareas is: Subarea 1 - 1.98 feet; Subarea 2 - 2.09 feet; Subarea 3 - 1.68 feet; and, Subarea 4 - 3.06 feet. As can be ascertained from the above values, MDEQ believes the two-foot criteria is reasonable and defensible.

of ground water should be identified for the protectiveness that it will add to a remedy.

K Including excavation of all tailings/impacted soils within two feet of ground water also provides additional protectiveness to the stream from impacts due to erosion. Because of the natural geometry of the ground water-stream recharge system, tailings/impacted soils within two feet of ground water are predominantly in the near stream area. Excavation and relocation or removal of these tailings/impacted soils would significantly reduce the volume of tailings/impacted soils that are susceptible to streambank erosion. This was not considered appropriately in MDEQ's analysis in Revision 2 of the DFSR.

K MDEQ disagrees with this statement. On page 91 of Revision 2 of the Draft FS, under the general application of *Overall Protection of Human Health and the Environment* for Alternative TS5, the following statement is made: "Tailings/impacted soils close to, or saturated by, ground water would be relocated outside of the floodplain and treated, reducing the potential for impacts to ground water and erosion of tailings/impacted soils to the stream. Runoff and transport of total and dissolved metals and arsenic to the stream would be significantly reduced or eliminated. Erosion would be reduced by establishing vegetation and placing limited backfill to maintain channel stability." This same statement was made for Alternative TS6 on page 99 of the Draft FS.

L Finally, solid waste management regulations require that there be "adequate separation of such wastes from underlying or adjacent water," taking into consideration the terrain, type of underlying soils, and geometry of the solid waste body. MDEQ neglected to point out that requiring excavation of all tailings/impacted soils within two feet of ground water would ensure that there was "adequate separation" (over two feet) between tailings/impacted soils and ground water. This also was not appropriately considered in MDEQ's analysis of alternatives in Revision 2 of the DFSR.

L As stated on page 93 of Revision 2 of the Draft FS under the general application of *Compliance with ARARs* for Alternative TS5, the following statement is made: "Relocation areas will be located and designed to meet floodplain regulations and requirements and applicable solid waste management requirements. For those areas that are STARS treated within the floodplain, storage and disposal of solid wastes and toxic or hazardous materials in the floodplain would not comply with applicable floodplain and solid waste disposal regulations."

This criteria does not insure a two-foot separation between tailings/impacted soils and groundwater, since it is based on the October 1992 low water table elevation. It is an attempt to resonably identify those tailings that would be actually saturated by groundwater at some point during the year. In any event, a two-foot separation would most likely not meet the solid waste requirement for "adequate separation," since the State Soild Waste Program typically requires at least a 10 to 20 foot separation.

M D. *MDEQ Biased Presentation of STARS Long-Term Effectiveness* -- On Page 85, Paragraph 2 of the DFSR Revision 2, the MDEQ expresses its concerns with the pong-term effectiveness of STARS treatment. The text states: "The adequacy and reliability of existing and future ICs

M With respect to the reference made to the mine-site near Cooke City, Montana, studies have been conducted by the U.S. Forest Service since the late 1970s. It is MDEQ's understanding that vegetation failures occurred on many of the plots amended in the early years of and monitoring to maintain the STARS treatment are unknown...Field studies have shown the STARS treatments to be effective over a period of approximately 5 years. Longer-term effectiveness and permanence evaluations are not available. However, based on the scientific principles involved, in situ amendment is expected to be effective at controlling the acidity of the tailings and the phytotoxicity of the amended soils. Issues of concern for long-term effectiveness and permanence include the potential for wide-spread vegetation failure, excessive erosion during bankfull and high flow events and leaching of amendments. Also, no components are included in the approach that could be implemented as a safeguard in the event floods separate the amendment from the source materials."

The MDEQ statement that field studies showing STARS treatments to be effective for approximately 5 years is technically correct. The STARS test plots and Governor's project were constructed in 1989 and 1990, providing approximately 5 years of demonstration of the treatment. However, the MDEQ is ignoring the common application of amendment and revegetation to reclaim mine tailings and mine waste at other sites. For example, at a mine site near Cooke City, Montana, revegetation of amended tailings has been established and thriving for over seventeen years. Revegetation of amended acid-generating phytotoxic mine wastes has likewise been demonstrated for long periods of time in the coal mining districts of Appalachia, and the hard rock mining districts of Canada. At a Superfund mine tailings site in Whitewood, South Dakota, 20 to 30 million cubic yards of acid-generating, phytotoxic tailings (ten times the volume in the SST OU) containing concentrations of arsenic, cadmium, mercury, lead, chromium, manganese and iron at levels similar to those in the SST OU have naturally become revegetated.

the study due to reacidification. To use the term "thriving" is inaccurate.

Further, there are prominent geochemical and physical differences between the coal mine wastes in Appalachia and hard rock mine wastes in Montana which include the type and concentrations of heavy metals, the amounts and types of organic materials present, and the differences in geology and hydrology.

Our research indicates that the Whitewood Creek, S.D. Superfund site contains much higher concentrations of arsenic (1,250 mg/kg) and similar concentrations of cadmium (9.4 mg/kg). Copper, lead, mercury, and zinc, the most critical elements in producing effects to aquatic systems, are not elevated to the magnitude of Silver Bow Creeks tailings/impacted soils (Hester and Harrison, 1994).

N Additionally, "kinetic" or "humidity cell tests" were performed on amended tailings/impacted soils from the SST OU area. These tests are designed to conservatively replicate long-term conditions in the laboratory in a relatively short period of time. The tests indicate that amendments will not be exhausted or leached-out over time. Test results referenced and included by ARCO in Revision 1 of the DFSR have been ignored and removed from Revision 2 by the MDEQ. The

N The humidity cell test results included in Appendix B-1, STARS Treatment Summary, Revision 1, submitted to MDEQ by ARCO consisted of a spreadsheet of numbers with no explanation of what the data represent, what type of samples were tested, where the samples came from, or how the test was conducted. The only reference to this data was the following statement: "Additionally, results from kinetic tests, humidity cell tests, which conservatively deleted test results contain valid information on the long-term effectiveness of STARS treatments that has been purposely and inappropriately ignored by the MDEQ.

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mimic long-term effects of in situ amendment, also indicate that a STARS amendment will be effective in the long-term. The results of these tests are presented in this appendix as Attachment 1." MDEQ requested further information from ARCO on these data but has yet to receive any information.

Dr. Ann Maest (1995) reviewed the humidity cell test results for the NRDL Program as part of the natural resources damage suit and found that Davis' conclusions were "highly suspect." Maest identified numerous problems in analytical methods used, data interpretation, and sampling design. Davis' own unreported data show that "a substantial amount of copper is leaching from the 12-15 inch depth and from the buried A horizon sample (15-20 inches)" (Maest, 1995). Although the pH conditions are questionable, Davis' data undoubtedly demonstrate that copper continued to leach in his humidity cell test.

O E. *MDEQ Exaggerated Operations and Maintenance (O&M) Requirements for STARS Treated Tailings/Impacted Soils* -- On Page 85, Paragraph 2 of the DFSR Revision 2, the MDEQ expresses its concerns with the O & M of STARS treated areas. The text states: "Vegetation in STARS-treated areas could require significant maintenance for a period of three to five years until vegetation success is established, although the type and degree of long-term management necessary for STARS treated areas are unknown." In this statement and in other parts of the DFSR Revision 2 text, the MDEQ states or implies that monitoring requirements and/or maintenance requirements will be greater for remedial alternatives employing STARS treatments than for other remedial alternatives. This is incorrect. First, the so-called "maintenance" described in the first three to five years is not legitimately considered maintenance. This time period is more appropriately considered to be a part of implementation. It often takes several growing seasons, particularly in the climate typical of the SST OU in southwestern Montana, to establish self-perpetuating vegetation. This is true for any revegetation project, not just for tailings (e.g., high ways construction). Monitoring the effectiveness of STARS treatment alternatives would be no more intensive than the monitoring required for total removal of tailings/impacted soil, which

O MDEQ disagrees with the statements made in this comment, both about maintenance of STARS and the differences between long-term monitoring of a STARS alternative versus a removal alternative. As shown at ARCO's Demonstration Project I site, reseeding is not the only failure that can occur on a STARS treated area. At the Demonstration Project I site, several areas required reseeding and reliming. It is MDEQ's position that this type of work is considered to be maintenance because it occurs after the remedial action is implemented. Although this may be a semantics issue, reliming and revegetating after the remedy is completed were considered maintenance for cost estimating purposes.

With regard to the maintenance and monitoring requirements for a total removal scenario, MDEQ believes that there is less likelihood for failure of vegetation in total removal areas because the contaminants of concern will be removed and lime amendments are not required to promote revegetation (which can increase soil salinity and thereby present adverse growing conditions in addition to metals and acid problems). However, when calculating the maintenance costs for total removal, the same vegetation failure rates were used for both total removal and STARS in the years 1 to 30, with the only difference would also be more rigorous on-site for the first five to ten years until vegetation was adequately established, and reduced following that period.

being the cost of maintenance which was higher for STARS because of the possibility that lime amendments may need to be applied as well as reseeding.

As for monitoring these two alternatives, less on site monitoring of environmental media other than vegetation, such as surface water and ground water, is expected for a total removal scenario because the contaminant sources will no longer be present. Because STARS treated areas still have the potential to yield contaminants to the OU under certain conditions discussed in the FS (i.e. high flow), monitoring of surface water and ground water will be more intensive.

P 6. Issue: Discussion of Demonstration Projects - A. *MDEQ Incomplete Presentation of Demonstration Project Results* -- ARCO performed three Demonstration Projects within the SST OU as treatability studies for various technologies that are evaluated in the DFSR. These treatability studies were intended for use in evaluating in the DFSR. These treatability studies were intended for use in evaluating the effectiveness, implementability and costs of technologies for the DFSR. ARCO submitted Draft Final Project Reports for the Silver Bow Creek Demonstration Projects I, II and III for the Streamside Tailings Operable Unit in December 1994. MDEQ is reviewing these reports. MDEQ removed almost all mention of the findings of these reports from the DFSR Revision 2. The only references to the Silver Bow Creek Demonstration Projects that have been included in the DFSR Revision 2 are that: (1) the reports are under review; (2) cost information from these projects has been incorporated in the cost estimates of the remedial alternatives; and (3) there exists the possibility of schedule delays due to various implementability concerns with the technologies in certain areas of the site. ARCO provided summary reports for agency review in December 1994. ARCO anticipates comments and revisions to these reports. However, appropriate discussion of the results of these projects including both the successes and difficulties should be included in the DFSR Revision 2 to provide a complete evaluation of the alternatives.

P On March 13, 1995 MDHES submitted comments on the initial review by Montana State University Reclamation Research Unit of the three Demonstration Project reports submitted in December 1994. The submitted comments stated "As can be ascertained from these comments, Montana State University - Reclamation Research Unit and MDHES have serious reservations about many issues including, but not limited to, sample density for determination of lime requirements, methods used in the acid-base accounting, equipment utilized in kiln dust application, crucial discrepancies in field and laboratory pH, etc. As can be understood, MDHES has numerous and critical questions with the project's design, implementation, and monitoring. It is essential to examine these issues in the future. Please contact me after a thorough review of the comments to discuss future actions." At numerous meetings, MDEQ explained to ARCO their concerns for the illogical science and unsubstantiated conclusions drawn in the ARCO Demonstration Project reports.

More importantly, the MDEQ makes little or no reference to other appropriate treatability studies, such as the Governor's Clark Fork River Demonstration Project, the Resource Indemnity Trust Clark Fork Demonstration Project, or the Anaconda Revegetation Technology Study. These projects were designed as demonstration projects with direct involvement by MDEQ and EPA. ARCO is perplexed as to why the agency did not use the information available from these projects in the evaluation of alternatives in DFSR Revision 2. The DFSR Revision 2 is incomplete without discussion of the successes and limitations of these demonstration projects.

Q B. *MDEQ Unsubstantiated Assertion of Increased Impacts Related to Berms* -- The MDEQ DFSR Revision 2 text is inconsistent and unsubstantiated in discussing the potential for construction of surface water berms to increase impacts to ground water and terrestrial flora and fauna. On Page 69, Paragraph 2, Line 4, the DFSR Revision 2 states: "Impacts to terrestrial flora and fauna would remain unchanged behind the berms. Potential migration of contaminants of concern to ground water would remain unchanged behind the berms. Ground water quality could be degraded in areas where impounded water could increase infiltration through near-stream tailings, especially where the tailings contact ground water." On Page 71, Paragraph 4, Line 6, the text states: "Impacts to terrestrial flora would remain unchanged or increase behind the berms or would increase as a result of buildup of metals salts on the tailings surface over time." These statements have no basis in fact. This potential impact to terrestrial biota and ground water has not been documented at similar berming projects on the Upper Clark Fork River or in any of the demonstration projects on either Silver Bow Creek or the Clark Fork River.

Q MDEQ disagrees with the conclusion presented in this comment. First, the statements made in Revision 2 of the Draft FS that conditions would remain unchanged behind the berms is a logical observation, since the tailings would not be treated. Therefore, vegetation will not become established behind the berms (impacts to terrestrial flora), wildlife will not use the areas for forage (impacts to terrestrial fauna), and conditions could worsen if those areas that are currently sparsely vegetated are inundated by metals and arsenic contaminated impounded water that could result in vegetative failure.

Consequently, the first statement, which is quoted from the general application of *Overall Protection of Human Health and the Environment* for Alternative TS2, is not inconsistent with the second statement quoted from the discussion of *Long-Term Effectiveness and Permanence* for Alternative TS2. Both statements are made based on current measured conditions as presented in the Draft RI and logical deductions of potential future conditions that either have not been measured or do not exist at any of the three demonstration projects cited in the comment.

R 7. Issue: Changes Made by the MDEQ to the Definitions of Alternatives - The development and definition of alternatives document in Revision 1 was based on over two years of discussion between ARCO and MDEQ. At the time of Revision 1 there was complete agreement on the list and definition of the alternatives the FS was to consider. The MDEQ changed the definitions of remedial alternatives subsequent to the submittal of DFSR Revision 1 and

R MDEQ disagrees with the statement that the definition of alternatives was changed subsequent to the submittal of Revision 1 of the Draft FS. The intent of each of the seven alternatives currently presented in the Draft FS is essentially the same as discussed during the development of the document. MDEQ did, however, refine the definition of the alternatives so that the detailed and comparative analyses could be more specific and provide more certain direction unilaterally has changed the detailed analysis of alternatives, the comparative analysis of alternatives and the combined-media, site-wide alternatives. These changes have been made without any sound technical basis for the changes. ARCO believes that this was due to the reversal of the MDEQ's legal interpretation of the compliance of in situ remediation of floodplain tailings with floodplain ARARs and the conflict with NRD previously described. As discussed in comment number 3, ARCO does not concur with the MDEQ interpretation of floodplain ARARs and believes that if this interpretation is ultimately relied upon and used for remedy selection, that a waiver of floodplain ARARs is appropriate.

Response: for use during remedial design. Thus, the definition of partial relocation and removal was refined to include the relocation or removal of saturated tailings, whereas previous discussions had only defined removal or relocation of "near-stream tailings/impacted soils susceptible to erosion" (as presented in Revision 0 dated December 1, 1994). MDEQ feels that refining the definition of these two alternatives was necessary based on the disclosure in the Draft RI of the connection between saturated tailings and identified ground water impacts. Other changes made to the list of the alternatives between Revision 0 and Revision 1 were inclusion of partial soil cover into the definition of STARS, which, previous to the submittal of Revision 1, was a separate alternative, because soil cover was one of the treatments studied during the STARS investigation.

S Specific MDEQ changes to the definitions of remedial alternatives in Revision 2 of the DFSR are included in the following list: A. *Inappropriate Removal of Surface Water Berms from TS3, TS4, TS5, TS6 and TS7 by MDEQ* -- The MDEQ changed the definition of the surface water control measures that were available for tailings/impacted soils remedial alternatives so that the option for surface water berms is only in TS2. Originally, surface water berms were included as necessary for TS2, TS3, TS4, TS5, TS6 and TS7. ARCO intended that surface water berms would be used to reduce the potential for overbank erosion in high flows. Removing berms potentially decreases the effectiveness of each of these alternatives.

S While Revision 0 of the Draft FS gave lip service to the inclusion of surface water berms in each of the remaining alternatives, neither the length nor placement of these berms was included in the detailed analysis, comparative analysis, or cost analysis of alternatives TS3 through TS7. Because of this, and because the use of surface water control berms in the remaining alternatives was rather nebulous, MDEQ removed them from the remaining tailings/soils alternatives in Revision 2.

T B. *Misrepresentation of the Changed Definition of Tailings/Impacted Soils Alternative Removal, Disposal and ICs (TS7) by MDEQ* -- The MDEQ removed text written by ARCO that defined the extent of tailings/impacted soils to be removed in Removal, Disposal and ICs (TS7) as the tailings/impacted soils as defined in the DRIR. The criteria used in the DRIR to identify the vertical extent of tailings was an approximate order of magnitude decrease in metals concentration with depth. This estimated volume based on these criteria was used as the basis for cost estimation for the TS7 remedial alternative. Removal of tailings/impacted soils to any other performance standard or criteria is not included in the cost estimates included in the DFSR Revisions 1 or 2 and will significantly change the overall evaluation of the alternative.

T MDEQ removed two sentences from the description of Alternative TS7 in Revision 1 because they were redundant when presented with the first sentence which was not removed and is presented in Revision 2 on page 51. This sentence states: "This remedial alternative consists of excavating all tailings/impacted soils located within the floodplain as defined in the Draft RI Report (ARCO, 1995)." No other performance criteria was considered in the revised detailed, comparative, or cost analysis presented in Revision 2.

U C. *Biased Change by MDEQ to the Definition of Source Control (GW2)* -- The MDEQ changed the definition of Source Control (GW2) remedial alternative, so that it is defined in the DFSR Revision 2 as pertaining only to tailings/impacted soils alternatives TS5-Partial Relocation, Partial STARS Treatment and ICs, TS6-Partial Removal and Disposal, Partial STARS Treatment and ICs, and TS7-Removal, Disposal and ICs. As previously discussed with the MDEQ and as intended by ARCO, TS2-Surface Water Controls and ICs, TS3-Near-Stream STARS Treatment and ICs, and TS4-STARS Treatment and ICs should also consider to be options under Source Control. The evaluation of the criteria for each of the alternatives will differ depending on the level of source control but should be the basis for the selection of one or more of the alternatives for the site. The effect of the MDEQ's changes is to "drive" the decision makers to the higher-intensity alternatives that doesn't provide significant additional real benefit.

U It is true that MDEQ initially agreed to evaluate each of the tailings/impacted soil alternatives as potential source control measures for ground water. This initial agreement was made prior to the disclosure in the Draft RI of the substantial amount of saturated tailings in the OU and the connection between saturated tailings and identified ground water impacts. During the revision of the Draft FS, it was apparent that "true" source control for ground water should address, in some way, saturated tailings. Because TS5, TS6, and TS7 were the only alternatives that directly addressed saturated tailings, these were the only alternatives identified as source control measures. However, even if Alternatives TS1 through TS4 were included in the discussion of the Source Control Alternative (GW2), as suggested in the comment, the analysis of the tailings/impacted soils alternatives discussed in the Draft FS would not change.

V D. *Misrepresentation of the Changed Definition of Limited Sediment Removal (SD2) by MDEQ* -- The MDEQ changed the definition of the remedial alternative Limited Sediment Removal SD2). As previously discussed with the MDEQ and as intended by ARCO, the limited removal alternative would include excavation and removal of sediments from the primary depositional areas in the stream, i.e., pools. The reasoning behind this definition of limited removal is that the fine-grained sediments which may contain greater concentrations of constituents of concern that may impact aquatic life and represent the fraction of sediments most susceptible to erosion and transport are within the pool reaches of the stream. The MDEQ changed that definition of Limited Sediment Removal to include removal of "all fine-grained sediments which would be transported in a bank-full event." This changed interpretation presents a poorly defined criteria subject to any number of interpretations and reflects a lack of understanding of the sediment issue. Additionally, there was no basis provided for this new ill-defined criterion. Revision 1 provided a clear basis for the limited removal of fine grain sediments in pools. This change also will result in a significant modification of the evaluation of this alternative, including implementability and costs without significant increased benefit. For instance, the new definition could be

V MDEQ defined Alternative SD2 to include all fine-grained material that would be moved in a bankfull flow event primarily because the sediment survey completed by ARCO during August 1994 was only qualitative, using only a few direct observations to conclude that most of the fine-grained sediment within the stream was confined to the pools. MDEQ never agreed that pools were the primary depositional areas of concern. In ARCOs most recent attempt to quantify the locations and quantities of sediment, runs contained the greatest volume of sediment in Silver Bow Creek (Sept. 15, 1995 letter from ARCO to Jim Ford/MDEQ). Concentrations of metals that exceed aquatic effects criteria are found in the 1 millimeter size fraction and less. Because the results of the more detailed sediment survey were to be used to define the nature and extent of fine-grained sediment in the stream, MDEQ did not believe the definition of limited sediment removal should be confined to a quasi-defined stream form.

MDEQ contends that the size standard is well-defined, not ill-defined as suggested by ARCO because, since it is based on the velocity of flow, a particular size criteria is defined (e.g. a grain size of less than interpreted to require removal of a very small volume of finer sediments from riffle areas that are armored with longer diameter particles that will not move during a bankfull flow. The implementability of performing this type of removal compared to excavation of pools (areas where large majority of the finer grained sediments are deposited) is significantly more difficult and more costly without significant additional benefit. Additionally, the MDEQ-defined alternative would significantly increase the total volume of sediments to be excavated. Appropriate modifications to the evaluation criteria were not made by MDEQ.

W G. *Biased and Unilateral Definition of Combined-Media, Site-Wide Alternatives by MDEQ* -- At the specific request of the MDEQ, ARCO prepared combined-media alternatives in DFSR Revision 2, but did not prepare site-wide alternatives. In the DFSR Revision 2, the MDEQ has unilaterally changed the definitions of combined-medial alternatives, created site-wide alternatives, and evaluated the combined-media and site-wide alternatives. These combined media, site-wide alternatives reflect the bias and lack of understanding of numerous issues previously described and is inconsistent with MDEQ's previous directives to ARCO. Over the last several years, ARCO has repeatedly endeavored to obtain agreement on combined-media, site-wide alternatives so that an appropriate evaluation of the alternatives could be performed.

During a series of technical meetings from August 1994, through the original submittal of the DFSR and submittal of the DFSR Revision 1, MDEQ refused to discuss combined-media alternatives or site-wide alternatives with ARCO. The only constructive discourse on these topics between the two parties was a meeting at which the MDEQ shoed ARCO a table in which the MDEQ had prepared preliminary combined-media alternatives (that were not site-wide) in February 1995. When ARCO asked for a copy of the table, the MDEQ refused to provide it. Therefore, after repeatedly attempting to devise combined-media, site-wide alternatives as a team with the MDEQ, the DFSR Revision 1 submitted by ARCO contained combined-media alternatives that were compiled by ARCO in the format required by MDEQ. These combined-media alternatives were developed by

1 millimeter). In MDEQ's view, this more refined definition is essentially the same as the grain size definition used in Revision 1.

W MDEQ has quite a different viewpoint on the discussion of site-wide alternatives and the final form of the Draft FS. First, MDEQ does not have a bias and lack of understanding of any issues regarding the RI/FS process for the SST OU. MDEQ has tried to remain unbiased throughout the process, and has consistently expressed to ARCO that the results of the detailed and comparative analyses of alternatives should guide the process and the formation of alternatives into site-wide alternatives.

MDEQ takes exception to the statement that we refused to discuss site-wide alternatives. MDEQ did want to see the results of the detailed and comparative analyses before committing to which alternatives would be combined into site-wide alternatives and therefore did not commit to the make-up of those alternatives. MDEQ consistently agreed with ARCO that the final chapter in the FS should present site-wide alternatives. MDEQ expressed in the technical meetings that the site-wide alternatives would be based on the best two or three alternatives for each subarea and the likely combinations of subarea-specific alternatives. During our final meetings in January and February, the composition of the final chapter was discussed and ARCO and its contractors asserted that they would present their version in Revision 1 of the draft.

Upon reading the combined-media alternative chapter in Revision 1, MDEQ felt strongly that this chapter did not further either the comprehension of a remedial action at the site or simplify the understanding of the multi-media cost of implementing a remedy at personnel with technical expertise in remediation and familiarity with the nature and extent of impacts in the SST OU in accordance with written EPA guidance to the extent possible given the limited MDEQ request for format.

the site. Because of this, and because MDEQ felt this final chapter should accomplish these two things if it were to be presented in the document, MDEQ rewrote this section in the resultant manner.

The table that ARCO implies MDEQ was withholding was only an example of one approach that could be used to formulate and analyze combined site-wide alternatives. The contents of this table and the approach used to create the table were discussed with ARCO at the February 1995 meeting. MDEQ did not provide a copy of the table because it was only an internal working document that had not been reviewed for release. MDEQ takes exception to the implied accusation it was hiding something from ARCO.

X Additionally, the MDEQ developed a new "modified" alternative that was not fully evaluated in the DFSR. This change redefined Partial Removal, TS6, for Subarea 2, to include excavation of all tailings/impacted soils within the 100-year floodplain. The definition of TS6 that had been previously discussed with the MDEQ and as intended by ARCO was excavation of tailings/impacted soils within two feet of the ground water elevation as shown on the Ground Water Elevation Map in the DRIR. This was done to address specific MDEQ concerns regarding the effectiveness of STARS treatment near ground water. The amount of tailings/impacted soils to be excavated in Subarea 2 by the previously-agreed-upon definition of TS6 is 60,000 cubic yards in the areas within 2 feet of ground water where STARS may be considered less effective. The amount of tailings/impacted soils to be excavated in Subarea 2 by MDEQ's new definition of TS6 for Subarea 2 is 610,000 cubic yards, or 72% of the total amount of tailings/impacted soils within Subarea 2. The need for this excessive removal is not supported by available RI data. The additional excavation of tailings does not provide significant additional protectiveness or other benefits and appears to be a result of the State's NRD bias for mass removal regardless of available technical data.

X As explained in Revision 2 of the Draft FS (page 185), MDEQ recognized that overall protection of human health and the environment and long-term effectiveness and permanence could be enhanced in certain subareas by modifying the quantity of material that would be excavated under the partial relocation and removal alternatives. As further explained, the considerable residual risk and the need for waiver of the floodplain and solid waste disposal ARARs associated with these alternatives led MDEQ to develop and consider modified partial removal and relocation alternatives that better protected the environment and better complied with ARARs. MDEQ believes the modifications up-graded these two alternatives by attempting to address the weaknesses of the alternatives that were recognized in the detailed and comparative analyses. MDEQ believes that the modified alternatives do provide additional protectiveness, are not a result of any NRD bias, and are supported both by the data presented in the Draft RI and by the analysis of alternatives presented in the Draft FS.

Y H. *MDEQ Bias toward Removal over Relocation* -- The changes of alternative definitions and evaluations as described above demonstrate the bias of MDEQ for removal rather than relocation of tailings/impacted soils.

Y MDEQ strongly disagrees with ARCO that the analysis presented in Revision 2 of the Draft FS indicates a bias toward removal. In the detailed analysis of alternatives for partial relocation (Alternative TS5), "Removal" is defined as excavation and transport of tailings/impacted soils to an off-site, regional repository such as Opportunity Ponds or a location on Brown's Gulch. "Relocation" is defined as excavation and placement of tailings outside the reconfigured floodplain. Relocation of tailings has numerous benefits that were not fully considered and evaluated by the MDEQ. Primarily, the protectiveness of human health and the environment of removal and relocation options are the same, but removal options have a number of significant problems not presented by relocation options.

Since both relocation and removal alternatives would remove tailings from the floodplain to secured areas, they equally address the reduction of human exposure, ground water impacts and erosion of tailings by Silver Bow Creek. However, relocation integrates the remedy on-site and eliminates "Not In My Backyard" (NIMBY) disposal concerns by residents in areas of the regional repositories. The MDEQ analysis presented in Revision 2 of the DFSR significantly understates the NIMBY concern, especially for residents of Opportunity and Brown's Gulch. MDEQ has not sought prior input or approval of landowners or residents in the areas of regional repositories being considered. Therefore, evaluation of removal to these areas is incomplete.

The short-term risks associated with removal are also significantly greater than those for relocation. The off-site disposal of excavated tailings/impacted soils will increase the duration of construction and the number of construction personnel required, and add a very large number of large haul trucks in a continuous stream to the highways and community roads/streets. All of these factors increase the short-term risk and the potential for accidents and facilities associated with the construction activities. These factors were not given appropriate weight by the MDEQ in Revision 2 of the DFSR.

Additionally, since the cost of removal is significantly higher and the benefits, as described above related to both human health and the environment and short-term risks are equivalent or higher for a relocation approach, the cost/benefit ratio for relocation is higher for relocation options compared to removal options. This information

under the general application for *Overall Protection of Human Health and the Environment*, the text states that this alternative is likely to achieve RAOs for tailings/impacted soils, surface water and air. A similar statement is made for partial removal.

In Table 5-1 of the Draft FS, which summarizes the comparative analysis of alternatives, Alternative TS5 and Alternative TS6 are rated equally in each subarea for seven of the evaluation criteria. Alternative TS5 is rated better than Alternative TS6 for *Reduction of Toxicity, Mobility, and Volume* in all subareas and better than Alternative TS6 for *Short Term Effectiveness* in Subareas 1, 2, and 3. In the description of the site-wide alternatives in the Draft FS, Site-Wide Alternative No. 6, which includes removal rather than relocation, the evaluation of the alternative (page 196) states that its general level of protectiveness and ability to meet ARARs is equivalent to Site-Wide Alternative No. 5 (the relocation alternative).

As shown in Table 4-1g of the Draft FS, the total cost difference between removal and relocation is within the +50% to -30% range that the cost estimates depict. Both the minimum and maximum costs for partial removal are approximately 23% higher than the minimum and maximum costs for partial relocation, respectively.

MDEQ has consistently applied the logic that there are two primary differences between relocation and removal. The first is that consolidation of tailings in one or two central repositories presents less of a residual risk than the numerous relocation areas simply due to the maintenance and monitoring requirements associated with many relocation areas versus one or two repositories. The second advantage is the fact that land use restrictions would be fewer and affect less people if repositories were used. In no way does MDEQ believe this presents a bias toward removal, rather it is a logical deduction that results from a careful analysis of the two alternatives. With regard to public input on the location of potential repositories, MDEQ actively sought comments on this issue by directly soliciting input through the Proposed Plan.

should have been included in the analysis of alternatives since it is consistent with current state and federal environmental regulatory trends.

Z **8. Issue: Discussion of Institutional Controls (ICs)** - The text written by the MDEQ does not correctly represent the ICs that are currently in place, the potential ICs, or the appropriate role of ICs in each remedial alternative.

A. *Misrepresentation of Butte-Silver Bow (BSB) County Regulations by MDEQ* -- The MDEQ presented a misleading and incomplete representation of the BSB regulations in Revision 2 of the DFSR . ARCO, MDEQ and BSB County representatives have had a number of discussions and a meeting to evaluate the measures and regulations that BSB currently enforce and will implement in 1995 as part of the amendments to the county master plan. These include stream corridor protection regulations, creation of a water quality district, building restrictions on steep slopes and a development permit system similar to that enacted in the Superfund Planning Overlay District of Anaconda-Deer Lodge (ADL). These regulations which utilized as ICs control land uses of certain areas to those which best benefit county residents. For instance, in ADL, land use restrictions and permanent controls were written into the county's planning documents at the request of county residents to allow the Old Works Gold Course to be sited on the Superfund site as a mechanism to both control exposure to mining wastes and provide an economic benefit to the community. None of these regulations are mentioned in the text written by the MDEQ and the discussion of these soon-to-be-enacted regulations that were presented by ARCO in Revision 1 of the DFSR have been removed.

Z At the time of the Draft FS development it was unclear which, if any, changes BSB was going to make to their master plan. It was clear that any changes to their master plan were/are not legally enforceable for Silver Bow Creek because BSB is only zoned in Butte and Rocker city limits. Anaconda-Deer Lodge County is zoned and has a Superfund overlay district. Any correlation between Anaconda-Deer Lodge regulations and BSB is misleading and incorrect.

Aa B. *Omission of Explanation of Fee-ownership Rights by MDEQ* -- Fee ownership is a legitimate IC which can be implemented by a land owner to significantly control land uses and exposure to constituents of concern. The MDEQ text does not provide appropriate evaluation of this IC. For instance, the following text was removed by the MDEQ from Section 3.2.2 of the DFSR Revision 1, Private ICs: "Fee ownership gives the owner control over all legal property rights in the

Aa Fee ownership does allow the landowner to control aspects of use of the property, as noted by ARCO, as long as the owner continues to hold the property. However, fee ownership can be terminated at any time, by the voluntary sale of the property, or through execution of judgments, lien foreclosure, or other involuntary means. Thus, fee ownership in itself does not constitute a reliable method of institutional control. The actual IC would consist of some type of land. This includes land use, access to the property, and use of resources such as ground water. An owner of property may establish and maintain property controls to support other elements in a remedy. There are several large landowners in the OU, including ARCO and the railroads." These deletions are inconsistent with the current Superfund direction integrating land use and land ownership into the remedial decision process. It is also inconsistent with recent FSs on other Upper Clark Fork River projects overseen by EPA and MDEQ. Additionally, ARCO is actively increasing its ownership of the corridor so that land uses consistent with the long-term effectiveness of the remedy may be established and maintained.

Response: restrictive covenant, conservation easement, or similar restriction that would legally control use of the property by subsequent owners as well, and these types of controls are recognized in the analysis. Fee ownership would give the owner sufficient right to establish such institutional controls, but would not ordinarily, without further restriction, constitute a perment control in and of itself.

Ab C. *Removal of the Detailed Analysis of ICs by the MDEQ* -- In ARCO's DFSR Revision 1, ICs that may be included with each of the remedial alternatives were subject to detailed analysis by seven criteria defined in the NCP. This evaluation was performed in response to a specific request from the MDEQ. Because the same ICs are available for every alternative, the detailed analysis of ICs by the threshold and balancing criteria was performed only once in Revision 1 of the DFSR, as an introductory section to the detailed analysis. MDEQ removed this test from DFSR Revision 2. Therefore, there is no evaluation of how ICs satisfy the seven criteria in Revision 2. This is in direct conflict with legislative intent, with guidance from the EPA, and with MDEQ's request. ICs must be considered an integral part of each remedial alternative and be evaluated accordingly.

Response Ab: In MDEQ's estimation, the discussion on ICs and the seven criteria were repetitive and uninforming. ICs alone do not meet the Threshold Criteria and therefore were not analyzed as a stand-alone remedy. Since ICs were the major component of the No Action Alternative for each of the environmental media and Site-Wide Alternative No. 1, a separate discussion was not necessary. MDEQ did consider ICs as a critical component of each of the remedial alternatives evaluated in Revision 2 of the Draft FS.

Ac **9. Issue: Misrepresentation of the Relative Significance of Pathways and Scale of Impacts by MDEQ** - In most cases, the document produced by the MDEQ (DFSR Revision 2) is written at the level of understanding of the Streamside Tailings Operable Unit (SST OU) that existed at the time the RI/FS Work Plan (ARCO, 1991) was prepared. The pathways and impacts are not evaluated in terms of their significance as determined by the Phase II RI work and published in the Draft RI Report (DRIR) (ARCO, 1995). One of the major conclusions of the Phase II RI was the determination of the relative significant of the pathways for migration of constituents of concern and exposure of receptors to risk. This relative significant

Response Ac: MDEQ does not agree with the assessment that the Draft FS ignores the findings of the Draft RI, especially since MDEQ substantially revised the Draft RI prior to its release to the public and therefore has a very good understanding of the conclusions presented in the Draft RI. The data ARCO chose to collect during the RI were not sufficient to quantitatively determine the contribution of contaminants from groundwater to surface water. Fortunately academic reasearcers were studing this pathway and in fact quantified impacts to in-stream sediments and surface water from contaminated groundwater discharge (Benner et al., 1995; Smart, 1995).

has been ignored in the detailed and comparative analysis of alternatives.

For example, the RI determined that surface water runoff to Silver Bow Creek is a significant migration pathway of metals and arsenic to surface water. However, in Revision 2 of the DFSR, this pathway is virtually ignored for the less significant impacts to surface water from ground water. Likewise, the potential for residential exposures is given significant weight in Revision 2 although the actual length of stream that may have bordering residential use is less than 3% of the total stream length. However, due to legal restrictions on residential development in a floodplain, restrictions to developing next to active railroads, and anticipated future land uses (to be controlled by deed restrictions by ARCO purchases), residential exposures will likely not occur even in these locations.

With regard to surface water and ground water impacts, Revision 2 of the Draft FS evaluates each alternative with respect to meeting Remedial Action Objectives (RAOs). Because there are RAOs for each media (i.e. surface water and ground water), descriptive words were used to determine whether the alternative would meet the respective RAO regardless of the significance of the pathway. Accordingly, MDEQ determined that Alternatives TS1 through TS3 were not likely to meet all of the RAOs established for the site. The STARS alternative (TS4) was determined to meet RAOs for surface water except in those areas where inputs of contaminated ground water occur. Alternative TS5 and TS6 were determined to likely meet RAOs for surface water because saturated tailings would be relocated or removed, eliminating the greatest contributor of contamination from the ground water to surface water pathway.

While the ground water/surface water pathway of contamination is certainly less significant than runoff and erosion of contaminants into the stream, meeting the RAO for surface water (aquatic life criteria) *could be jeopardized under certain flow conditions.* MDEQ believes that it would be inappropriate for the detailed evaluation of this alternative to submit that the RAO would be met when there is no hard data quantifying the impact of this pathway.

With regard to residential exposures, MDEQ maintains that exposures could and are occurring along the boundaries of the floodplain, as outlined in the residential exposure scenario defined in the Draft Risk Assessment. Thus, in the discussion for *Overall Protection of Human Health and the Environment* and *Long-Term Effectiveness and Permanence* for Alternatives TS1 through TS4, the condition of tailings, either treated or untreated, remaining in the floodplain was recognized as a potential residual risk. During the time that the Draft FS was developed, ARCO was one of the landowners of property in the OU but MDEQ was informed that ARCO's ownership did not exceed 15 to 20% of the land within the OU. As such, MDEQ did not feel that ownership of this amount of land would substantially reduce or eliminate potential future residential exposures.

Ad **10. Issue: Incorrect, Biased Interpretation of the Legislated Preference for Treatment that Reduces the Toxicity, Mobility or Volume of Contaminants by MDEQ** - The MDEQ removed text in Section 3.1.2 which identified and cited the legislated requirements for remedial alternatives. These requirements, as outlined in the National Contingency Plan (NCP); 40 Code of Federal Regulations 300.430(a)(10)(iii), included:

1. To use treatment to address the principal threat(s) posed by a site; 2. To use engineering controls, such as containment for waste that poses a relatively low long term threat or where treatment is impractical; 3. To use a combination of methods as appropriate to achieve protection of human health and the environment. In appropriate site situations, treatment of the principal threat(s) posed by a site, with priority placed on treating waste that is liquid, highly toxic, or highly mobile, will be combined with engineering controls, such as containment and institutional controls (ICs) for treatment residuals and untreated waste; 4. To use institutional controls such as land or water use and deed restrictions to supplement engineering controls as appropriate for short and long term management, to prevent or limit exposure to hazardous substances, pollutants, or contaminants; 5. To consider using innovative technology when such technology offers potential for comparable or superior treatment performance or implementability; and 6. To return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site.

These expectations were included in both Revisions 0 and 1 to provide a basis for the development and evaluation of alternatives for the SST OU and document compliance with the legal requirements. The omission of this text is significant for two reasons. First, Items 1, 3, and 5 identify the strong legislative preference that Congress intended for treatment technologies. The MDEQ has equated removal and containment as treatment. Although engineered controls, such as removal and containment, may limit the physical mobility of constituents of concern, they do not constitute treatment that reduces the toxicity and mobility of the contaminants of concern.

Ad MDEQ gave an extensive response to this issue in Appendix D-3, Response E.

Removal and containment alternatives are also directly counter to Congressional Intent. It is clear that only alternatives that include Streamside Tailings and Revegetation Studies (STARS) treatment of tailings/impacted soils, include any treatment that qualifies for the legislated preference for treatment technologies.

Additionally, the MDEQ text does not appropriately treat institutional controls as an integral portion of the remedial alternatives. For example, there is no discussion of how ICs may be used to satisfy the seven criteria in the detailed analysis of alternatives. ARCO's concerns about the MDEQ Discussion of ICs in the DFSR Revision 2 are further outlined in Disclaimer Comment 8.

Ae **11. Issue: MDEQ Text in the DFSR Revision 2 is Inconsistent to the DRIR** - MDEQ text for Revision 2 of the DFSR is inconsistent with its text in the DRIR. Examples of some significant inconsistencies between the documents are identified below:

A. *Incorrect Implication that the Majority of Tailings/Impacted Soils are Saturated by MDEQ* -- On Page 14, Second Bullet Item of the DFSR Revision 2, the MDEQ states "In many areas, ground water is in direct contact with tailings for at least part of a typical year." This is inaccurate. Additionally, using the word "many" implies a majority. However, as noted in the DRIR, only 20 percent of the tailings/impacted soils are within the zone of maximum ground water fluctuation, depicted in the Ground Water Elevation Map presented in the DRIR.

Response Ae: Saturated tailings/impacted soils are located in every reach and all four subareas. This wide geographic distribution constitutes "many areas".

Af B. *Incorrect Discussion of Railroad Ballast by MDEQ* -- On Page 53, Paragraph 2, Line 6 of the DFSR Revision 2, the MDEQ states, in describing the Limited Removal of Railroad Materials Remedial Alternative (RRM2), that: "Ballast would not be removed if the ballast is not a significant source of leachable or bioavailable metals." Railroad ballast is made of slag throughout the SST OU. The site characterization in the DRIR on Page 118, Paragraph 1, Line 2 states that "Numerous analytical tests on characteristic slag within the Butte/Anaconda region indicate that metals in slag are effectively immobilized (ARCO, 1994e)." Therefore, it has already been determined that the ballast is not a

Response Af: MDEQ does acknowledge the ARCO, 1994e reference to slag test results. However, the leachability of slag has yet to be definitely established in the OU. Therefore, the statement that "Ballast would not be removed if the ballast is not a significant source of leachable or bioavailable metals" is neither improper nor inappropriate. MDEQ also fails to understand how any bias could be interpreted in this statement.

significant source of leachable or bioavailable metals. Any implication otherwise is inappropriate and presents an improper bias.

Ag **12. Issue: Incorrect Draft Baseline Risk Assessment (DBRA) by MDEQ** - MDEQ included inappropriate risk calculations from the DBRA that was prepared by MDEQ. MDEQ and ARCO agreed that these errors misrepresent risk posed by constituents of concern at the site. These inaccuracies bias the evaluation of alternatives in the DFSR Revision 2.

ARCO and the MDEQ have had a series of technical meetings to discuss the numerous errors and inaccuracies that were incorporated in the DBRA by MDEQ. MDEQ and ARCO have agreed that technical inaccuracies are presented in the DBRA. However, the MDEQ incorporated the inaccurate results and removed all caveats or disclaimers to the results of the DBRA that ARCO wrote in DFSR Revision 1. The MDEQ text makes no mention of the changes that are expected to be incorporated in the Final BRA in either the text or appendices of the DFSR Revision 2.

Two significant concerns in the risk assessment which MDEQ revision deleted are the actual risk to human health due to use of the abandoned rail lines and the actual risk associated with in-stream sediments. ARCO's specific comments these and other issues in the DBRA will not be enumerated here. ARCO's specific comments on the DBRA are presented in a letter from Chuck Stilwell of ARCO to Jim Ford of the MDEQ, dated April 10, 1995.

Ag MDEQ does not agree that any potential mistakes in the Draft BRA misrepresent risks posed by contaminants within the OU. Please refer to MDEQ's response to ARCO's disclaimer of the Draft BRA in Appendix D-4 of this Responsiveness Summary.

Ah **13. Issue: Estimation of Remedial Alternative Costs** - The MDEQ made several changes to the cost estimations that were made by ARCO in DFSR Revision 1. The net effect of the changes is to reduce the costs of the removal-based alternatives and increase the costs of the other alternatives. ARCO believes that this contrived adjustment to the total costs of the remedial alternatives has been made entirely to reduce the range of costs between the removal-based alternatives and the other alternatives so that cost would not be considered inhibitory for the removal-based alternatives. ARCO prepared the cost estimates with actual analogous cost data from Montana sites

Ah MDEQ did not contrive to lower the total costs to make removal a more palatable option. Rather, MDEQ believes that ARCO inflated certain unit costs so that the removal-based alternatives appeared to be cost prohibitive. In reviewing ARCO's cost estimate provided in Revision 1 of the Draft FS, numerous unit costs and unit quantities were outside conventional construction cost data, were not supported by costs derived during the demonstration projects, and did not represent meaningful contingencies that might be expected during remedial action. In fact, MDEQ lowered only three out of the 25 unit cost items for tailings/soils, lowered the quantity of only one and with input from experienced construction and cost-estimating personnel to be as accurate as possible and represent the range of conditions and contingencies represented by the alternatives.

The major specific items with which ARCO disagrees are listed and discussed further below.

Ai A. *MDEQ Removal of Site-Specific Cost Information* -- On Page 57, Paragraph 3, Line 2 of the DFSR Revision 2, the MDEQ states: "...cost criteria are based upon the findings of the Draft RI Report (ARCO, 1995) and on the results of treatability studies, including STARS (RRU and Schafer, 1993), Demonstration Projects I, II and III, and the Governor's Demonstration Project (Schafer, 1994)." However, in several specific instances, the MDEQ has replaced site-specific unit costs that ARCO derived form the demonstration projects with lower unit costs from generic engineering references based upon worldwide sites. An example of this is the MDEQ reduction of scraper costs from those determined at the Mill-Willow Bypass Project ($4.64 to $5.04 per cubic yard) to those cited in *Means Building Construction Cost Data, 1994* for common earth excavation ($2.30 per cubic yard). Replacing actual costs incurred in Montana on the Upper Clark Fork Sites with generic cost data from a nationwide database is inappropriate and misleading.

Aj B. *MDEQ Misrepresentation of the Change to Costs Due to Changed Remedial Alternative Definitions* -- As discussed in a previous Disclaimer Comment, the MDEQ changed the definitions of several of the remedial alternatives from those that had been used throughout the RI/FS process to date when it created Revision 2 of the DFSR. The potential change in the delineation of tailings/impacted soils for Removal, Disposal and ICs (TS7), the change in delineation of sediments to be removed for both Limited Sediment Removal (SD2) and Total Sediment Removal (SD3) each significantly increase the cost of these remedial alternatives. For example, costs for the newly defined sediment alternatives could easily double or triple given the uncertainty of the new ill-defined criteria. The changes in definitions

Response

unit quantity for all the tailings/soils alternatives, and increased unit quantities for four items. The changes and justifications for the revisions made to the cost estimates are explained in Appendix F-1 of Revision 2 of the SST OU FS.

Ai It appears that ARCO misread the revised cost estimates because MDEQ did not change the unit cost for scrapers from those originally submitted by ARCO. The only changes made to unit costs were those that were not substantiated in any of the demonstration projects. These unit cost changes included the following: 1) Lowering the cost to place and regrade tailings at the regional repository - ARCO's original cost to place and regrade was the same as the cost to excavate the tailings; 2) Lowering the cost to roller compact tailings at the repository - ARCO presented no construction cost data from either the demonstration projects or remedial action projects to justify their unit cost which was approximately twice as high as the average cost reported for this item in the 1994 Means Construction Cost Data handbook; and, 3) Lowered the unit cost for grading which was based on the cost to clear and grub at the Demonstration III project - ARCO used a maximum cost derived from the Demonstration I project which required disposal of a large quantity of railroad ties and other debris.

Aj MDEQ disagrees that the in-stream sediment alternative definition had any impact on the cost of implementing the alternatives. Please refer to our response to this issue in Comment V above.

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were not incorporated in the cost estimations made by the MDEQ in DFSR Revision 2.

Ak C. *Inappropriate Retention of Rail Transport for Removal Alternatives in Subareas 1 and 2 by MDEQ* -- MDEQ has chosen to retain the potential for rail transport with removal alternatives in Subareas 1 and 2, without increasing the relevant factors in the cost estimates. In the letter from Jim Ford of the MDEQ to Chuck Stilwell of ARCO dated May 8, 1995 concerning "Draft Feasibility Study Comments/Revision - Streamside Tailings Operable Unit," the MDEQ states: "MDHES [MDEQ] will retain rail transport for further consideration, although the cost estimates presented in Appendix D [Appendix F of the DFSR Revision 2] have not been changed at this time to include an item for rail haul." The net results of retaining rail haul in Subareas 1 and 2 is increased cost for these alternatives that include removal which is not presented in the DFSR.

Additionally, MDEQ's analysis of the costs of rail haul is incorrect. ARCO has direct experience, based upon an actual contract for rail transport of materials from Lower Area One to the Opportunity Ponds, that rail costs will range from $8.23 to $11.23 per bank cubic yard to load and haul with an additional $400,000 per mile to construct sidings. MDEQ's analysis used unsubstantiated unit costs of $4.00 to $5.50 per bank cubic yard and neglected to include the cost of siding construction.

ARCO is also concerned about MDEQ's misperception of the capacity of the existing rail facilities. The capacity of rail haul in the SST OU is limited due to both rail company equipment and the shared use of rail lines in the SST OU with other companies. The maximum capacity of the RARUS Railroad to haul materials from the SST OU is 3 unit trains per day. Each unit train includes 17 rail cars, each with 50 cubic yard capacity (Paul McCarthy, RARUS Railroad, personal communication, June 5, 1995). It would require a minimum of approximately 10 years to transport all of the tailings/impacted soils from the SST OU to Opportunity Ponds. Therefore, use of rail haul would extend the duration of remediation. This will also increase

Ak MDEQ believes that rail transport is a viable option for transport of tailings/soils removed from Subareas 1 and 2 if the Opportunity Ponds were used as a central repository. MDEQ also understands the cost implications and, using the cost information transmitted to MDEQ by ARCO, conducted its own cost analysis supplemented by information supplied by other outside transportation authorities. Using both ARCO's and MDEQ's analyses, rail transportation compares very favorably from a cost standpoint for transport of tailings from Subarea 1. While ARCO's analysis indicates that it is approximately 25% more expensive to haul by rail than by truck from Subarea 2, there are other trade-offs in terms of the public and worker safety that make rail transportation attractive.

Contrary to the comment, MDEQ did include in its cost analysis construction of siding in each subarea at the same cost of $400,000 per mile that ARCO used. MDEQ included this cost so that its analysis was conservative even though there are several sidings present in the operable unit, namely at Rocker, Ramsay, and Browns Gulch, that could be used to offset this cost.

Also contrary to the comment, MDEQ's total unit cost for excavation, loading, rail transport, unloading, and truck transport to the repository site at Opportunity are $8.70 to $12.40 not $4.00 to $5.50. With regard to the total daily capacity, ARCO has submitted no analysis that suggests the total daily capacity could not be increased, either by running longer trains or by running more round trips per day. Finally, MDEQ is puzzled as to why ARCO is reluctant to thoroughly analyze potential rail alternatives when the benefit to the public and worker safety may greatly exceed any cost considerations.

the costs associated with engineering and construction overheads and oversight.

Additionally, MDEQ neglects rail spur construction that would be required for loading unit trains without disrupting existing rail service on the rail lines. In addition to misrepresenting capital construction costs, this would further increase the duration of construction activity within the site and associated costs, and the related disruption to the surrounding community.

AI D. *Inappropriate Amount of Roads Included in Cost Estimation by MDEQ* -- MDEQ reduced the amount of road building included in alternatives TS2 through TS7. ARCO does not agree with MDEQ that the quantity of road building that it initially estimated for TS2, TS5, TS6 and TS7 is excessive. ARCO agrees that road building could be reduced from the amounts it estimated for TS3 and TS4, at the cost of relative efficiency and time required to implement the remedial alternative. The net result of the MDEQ changes is a reduction in cost of each alternative.

AI MDEQ believes that the initial roadbuilding unit quantities submitted by ARCO were unsupported by any of the demonstration projects. ARCO's Revision 1 submittal was based on 2 or 4 times the stream length and included the following road miles to be constructed for each alternative (site-wide basis): TS2, 46 miles; TS3, 46 miles; TS4, 46 miles; TS5, 92 miles; TS6, 92 miles; TS7, 92 miles.

MDEQ's analysis of the length of roads built for Demonstration Project I, which closely resembles partial relocation (Alternative TS5), showed that internal roads were one times the stream length. At Demonstration Project II, which is analogous to partial removal (Alternative TS6), internal road lengths were slightly less than one times the stream length. For Demonstration Project III, which is analogous to Alternative TS4, no roads were built. External roads were only built for Demonstration Project II. This analysis was used as the basis to revise the roadbuilding lengths for each alternative. The resulting road lengths in Revision 2 of the Draft FS were the following (site-wide): TS2, 23 miles of internal and 23 miles of external roads; TS3, 23 miles of external roads; TS4, TS5, TS6 and TS7, 23 miles of internal and 23 miles of external roads.

Am **14. Issue: Misrepresentation of the Relative Likelihood of Events by MDEQ** - Throughout the DFSR Revision 2, the MDEQ suggests the occurrence of catastrophic events that may reduce the protectiveness of remedial alternatives without qualifying these suggestions by explaining to the reader the relative low probability of these rate events. This is misleading and may lead to inaccurate public perception of the protectiveness of the remedial alternatives.

Am This comment implies that Revision 2 of the Draft FS is replete with misrepresentations and misleading statements about both the site and the analysis of alternatives. In fact, MDEQ believes that Revision 2 of the Draft FS addresses issues that ARCO has consistently downplayed. Because one of the objectives of writing the Draft FS is public disclosure of the various consequences of implementing an alternative, MDEQ strongly feels that long-term permanence issues

An example of this misleading text includes Page 15, Paragraph 3 of DFSR Revision 2: "Contaminants not carried into Silver Bow Creek may also be adsorbed to the soil. These metals will remain in this stable form until geochemical conditions alter the chemical stability of the soil system to re-release the metals." This statement does not inform the reader that conditions which could cause a change of soil geochemistry that would re-release metals from the floodplain soils would likely never occur.

An **15. Issue: Incorrect Implication by MDEQ of Inadequate Site Characterization** - MDEQ implies in several statements in Revision 2 of the DFSR that site characterization presented in the DRIR is inadequate for the evaluations in the FS. For example, MDEQ states in DFSR Revision 2 that the degree to which surface water quality impacted ground water "could not be quantified in the RI" (Page 10, paragraph 2, Line 7): that railroad materials were "characterized in the Draft RI by collecting limited number of samples" (Page 52, Paragraph 3, Line 1); and that existing ground water data "may not fully characterize the range of contaminant concentrations or locations for the site" (Page 12, Paragraph 3, Line 5).

The RI was conducted with MDEQ and EPA participation, oversight and approval, to fulfill the data gaps identified in the RI/FS Work Plan (ARCO, 1991), in accordance with the Sampling and Analysis Plans (ARCO, 1991; ARCO 1992), all of which were also reviewed and approved by the agencies. The extent of investigation activities was jointly determined to be appropriate to represent the conditions on the SST OU. For example, prior to collecting the "limited number" of railroad materials samples, the railroad bed and ballast materials were mapped in detail (with oversight by the MDEQ). An appropriate number of sample locations were then selected to best represent the types of materials identified.

associated with the alternatives should be addressed at the very least by mention, which ARCO often failed to do in Revision 1. One of the realities of implementing a remedy in the dynamic system of the floodplain environment is that any number of conditions can change with time, especially erosion and redeposition. This is the mechanism that led to the statement referenced by ARCO - that geochemical conditions can change radically in a flood event and that contaminants that may be stable in one environment may become unstabilized in another.

An In October 1994, MDEQ compiled a list of significant tasks, identified in the SST OU RI/FS *Work Plan*, that were required to be addressed prior to completion of either the RI or FS document. MDEQ was led to believe that many of these tasks were being finalized, but wanted written confirmation indicating when MDEQ could expect to receive them. The following items were required elements of the RI/FS (as stated in the referenced section of the Work Plan) that were not provided to MDEQ:

> **6.3.2 - Streambank and Streambed Sediment Erosion and Transport** --- Water quality and sediment transport models will be used in this analysis to quantify the rate of contaminant movement associated with channel erosion (SST OU Work Plan, 1990).
>
> "Sediment erosion was required to be evaluated. Potential modeling techniques that could have been used to assess loading mechanisms and transport include, but were not limited to, mass balance, tractive force, suspended sediment rating, rainfall intensity, and sediment leach relationships." (MDEQ letter to ARCO October 1994)
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> **6.3.5 - Flood Hazard and Channel Stability Analysis** --- Hydrodynamics of the 100-year flood and an assessment of channel stability at selected representative locations will be analyzed for each

remedial alternative, including the no-action alternative.

6.3.8 - Land Use --- MDHES anticipated a Technical Memorandum (TM) which will evaluate Anaconda-Deer Lodge and Butte-Silver Bow County's waste repository siting studies for consideration under the SST RI/FS. The submittal of the TM is expected prior to the Draft FS. MDHES will determine the adequacy of this document for the SST RI/FS. If the studies are deemed acceptable then the suitable disposal sites will be utilized with the appropriate FS alternatives. Incorporation of potential repository sites within the FS is a essential requirement of the SST OU Work Plan.

6.3.5 - Air Resources --- Air monitoring will not include; wind speed, wind direction, temperature, and PM-10 at Rocker, Ramsay School, and Opportunity. The PM-10 was to be collected every sixth day for a 24-hour period.

5.1.2.2 - A. Conduct vadose zone monitoring in the capillary fringe at well sites where contaminated groundwater is found, in order to evaluate the effects of pore water transport to groundwater.

6.1.3 - Groundwater and Vadose Zone Investigation --- Perform aquifer tests to determine aquifer properties (hydraulic conductivity, storativity, and leakage of underlying aquifer units) on key wells. MDHES believes that there is adequate data from other operable units, and in the scientific literature, to define these hydrologic characteristics.

6.2.3 - Geographic Information System (GIS) Application ---Mapped information need not include the following: 10-year floodplain; Spatial variability of tailing elemental concentrations; Spatial variability of stream water elemental concentrations; Recreational facilities/Levels of use; Wildlife habitat features; Erosion/geologic hazard areas; Surface metallic salt distribution; Historic stream channel.

6.3.3 - Groundwater Contaminant Transport --- Numerical modeling techniques to assess groundwater contaminant transport to Silver Bow Creek will not include 1- or 2-dimensional solute transport models.

6.3.6 - Food Chain Uptake --- The potential for food chain uptake will be evaluated on a metal-specific basis, using plant tissue data and ecological surveys. This task will be more thoroughly discussed in the human health and ecological risk assessments.

6.4.4 - Development of Alternatives Report (DOAR) --- This report was to present the process of developing general response actions for each medium of interest. All alternatives presented in the DOAR would have been screened during preparation of the subsequent Initial Alternatives Screening Document (IASD). Because MDHES has required ARCO to address the full-range of remedial alternatives this document was considered unnecessary. The rational for developing the alternatives considered will be summarized in the feasibility study.

Initial Alternatives Screening Document (IASD) --- Since MDHES is requiring ARCO to consider a full range of remedial alternatives in the detailed analysis section of the feasibility study, the IASD will not be required.

Ao **16. Issue: Biased Presentation** - Much of the language and presentation of the DFSR Revision 2 is biased and misrepresents the remedial alternatives. ARCO believes that this is a result of the conflict-of-interest issues mentioned previously. In an effort to illustrate these points, several examples of the text that is perceived as biased and misrepresentative are listed here.

A. *Presentation of Primarly Weakness of Each Remedial Alternative by MDEQ* -- All of the remedial alternatives (with the exception of the No Action Alternative) that were developed throughout the RI/FS process offer some level of protectiveness and have some merit as remediation alternatives. ARCO belies that the emphasis placed upon residual risk will drive public perception to support only the most radical and intensive remediation, and that the text written by the MDEQ does not appropriately present the relative costs and relative benefits of that intensive remediation. For example, on Page 82, Paragraph 3, Line 4 of DFSR Revision 2 the statement is made that : "considerable monitoring and enforcement of existing and planned ICs limiting exposure and land use and protecting the remedy would be required." In addition to this statement being untrue, this presents ICs in a negative context, rather than pointing out that the remedy (TS4) may be protected by ICs that are available. Another example of negative bias toward ICs is found on Page 40, Paragraph 2, Line 8 of DFSR Revision 2, the MDEQ states: "If maintained over time and enforced, these regulations [state floodplain and subdivision ordinances, and county subdivision and zoning regulations] ..." MDEQ text never states the same concern about the maintenance and enforcement of other regulations, such as the water quality standards promulgated by the State of Montana in Water Quality Bureau Circular 7, which recent legislative activity has shown are as likely or more likely to be rescinded than the ICs identified by the MDEQ.

B. *MDEQ Bias in Word Choice* -- In several places in the text, the MDEQ replaced words chosen by ARCO with alternatives words which

Ao It is unfortunate that ARCO feels that MDEQ's choice of words is biased. MDEQ attempted to choose appropriate words which adequately described the topic. MDEQ's viewpoint sometimes differs from that of ARCO, therefore word choice may differ. MDEQ feels that the referenced text is factual and accurate. MDEQ stands by its analysis and therefore its wording in the examples referenced by ARCO.

present an alternative viewpoint, or chose strong language or adjectives that are inappropriate. Examples of biased word choices are instances in which reference is made to "some" when the actual amount in question is a majority of the occurrences. For instance, MDEQ added the sentence, "Impacts to aquatic biota would be reduced, enhancing natural recovery of the streambed sediments to some degree by limiting the input of contaminants of concern under some flow conditions (emphasis added) (Page 72, Paragraph 5, Line 4, DFSR Revision 2). In reality, this is true for most flow conditions. another example of biased wording implies that a low intensity alternative is less protective than it actually is by using "most flow conditions" when the actual conditions must be flows greater than the 100-year flood (on Page 46, Paragraph 2, Line 1, DFSR Revision 2): "Additionally, this remedial alternative includes streambank grading and protection in areas of steep cutbanks to prevent the undercutting and direct erosion of streambanks during most flow conditions." On Page 62, Paragraph 2, Line 5, DFSR Revision 2 the MDEQ text implies that restrictions on building in the 100-year floodplain are related to CERCLA, rather than a standard state and federal regulation. In some places in the text, MDEQ expressed bias by selective editing as well as word choice and additions to the text.

Ap **17. Issue: Inaccuracies in MDEQ Text Concerning RAOs** - The text on Page 69, Paragraph 2, Line 11 states that the alternative does not meet sediment RAOs. This is incorrect, because there are no sediment RAOs.

Ap Preliminary RAOs for sediments are covered in the RAOs for surface water. These objectives were to be established at the conclusion of the baseline risk assessment. ARCO's comment is correct and noted.

Aq **18. Issue: ARCO's Disclaimer to the DRIR, January 6, 1995** - Each of the items listed and disclaimed in ARCO's Disclaimer to the DRIR, dated January 5, 1995 are also pertinent to the DFSR Revision 2. The most significant of these are mentioned here.

Aq Please refer to the responses to ARCO's RI disclaimer (see Appendix D-6 to this Responsiveness Summary).

A. *Biased MDEQ Land Use Description* -- There is limited access to much of the land within the SST OU due to railroad rights-of-way, limited land parcel sizes, and physical constraints such as those in Durant Canyon. Following extensive discussions with land owners, ARCO and the MDEQ had previously agreed that the appropriate phrase for describing land use for much of the SST OU was "minimally-used rangeland." Despite the negotiated agreement that found this phrase to be a realistic portrayal of land use with terms that were considered unbiased by both parties, the words "minimally-used" were removed from the text by the MDEQ in DFSR Revision 2.

B. *MDEQ Misrepresentation of Residential Land Use* -- As discussed in ARCO's Disclaimer to the DRIR and in several Disclaimer Comments above, there is extremely limited possibility for residential land use of areas impacted by tailings.