

ADMINISTRATIVE RECORD

RECORD OF DECISION

**ANACONDA CO. SMELTER NPL SITE
FLUE DUST OPERABLE UNIT
ANACONDA, DEER LODGE COUNTY, MONTANA**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 1991

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RECORD OF DECISION

PART I: THE DECLARATION

**ANACONDA CO. SMELTER NPL SITE
FLUE DUST OPERABLE UNIT
ANACONDA, DEER LODGE COUNTY, MONTANA**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 1991

RECORD OF DECISION
PART I: THE DECLARATION

SITE NAME AND LOCATION

Anaconda Co. Smelter Site
Anaconda, Deer Lodge County, Montana
Operable Unit 11 - Flue Dust

STATEMENT OF BASIS AND PURPOSE

This decision document presents the remedial action for the Flue Dust Operable Unit of the Anaconda Smelter Site in Deer Lodge County, Montana, selected by the U.S. Environmental Protection Agency (EPA) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Contingency Plan (NCP).

This decision is based on the administrative record file for the Flue Dust Operable Unit of the Anaconda Smelter Site. The Administrative Record Index and copies of key documents are available for public review at the Hearst Free Library located on the corner of Fourth and Main in Anaconda, Montana. The complete administrative record may be reviewed at the offices of the U.S. EPA, 301 South Park, Federal Building, Helena, Montana.

The State of Montana supported the remedy selected in the proposed plan and it is anticipated that the State will concur with the selected remedy in this Record of Decision (ROD).

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE REMEDY

The Flue Dust Operable Unit is the second remedial action to be taken at the Anaconda Smelter site. The first action was taken at the Mill Creek Operable Unit which involved the relocation of residents from the community of Mill Creek. The Flue Dust Operable Unit addresses one of the principal threat wastes (flue dust) remaining on the Anaconda Smelter site. This action addresses flue dust at the nine discrete source areas on the Anaconda Smelter site through removal, treatment and containment. Future operable units will address remaining wastes


on the site. Remedial and removal actions on several of these future operable units are already in progress.

The major components of the selected remedy include:

- Removal and treatment via on-site cement/silicate based stabilization of approximately 316,500 cubic yards of flue dust material located on Smelter Hill;
- Disposal of treatment residues in an on-site engineered repository; and
- Long-term monitoring and institutional controls including site access control.

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, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy may result in hazardous substances remaining on site above regulatory or health based levels, a review will be conducted within five years after commencement of the remedial action and every five years thereafter to ensure that the remedy continues to provide adequate protection of human health and the environment.



Jack W. McGraw
Acting Regional Administrator
Region VIII, U.S. EPA

9/23/91
Date

RECORD OF DECISION

PART II: THE DECISION SUMMARY

**ANACONDA CO. SMELTER NPL SITE
FLUE DUST OPERABLE UNIT
ANACONDA, DEER LODGE COUNTY, MONTANA**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 1991

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RECORD OF DECISION

PART II: THE DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

The Anaconda Smelter Superfund site (Figure 1) is located in southwestern Montana at geographic coordinates N46, 07.7', W112, 53.9'. The site is situated in and adjacent to the community of Anaconda in Deer Lodge County. The site is bounded by the Anaconda-Pintler mountains to the south and the Flint Creek mountains to the northwest and is located in the southwestern part of Deer Lodge Valley at an elevation of approximately 5,400 feet above sea level.

The Anaconda Smelter site was used for the processing of copper and associated ores from 1884 until approximately September 1980. This site includes several inactive smelting, refining and tailings disposal areas. A series of large, unlined tailings and wastewater treatment ponds, including the Anaconda and Opportunity pond systems, extends seven miles eastward from the Smelter to the neighboring community of Warm Springs. Numerous other smaller ponds and slag piles also are present. The site (Figure 2) encompasses more than 6,000 acres.

Flue dust was generated as a by-product of copper smelting operations and contains metals such as copper, iron, arsenic, cadmium, and lead. The majority of the flue dust generated on Smelter Hill during facility operation was reprocessed. However, approximately 316,500 cubic yards remain stockpiled at nine locations on and around Smelter Hill (Map, cover). Although the Smelter is closed, flue dust stored at several locations on the property continues to be a source of environmental contamination.

Some of the 316,500 cubic yards of flue dust has been consolidated into a structure known as the interim Flue Dust Storage (FDS) facility and flue dust has also been contained in the collapsed Main Flue which extends down Smelter Hill from the stack. The remainder of the flue dust is present at seven other site locations on Smelter Hill. Each of the nine flue dust site locations are listed below.

<u>Site Location</u>	<u>Map Area Designation</u>
Bradley Ponds	7a, 7b
Main Flue	5
Thickener	2a
Area Cut	2b
Coal Pile Tracks	1a
Miscellaneous Piles	1c
FDS Facility	1b
Switchback	1d
Iron Ponds	3a

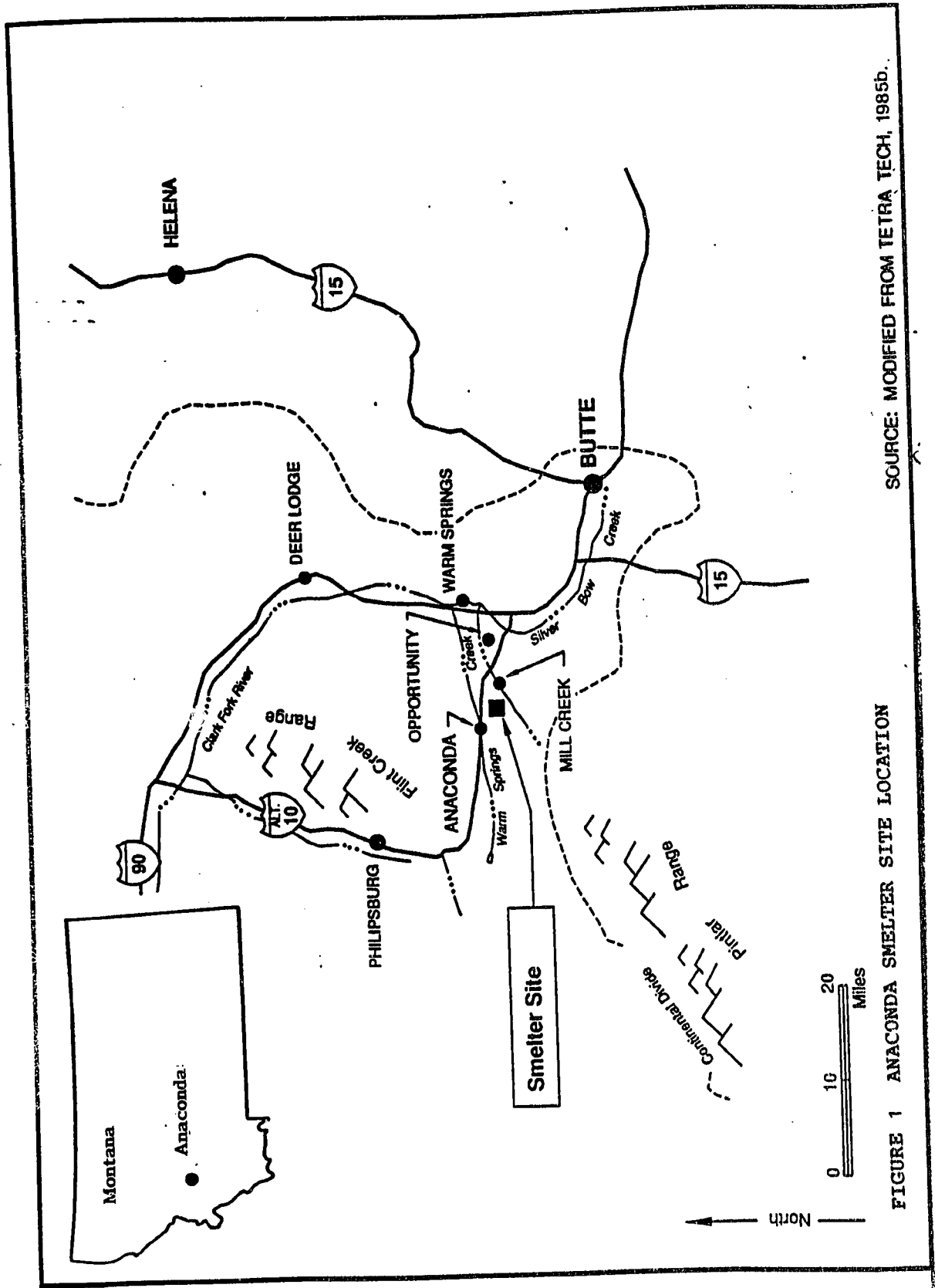


FIGURE 1 ANACONDA SMELTER SITE LOCATION

SOURCE: MODIFIED FROM TETRA TECH, 1985b.

This Record of Decision (ROD) addresses the Flue Dust as an "Operable Unit" of the Anaconda Smelter site. Under the National Contingency Plan (NCP), an operable unit is a "discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration, or eliminates or mitigates a release, threat of release, or pathway of exposure." (40 CFR Sect. 300.5). Subsequent operable units will address other mine and smelting wastes, surface water, ground water, soils, and other environmental media.

The centers of population in the vicinity of the Anaconda Smelter include the communities of Anaconda, Opportunity and Warm Springs. Approximately 10,500 (84%) of the 12,518 residents of Deer Lodge County reside within the city limits of Anaconda, approximately 1.5 miles west of Smelter Hill. The remainder reside within Warm Springs, Opportunity and surrounding rural areas.

The land immediately surrounding the present flue dust site locations has been previously used for mineral processing operations. This land currently has no specific use but has recently been classified through the Anaconda-Deer Lodge County Comprehensive Master Plan as an area that is the least likely to be developed over the next 30 years due to natural or man-made limitations, ARCO ownership and the lack of public services.

The region around the site has a complex geologic history which has resulted in the deposition of sedimentary, igneous, and metamorphic rocks. A high-angle, north-south trending normal fault is located approximately 2,000 feet west of the FDS facility. An inactive geyser is situated close to the junction of the two fault lines. Quaternary alluvial deposits composed of sand, gravel, and cobbles have been identified on the eastern edge of the Smelter Hill site near the former location of Mill Creek. Perched ground-water zones have been found in the tuff bedrock in the vicinity of the Main Flue at depths ranging from 55 to 278 feet below ground surface. Numerous springs, including hot springs, are present within the Clark Fork Basin.

On Smelter Hill, adjacent to the flue, the native soil is primarily colluvium consisting of clay, silt, sand, and bedrock fragments derived from the volcanic deposits. Soils beneath the eastern portion of the site are rich in calcium carbonate (travertine). Vegetation in the vicinity of the flue dust site locations is comprised of rye grasses and small shrubs.

Deer Lodge Valley is drained to the north by the Clark Fork River, which is part of the Columbia River drainage. Warm Springs Creek and Mill Creek roughly bound the site on the north and east sides, respectively, which join with discharges from the Warm Springs Ponds to form the Clark Fork River.

The Smelter Hill site lies within the Warm Springs and Mill Creek watersheds which are both classified as B-1 streams by the State of Montana. This classifies the stream as suitable for use as a source of drinking water, for propagation of salmonoid fish and associated aquatic life, and other uses. The eastern part of the site, including the FDS facility (1b), the Miscellaneous Piles (1c), and the Coal Pile Tracks (1a) are located within the Mill Creek watershed. Runoff from a large portion of the site is diverted to a number of ditches which flow through, or adjacent to, the Opportunity tailings ponds and discharge to the Mill-Willow Bypass. Surface-water runoff from the southeast and eastern part of the Smelter site flows through a series of man-made diversions to Mill Creek.

The climate of the site is typical of the western Montana semi-arid mountain valleys with cold winters, cool summers, and low precipitation. The annual mean precipitation is 13.52 inches. Prevailing wind directions at the top of the Smelter stack are generally from the south to southwest; however, winds occasionally blow from the east.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Site History

In 1884, processing of copper ore from mines in Butte commenced in the Anaconda, Montana area. Since that time, ore and concentrates have been processed using a variety of techniques at the Old Works, Washoe Smelter and the Arbiter Plant. The smelting and concentrating operations at the Washoe Smelter on Smelter Hill began in 1902.

Prior to 1976, flue dust was generated from reverberatory furnaces and converters and was collected at various stages between the furnaces and the stack. Small amounts of flue dust were also collected in flues leading from a zinc roaster. Initially, the flue dust was reprocessed for arsenic and all residuals from the Smelter were reprocessed on-site.

In 1976, the ore processing operation was modified with the installation of an electric arc furnace. Flue dust from the electric furnace was collected in a baghouse or a Ducon scrubber which produced pelletized dust and limed scrubber sludges. These slurried materials were piped to the Bradley Ponds and Iron Ponds where they were stored.

Smelting operations ceased at the site in 1980, and in September 1983 the Cleveland Wrecking Company began demolition of structures associated with the concentrating and smelting operations. The flue dust was removed from the small, subsidiary flues, baghouses, and precipitators and deposited at the

Thickener (2a), Area Cut (2b), Coal Pile Tracks (1a), Switchback (1d), and Miscellaneous Piles (1c). Most of the flue dust in the Main Flue (5) remained in place.

Construction and placement of flue dust in the FDS facility (1b) commenced in May 1983. Initially, the FDS facility was designed as a temporary repository for the flue dust material from other on-site locations. The facility was never completed because of interest in reprocessing of the flue dust.

During demolition of the Main Flue, the above-ground walls of the Main Flue were collapsed into the flue and on top of remaining dust. Soil and rubble from the adjacent area were placed on top of the debris. All of the material was covered with a compacted soil cap and sealed with a soil binder. Berms were constructed to control storm water runoff along both sides of the Main Flue.

2.2 Response History

The Anaconda Smelter site was placed on the National Priorities List (NPL) in September 1983, 48 FR 40658 (September 8, 1983). In October 1984, Anaconda Minerals Company (later ARCO) entered into an agreement with EPA to conduct a Remedial Investigation at the site under Administrative Order on Consent Docket No. CERCLA-VII-84-08 (Consent Order 84-08).

Pursuant to Consent Order 84-08, a Work Plan for the Anaconda Smelter Site RI/FS was developed. The Work Plan divided the study process into two stages. Stage I included the master investigation and a number of focused investigations, each with its own RI/FS. Flue dust piles remaining at the site were designated as one of the several operable units identified for focused investigations. Two Draft Stage I RI reports were prepared (Flue and FDS Facility Draft Stage I RI reports).

Administrative Order on Consent Docket No. CERCLA-VIII-85-09 was issued in 1985 to require further investigation and initiation of control measures to abate the release of fugitive dust from the Smelter Hill Complex. This Order required ARCO to spray the flue dust piles, excluding the Main Flue, with surfactant biannually and inspect them daily. In 1987, Administrative Order on Consent Docket No. CERCLA-VIII-87-04 was issued to require investigation of a process to reclaim metals and treat the flue dust material.

A Consent Decree (Civil Action 88-32) was issued in 1988 to relocate all 37 residents of the Mill Creek community because of contaminants present in the community and potential sources remaining on the Smelter site, including flue dust.

In September 1988, the Flue Dust RI/FS Final Work Plan was prepared pursuant to Administrative Order on Consent Docket No. CERCLA-VIII-88-16, which superceded Consent Order 84-08. The objectives of the Flue Dust RI/FS were: 1) To determine the nature and extent of the flue dust contamination at the Anaconda Smelter site and to identify the extent to which a threat, or potential threat, to human health or the environment exists; and 2) To identify and screen treatment technologies, evaluate alternatives and select a preferred clean up remedy. Because of the potential saleable metal content of flue dust, special emphasis was given to metals recovery technologies. Extensive bench and pilot scale testing was conducted throughout the RI/FS.

This ROD sets forth the remedy selected for the Flue Dust Operable Unit of the Anaconda Smelter Site. The primary purpose of the remedy is to remove, stabilize and contain contaminated flue dust materials. Subsequent remedial or removal actions underway or planned at the site will address site contamination in adjacent soils, surface and ground water.

There are no records of emergency incidents involving fire, explosion, death, or injury at the nine flue dust site locations. However, in June 1986, a heavy rainstorm caused erosion damage to the Main Flue cap. The collector ditches on each side of the flue eroded up to 2 feet deep and portions of the original flue walls were exposed in some areas. No other major incidents at the flue dust site location have been documented. An EPA-designated on-site monitor has observed releases of flue dust, due to wind, from various locations on several occasions.

Monitoring data collected since May 20, 1986 indicates that no exceedances of lead and TSP air quality Federal and State standards, or cadmium, zinc, and PM-10 air quality criteria occurred. However, exceedances of air quality criteria for copper and arsenic have occurred.

2.3 Enforcement History

The Atlantic Richfield Company (ARCO) has been identified as the primary potentially responsible party. ARCO merged with the Anaconda Minerals Company (AMC) in 1977. AMC owned and operated the smelters from approximately 1884 to 1977. The Cleveland Wrecking Company was also identified as a PRP for their involvement with transportation and disposal of wastes during demolition activities.

EPA has issued notice letters to ARCO on several occasions. ARCO has been actively involved in conducting investigations at the site since the site was placed on the NPL in September 1983. EPA, MDHES and ARCO entered into agreement to conduct the Flue Dust RI/FS in September 1988 under Administrative Order on Consent, Docket No. CERCLA VIII-88-16.

EPA filed suit in 1989 to recover past response costs at the Smelter site. This case (United States v. Atlantic Richfield Company, Inc. and Cleveland Wrecking Company, Inc., Docket No. CV 89-39-BU) is currently in litigation.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Community involvement in Anaconda Smelter site activities began early at the site, with the development of the community relations plan in 1984 and meetings with interested community groups. The Anaconda Smelter site has drawn much community interest in the past. Community interest was very intense in 1986-1987 when site contamination required the relocation of the entire community at Mill Creek (37 residents). Public meetings and citizen committee gatherings often became highly emotional encounters between concerned residents and public officials. Media coverage was extensive including coverage by state and national newspapers and local and state television stations.

State legislators and Congressional staff members have recently taken great interest in site activities throughout the Clark Fork basin with the focus on expediting cleanups. Their efforts brought Administrator William Reilly to Anaconda in 1990.

From the beginning of the RI/FS process for the Smelter site, EPA and MDHES have conducted community relations activities and sought the involvement of potentially responsible parties (PRP). These activities have included correspondence with PRPs and members of the public, preparation of press releases and fact sheets, and periodic meetings with elected officials and the community to discuss the Superfund process and the status of site activities. EPA has also contracted an Anaconda community relations liaison to assist the community with information requests. The community of Anaconda is also represented on the Clark Fork Coordinating Forum, an advisory committee for superfund activities in the Clark Fork Basin.

During the course of the Flue Dust RI/FS (September 1988 - June 1991), EPA held several public meetings and solicited comments on the RI/FS Work Plan, Sampling and Analysis Plan, data reports and the risk assessment. EPA and State officials met regularly with the Anaconda-Deer Lodge Reclamation Advocates as well as with community public officials.

To further fulfill the requirements of CERCLA Section 113(k)(2)(B)(i-v) and Section 117, the Administrative Record file was established at EPA's Helena, Montana office. In addition, important site documents were also kept at the Hearst Free Library in Anaconda.

The RI/FS and Proposed Plan were issued on June 3, 1991 with announcements in the Anaconda Leader and Montana Standard. Copies of the Proposed Plan were also mailed to several hundred people on the Anaconda mailing list. Because of initial requests, the RI/FS and Proposed Plan were available for a 60 day public comment period rather than 30 days. Two public meetings were held in Anaconda at the Copper Village Art Center: 1) an information meeting, on June 19, 1991, was attended by approximately 40 people; 2) a public hearing, on July 23, 1991, was attended by approximately 45 people. A transcript of the public meeting is included in Administrative Record.

Eleven oral comments were received at the public hearing and 22 written comments were submitted to EPA. The majority of comments from the local community were in support of the selected remedy with most wanting an expedient cleanup of the flue dust. Responses to comments received during the public comment period are included in the responsiveness summary, which is part of this Record of Decision.

This decision document presents the selected remedial action for the Flue Dust Operable Unit of the Anaconda Smelter Site, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. This decision is based on the administrative record.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

The Anaconda Smelter site consists of the Old Works, Washoe Smelter, Arbiter Plant, numerous waste piles, waste ponds, and associated areas contaminated by airborne deposits of smelter stack emissions. The Anaconda Smelter site covers a wide area. Because of its size and its complexity, EPA has divided the site into several smaller operable units. These include the following:

- OU3 Regional Soils
- OU4 Regional Surface/Ground Water/Tailings
- OU7 Old Works
- OU9 Beryllium
- OU10 Slag
- OU11 Flue Dust
- OU12 Arbiter
- OU14 Smelter Hill
- OU15 Mill Creek
- OU16 Community Soils

Operable units were prioritized based on their potential risk to human health and the environment. Mill Creek was considered the highest priority and a cleanup action was selected there in 1988. Since flue dust is a principal threat waste and a source material, the Flue Dust operable unit was considered the

next highest priority. Several removal actions at other operable units are also underway (OU7, OU9, OU12, OU16) to address other principal threats at the site, including residential yard removals. RI/FS studies are also being conducted on several media-based units at the site (OU7/12 and OU14).

The Flue Dust Operable Unit is located within the boundaries of the Smelter Hill Operable Unit. It was not the intent of the Flue Dust RI/FS to address potential risks associated with adjacent soils, groundwater, or surface water. These will be addressed under the Smelter Hill Operable Unit RI/FS. The Flue Dust Operable Unit remedial action, however, will be consistent with the overall site cleanup objectives.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Flue Dust Characteristics

Ore processing and smelting at Anaconda have led to environmental contamination through several routes. Historically, airborne emissions from the Smelter during operation, especially from the stack atop Smelter Hill, were a significant source of contamination. These emissions consisted of very fine particulate matter containing metallic compounds (contaminants of concern being arsenic, cadmium and lead). As a result of their small size, they were distributed widely by the wind and ultimately deposited on the ground. Since the Smelter is now closed, it is no longer of concern as a release source. However, flue dust from prior emissions continues to be a concern.

Approximately 316,500 cubic yards (approximately 316,500 dry tons) of flue dust are present at the nine site locations on Smelter Hill. Flue dust contains high concentrations of metals such as copper, arsenic, cadmium, lead, and zinc. Flue dust was generated by smelting operations involving reverberatory furnaces, electric furnaces, and roasters. The dust collects in flues or is removed from the off gases of these processes and collected by particulate control systems such as baghouses and electrostatic precipitators.

Flue dust within the Smelter complex can be classified according to their sources and treatment. Prior to 1976, flue dust was generated from a reverberatory furnace and was collected at various stages between the furnace and the stack. A small amount of flue dust also was collected in flues leading from a zinc roaster. After 1976, flue dust was generated from an electric furnace and collected in the baghouse or the Ducon scrubber. Some of the flue dust from the electric furnace was piped to settling ponds in a limed slurry or pelletized. The four general types of flue dust include:

TABLE 1
 LOCATION AND SOURCE OF FLUE DUST,
 FLUE DUST VOLUME AND TONNAGE ESTIMATES

SITE LOCATION	MAP AREA DESIGNATION	SOURCE	DESCRIPTION	VOLUME (YD3)	TONNAGE
Bradley Ponds	7a, 7b	Ducon Scrubber/ Electric Furnace	Limed scrubber sludge	93,534	84,272
Thickner	2a	Baghouse/Electric Furnace	Pelletized dust	6,491	6,340
Area Cut	2b	Baghouse/Electric Furnace	Pelletized dust	3,640	4,383
Coal Pile Tracks	1a	Reverberatory Copper Furnace	Furnace flue dust and slag mixture	39,534	44,605
Switchback	1d	Reverberatory Copper Furnace Precipitators	Furnace flue dust and slag mixture	4,067	4,315
Iron Ponds	3a	Baghouse	Limed baghouse dust	69,648	65,680
Miscellaneous Piles	1c	Unknown-Possibly from Reverberatory Copper Furnace	Debris-metal, glass, rubble Furnace flue dust	5,729	6,802
FDS Facility	1b	Thickner, 60-foot Flue and Cottrells, Miscellaneous Piles of Reverberatory Flue Dust	Pelletized dust from baghouse, furnace, copper reverberatory flue dust, some debris	57,221	59,779
Main Flue	5	Reverberatory Copper Furnace Erick and Debris from Flue	Furnace flue dust, scrap metal, rubble, soil, brick, masonry	36,667 316,536	40,753 316,929

TABLE 2 SUMMARY OF FLUE DUST CONSTITUENTS: 1989 DATA (a)

Constituent	Flue Dust Locations (b)							Average Concentration		
	2b	7a,7b	1a	FDS	3a,3b	5	1c		1d	2a
Arsenic	16,500	13,700	78,400	79,200	22,300	58,200	52,800	80,000	42,800	49,322
Bismuth	1,820	1,330	3,220	2,180	1,440	1,250	1,090	1,200	2,630	1,796
Cadmium	989	1,250	2,940	1,700	1,310	557	176	315 (c)	3,590	1,564
Cobalt	44.0	27.0	71.6	30.4	32.8	57.7	43.0	19.0	22.0	38.6
Copper	244,000	69,400 (c)	166,000	157,000	103,000	172,000	172,000	82,100	146,000	155,263
Gold	-- (d)	--	--	--	--	--	18.9 (c)	--	--	NA (e)
Iron	118,000	77,100	127,000	111,000	175,000	138,000	141,000	77,400	107,000	119,056
Lead	14,400	16,100	32,300	20,300	21,300	9,260	10,900	10,200	20,300	17,229
Magnesium	2,640	4,560	3,070	2,110	2,510	2,040	5,040	1,870	2,340	2,909
Mercury	27.0	8.3	59.3	218	25.0	86.4	20.5	206 (c)	141	73.2
Molybdenum	1,150	255	857	715	534	469	250	169	974	597
Nickel	110	29.5	84.9	39.5	36.1	82.3	92.2	33.8	22.7	59.0
Silver	290	106	240	219	154	186	211	122	256	198
Zinc	28,600	20,900	46,000	32,000	29,200	32,000	20,400	19,200	49,000	30,811

(a) All concentrations in mg/kg. Average concentration is arithmetic mean. Source: Dames & Moore (1989).

(b) Flue dust site numbers defined on Figure 2-1.

(c) Estimated value. Not used in calculation of average concentration.

(d) -- = undetected.

(e) NA = not applicable.

TABLE 3 EPTOX ANALYSES FOR COMPOSITE FLUE DUST SAMPLES

Site Location	Sample ID	EPTOX (µg/L) ^a							
		As	Ba	Cd	Cr	Pb	Hg	Se	Hg
Area cut composite	AC-COMP	84.5	10.8 JS	18,000	6.0 U	2,600	0.20	122	7.0
Bradley Ponds composite	BP-COMP	4,650	172 RS	22,100	6.0 U	2,580	77.9	99.0	2.0 U
Coal pile track composite	CTP-COMP	22,600	3.8 JS	43,700	6.0 U	2,930	0.20	304	21.9
Flue dust storage composite	FDS-COMP	106,000	33.9 JS	14,000	6.0 U	1,210	0.30	153	8.5
Iron Ponds composite	IP-COMP	4,660	4.9 UJS*	24,900 JE	6.0 U	4,380	0.20 U	30.0 U	2.0 U
Main flue composite	MF-COMP	1,190	21.5 JS*	13,800 JE	6.0 U	1,990	0.44	165	15.0
Miscellaneous piles composite	MP-COMP	2,020	20.2 JS*	7,060 JE	6.0 U	2,000	0.20 U	177	6.9
Switch back composite	SB-COMP	81,400	28.7 JS*	2,910 JE	6.0 U	562	0.20 U	609	8.4
Thickener composite	TH-COMP	8,110	20.2 JS	66,400	6.0 U	749	0.20	257	3.9

Reference: Dames and Moore (1989a).

- ^a J - estimated
- S - matrix spike recovery outside control limits
- U - undetected at reported concentration
- R - unusable
- E - interference check sample recovery outside control limits
- * - duplicate relative percent difference >20.

TABLE 4 COMPARISON OF EP-TOXICITY DATA TO REGULATORY LIMITS^(a)

Contaminant	EP Toxicity ^(b) Limit, mg/L	Site Locations Exceeding Limits	Exceedance Value, mg/L
Arsenic	5.0	Coal Pile Tracks	22.6
		FDS Facility	106.0
		Switchback	81.4
Barium	5.0	None	--- ^(c)
Cadmium	1.0	Area Cut	18.0
		Bradley Ponds	22.1
		Coal Pile Tracks	43.7
		FDS Facility	14.0
		Iron Ponds	24.9
		Main Flue	13.8
		Miscellaneous Piles	7.1
Switchback	2.9		
Thickener	66.4		
Chromium	5.0	None	---
Lead	5.0	None	---
Mercury	0.2	None	---
Selenium	1.0	None	---
Silver	5.0	None	---

(a) Source: Dames & Moore 1989.
 (b) RCRA regulations, Part 261.
 (c) No exceedance.

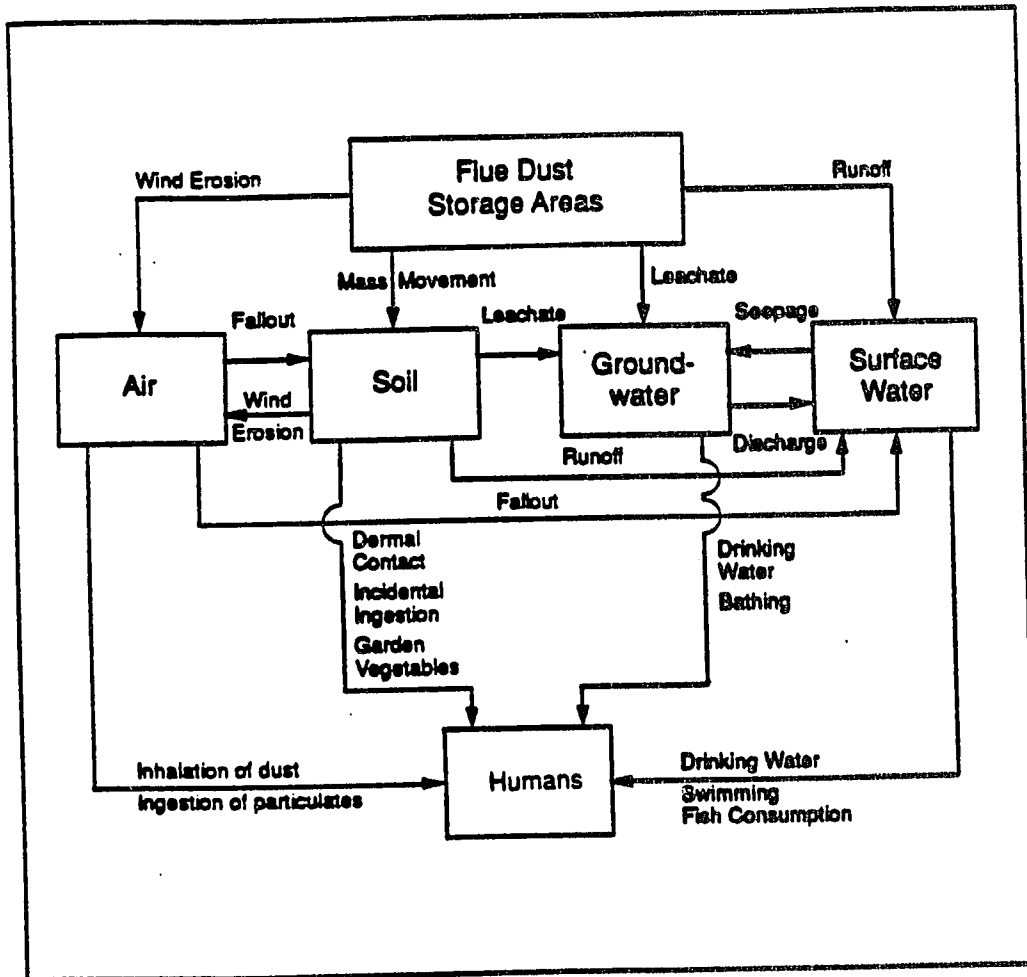


FIGURE 3 CONCEPTUAL MODEL OF CONTAMINANT TRANSPORT AND HUMAN EXPOSURE IN THE VICINITY OF THE ANACONDA SMELTER

- o Limed sludge from Ducon scrubber
- o Pelletized dust from the baghouse
- o Reverberatory furnace flue dust
- o Limed sludge from the baghouse

These flue dust types and the amounts at each location are summarized in Table 1 and shown on the map (back cover).

Composite samples from each of the flue dust locations were collected and analyzed by the Contract Laboratory Program (CLP) for total metals and EP toxicity. Fourteen metals were analyzed in the flue dust averaging 35% of the sample weight (Table 2). These data are classified by EPA as enforcement quality. That is, the data are determined to be valid, defensible, comparable and of known accuracy and precision. These data are adequate for use in calculations involving the estimation of risks from exposure to flue dust.

The major metal constituents are copper and iron, with lesser amounts of zinc, arsenic, cadmium and lead. Copper was detected in composite samples with a range of concentration of 6.9 to 24.4 percent, with an average concentration of 14.6 percent. Arsenic concentrations in the composite samples ranged from 1.4 to 7.9 percent, with an average concentration of 4.9 percent. Cadmium concentrations in the composite samples ranged from 0.02 to 0.36 percent, with an average concentration of 0.14 percent.

The extraction procedure (EP) toxicity results on the composite samples (Table 3) indicated that dissolved metals would leach from the flue dust material in quantities greater than Resource Conservation and Recovery Act (RCRA) regulatory limits (Table 4). Measured values for cadmium exceeded RCRA regulatory limits at all nine locations and arsenic results exceeded regulatory limits at three locations. An exceedance of the regulatory limits is used by EPA to determine if a waste is hazardous under RCRA. The toxicity characteristic leaching procedure (TCLP) is presently used to determine compliance with regulatory limits. TCLP was not used on the flue dust as the EP was in effect at the time of sampling. However, TCLP was later used to determine the characteristic of any treated materials.

5.2 Environmental Releases

Under dry and windy conditions, flue dust is subject to wind erosion and dispersion, followed by deposition on soil. When exposed to rainfall or snow melt, the metals in the flue dust can form a leachate which may adversely affect the quality of adjacent surface water and groundwater.

Figure 3 is a conceptual transport and exposure model identifying the methods by which contaminants may be released to

the environment, transported between environmental media and contacted by human receptors. Based on available monitoring data, air, soil, surface water and groundwater are all known or likely to be contaminated to some extent with metals from the flue dust. Significant pathways of environmental contamination are summarized by transport medium below.

A background study for the Mill Creek RI/FS attempted to establish background levels for the contaminants of concern at the Anaconda Smelter site by evaluating similar areas in the region. Results of the data (arsenic 15.5 ppm, cadmium 1.4 ppm and lead 70.4 ppm) indicated that background levels at the site would be within the range found in most U.S. soils.

Soils with elevated (above background) concentrations of metals occur throughout the southern portion of the Deer Lodge Valley. Elevated concentrations of metals have been detected in surface soils more than seven miles northeast of the Smelter. Soils can become contaminated from wind erosion and subsequent wet and dry deposition of particulate from the air.

Air monitoring data collected near the Anaconda Smelter site indicate that airborne concentrations of arsenic, lead and cadmium are also above background concentrations. Of all of the wastes analyzed at the site, flue dust is the only waste type with extremely elevated arsenic levels. The elevated concentrations of metals in the airborne particulate samples indicate that flue dust is clearly a source of contaminants due to air transport occurring near the site. This is further substantiated by direct visual observations of flue dust emissions to air during on-site operations.

Small, unnamed tributaries carry surface water runoff in the vicinity of the site. A complex system of berms and diversion channels currently control runoff on-site to the Opportunity Ponds, and also divert runoff from surrounding areas around the site. This system is known to have failed under extreme conditions (e.g. a very strong storm following spring snow melt causing contaminated runoff to flow into Mill Creek). Except for these extreme conditions, it is believed that the current runoff control system and maintenance practices prevent or minimize flue dust transport by surface water to surrounding streams.

Many other potential release sources are found on the Smelter site including tailings ponds and slag piles. Data indicating the nature and distribution in the environment of flue dust material from the nine flue dust site locations have been reviewed and assessed. However, it is difficult to dissociate flue dust and other source distribution associated with past process operations from the distribution associated with current flue dust site locations.

6.0 SUMMARY OF SITE RISKS

During soil sampling of communities near the smelter, it was discovered that the former community of Mill Creek had extremely high levels of arsenic (mean avg - 840 ppm) and other heavy metal contaminants when compared to other communities in the area. A Center for Disease Control (CDC) study showed that pre-school children from the community of Mill Creek had greater arsenic exposure than children of other communities in the Anaconda area.

A detailed, quantitative endangerment assessment was prepared by EPA for the Mill Creek RI/FS, where EPA identified significant public health risks for children and adults posed by exposure to arsenic and heavy metals in soil, drinking water, air, and households in the community of Mill Creek. The principal waste sources that contributed to contamination in Mill Creek were the result of Anaconda Smelter operations that have occurred for nearly 100 years. These sources include historic stack and fugitive emissions and ongoing fugitive emission from contaminated areas, including the flue dust locations.

As part of the Flue Dust RI/FS, EPA prepared a Baseline Risk Assessment in November 1990. This Risk Assessment was to characterize, in the absence of remedial action (i.e. the "No Action" alternative), the current and potential threat to human health and the environment that may be posed by contaminants migrating from the flue dust source area. The following sections summarize the findings of the risk assessment.

6.1 Contaminants of Concern

Flue dust contains numerous metallic components of potential health concern. The Risk Assessment focused on those contaminants that are present in high concentrations and are the most toxic. In most cases, the relative risk of chemicals at a site may be evaluated from site monitoring data. In this case, however, monitoring data on the levels of metals in air and soil in and around the site do not distinguish between flue dust and other possible sources of metals (historical deposition from past Smelter operations, slag piles, natural background levels, etc.). For this reason, chemical screening was based on the concentration of each metal in flue dust (Table 5) with a consideration of the toxic potency of each metal.

Based on this screening the chemicals of primary concern for noncarcinogenic effects are arsenic, copper, lead and cadmium. The chemical of primary carcinogenic concern is arsenic, both by the oral (soil) and inhalation (air) routes. Cadmium also contributes a small amount of relative risk via the air route. Lead may contribute some carcinogenic risk, but the carcinogenic effects are usually not considered as important as the noncarcinogenic effects.

TABLE 5 SCREENING OF CHEMICALS, 1989 DATA

Toxicity Class	Flue Dust Component	Concentration (C) ^(a) Flue Dust, mg/kg	Soil			Air					
			Toxicity (t) Criterion	Risk Factor (R) (c)	Percent (b) Total	Rank	Toxicity Criterion	Risk Factor (R) (f)	Percent (d) Total	Rank	
Noncancer	Arsenic	49,322.0	1.0E-3	4.9E+7	28	2	-- (e)	NA (f)	0	0	
	Cadmium	1,564.0	1.0E-3	1.6E+6	1	4	--	NA	0	0	
	Copper	155,263.0	3.7E-2	4.2E+6	2	3	--	NA	0	0	
	Lead	17,729.0	1.4E-4	1.2E+8	69	1	4.3E-4	4.0E+7	99	1	
	Mercury	73.0	3.0E-4	2.4E+5	0	5	3.0E-4	2.4E+5	1	2	
	Nickel	59.0	2.0E-2	3.0E+3	0	0	--	NA	0	0	
	Silver	198.0	3.0E-3	6.6E+4	0	0	--	NA	0	0	
	Zinc	30,811.0	2.0E-1	1.5E+5	0	0	--	NA	0	0	
	Total Risk Factor					100			4.0E+7	100	
	Cancer	Arsenic	49,322.0	1.75E+0	8.6E+4	100		1.5E+1	7.4E+5	99	1
Cadmium		1,564.0	--	NA	0		6.1E+0	9.5E+3	1	2	
Lead		17,229.0	--	NA	0		--	NA	0	0	
Nickel		59.0	--	NA	0		8.4E-1	5.0E+1	0	0	
Total Risk Factor					100			7.5E+5	100		

(a) Source: Dames and Moore 1989.

(b) For noncancer this value is the chronic RfD; for cancer this value is the cancer slope factor (SF). Noncancer toxicity values for lead are extrapolated from existing or proposed regulations for lead in air and water.

(c) The risk factor (R) for each chemical is calculated by the following formulas:

1. For Noncancer: $R = \frac{1}{RfD} \times C$

2. For Cancer: $R = SF \times C$

(d) This value is calculated by dividing each individual risk factor by the sum of all risk factors and multiplying by 100.

(e) -- = Toxicity criterion not available for this chemical or exposure route, either because sufficient data are not available, or the chemical has not been evaluated.

(f) NA = Not applicable since no toxicity criterion is available.

6.2 Exposure Assessment

Two residential populations were selected as those most likely to be exposed to contaminated media identified in the previous section. They are the closest current residents located in East Anaconda and those who may reside on the site some time in the future. Both child and adult residents were evaluated.

Although access to the site is currently restricted, under the no-action alternative it is assumed that access becomes unlimited and that a variety of people might visit the site. It is also assumed that spraying of the flue dust piles to control release would not be continued. Those who might visit the site include site maintenance personnel, hunters, dirt-bike riders, rock and mineral collectors and tourists. Of these individuals, dirt-bike riders are assumed to be subject to the highest level of exposure because wheeled vehicles traversing the storage piles can raise a large volume of dirt and dust. The suspended particles may then be inhaled or ingested by the riders.

Based on the distribution of chemicals in the environment and likely human contact with environmental media, a number of exposure pathways were identified as being likely or plausible, including:

- o Inhalation of particulate matter in air
- o Ingestion of soils
- o Ingestion of groundwater
- o Ingestion of surface water
- o Dermal contact with soil or surface water
- o Ingestion of food grown in contaminated soil.

The intake of contaminants via three routes: 1) Inhalation of flue dust, 2) Ingestion of soils and dust and 3) Ingestion of groundwater (for future residents only) were identified as most likely to result in significant health risks, and exposures by these pathways were selected for quantification.

The contaminant intake equations and values chosen for various intake parameters were derived from standard exposure equations and data presented in EPA guidance documents and site specific data. Table 6 is a summary of the information, assumptions and values used for each scenario.

Two types of dose calculations were performed: best estimate and reasonable maximum. The best estimate dose was calculated using the geometric mean concentration value of each chemical in each medium (soil, air, water). The reasonable maximum dose was calculated using the upper 95th confidence limit of the geometric mean concentration in each medium.

TABLE 6 SUMMARY OF HUMAN EXPOSURE PARAMETERS

Population	Body Wt (kg)	<u>Inhalation of Particulates</u>		<u>Ingestion of Soil</u>		<u>Ingestion of Water</u>	
		Exposure Frequency & Duration	Breathing Rate	Exposure Frequency & Duration	Soil Intake	Exposure Frequency & Duration	Water Intake
Adult Resident	70	24 hr/d, 215 d/y, 30 yr	1.3 m ³ /hr	215 d/yr, 30 yr	100 mg/d	365 d/yr, 30 yr	2 L/d
Child Resident	16	24 hr/d, 215 d/yr, 6 yr	1.0 m ³ /hr	215 d/yr, 6 yr	200 mg/d	365 d/yr, 6 yr	1 L/d
Dirt Bike Rider	70	3 hr/wk, 13 wk/yr, 30 yr	2.5 m ³ /hr	4 events/wk, 13 wk/yr, 30 yr	50 mg/event	-(a)	-(a)

(a) Not evaluated, due to lack of exposure.

Estimation of concentration values is complicated by the fact that direct measurement (monitoring) of the concentration of various metallic components of flue dust in environmental media (air, soil, water) cannot distinguish the levels of contaminants contributed by flue dust from those contributed by other sources. For hypothetical future on-site residents, this is of little concern, since the relative contribution of other sources is likely to be small in the immediate vicinity of the flue dust piles themselves. However, for off-site exposures, the relative contribution of flue dust to total environmental contamination can only be estimated using mathematical models. Calculations using available data and simple models indicated that the results of such modeling efforts were not sufficiently accurate to justify use of the values to estimate flue-dust-specific exposure or risks. For this reason, estimates of exposure of off-site residents have been performed using only the total level of contaminants measured in air and soil; these values should not be confused with estimates of exposure and risk due specifically to flue dust.

6.3 Toxicity Assessment

Many of the metallic constituents in flue dust can cause adverse health effects in humans. A brief summary of the effects of the four metals of chief concern are presented below.

Arsenic. Arsenic is a known human carcinogen, causing lung cancer when inhaled and skin cancer when ingested. Ingestion of arsenic may also cause other internal tumors. Arsenic causes a wide variety of noncancer effects on the skin, blood, nervous system, liver and kidneys.

Cadmium. Cadmium is a probable human carcinogen, causing lung cancer when inhaled. It is not believed to cause cancer when ingested. Chronic ingestion or inhalation of cadmium can lead to serious injury to the kidneys.

Lead. Lead has been shown to cause liver cancer in rats exposed to very high doses. However, the noncancer effects of lead are usually of greater concern. Lead can injure a number of tissues in the body, but the most sensitive is the nervous system. Infants and fetuses are most susceptible to the neurotoxic effects of lead, since the nervous system is still developing in these individuals. Lead may also cause increased blood pressure in adults.

Copper. Copper is a beneficial substance at low doses, and has relatively low toxicity to humans. The chief effect associated with ingesting copper is irritation of the gastrointestinal tract. However, high doses can cause serious effects, including hemolysis, liver necrosis, kidney failure, tachycardia, and convulsions. Copper is not believed to be carcinogenic. Copper

can also be quite toxic to aquatic species exposed to runoff or leachate into surface waters.

The toxic effects of a chemical are quantified by two parameters: 1) the Reference Dose (RfD), which is a dose below which no noncancer effects are expected to occur, even in susceptible individuals, and 2) the cancer slope factor (SF), which is a conservative estimate of the cancer risk per unit exposure.

The following summarizes the RfD values for the metals of concern at this site.

Route	Duration	Reference Dose (RfD) (mg/kg-d)(a)			
		Arsenic	Cadmium	Copper	Lead
Oral	Subchronic	1E-3(b)	NA(c)	3.7E-2(d)	NA
	Chronic	1E-3(b)	1E-3(e)	3.7E-2(d)	NA
Inhalation	Subchronic	NA	NA	NA	NA
	Chronic	NA	NA	NA	NA

(a) Source: USEPA 1990 (HEAST).

(b) This value currently undergoing Agency review.

(c) NA = Not available

(d) Based on current MCL of 1.3 mg/L.

(e) This value is for cadmium in food. This value was chosen because it is believed to be most applicable to cadmium in flue dust.

Cancer slope factors for the carcinogenic indicator chemicals are shown below:

Route	Chemical	Cancer Weight of Evidence		Reference
		Category	SF (mg/kg/day)	
Oral	Arsenic	A	1.75	USEPA 1990
	Lead	B2	NA(a)	USEPA 1988c
Inhalation	Arsenic	A	15(b)	USEPA 1988a
	Cadmium	B1	6.1	USEPA 1990

(a) NA = not available

(b) The SF for inhaled arsenic reported in USEPA (1990) is 50 (mg/kg/day)⁻¹. This is based on the absorbed dose of arsenic, which was assumed by the USEPA to be 30% of inhaled dose. This value has therefore been multiplied by 0.3 to yield a SF applicable to inhaled (rather than absorbed) dose.

6.4 Risk Characterization

The risk of cancer from exposure to a chemical is calculated by multiplying the lifetime average daily dose by the appropriate cancer slope factor (SF). When there is more than one carcinogenic chemical present, or if exposure to carcinogens occurs by more than one route, the total cancer risk to an individual is calculated simply by summing each of the chemical and route-specific values.

The potential risks of adverse noncarcinogenic effects from chemical exposures can be expressed in terms of the Hazard Quotient (HQ). The HQ is the ratio of the estimated dose which a human receives to the estimated dose level believed to be safe, the Reference Dose (RfD). This is calculated as follows:

$$HQ = DI / RfD$$

where:

HQ=Hazard Quotient for Chronic Exposure
 DI=Daily Intake
 RfD=Reference Dose

If the HQ value is less than one (1E+0), it is believed that there is no significant risk of noncarcinogenic effects. If the HQ is greater than 1E+0, there is risk that noncancer effects may occur. However, since most RfD values are derived in a conservative fashion, an HQ value greater than 1E+0 does not imply that an adverse effect will necessarily occur.

Although lead can cause serious noncancer effects, there is no currently agreed upon RfD value. Rather, the noncancer risks of lead are evaluated by estimating the distribution of concentrations of lead that would occur in the blood of children under the exposure conditions assumed. Levels above 10 ug/dl are considered undesirable.

In the risk characterization, the aggregate carcinogenic risk due to flue dust contaminants is compared to an acceptable target risk. The chance of one person in one million people (10^{-6}) is used as a target value or point of departure above which carcinogenic risks may be considered unacceptable. This 10^{-6} point of departure is used when ARARs are not available or are not sufficiently protective of human health and the environment.

Using the above mentioned approaches, EPA evaluated the cancer and noncancer risks associated with the no action alternative for the Flue Dust Operable Unit in the Final Draft Baseline Risk Assessment for the Flue Dust Operable Unit. The results for the reasonable maximum exposure (RME) for arsenic, cadmium and copper are shown in Table 7. Because of the inherent uncertainty in these calculations, all results are shown to only

TABLE 7 SUMMARY OF ESTIMATED HUMAN HEALTH RISKS FROM ARSENIC, CADMIUM, AND COPPER

Exposed Population	Exposure Scenario	Chemical of Concern	Excess Cancer Risk	Noncancer Risk (HQ)
Future On-Site Adult Resident	(1) Ingestion of Soil	Arsenic	7×10^{-2}	100
		Cadmium		2
		Copper		5
	(2) Inhalation of Dust	Arsenic	7×10^{-2}	NA ^(a)
		Cadmium		NA
		Copper		NA
	(3) Ingestion of Water	Arsenic	5×10^{-2}	70
		Cadmium		70
		Copper		3
TOTAL FOR FUTURE ON-SITE ADULT			2×10^{-1}	
Future On-Site Child Resident	(1) Ingestion of Soil	Arsenic		800
		Cadmium		NA
		Copper		40
	(2) Inhalation of Dust	Arsenic		NA
		Cadmium		NA
		Copper		NA
	(3) Ingestion of Water	Arsenic		200
		Cadmium		NA
		Copper		6
TOTAL FOR FUTURE ON-SITE CHILD				
Current Off-Site Adult Resident	(1) Ingestion of Soil	Arsenic	9×10^{-5}	0.1
		Cadmium		0.007
		Copper		0.02
	(2) Inhalation of Dust	Arsenic	3×10^{-5}	NA
		Cadmium		2×10^{-6}
		Copper		NA
TOTAL FOR CURRENT OFF-SITE ADULT			1×10^{-4}	
Current Off-Site Child Resident	(1) Ingestion of Soil	Arsenic		1
		Cadmium		NA
		Copper		0.1
	(2) Inhalation of Dust	Arsenic		NA
		Cadmium		NA
		Copper		NA
TOTAL FOR CURRENT OFF-SITE CHILD				
Dirt Bike Rider	(1) Ingestion of Soil	Arsenic	9×10^{-3}	10
		Cadmium		0.2
		Copper		0.6
	(2) Inhalation of Dust	Arsenic	4×10^{-3}	NA
		Cadmium		3×10^{-5}
		Copper		NA
TOTAL FOR CURRENT DIRT BIKE RIDER			1×10^{-2}	

(a) NA = Not calculated because RFD not available.

one significant figure.

This analysis yields the following main conclusion:

- o An imminent and substantial endangerment would exist for hypothetical future on-site residents. Of chief concern would be a high risk of lung cancer (7 in 100) resulting from inhalation of arsenic in air, with a smaller, but still significant risk of lung cancer (5 in 10,000) contributed by cadmium in air. Also, a concern would be the high risk of skin cancer (7 in 100) due to ingestion of arsenic. Total risk for cancer is calculated to be 2 in 10. Future on-site residents (especially children) would also be subject to high risks of noncarcinogenic effects from arsenic, cadmium and copper in soil and water.
- o Total lifetime lung cancer risks to current residents of East Anaconda appear to be on the order of 3 in 100,000. This is due mainly to arsenic in air, with lower risk levels due to cadmium in the air. Skin cancer risks from ingestion of arsenic in soil are probably around 9 in 100,000. As noted earlier, these are total risks, and the fraction of this risk that is due specifically to flue dust is not known.
- o Occasional visitors to the site (dirt-bike riders) could have a substantial cancer risk (up to a risk of 9 out of 1,000 for skin cancer and 4 out of 1,000 for lung cancer) if site visits involved significant contact with flue dust and site visits occurred over a long period. In addition, significant risks of noncancer effects could also occur, due mainly to the presence of arsenic in flue dust.

As noted above, the effects of lead are evaluated by calculating the expected distribution of blood lead values. For the future on-site residential child, the average blood lead would be 73 ug/dL, far above acceptable levels (10 ug/dL). For current off-site children, the estimated average blood lead value is 2.6 ug/dL, within the acceptable range.

Thus, the flue dust piles currently on site pose a significant health risk to hypothetical future residents of the site and may also be contributing to health risks of site visitors or nearby residents. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or, the environment.

6.5 Environmental Risks

Flue dust can also lead to environmental contamination in a variety of ways. One important pathway is wind erosion of the flue dust, followed by dispersion of these particles in air to surrounding areas. The flue dust then settles, leading to a gradual accumulation in the soil. Flue dust may also contaminate the environment through leaching of the contamination to surface waters (ponds, creeks, etc.) or into the groundwater beneath the piles.

Risks to plant and animal species on and around the site cannot be evaluated quantitatively with current data, but analysis of information of species likely to be present and pathways of flue dust migration suggest the following:

- o Aquatic species in Warm Springs Creek or Mill Creek are not likely to be affected by flue dust under current conditions, since runoff from the site is controlled and does not reach these waters. Under the no-action alternative, however, current control systems would be expected to fail and runoff would likely lead to significant exposure of organisms in the creeks.
- o Flue dust contamination of soil, both on site and off site (primarily in the downwind direction) can lead to contaminant uptake by vegetation and crops. This could be further increased by direct deposition (wet or dry) of flue dust on foliar surfaces.
- o Herbivorous wildlife could be exposed by consumption of contaminated plant material or soil, as well as by direct inhalation of flue dust in air. Although the magnitude of the risks posed to ecological species by flue dust cannot be estimated with current data, these risks are of concern.

7.0 DESCRIPTION OF ALTERNATIVES

A feasibility study was conducted to develop and evaluate alternatives for the Flue Dust Operable Unit. Remedial alternatives were assembled from applicable remedial technology process options and were initially evaluated for effectiveness, implementability, and cost. The alternatives meeting these criteria were then evaluated and compared to nine criteria required by the NCP. In addition to the remedial alternatives, the NCP requires that a no-action alternative be considered at every site. The no-action alternative serves primarily as a point of comparison for other alternatives.

The feasibility study evaluated six alternatives for addressing human health and environmental problems caused by the flue dust material. Each of the six alternatives is summarized in the following sections and on Table 8.

7.1 ALTERNATIVE 1: NO ACTION

The NCP requires that the "No Action" alternative be evaluated at every site to establish a baseline for comparison. Under this alternative, EPA would take no further action at the site to prevent exposure to flue dust, including the current biannual surfactant applications.

Because this alternative would result in contaminants remaining on-site, CERCLA requires that the site be reviewed every five years. If indicated by the review, remedial actions would be implemented at that time to remove or treat the wastes. Since no action would take place, there would be no capital or operation and maintenance costs.

7.2 ALTERNATIVE 2: DISPOSAL OF UNTREATED FLUE DUST IN AN ONSITE REPOSITORY

Under this alternative, all 316,500 cubic yards of flue dust and debris from the nine pile locations would be excavated, hauled, and directly placed into a repository meeting applicable or relevant and appropriate Montana Hazardous Waste Act and Resource Conservation and Recovery Act (RCRA) Subtitle C statutory and regulatory disposal site requirements.

Flue dust is a mineral processing waste that is a characteristic hazardous waste and that was disposed of after 1980. Recently, materials such as flue dust were removed from the Bevill exclusion (newly identified waste) making RCRA Subtitle C an applicable requirement. Although this alternative would involve the excavation and placement of a hazardous waste, regulated under RCRA, the RCRA Land Disposal Restrictions (LDRs) are not applicable requirements as newly identified wastes do not have treatment standards under the land disposal restrictions.

This alternative includes the removal of all flue dust located on Smelter Hill (316,500 cubic yards), including flue dust in the Main Flue. This includes the removal of adjacent soils that contain visually distinct flue dust in concentrations greater than concentrations of contaminants in surrounding soils. Confirmation sampling of arsenic and cadmium would be required to ensure adequate removal. Cleanup of remaining soils will be evaluated under the Smelter Hill Operable Unit. Some RCRA closure requirements contained in 40 CFR § 264.258 as incorporated into ARM § 16.44.702 would be relevant and appropriate to stabilize the site. Final closure of the nine flue dust locations is not within the scope of this project but

TABLE 8
SUMMARY OF ALTERNATIVES

<u>COMPONENTS</u>	<u>ALTERNATIVES *</u>					
	1	2	3	4	5	6
Removal						
o Complete		x	x	x	x	x
o Partial						
Treatment						
o Cement/silicate Stabilization				x	?	x
o Metals Removal					x	x
o Chemical Fixation					x	
Disposal						
o Offsite (TSD)			x			
o Onsite (RCRA Subtitle C)		x				
o Onsite (Engineered Repository)				x	x	x
Institutional Controls						
o Groundwater Monitoring		x		x	x	x
o Site Access Restriction		x				

ALTERNATIVES *

1. No Action
2. Disposal of untreated flue dust in and onsite repository.
3. Offsite disposal of untreated flue dust.
4. Onsite stabilization/fixation, disposal in and engineerepository.
5. Onsite metal removal/chemical fixation, disposal in an engineered onsite repository.
6. Onsite metal removal, stabilization, disposal in an engineered onsite repository.

rather to be determined under the Smelter Hill Operable Unit.

Flue dust would be excavated and transported to the repository using conventional earthmoving equipment such as loaders, dozers and off road haul trucks. Because of the potential for release during excavation and transport, dust suppression and air monitoring would be required.

The repository would be designed and constructed in accordance with the requirements specified in ARM § 16.44.702 as it incorporates 40 CFR § 264.301, including among other things, a double liner system, leachate control, impermeable cap and monitoring. The liner system would be designed and constructed to prevent the migration of contaminants out of the repository into underlying soils or groundwater and would include a leachate collection and removal system. The cap would be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying contaminated soils. Consistent with the requirements of ARM § 16.44.702 as it incorporates 40 CFR § 264.117, long-term operation and maintenance would be conducted to monitor the groundwater around the repository and to ensure the integrity of the cap.

The repository would be protected with institutional controls which include site access and land use restrictions. Successful excavation and placement of the flue dust in a repository meeting applicable or relevant and appropriate RCRA Subtitle C requirements would be expected to reduce contamination levels at the flue dust locations to concentrations equivalent to surrounding soils and effectively reduce the risk of flue dust contaminant release from the repository. The estimated capital cost of this alternative is \$7,482,000, with annual O&M costs estimated to be \$10,000. The estimated time to implement this remedy and meet the cleanup requirements is approximately two years.

7.3 ALTERNATIVE 3: OFFSITE DISPOSAL OF UNTREATED FLUE DUST

Under this alternative, flue dust from the nine pile locations would be excavated and transported to an offsite RCRA Transfer, Storage and Disposal (TSD) facility. Requirements under RCRA would govern shipping and manifesting the material to the TSD facility.

This alternative includes the removal of all flue dust located on Smelter Hill (316,500 cubic yards), including flue dust in the Main Flue. This includes the removal of adjacent soils that contain visually distinct flue dust in concentrations greater than concentrations of contaminants in surrounding soils. Confirmation sampling of arsenic and cadmium would be required to ensure adequate removal. Cleanup of remaining soils will be

evaluated under the Smelter Hill Operable Unit. Some RCRA closure requirements 40 CFR § 264.258 as incorporated into ARM § 16.44.702 would be relevant and appropriate to stabilize the site. Final closure of the nine flue dust locations is not within the scope of this project but rather to be determined under the Smelter Hill Operable Unit.

Flue dust would be excavated and transported to a transfer station using conventional earthmoving equipment such as loaders, dozers and off road haul trucks. The flue dust would be transferred from haul trucks through a mobile hopper for conveyance to railroad container cars at the site. Because of the potential for release during excavation and transfer, dust suppression and air monitoring would be required. Rail transport would occur on existing lines at the site.

The flue dust would then be transported to a permitted out-of-state disposal facility. Requirements under the Montana Hazardous Waste Act, RCRA and Department of Transportation regulations would govern shipping and manifesting the material to the disposal facility. Maintenance and monitoring of the disposed material would be the responsibility of the facility operator.

Successful excavation and transport of flue dust to a permitted RCRA TSD facility would be expected to reduce contamination levels at the flue dust locations to equivalent concentrations in surrounding soils and effectively reduce the risk of flue dust contaminant release from the TSD facility. The estimated capital cost of this alternative is \$71,933,000, with no annual O&M costs. The estimated time to implement this remedy and meet the cleanup requirements is approximately one year.

7.4 ALTERNATIVE 4: ONSITE STABILIZATION, DISPOSAL IN AN ONSITE ENGINEERED REPOSITORY

This alternative is the selected remedy and was identified as the preferred remedy in the Proposed Plan. The major components of this alternative include the excavation of flue dust at each of the nine flue dust locations, onsite stabilization using a cement/silicate based process, and disposal of treated residues in an onsite engineered repository.

This alternative includes the removal of all flue dust located on Smelter Hill (316,500 cubic yards), including flue dust in the Main Flue. This includes the removal of adjacent soils that contain visually distinct flue dust in concentrations greater than concentrations of contaminants in surrounding soils. Confirmation sampling of arsenic and cadmium will be required to ensure adequate removal. Cleanup of remaining soils will be evaluated under the Smelter Hill Operable Unit. Some RCRA closure requirements 40 CFR § 264.258 as incorporated into ARM §

16.44.702 will be relevant and appropriate to stabilize the site. Final closure of the nine flue dust locations is not within the scope of this project but rather to be determined under the Smelter Hill Operable Unit.

The flue dust will be treated at each of the nine flue dust locations with a mobile crusher and cement batch plant. The flue dust will be stabilized to meet RCRA TCLP regulatory limits. The flue dust will be treated in accordance with 40 CFR Subpart X, as incorporated into ARM § 16.44.702, for standards for a treatment unit. The specific process will be determined in the Remedial Design Phase through engineering design and analysis.

The processed material will then be transported to an onsite repository for disposal using standard cement trucks. Dust suppression and air monitoring will be required. No transport on public roads will be allowed.

Treatability testing indicated that the mobility of contaminants of concern (arsenic, cadmium and lead) can be effectively reduced (62% to 99%) to meet the BDAT or TCLP RCRA regulatory limits. Additional leaching tests (MEP, ANS 16.1) also indicated that the material will meet the regulatory limits over the long term (see attachment 2).

Because it is expected that treatment of the flue dust material will remove the hazardous characteristic from the material, this alternative will not involve the disposal of a RCRA regulated waste, and RCRA Subtitle C requirements are not applicable. However, some RCRA Subtitle C requirements have been determined to be relevant and appropriate to the type of substances being managed. The repository will be designed and constructed in accordance with the requirements specified in the Montana Solid Waste Management Act, RCRA Subtitle D, and selected RCRA Subtitle C requirements and will include among other things, a liner system, leachate control, impermeable cap and monitoring. The liner system will be designed and constructed to prevent the migration of contaminants out of the repository into underlying soils or groundwater and will include a leachate collection and removal system. The cap will be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying contaminated soils. Consistent with the requirements of 40 CFR Section 264.117, as incorporated into ARM Section 16.44.702, long-term operation and maintenance will be conducted to monitor the groundwater around the repository and to ensure the integrity of the cap.

The repository will be protected with institutional controls which include site access and land use restrictions. Successful excavation, treatment and placement of the treated flue dust material in an onsite engineered repository will be expected to reduce contamination levels at the flue dust locations to equivalent concentrations in surrounding soils and effectively reduce the risk of flue dust contaminant release from the repository. The estimated capital cost of this alternative is \$25,338,000, with annual O&M costs estimated to be \$10,000. The estimated time to implement this remedy and meet the cleanup requirements is approximately three years.

7.5 ALTERNATIVE 5: ONSITE METAL REMOVAL/CHEMICAL FIXATION, WITH OR WITHOUT ADDITIONAL STABILIZATION, DISPOSAL IN AN ENGINEERED ONSITE REPOSITORY

The major components of this alternative include the excavation of flue dust at each of the nine flue dust locations, onsite hydrometallurgical treatment and disposal of the treated material in an onsite engineered repository.

This alternative includes the removal of all flue dust located on Smelter Hill (316,500 cubic yards), including flue dust in the Main Flue. This includes the removal of adjacent soils that contain visually distinct flue dust in concentrations greater than concentration of contaminants in surrounding soils. Confirmation sampling of arsenic and cadmium would be required to ensure adequate removal. Cleanup of remaining soils will be evaluated under the Smelter Hill Operable Unit. Some RCRA closure requirements 40 CFR § 264.258 and ARM § 16.44.702 would be relevant and appropriate to stabilize the site. Final closure of the nine flue dust locations is not within the scope of this project but rather to be determined under the Smelter Hill Operable Unit.

Flue dust would be transferred from the nine flue dust locations to a central location for treatment using a chloride leaching technology which would remove saleable metals and produce a long-term stable residue material which would not leach contaminants above RCRA TCLP regulatory limits. The flue dust would be treated in accordance with 40 CFR Subpart X, as incorporated into ARM Section 16.44.702, standards for a treatment unit. The specific process would be determined in the Remedial Design Phase through engineering design and analysis. The processed material would then be transported to an onsite repository for disposal. Because of the potential for release of contaminants during excavation, transfer and treatment, dust suppression and air monitoring would be required.

The chloride leaching technology was represented by the innovative Cashman Process. Initial bench-scale test results indicated that saleable metals could be removed while producing a stable residue product. Additional test results collected during the pilot-scale testing indicated that the residue would fail TCLP limits for lead (see Attachment 2). Although it is believed that the process could be adjusted to produce the desired residue, testing also indicated that the technology would be very complex and would be difficult to operate and produce a consistently stable residue. If a desired residue could not be produced, additional stabilization of the material would be required to meet RCRA regulatory limits. Marketable products would be sold to various metallurgical processing facilities for subsequent metal recovery.

Because treatment of the flue dust material (possibly with additional stabilization) would remove the hazardous characteristic from the material, this alternative would not involve the disposal of a RCRA regulated waste, and RCRA Subtitle C requirements are not applicable. However, some RCRA Subtitle C requirements have been determined to be relevant and appropriate to the type of substances being managed. The repository would be designed and constructed in accordance with the requirements specified in the Montana Solid Waste Management Act, RCRA Subtitle D and selected RCRA Subtitle C requirements and will include among other things, a liner system, leachate control, impermeable cap and monitoring. The liner system would be designed and constructed to prevent the migration of contaminants out of the repository into underlying soils or groundwater and would include a leachate collection and removal system. The cap would be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying contaminated soils. Consistent with the requirements of 40 CFR § 264.117, as incorporated into ARM § 16.44.702, long-term operation and maintenance would be conducted to monitor the groundwater around the repository and to ensure the integrity of the cap.

The repository would be protected with institutional controls which include site access and land use restrictions. Successful excavation, treatment and placement of the treated flue dust material in an onsite engineered repository would be expected to reduce contamination levels at the nine flue dust locations to concentrations equivalent in surrounding soils and effectively reduce the risk of flue dust contaminant release from the repository. The estimated capital cost of this alternative is \$47,854,000, with annual O&M costs estimated to be \$14,487,000 during the treatment operation and \$10,000 thereafter. Recoverable revenue is estimated to be \$12,000,000 during the treatment operation. The estimated time to implement this remedy and meet the cleanup requirements is approximately seven to ten years.

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7.6 ALTERNATIVE 6: ONSITE METAL REMOVAL, STABILIZATION, DISPOSAL IN AN ENGINEERED ONSITE REPOSITORY

The major components of this alternative include the excavation of flue dust at each of the nine flue dust locations, onsite metals removal, stabilization of treated residues and disposal of the treated material in an onsite engineered repository.

This alternative includes the removal of all flue dust located on Smelter Hill (316,500 cubic yards), including flue dust in the Main Flue. This includes the removal of adjacent soils that contain visually distinct flue dust in concentrations greater than concentrations of contaminants in surrounding soils. Confirmation sampling of arsenic and cadmium would be required to ensure adequate removal. Cleanup of remaining soils will be evaluated under the Smelter Hill Operable Unit. Some RCRA closure requirements 40 CFR § 264.258 and ARM § 16.44.702 would be relevant and appropriate to stabilize the site. Final closure of the nine flue dust locations is not within the scope of this project but rather to be determined under the Smelter Hill Operable Unit.

The flue dust materials would be transported from the nine flue dust locations to a central location for treatment using a sulfuric acid leaching technology to remove saleable metals. Based on treatability testing, leach residues are not expected to meet TCLP regulatory limits. Residues not meeting the TCLP limits would be stabilized by a cement/silicate-based stabilization process as described in Alternative 4. Testing of stabilized treated residues indicated that the material would meet TCLP regulatory limits and be stable over the long term (see Attachment 2). Marketable products would be sold to various metallurgical processing facilities for subsequent metal recovery.

The flue dust would be treated in accordance with 40 CFR Subpart X, as incorporated into ARM § 16.44.702, standards for a treatment unit. The specific process would be determined in the Remedial Design Phase through engineering design and analysis. The processed material would then be transported to an onsite repository for disposal. Because of potential releases during excavation, transport and treatment, dust suppression and air monitoring would be required.

Because treatment of the flue dust material (with additional stabilization) would be expected to remove the hazardous characteristic from the material, this alternative would not involve the disposal of a RCRA regulated waste, and RCRA Subtitle C requirements would not be applicable. However, RCRA Subtitle C requirements have been determined to be relevant and appropriate to the type of substances being managed. The repository would be

TABLE 9 CLEANUP EVALUATION CRITERIA

Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection and evaluates how risks posed through each pathway are eliminated, reduced, or controlled.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy will meet all applicable or relevant and appropriate Federal and State environmental laws and/or provide grounds for a waiver.

Short-Term Effectiveness addresses the period of time needed to complete the remedy, and any risks to human health and the environment that may be posed during the construction and implementation of the remedy.

Long-Term Effectiveness and Permanence refers to the ability of a remedy to provide reliable protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume Through Treatment refers to the preference for a remedy that reduces health hazards, movement, or quantity of contaminants at the site.

Implementability refers to the technical and administrative feasibility of a remedy. This includes the availability of materials and services needed to carry out a remedy. It also includes coordination of Federal, State, and local governments to work together to cleanup the site.

Cost-Effectiveness evaluates the estimated capital and operation and maintenance costs of each alternative in comparison to other equally protective alternatives.

State Acceptance indicates whether the State agrees with, opposes, or has no comment on the preferred alternative.

Community Acceptance includes determining which parts of the alternatives interested persons in the community support, have reservations about, or oppose.

TABLE 10 COMPARATIVE ANALYSIS

CRITERIA	ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 ONSITE DISPOSAL	ALTERNATIVE 3 OFFSITE DISPOSAL	ALTERNATIVE 4 STABILIZATION/ FIXATION
OVERALL PROTECTIVENESS	Does not provide adequate protection of human health and the environment.	Protection of human health and the environment achieved through placement of Flue Dust in a RCRA Subtitle C repository.	Protection of human health and the environment achieved through placement of Flue Dust in a permitted RCRA TSD facility.	Protection of human health and the environment achieved through production of a stable non-characteristic material and placement in an engineered repository.
COMPLIANCE WITH ARARS	Would not attain ARARs.	Would attain ARARs.	Would attain ARARs.	Would attain ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Existing risk would remain and may increase.	Risk of contaminant releases effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCRA Subtitle C repository.	Risk of contaminant releases effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCRA TSD facility.	Risk of contaminant release effectively reduced; but will be dependent on the long-term stability of treated material, and long-term integrity, maintenance and monitoring of an engineered repository.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	No reduction in toxicity, mobility, or volume.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	Reduction of toxicity and mobility to below noncharacteristic (TCLP) levels. Increase of volume by approximately 15%.
SHORT-TERM EFFECTIVENESS	Not applicable.	Dust controls required to reduce worker and community risk. Two year implementation.	Dust controls required to reduce worker and community risk. Additional handling and transportation would increase potential for release. Six month implementation.	Dust controls required to reduce worker and community risk. Additional controls required for treatment. Three year implementation.
IMPLEMENTABILITY	Not applicable.	Simple to construct and operate. Services, equipment and technology are readily available.	Simple to operate. No construction. Services, equipment and technology are readily available.	Simple to construct, somewhat complex, but proven, to operate to meet ARARs. Services equipment and technology are readily available.
PRESENT WORTH COST AT 10% DISCOUNT	Not applicable.	\$6,911,000	\$71,933,000	\$21,866,000

COMPARATIVE ANALYSIS OF ALTERNATIVES

CRITERIA	ALTERNATIVE 5A CASEMAN PROCESS WITH STABILIZATION	ALTERNATIVE 5B CASEMAN PROCESS WITHOUT STABILIZATION	ALTERNATIVE 6 AMBIENT ACID LEACH WITH STABILIZATION
OVERALL PROTECTIVENESS	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of non-characteristic material in an engineered repository.	Protection of human health and the environment achieved through removal of some contaminants, production of a stable non-characteristic residue, and placement in an engineered repository.	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of non-characteristic material in an engineered repository.
COMPLIANCE WITH ARARs	Would attain ARARs.	Would attain ARARs.	Would attain ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Risk of contaminant release effectively reduced; but will be dependent on long-term stability of treated material, and long-term integrity, maintenance and monitoring of an engineered repository.	Risk of contaminant release effectively reduced; but will be dependent upon the ability to produce a long-term stable non-characteristic residue, and the long-term integrity, maintenance, and monitoring of an engineered repository.	Risk of contaminant release effectively reduced, but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	Reduction of toxicity and mobility to below non-characteristic (TCLP) levels. Increase of volume by approximately 16%.	Reduction of toxicity and mobility, although possibly not to below non-characteristic (TCLP) levels. Increase of volume by approximately 4%.	Reduction of toxicity and mobility to below non-characteristic (TCLP) levels. Increase of volume by approximately 16%.
SHORT-TERM EFFECTIVENESS	Dust controls required to reduce worker and community risk. Controls also needed for treatment operations. Seven to eight-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for treatment operations. Approximate seven-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for treatment operations. Seven to eight-year implementation.
IMPLEMENTABILITY	Complex to construct and operate. Some exotic equipment needed. Training of personnel required. Technology not proven at full scale, except for stabilization stage.	Complex to construct and operate. Some exotic equipment needed. Training of personnel required. Technology not proven at full scale.	Complex to construct and operate. Services, equipment technology are available. Training of personnel may be required. Technology proven in commercial operations.
PRESENT WORTH COST AT 10% DISCOUNT	<<CONFIDENTIAL>>	<<CONFIDENTIAL>>	\$19,189,000

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TABLE 10 COMPARATIVE ANALYSIS OF ALTERNATIVES

CRITERIA	ALTERNATIVE 1 ON-SITE DISPOSAL	ALTERNATIVE 2 ON-SITE DISPOSAL	ALTERNATIVE 3 OFF-SITE DISPOSAL	ALTERNATIVE 4 ON-SITE DISPOSAL	ALTERNATIVE 5 ON-SITE DISPOSAL	ALTERNATIVE 6 ON-SITE DISPOSAL
OVERALL PROTECTIVENESS	Protection of human health and the environment achieved through placement of Plus Dust in a RCRA Subtitle C repository.	Protection of human health and the environment achieved through placement of Plus Dust in a RCRA Subtitle C repository.	Protection of human health and the environment achieved through placement of Plus Dust in a RCRA Subtitle C repository.	Protection of human health and the environment achieved through placement of Plus Dust in a RCRA Subtitle C repository.	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of an engineered material in an engineered repository.	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of an engineered material in an engineered repository.
COMPLIANCE WITH ARMS	Would not attain ARMS.	Would attain ARMS.	Would attain ARMS.	Would attain ARMS.	Would attain ARMS.	Would attain ARMS.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCNA repository.	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCNA repository.	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCNA repository.	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.	Risk of contaminant release effectively reduced, but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.	Risk of contaminant release effectively reduced, but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	Reduction of toxicity and mobility, although possible (TSP) levels. Increase of volume by approximately 4%.	Reduction of toxicity and mobility, although possible (TSP) levels. Increase of volume by approximately 4%.	Reduction of toxicity and mobility, although possible (TSP) levels. Increase of volume by approximately 4%.
SHORT-TERM EFFECTIVENESS	Not applicable.	Dust controls required to reduce worker and community risk. Two year implementation.	Dust controls required to reduce worker and community risk. Additional controls required for portation would increase potential for such implementation.	Dust controls required to reduce worker and community risk. Controls also needed for eight-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for eight-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for eight-year implementation.
IMPLEMENTABILITY	Not applicable.	Simple to construct and operate. Services, equipment and technology are readily available.	Simple to construct. No construction. Services, equipment and technology are readily available.	Complex to construct and operate. Some specific equipment needed. Training of personnel required. Technology not proven at full scale. Major for stabilization stage.	Complex to construct and operate. Training of personnel required. Technology not proven at full scale.	Complex to construct and operate. Training of personnel required. Technology not proven at full scale.
PRESENT WORTH COST AT 10% DISCOUNT	Not applicable.	\$4,911,000	\$71,931,000	\$21,856,000	<<CONFIDENTIAL>>	\$19,189,000

CRITERIA	ALTERNATIVE 1 ON-SITE DISPOSAL	ALTERNATIVE 2 ON-SITE DISPOSAL	ALTERNATIVE 3 OFF-SITE DISPOSAL	ALTERNATIVE 4 ON-SITE DISPOSAL	ALTERNATIVE 5 ON-SITE DISPOSAL	ALTERNATIVE 6 ON-SITE DISPOSAL
OVERALL PROTECTIVENESS	Does not provide protection of human health and the environment.	Protection of human health and the environment achieved through placement of Plus Dust in a RCNA Subtitle C repository.	Protection of human health and the environment achieved through placement of Plus Dust in a RCNA Subtitle C repository.	Protection of human health and the environment achieved through placement of Plus Dust in a RCNA Subtitle C repository.	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of an engineered material in an engineered repository.	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of an engineered material in an engineered repository.
COMPLIANCE WITH ARMS	Would not attain ARMS.	Would attain ARMS.	Would attain ARMS.	Would attain ARMS.	Would attain ARMS.	Would attain ARMS.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Existing risk would remain and may increase.	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCNA repository.	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCNA repository.	Risk of contaminant release effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.	Risk of contaminant release effectively reduced, but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.	Risk of contaminant release effectively reduced, but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	Reduction of toxicity and mobility, although possible (TSP) levels. Increase of volume by approximately 4%.	Reduction of toxicity and mobility, although possible (TSP) levels. Increase of volume by approximately 4%.	Reduction of toxicity and mobility, although possible (TSP) levels. Increase of volume by approximately 4%.
SHORT-TERM EFFECTIVENESS	Not applicable.	Dust controls required to reduce worker and community risk. Two year implementation.	Dust controls required to reduce worker and community risk. Additional controls required for portation would increase potential for such implementation.	Dust controls required to reduce worker and community risk. Controls also needed for eight-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for eight-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for eight-year implementation.
IMPLEMENTABILITY	Not applicable.	Simple to construct and operate. Services, equipment and technology are readily available.	Simple to construct. No construction. Services, equipment and technology are readily available.	Complex to construct and operate. Some specific equipment needed. Training of personnel required. Technology not proven at full scale. Major for stabilization stage.	Complex to construct and operate. Training of personnel required. Technology not proven at full scale.	Complex to construct and operate. Training of personnel required. Technology not proven at full scale.
PRESENT WORTH COST AT 10% DISCOUNT	Not applicable.	\$4,911,000	\$71,931,000	\$21,856,000	<<CONFIDENTIAL>>	\$19,189,000

designed and constructed in accordance with the requirements specified in the Montana Solid Waste Management Act, RCRA Subtitle D and selected RCRA Subtitle C requirements and will include among other things, a liner system, leachate control, impermeable cap and monitoring. The liner system would be designed and constructed to prevent the migration of contaminants out of the repository into underlying soils or groundwater and would include a leachate collection and removal system. The cap would be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying contaminated soils. Consistent with the requirements of 40 CFR § 264.117, as incorporated into ARM § 16.44.702, long-term operation and maintenance would be conducted to monitor the groundwater around the repository and to ensure the integrity of the cap.

The repository would be protected with institutional controls which include site access and land use restrictions. Successful excavation, treatment and placement of the treated flue dust material in an onsite engineered repository would be expected to reduce contamination levels at the nine flue dust locations to concentrations equivalent in surrounding soils and effectively reduce the risk of flue dust contaminant release from the repository. The estimated capital cost of this alternative is \$14,720,000, with annual O&M costs estimated to be \$8,033,000 during the operation and \$10,000 thereafter. The estimated recoverable revenue is \$7,152,000 during the operation. The estimated time to implement this remedy and meet the cleanup requirements is approximately seven to ten years.

8.0 EVALUATION OF ALTERNATIVES

In accordance with the NCP, 40 CFR Section 300.430(e), the remedial alternatives developed in the FS were analyzed in detail using the nine evaluation criteria (Table 9). These criteria are: 1) overall protection of human health and the environment; 2) compliance with applicable or relevant and appropriate requirements (ARARs); 3) reduction of toxicity, mobility, or volume through treatment; 4) long-term effectiveness and permanence; 5) short-term effectiveness; 6) implementability; 7) cost; 8) state acceptance; and 9) community acceptance. Each of the alternatives were evaluated against the nine criteria (Table 10) and against the other alternatives as discussed below.

8.1 Overall Protection

All of the alternatives, with the exception of the "no action" alternative, would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional controls. Alternative 4 would immobilize hazardous

constituents, through treatment, and contain the treated materials in an engineered repository to reduce risks associated with direct contact effectively reducing the release of contaminants to the environment. Alternative 4 would appear to provide the greatest overall protection through the containment of an effective long-term material, using a demonstrated technology, in a timely manner.

Alternative 6 would also provide similar overall protection, to Alternative 4, by immobilizing hazardous constituents through metals removal and stabilization under Alternative 4. The removal of saleable metals, primarily copper, would not significantly improve the overall protection as the contaminants of most concern (arsenic, cadmium and lead) would remain in the treated material.

Alternative 5 would also provide similar protection to Alternative 4, with the removal of copper, zinc, cadmium and lead, but with arsenic remaining in the treated material. Alternative 6 would immobilize arsenic, similar to Alternative 4, through metals removal and stabilization. Although uncertain at this time, immobilization could be achieved without additional stabilization. In both Alternatives 5 & 6, overall protection would take longer to achieve and with a significantly greater chance of uncertainty for success.

Because the "no action" alternative is not protective of human health and the environment, it is not considered further in this analysis as an option for this operable unit.

8.2 Compliance With ARARs

All alternatives would be designed and implemented to attain all their respective applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental laws. No waiver from ARARs is necessary to implement Alternatives 2 through 6.

8.3 Long-Term Effectiveness and Permanence

Alternative 4 would provide for a high degree of long-term effectiveness and permanence by immobilizing the hazardous constituents, through stabilization, using a demonstrated technology. Containment of the stabilized material in an engineered repository would provide for additional long-term security. Long-term effectiveness and permanence would be dependent on the long-term stability of the stabilized material and the long-term integrity, maintenance, and monitoring of the engineered repository.

Treatability testing indicated that the stabilized material would immobilize arsenic, cadmium and lead to meet regulatory limits (TCLP leach tests) and provide for long-term stability as determined from the Multiple Extraction Procedure (MEP) and leach tests used by the American Nuclear Society (see Attachment 2). Alternative 6 would also provide similar long-term effectiveness and permanence to Alternative 4 through the additional stabilization of materials.

Alternative 5 would provide additional long-term effectiveness and permanence through the removal of cadmium and lead. However, testing (lead values) has indicated that the treated material would require additional stabilization. Arsenic values, however, would appear to be lower over the long-term. As stated above, there is a much higher degree of uncertainty for success associated with both the metal removal alternatives.

Alternative 2 would provide for containment of flue dust, but since there is no treatment, the potential for release exists, if there were a failure of the monitoring or containment system. Alternative 3 would provide long-term effectiveness and permanence through the removal of flue dust offsite. However, since there is no treatment, the same potential for release would exist at the out-of-state facility.

8.4 Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Only alternatives 4 through 6 would treat the flue dust material. Alternative 4 would reduce the mobility of contaminants in the flue dust material. Arsenic leachate would be reduced by 62-99 percent, cadmium by 99 percent and lead 90-99 percent. Volume would be increased by approximately 15 percent.

Alternative 6 would remove some saleable metals, mainly copper, reduce arsenic, cadmium and lead leachate mobility through treatment, similar to Alternative 4, and increase the total volume for disposal by approximately 16 percent. Although this alternative removes copper, it does not reduce the toxicity of flue dust with respect to the primary elements of concern (i.e. arsenic, cadmium and lead).

Alternative 5, would remove additional saleable metals including cadmium and lead, but would not remove arsenic. If the hydrometallurgical treatment alone was successful in producing a stable residue material, volume increase would only be approximately four percent. If additional stabilization is necessary to reduce the mobility of flue dust contaminants, volume would increase by approximately 13 percent.

Treatability testing indicated that the stabilized material would immobilize arsenic, cadmium and lead to meet regulatory limits (TCLP leach tests) and provide for long-term stability as determined from the Multiple Extraction Procedure (MEP) and leach tests used by the American Nuclear Society (see Attachment 2). Alternative 6 would also provide similar long-term effectiveness and permanence to Alternative 4 through the additional stabilization of materials.

Alternative 5 would provide additional long-term effectiveness and permanence through the removal of cadmium and lead. However, testing (lead values) has indicated that the treated material would require additional stabilization. Arsenic values, however, would appear to be lower over the long-term. As stated above, there is a much higher degree of uncertainty for success associated with both the metal removal alternatives.

Alternative 2 would provide for containment of flue dust, but since there is no treatment, the potential for release exists, if there were a failure of the monitoring or containment system. Alternative 3 would provide long-term effectiveness and permanence through the removal of flue dust offsite. However, since there is no treatment, the same potential for release would exist at the out-of-state facility.

8.4 Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment

Only alternatives 4 through 6 would treat the flue dust material. Alternative 4 would reduce the mobility of contaminants in the flue dust material. Arsenic leachate would be reduced by 62-99 percent, cadmium by 99 percent and lead 90-99 percent. Volume would be increased by approximately 15 percent.

Alternative 6 would remove some saleable metals, mainly copper, reduce arsenic, cadmium and lead leachate mobility through treatment, similar to Alternative 4, and increase the total volume for disposal by approximately 16 percent. Although this alternative removes copper, it does not reduce the toxicity of flue dust with respect to the primary elements of concern (i.e. arsenic, cadmium and lead).

Alternative 5, would remove additional saleable metals including cadmium and lead, but would not remove arsenic. If the hydrometallurgical treatment alone was successful in producing a stable residue material, volume increase would only be approximately four percent. If additional stabilization is necessary to reduce the mobility of flue dust contaminants, volume would increase by approximately 13 percent.

8.5 Short-Term Effectiveness

Alternatives 2 through 6 each involve flue dust excavation and transportation. Similar dust control activities would be implemented under each of these alternatives. Alternative 4 provides the greatest short-term effectiveness by having the least number of untreated flue dust handling and transportation steps. Under Alternative 4, a mobile crusher and batch plant would be set up at each of the flue dust piles reducing the chance of contaminant release through transporting of flue dust. The treated material would then be transported to the repository. Alternative 4 would be completed in three years.

Alternatives 5 and 6 would require additional dust control during transportation of flue dust to a central process area where blending of flue dust would be needed to prepare a feedstock. Completion of both alternatives would take seven to ten years and could have other short-term risks related to process activities which could impact the workers and the environment, including the production of additional waste streams.

Alternative 2 would require additional dust control during transport and placement into an onsite repository and take approximately two years. Alternative 3 would require additional dust control during flue dust on-loading and off-loading from the railroad container cars and take approximately one year. However, untreated flue dust would be stockpiled at the out-of-state facility another two to three years before disposal.

8.6 Implementability

Alternative 2 is easiest to implement. Excavation and transport of flue dust could be accomplished with conventional equipment. Dust control could also be obtained with standard technology. Implementability concerns are anticipated to be minimal for the repository associated with alternatives 2, 4, 5 and 6.

Alternative 4 would be implemented with a demonstrated stabilization technology, using standard equipment and would be easily accomplished. Alternative 3 would use standard, proven technologies for excavation and transportation. However, moving large volumes of waste over long distances could cause some additional concerns.

Alternative 5 would require construction of a relatively complex processing facility using exceptionally expensive construction materials. Replacement parts and backup equipment would be more difficult to obtain. Alternative 6 would also require the construction of a complex hydrometallurgical facility. Technologies in Alternatives 5 and 6 have not been

proven at a full scale operation and would require additional design and testing. Uncertainties with implementability are considered high.

8.7 Cost

The following cost figures were estimated for purposes of comparing the various alternatives in the RI/FS, and were based on limited site specific information. The costs are presented as present worth, which is the total cost of the remedy over time, including operation and maintenance, in present day dollars. The lowest cost alternative would be Alternative 2 at \$6,911,000. The highest cost alternative would be Alternative 3 at \$71,933,000. The present worth cost for Alternative 6 would be \$19,189,569. The present worth cost of Alternative 4 would be \$21,866,000. The present worth cost for Alternative 5 would be \$50,200,000 with additional stabilization and \$40,100,000 without additional stabilization. Table 11 compares the costs of the alternatives.

A sensitivity analysis of the net present value costs of Alternatives 4 through 6 was performed. The economic variables evaluated were those with significant economic impact (i.e. construction costs, operation and maintenance costs and price of copper). Based on a "best case" "worst case" analysis, both Alternatives 5 and 6 had a high degree of cost variability, while Alternative 4 had the least variation. Costs ranged from \$19.1 million to \$24.9 million for Alternative 4, \$27.8 million to \$88.4 million for Alternative 5 with the additional stabilization (\$18.7 million to \$78.4 million without stabilization); and \$6.5 million to \$34.7 million for Alternative 6.

8.8 State Acceptance

MDHES has provided input to EPA during the RI/FS process. Based upon information that was available, MDHES concurred with EPA's selection of Alternative 4 as the Preferred Alternative in the Proposed Plan. MDHES's concurrence in the selection of Alternative 4 was based upon the understanding that all regulatory requirements would be met, including the applicable or relevant and appropriate Montana Hazardous Waste Act and RCRA Subtitle C repository design requirements. It is anticipated that the State of Montana will also concur with the selected remedy in this ROD.

8.9 Community Acceptance

Based upon public comment, the majority of the community supports EPA's selection of Alternative 4 as the remedy. The responsiveness summary is included in this ROD.

TABLE 11 ESTIMATED NET PRESENT WORTH ANALYSIS

Item	Alternative 1 No Action	Alternative 2 Onsite Disposal	Alternative 3 Offsite Disposal	Alternative 4 Stabilization Fixation	Alternative 5A Cashman Process	Alternative 5B Cashman Process	Alternative 6 Ambient Leach
Initial Cost	0	3,741,000	71,933,000	8,446,000	47,854,000	47,854,000	7,360,000
O&M	0	10,000	None	10,000 ²	11,546,000 ⁴ 10,000 ⁸	14,487,000 ⁴ 10,000 ⁹	8,033,000 ⁴ 4,217,000 ⁶ 10,000 ⁵
Future Cost	0	3,741,000 ¹	None	8,446,000 ³			7,360,000 ¹
Saleable Products	0	0	0	0	12,000,000 ⁴	12,000,000 ⁴	7,152,000 ⁴
Total Present Worth	0	6,911,000	71,933,000	21,866,000	40,100,000	50,200,000	19,189,569
¹ year 2	² years 1-30	³ years 2 and 3	⁴ years 3-7	⁵ years 3-30	⁶ year 3		

9.0 THE SELECTED REMEDY

EPA has selected Alternative 4 as the cleanup remedy for the Flue Dust Operable Unit of the Anaconda Smelter Site. The remedy is made up of the following components:

- o Removal and treatment via cement/silicate-based stabilization of approximately 316,500 cubic yards of flue dust material located on Smelter Hill;
- o Disposal of treatment residuals in an on-site engineered repository; and
- o Implementation of institutional controls and monitoring of the disposal area.

This alternative includes the removal of all flue dust located on Smelter Hill (316,500 cubic yards), including flue dust in the Main Flue. This includes the removal of soils adjacent to the flue dust that contain visually distinct flue dust in concentrations greater than concentrations of contaminants in surrounding soils. Confirmation sampling of arsenic and cadmium would be required to ensure adequate removal of flue dust materials. Cleanup of remaining soils will be evaluated under the Smelter Hill Operable Unit. Some RCRA closure requirements 40 CFR § 264.258 and ARM § 16.44.702 would be relevant and appropriate to stabilize the site. Final closure of the nine flue dust locations is not within the scope of this project but rather to be determined under the Smelter Hill Operable Unit.

Conventional earthmoving equipment such as front-end loaders will be used to excavate the above grade flue dust materials. Subgrade excavation of the Main Flue will be accomplished using equipment such as an excavator. Dust suppression and air monitoring will be required during all flue dust excavation and transportation activities. There will be no transport of flue dust on public roads.

The flue dust will be treated at each of the nine flue dust locations with a mobile crusher and cement batch plant. Large debris (metal and wood) which cannot be crushed will be separated and placed in the repository in a manner to prevent potential damage to the repository liner. The flue dust will be treated to render the material non-hazardous by meeting RCRA TCLP regulatory limits (Maximum Concentration of Contaminants for the Toxicity Characteristic, ARM § 16.44.324). The flue dust will be treated in accordance with 40 CFR Subpart X, as incorporated into ARM § 16.44.702, standards for a treatment unit. The specific process will be determined in the Remedial Design Phase through engineering design and analysis. The processed material will then be transported to an onsite repository for disposal. Dust

being filmed

suppression and air monitoring would be required.

Treatability testing indicated that the residue product will meet RCRA TCLP regulatory limits and that the mobility of contaminants of concern could be reduced up to 99%.

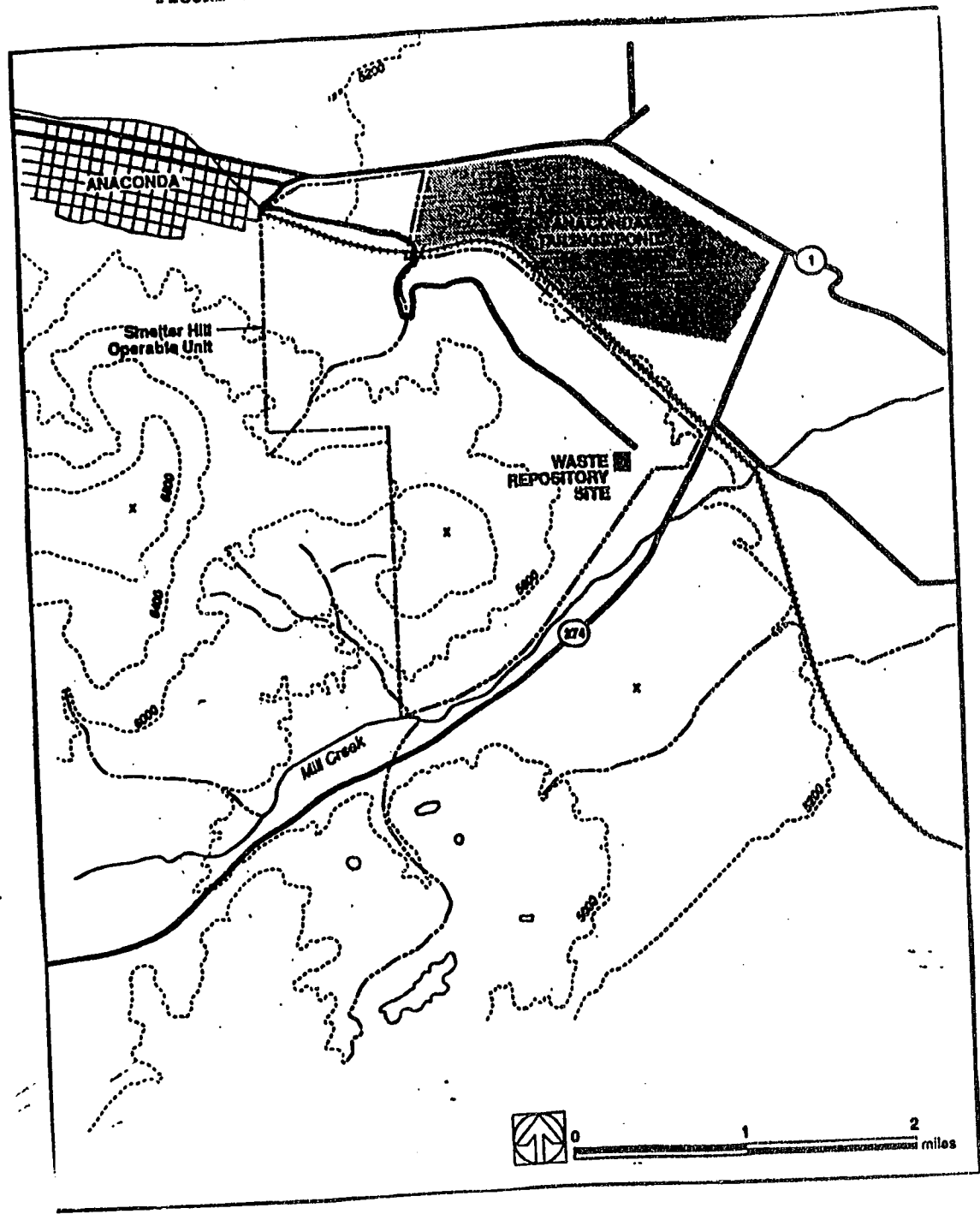
Because it is expected that treatment of the flue dust will render the material non-hazardous, this alternative will not involve the disposal of a RCRA regulated waste, and RCRA Subtitle C requirements are not applicable. However, RCRA Subtitle C requirements have been determined to be relevant and appropriate to the type of substances being managed. The repository will be designed and constructed in accordance with the requirements specified in the Montana Solid Waste Management Act, RCRA Subtitle D and selected RCRA Subtitle C requirements and will include among other things, a liner system, leachate control, impermeable cap and monitoring. The liner system will be designed and constructed to prevent the migration of contaminants out of the repository into underlying soils or groundwater and will include a leachate collection and removal system. The cap will be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying contaminated soils. Consistent with the requirements of 40 CFR § 264.117, as incorporated into ARM § 16.44.702, long-term operation and maintenance would be conducted to monitor the groundwater around the repository and to ensure the integrity of the cap.

The repository will be located east of the stack near the FDS facility shown in Figure 4. This site was identified as Potential Siting Area (PSA) #9 in the Anaconda Smelter NPL Site Repository Siting Analysis and is located on the eastern slope of Smelter Hill, west of Mill Creek. This site was selected over others because of its depth to groundwater, low transportation impacts, favorable soils properties (attenuation capacity), constructability, and favorable institutional controls such as zoning and restricted access. The site is consistent with the Anaconda-Deer Lodge County Comprehensive Master Plan.

The repository will be protected with institutional controls which include site access and land use restrictions. A monitoring program for the repository will include visual inspection, appropriate maintenance activities, and groundwater monitoring. Site access and land use restrictions will begin implemented immediately. Additional institutional controls may be imposed in ROD's for other operable units. Groundwater monitoring will begin upon implementation of the remedy.

Successful excavation, treatment and placement of the treated flue dust material in an onsite engineered repository is expected to reduce contamination levels at the flue dust locations to concentrations equivalent in surrounding soils and

FIGURE 4 LOCATION OF ONSITE WASTE REPOSITORY



effectively reduce the risk of flue dust contaminant release from the repository. Remaining risk will be addressed in the Smelter Hill Operable Unit. Risk reduction for the flue dust remedy was not quantified because contamination from flue dust cannot be separated from contamination remaining on site. However, it is anticipated that this remedy will contribute to the overall reduction of risk on the site to levels satisfying future remediation goals.

The estimated capital cost of this alternative is \$25,338,000, with annual O&M costs estimated to be \$10,000. Detailed costs are shown on Table 12. The estimated time to implement this remedy and meet the cleanup requirements is approximately three years. Work would be seasonal and would continue each year for as long as possible under the given weather conditions. The repository would be constructed during the first operating season and individual cells would be closed each field season.

The remedial design will determine the specific stabilization process necessary to meet the remediation goals. Additional testing of processes may be necessary to determine the specific process or optimum stabilization formula. Some modifications or refinements may be made to the remedy during remedial design and construction. Such modifications or refinements would reflect results of the engineering design process.

General remediation goals include the following:

- 1) Removal of all flue dust materials located on Smelter Hill (approximately 316,500 cubic yards) to equivalent concentration levels found in adjacent soils. Remaining soils will be addressed under the Smelter Hill Operable Unit;
- 2) Treatment of flue dust via cement/silicate-based stabilization to render the material non-hazardous by meeting RCRA regulatory limits (Maximum Concentration of Contaminants for the Toxicity Characteristic, ARM § 16.44.324, as determined by the Toxicity Characteristic Leaching Procedure.

Arsenic	5.0 mg/l
Cadmium	1.0 mg/l
Lead	5.0 mg/l

These RCRA regulatory limits were determined through consideration of Best Demonstrated Available Technologies (BDAT). In addition, the treated residual material will be expected to be stable over the long term. Long-term stability criteria (i.e. leaching, durability, permeability

TABLE 12 COST ESTIMATES FOR

EXCAVATE/PLACE FLUE DUST IN STOCKPILE FOR CRUSHER

SITE LOCATION	HOURS	QUANTITY	UNIT	UNIT PRICE	TOTAL
1.AREA CUT	24	4,689	CY	\$3.14	\$14,700
2.BRADLEY POND	500	100,022	CY	\$3.14	\$313,569
3.COAL PILE TRACKS	217	43,284	CY	\$3.14	\$135,695
4.FDS FACILITY	327	65,440	CY	\$3.13	\$205,154
5.IRON POND	376	75,167	CY	\$3.14	\$235,649
6.MAIN FLUE	188	37,507	CY	\$1.95	\$72,951
7.MISC PILES	40	7,954	CY	\$3.14	\$24,956
8.SWITCH BACK	26	5,201	CY	\$3.13	\$16,305
9.THICKENER	37	7,307	CY	\$3.71	\$27,109
SUB TOTAL	1735	346,571	CY		\$1,046,068
CONSTRUCTION WATER		11,017	CF	\$0.33	\$3,649
HEALTH & SAFETY (INCLUDES 40 HR CLASS, MEDICAL EXAMS & EQUIP)			8 EA	\$6,376.00	\$51,008
TOTALS				\$3.18	\$1,100,745

ASSUMPTION FOR CALCULATIONS ARE BASED ON USING CAT 235 EXCAVATOR, CAT 769 OFF ROAD 35 TON DUMP TRUCKS, CAT 146 ROAD GRADER, CAT D6 DOZER WITH RIPPER, ONE 4,000 GALLON WATER TRUCK FOR ROADBED DUST CONTROL, ONE 4,000 GALLON WATER TRUCK WITH WATER CANNON FOR FLUE DUST CONTROL. EQUIPMENT AND LABOR PRICES ARE BASED ON HOURLY RATES BY WASHINGTON CONSTRUCTION. CUBIC YARD TOTALS FOR THE NINE AREAS INCLUDES REMOVING ADDITIONAL 6 INCHES OF MATERIAL BELOW EXISTING PILES, AND AN ADDITIONAL 6 INCHES OF MATERIAL IN AREA WHERE BATCH PLANT AND CRUSHER ARE PLACED. TOTAL AMOUNT OF FLUE DUST IS BASED ON 316,500 CUBIC YARDS. CONCRETE WALLS AND BOTTOM OF THE THICKENER WILL REMAIN IN PLACE. FLUE DUST FROM THE MAIN FLUE SYSTEM WILL BE STOCKPILED AT THE BOTTOM (NORTH END) OF THE MAIN FLUE SYSTEM BY OTHERS. MOBILIZATION FOR EQUIPMENT IS NOT INCLUDED. PRICES ARE BASED ON 1990 QUOTES WITHOUT ESCALATION.

PLACE MATERIAL FROM NINE AREAS INTO CRUSHER AND STOCKPILE

ITEM	QUANTITY
CRUSHER	346,571
MOBILIZATION	3
BERMS FOR EROSION CONTROL	1
MOBILIZATION TO EACH SITE	9
HEALTH & SAFETY (INCLUDES 40 HR CLASS, MEDICAL EXAMS AND EQUIPMENT)	9
TOTALS	

PRICES ARE BASED ON QUOTE FROM PEBBLE HAULERS BASED ON 1990 QUOTES WITHOUT ESCALATION. INCLUDES LABOR AND EQUIPMENT. RECYCLE CRUSHER WILL CRUSH TO 1 1/2" MINUS. CRUSHER WILL HANDLE 3" MATERIAL. PRICES ARE BASED ON 1990 QUOTES WITHOUT ESCALATION.

CONSTRUCT REPOSITORY

ITEM	QUANTITY
CUT/STOCKPILE	222,076
80 MIL HDPE LINER	652,664
CONSTRUCTION WATER	9,260
PLACE FROM STOCKPILE TO BOTTOM	43,706
PLACE FROM STOCKPILE TO SIDES	37,098
GRAVEL 6" DRAINAGE LAYER	10,120
PLACE FROM STOCKPILE TO CAP	140,373
4" PVC COLLECTION PIPE	4,301
6" PVC PERF COLLECTION PIPE	2,657
MANHOLE	106
6" PVC OBSERVATION PIPE	106
SUMP PUMPS	4
FENCE	5,786
SEEDING	25
FIELD & LAB TESTING FOR RCRA	1
HEALTH & SAFETY, (INCLUDES 40 HR CLASS, MEDICAL EXAMS AND EQUIPMENT)	18
TOTALS	

ASSUMPTION FOR CALCULATIONS ARE BASED ON USING CAT 235 EXCAVATOR, CAT 769 OFF ROAD 35 TON DUMP TRUCKS, CAT 146 ROAD GRADER, CAT D6 DOZER, WATER TRUCK WITH RIPPER, ONE 4,000 GALLON WATER TRUCK FOR ROADBED DUST CONTROL, ONE 4,000 GALLON WATER TRUCK WITH WATER CANNON FOR FLUE DUST CONTROL. EQUIPMENT AND LABOR PRICES ARE BASED ON HOURLY RATES BY WASHINGTON CONSTRUCTION. CUBIC YARD TOTALS FOR THE NINE AREAS INCLUDES REMOVING ADDITIONAL 6 INCHES OF MATERIAL BELOW EXISTING PILES, AND AN ADDITIONAL 6 INCHES OF MATERIAL IN AREA WHERE BATCH PLANT AND CRUSHER ARE PLACED. TOTAL AMOUNT OF FLUE DUST IS BASED ON 316,500 CUBIC YARDS. CONCRETE WALLS AND BOTTOM OF THE THICKENER WILL REMAIN IN PLACE. FLUE DUST FROM THE MAIN FLUE SYSTEM WILL BE STOCKPILED AT THE BOTTOM (NORTH END) OF THE MAIN FLUE SYSTEM BY OTHERS. MOBILIZATION FOR EQUIPMENT IS NOT INCLUDED. PRICES ARE BASED ON 1990 QUOTES WITHOUT ESCALATION. QUANTITIES BASED ON RCRA REPOSITORY.

ESTIMATES FOR ALTERNATIVE 4

AREAS INTO CRUSHER AND STOCKPILE FOR BATCH PLANT

QUANTITY	UNIT	UNIT PRICE	TOTAL
346,571	CY	\$3.65	\$1,264,984
3	EA	\$35,000.00	\$105,000
1	EA	\$9,120.00	\$9,120
8	EA	\$6,560.00	\$52,480
5	EA	\$6,376.00	\$31,880
		\$4.22	\$1,463,464

NOTE FROM PEBBLE HAULERS BASED ON THREE MOBILIZATIONS. EQUIPMENT. RECYCLE CRUSHER HANDLES CONCRETE, STEEL AND REBAR, MINIMUMS. CRUSHER WILL HANDLE 350 TONS PER HOUR. PRICES INCLUDES WITHOUT ESCALATION.

LOAD TREATED MATERIAL/HAUL TO REPOSITORY AND PLACE

SITE LOCATION	HOURS	QUANTITY	UNIT	UNIT PRICE	TOTAL
1. AREA CUT	42	7,065	TN	\$4.13	\$29,207
2. BRADLEY PONDS	736	139,436	TN	\$5.30	\$739,167
3. COAL PILE TRACKS	366	60,968	TN	\$4.13	\$252,184
4. FDS FACILITY	479	93,906	TN	\$4.69	\$439,968
5. IRON PONDS	645	109,233	TN	\$4.87	\$524,471
6. MAIN FLUE	314	51,179	TN	\$4.87	\$249,235
7. MISC PILES	74	12,260	TN	\$4.13	\$50,683
8. SWITCH BACK	52	7,832	TN	\$5.29	\$41,457
9. THICKENER	62	10,409	TN	\$4.13	\$43,091
SUB TOTAL	2930	488,308	TN		\$2,357,343
		(361,710)	CY		
CONSTRUCTION WATER		15,668	CF	\$0.33	\$5,217
WHEEL WASHES		7	EA	\$13,600.00	\$95,200
HAUL ROADS		1	LS	\$17,560.00	\$17,560
HEALTH & SAFETY, INCLUDES 40 HR CLASS, MEDICAL EXAMS & EQUIP)		8	EA	\$6,376.00	\$51,008
TOTALS				\$6.98	\$2,526,329

ASSUMPTION FOR CALCULATIONS ARE BASED ON USING CAT 235 EXCAVATOR, CAT 769 OFF ROAD 35 TON DUMP TRUCKS, CAT 14G ROAD GRADER, CAT D6 DOZER WITH RIPPER, ONE 4,000 GALLON WATER TRUCK FOR ROADBED DUST CONTROL, ONE 4,000 GALLON WATER TRUCK WITH WATER CANNON FOR FLUE DUST CONTROL. EQUIPMENT AND LABOR PRICES ARE BASED ON HOURLY RATES BY WASHINGTON CONSTRUCTION. CUBIC YARD TOTALS FOR THE NINE AREAS INCLUDES REMOVING ADDITIONAL 6 INCHES OF MATERIAL BELOW EXISTING PILES, AN ADDITIONAL 6 INCHES OF MATERIAL BELOW THE CRUSHER/BATCH PLANT AREA, AND THE ADDITION OF PORTLAND CEMENT AND HYDRATED LIME. TOTAL AMOUNT OF FLUE DUST IS BASED ON 316,500 CUBIC YARDS. CONCRETE WALLS & BOTTOM OF THE THICKENER WILL REMAIN IN PLACE. FLUE DUST FROM THE MAIN FLUE SYSTEM WILL BE STOCKPILED AT THE BOTTOM (NORTH END) OF THE MAIN FLUE SYSTEM BY OTHERS. MOBILIZATION FOR EQUIPMENT IS NOT INCLUDED. PRICES ARE BASED ON 1990 QUOTES WITHOUT ESCALATION.

QUANTITY	UNIT	UNIT PRICE	TOTAL
222,076	CY	\$2.50	\$555,190
652,664	SF	\$0.90	\$587,398
9,260	CF	\$0.33	\$3,084
43,706	CY	\$1.50	\$65,559
37,998	CY	\$2.00	\$75,996
10,120	CY	\$14.50	\$146,740
140,373	CY	\$1.50	\$210,560
4,301	LF	\$7.00	\$30,107
2,657	LF	\$9.00	\$23,913
106	LF	\$65.00	\$6,890
106	LF	\$9.00	\$954
4	EA	\$2,200.00	\$8,800
5,786	LF	\$6.00	\$34,716
23	AC	\$1,500.00	\$34,500
1	LS	\$34,200.00	\$34,200
18	EA	\$6,376.00	\$114,768
			\$1,933,374

ASSUMPTIONS ARE BASED ON USING CAT 637 SCRAPERS, CAT 14G ROAD GRADER, CAT D6 DOZER, WATER TRUCKS. EQUIPMENT AND LABOR PRICES ARE BASED ON HOURLY RATES BY WASHINGTON CONSTRUCTION. LINERS ARE BASED ON QUOTE FROM DAMES & MOORE CONTRACTS. COST FOR NON-RCRA 2 REPOSITORY CONSTRUCTION DOES NOT INCLUDE LONG-TERM MAINTENANCE AND MONITORING. PRICES ARE BASED ON 1990 QUOTES WITHOUT ESCALATION. MOBILIZATION FOR EQUIPMENT AND LABOR PRICES ARE BASED ON RCRA REPOSITORY MINUS 15%.

PLACE STOCKPILED MATERIAL INTO BATCH PLANT AND PROCESS

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL
STOCKPILE/INTO PUGHILL	488,308	TN	\$3.45	\$1,684,663
	(361,710)	CY		
MOBILIZATION	3	EA	\$35,000.00	\$105,000
CONSTRUCTION WATER	7,181	CF	\$0.33	\$2,391
WATER FOR DUST CONTROL	15,668	CF	\$0.33	\$5,217
WATER LINE ABOVE GROUND	14,000	LF	\$4.16	\$58,240
ABOVE GROUND WATER TANK	1	EA	\$22,000.00	\$22,000
PORTLAND CEMENT	90,428	TN	\$75.00	\$6,782,100
HYDRATED LIME	36,171	TN	\$100.00	\$3,617,100
HEALTH & SAFETY (INCLUDES 40 HR CLASS, MEDICAL EXAMS & EQUIPMENT)	14	EA	\$6,376.00	\$89,264
TCLP TESTS (CLP METHODS)	488	EA	\$795.00	\$387,960
LAB TECHNICIAN	366	DA	\$84.00	\$30,744
TOTALS			\$26.18	\$12,784,679

PRICES ARE BASED ON QUOTE FROM PEBBLE HAULERS BASED ON THREE MOBILIZATIONS. PORTLAND CEMENT USAGE IS BASED ON USING 25% OF TOTAL TONS OF DRY FLUE DUST, HYDRATED LIME USAGE IS BASED ON USING 10% OF TOTAL TONS OF DRY FLUE DUST. LABORATORY TESTS ARE BASED ON USING TWO DAY TURN AROUND TIME PER SAMPLE FOR CLP METHODOLOGY. TECHNICIANS ARE BASED ON 5 DAYS PER WEEK. PRICES ARE BASED ON 1990 QUOTES WITHOUT ESCALATION.

and strength) will be determined in the remedial design phase;

3) Containment of treatment residues in an engineered repository designed and constructed in accordance with the requirements specified in the Montana Solid Waste Management Act, RCRA Subtitle D and selected RCRA Subtitle C requirements, that at a minimum include: a liner system, leachate control, impermeable cap and monitoring. The liner system will be designed and constructed to prevent the migration of contaminants out of the repository into underlying soils or groundwater and would include a leachate collection and removal system. The cap will be designed and constructed to promote drainage, minimize erosion of the cover, and provide long-term minimization of migration of liquids through the underlying contaminated soils; and

4) Long-term operation and maintenance, consistent with the requirements of 40 CFR Section 264.117, as incorporated into ARM Section 16.44.702, will be conducted to monitor the groundwater around the repository and to ensure the integrity of the cap.

More specific remediation goals and considerations include the following:

- A. Engineered Waste repository: The repository for the treated flue dust materials will be designed and operated exclusively for the treated wastes. A design incorporating RCRA Subtitle D requirements plus certain criteria included in the RCRA Subtitle C regulations will be necessary to assure that the contaminants remaining in the treated wastes are not released into the environment.
1. The repository will be designed specifically for the physical and chemical characteristics of treated flue dust.
 2. The repository will include at a minimum a single soil, clay or composite liner and leachate collection system meeting the criteria listed in 40 CFR Section 264.301(a), as incorporated into ARM Section 16.44.702.
 3. Run-on and run-off systems and operating criteria will meet the requirements of 40 CFR §§ 264.301(f),(g) and (h) as incorporated into ARM § 16.44.702.

4. Construction and operation of the repository will include control of wind dispersal of particulate matter (40 CFR § 264.301(i), as incorporated into ARM § 16.44.702) and inspection of the liner, run-on and run-off systems, and the leachate collection and removal system (40 CFR § 264.303, as incorporated into ARM § 16.44.702).
 5. Monitoring and protection of the groundwater will be addressed as described in 40 CFR Part 264, Subpart F, as incorporated into ARM § 16.44.702.
 6. Closure and post-closure care of the repository will include the criteria listed in 40 CFR § 264.310 and Subpart G, as incorporated into ARM § 16.44.702.
- B. Stabilized flue dust: Remedial Design will consider the following characteristics in determining the specific process or formula to treat flue dust materials. The variability of the flue dust materials and the difficulties of quality control due to this variability will also be considered in the design of the treatment process. The proposed design of the repository for the treated wastes will also influence the required characteristics of the in-place wastes.
1. Leachability: The in-place treated waste will meet the RCRA TCLP regulatory limits. The permeability and homogeneity of any monolithic waste placements will be considered in developing methods to test the in-place waste or to otherwise verify the leachability of the in-place waste.
 2. Free liquid content of waste: No liquid may be exuded from the in-place waste under the maximum loading proposed in the repository design.
 3. Physical stability of waste under burial conditions: The in-place waste should be able to support construction equipment used in disposal of the waste. Operation of equipment on the in-place waste should not affect the design properties necessary to meet TCLP. The waste should not subside over the long term, causing final cover collapse or failure.
 4. Reactivity of waste: The treated waste should be nonreactive.
 5. Ignitability: The treated waste should be nonpyrophoric.

6. Susceptibility to biodegradation: The treated waste should not support microbial growth.
7. Strength or bearing capacity: The in-place waste should be able to support the weight of the waste above plus the final cover without losing design properties.
8. Permeability: Any in-place monolithic waste masses should have adequate impermeability and structural integrity (e.g. absence of cracks and voids) to limit mobility in the treated wastes and limit transfer of contaminants from the solid mass to leaching water.
9. Durability: The in-place wastes should be resistant to freeze/thaw and wet/dry cycles to the extent expected in the design and operation of the repository. This includes the period between placement of the wastes and final covering of the entire repository. The projected three year duration of the treatment project will be considered.

Stabilization of flue dust is consistent with BDAT and would appear to satisfy future land disposal restrictions. An engineered repository will provide sufficient long-term waste management and additional protection to human health and the environment. Stabilization and containment of waste materials is consistent with the overall cleanup objectives for the site.

Treatment of flue dust to meet remediation goals is fully expected. However, if the remedial design phase indicates that treatment via stabilization will not produce residue materials that meet the desired cleanup criteria, the flue dust would still be treated via stabilization and placed in a repository designed to meet all RCRA Subtitle C requirements. Additionally, if at any time confirmation sampling indicates that treated flue dust is a hazardous waste, the hazardous waste will be placed in a repository designed to meet all RCRA Subtitle C requirements.

The selection of this remedy is based upon the comparative analysis of alternatives presented in the previous section. This cleanup action will achieve substantial risk reduction through the immobilization of contaminant, including arsenic, cadmium and lead and by containment of the treated material in an engineered onsite repository. It will provide a high degree of long-term protection of human health and the environment and will attain ARARs. This remedy achieves risk reduction quickly using a demonstrated technology which will be easily implemented. This remedy is cost effective and is consistent with the overall cleanup objectives for the Anaconda Smelter Site. Based on the information available at this time, EPA believes this remedy provides the best balance of trade-offs among the other alternatives with respect to the nine evaluation criteria.

10.0 STATUTORY DETERMINATIONS

EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. CERCLA also requires that the selected remedial action for the site comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must also be cost effective and utilize permanent treatment technologies or resource recovery technologies to the maximum extent practicable. CERCLA also contains a preference for remedies that include treatment as a principle element. The following sections discuss how the selected remedy for the flue dust materials at the Anaconda Smelter site meets these statutory requirements

10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment through the immobilization of contaminants, including arsenic, cadmium and lead and through the containment of treated material in an engineered onsite repository.

Through source removal, the exposure pathways to potential receptors are interrupted. Stabilization and containment will eliminate the threat of exposure to most contaminants from direct contact, the inhalation route and ingestion of soil and groundwater. Successful excavation, and disposal of treated material in an engineered repository is expected to reduce contamination levels at the flue dust piles to concentrations equivalent to adjacent soils. Containment of treated material will effectively reduce the risk of flue dust contaminant release to the environment. The repository will be capped and closed to reduce the likelihood of contaminant migration.

There are no short-term threats associated with the selected remedy that cannot be readily controlled through applicable occupational health requirements.

10.2 Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy of removal, onsite cement/silicate based stabilization and disposal of treated material in an onsite repository will comply with all applicable or relevant and appropriate contaminant- action- and location-specific requirements (ARARs). The ARARs for the selected remedy are specified in Attachment 1.

10.3 Cost Effectiveness

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportional to its costs, the net present worth value being \$21,866,000. The estimated costs of the selected remedy are within an order of magnitude of (less than four times) the cost associated with disposal of untreated flue dust in a full RCRA Subtitle C repository, and yet the selected remedy assures a much higher degree of certainty that the remedy will be effective in the long-term due to significant reduction in contaminant mobility of the flue dust.

Although metals recovery in Alternative 6 was shown to be similar in cost, it had a much higher degree of uncertainty potentially doubling the cost of the remedy. Also, a higher degree of uncertainty existed with its success.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost effective manner for the Flue Dust Operable Unit at the Anaconda Smelter Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the EPA has determined that this selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume, through treatment, short-term effectiveness, implementability, cost and considers the statutory preference for treatment as a principal element, State and community acceptance.

The selected remedy treats the principal threats posed by the flue dust, significantly reducing the mobility of the contaminants of concern. The selected remedy is more effective than all other treatment alternatives in the short-term, requiring two to three years to complete compared to seven to ten years for metals removal. The implementability of the selected remedy is comparable to the nontreatment options and significantly better than metals removal. The selected remedy is cost effective in comparison to metals removal but with a higher degree of certainty, and is much less than some metals removal and off-site disposal alternatives.

The selection of treatment of flue dust is consistent with EPA expectations that indicate that highly toxic and mobile wastes are a priority for treatment and that treatment is often necessary to ensure long-term effectiveness of the remedy. Since stabilization and metals removal with stabilization are

comparable with respect to long-term effectiveness and the toxicity and mobility reductions achieved, the major tradeoffs that provide the basis for this selection decision are short-term effectiveness, implementability and cost. The selected remedy can be implemented more quickly, with less difficulty and at less cost than the metals removal options and is therefore determined to be the most appropriate solution for the flue dust at the Anaconda Smelter site.

10.5 Preference for treatment as a Principal Element

By treating the flue dust material through cement/silicate based stabilization, the selected remedy addresses one of the principal threats posed by the site through use of treatment and permanent solutions to the maximum extent possible. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

ATTACHMENT 1

**APPLICABLE OR RELEVANT AND APPROPRIATE
REQUIREMENTS, STANDARDS, CONTROLS, CRITERIA, OR LIMITATIONS
FOR THE ANACONDA SMELTER SUPERFUND SITE
FLUE DUST OPERABLE UNIT**

ATTACHMENT 1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS, CONTROLS, CRITERIA, OR LIMITATIONS FOR THE ANACONDA SMELTER SUPERFUND SITE - FLUE DUST OPERABLE UNIT

Section 121(d) of CERCLA, 42 U.S.C. Section 9621(d), the National Oil and Hazardous Substances Pollution Contingency Plan (the NCP), 40 C.F.R. Part 300 (1990), and guidance and policy issued by the Environmental Protection Agency (EPA) require that remedial actions under CERCLA comply with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations from state and federal environmental laws and state facility siting 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. The Feasibility Study for the Flue Dust operable unit proposed a set of such requirements, and gave justification for identifying the proposed requirements. After consideration of public comments on the proposed requirements, and further review of applicable guidance and standards, including the NCP, the following is the final list of ARARs for the Flue Dust operable unit Record of Decision.

Each ARAR or group of related ARARs is identified by statutory or regulatory citation, followed by an explanation of the ARAR, including a compliance description which addresses how and when compliance with the ARAR will be measured (some ARARs will govern the conduct of the implementation of the remedial action, some will govern the measure of success of the remedial action, and some will do both). Some ARARs will be pertinent to the waste repository while some will be pertinent both to the repository as well as flue dust in the nine waste piles and the collapsed main flue.

Also contained in this list are policies, guidance or other sources of information which are "to be considered" during the selection and implementation of the ROD. Although not enforceable requirements, these documents and laws are important sources of information which EPA and the State of Montana Department of Health and Environmental Sciences (MDHES) referred to 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 during evaluation and approval of various activities during the ROD implementation.

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

Responses to comments on the proposed ARARs and further discussion of EPA's rationale for selecting these ARARs is contained in the responsiveness summary attached to this ROD. The portions of the Feasibility Study (FS) which address ARARs, the ARARs section of the responsiveness summary, and applicable EPA guidance, policy, regulation, and statutory authority, form the basis for the final selection of ARARs contained in this list.

ARARs are contaminant, location, or action specific. Contaminant specific requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of chemicals which may be found in, or discharged to, the ambient environment.

Location specific requirements are restrictions placed upon the concentrations of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographic or physical positions of sites, rather than to the nature of the contaminants at sites.

Action specific requirements are usually technology based or activity based requirements or limitations on actions taken with respect to hazardous substances, pollutants or contaminants. A given cleanup activity may trigger an action specific requirement. Such requirements do not themselves determine the cleanup alternative, but define how chosen cleanup methods should be performed.

Many requirements listed here are promulgated as identical or near identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by EPA and the state, such as the requirements of the federal Clean Water Act and the Montana Water Quality Act. The preamble to the NCP states that such a situation results in citation to the state provision as the more stringent standard but treatment of the provision as a federal requirement.

I. Contaminant Specific ARARs.

A. Air.

1. ARARs pertinent to areas from which flue dust will be excavated.

Final remediation of air at areas from which flue dust will be excavated is not within the scope of the Flue Dust operable unit remedial action. It is not anticipated that existing air quality will be adversely impacted after excavation of flue dust, as all flue dust will be removed. Action specific requirements for air set forth below at Section III.B. will assure that air quality is not adversely affected during excavation and treatment of flue dust. EPA's expectation is that final contaminant specific air standards for excavated areas will be ARARs at the time of the Smelter Hill operable unit ("OU") remedial action. The waste repository will be designed and will be expected to contribute efficiently to final compliance with all air requirements as provided below at Section III.C.4.

2. See air ARARs set forth for the waste repository at Section III.C.4., below.

B. Water.

1. ARARs pertinent to areas from which flue dust will be excavated.

Remediation of ground and surface water in areas from which flue dust will be excavated is not within the scope of the Flue Dust operable unit remedial action. Ground and surface water were not sampled or studied as part of the Flue Dust RI/FS and it is not anticipated that ground or surface water will be adversely impacted in any way as a result of remedial activity to be implemented. Therefore, ground and surface water standards for excavated areas are not set forth herein as ARARs. EPA's expectation is that these requirements will be ARARs at the time of the Smelter Hill operable unit remedial action. Should remedial activity in some unforeseen way impact ground or surface water, then EPA reserves the right to reexamine water ARARs for the excavated areas and to look to these provisions in dealing with impacts to affected waters.

2. See water ARARs set forth for the waste repository at Section III.C.3., below.

II. Location Specific ARARs.

- A. The statutes and regulations set forth below relate to the preservation of certain cultural, historic, natural or other national resources which may be adversely affected by the removal action. They require that such resources be identified, and that steps be taken to minimize the impact of the remedial action upon any such resources.

1. National Historic Preservation Act, 16 U.S.C. § 470, 40 C.F.R. § 6.301(b), 36 C.F.R. Part 800.

Cultural resources associated with the Flue Dust operable unit must be identified and the impact of remedial action upon these resources determined. Based upon current information, EPA has previously determined that the flue dust locations are not eligible for listing on the National Register of Historic Places. However, The State Historic Preservation Office has not concurred with this determination and has indicated that there is potential for Smelter Hill to be a historic district.

2. Archaeological and Historic Preservation Act, 16 U.S.C. § 469, 40 C.F.R. § 6.301(c).

This requires the preservation of data concerning scientific, prehistoric, or archaeological artifacts.

3. Endangered Species Act, 16 U.S.C. § 1531, 40 C.F.R. § 6.302(h), 50 C.F.R. Parts 17 and 402.

This statute and implementing regulations provide that federal activity not jeopardize the continued existence of any threatened or endangered species. Continued consultation with the U.S. Fish and Wildlife Service will be required. However, based upon available information and consultation with the U.S. Fish and Wildlife Service, there are no threatened or endangered species with the Smelter project area. However, bald eagles and peregrine falcons may occur within or near the site as migrants and/or winter residents.

4. 40 C.F.R. Part 6, Appendix A. It should be noted that it is not expected that this remedial action will affect any wetlands, nor is any part of this action expected to take place within a floodplain. However, if wetlands are potentially affected, the following requirements would apply.

- a. Wetlands Protection, Executive Order No. 11990.

This requires the avoidance of adverse impacts to wetlands and the avoidance of construction in wetlands if practicable. In addition, the action shall result in "no net loss" of wetlands.

- b. Floodplain Management, Executive Order No. 11988.

Facilities within a 100 year floodplain must be designed, constructed, and maintained to avoid washout. It is not expected that any portion of this remedial action will take place within a 100 year floodplain.

B. State of Montana requirements.

1. MCA §§ 76-5-402, -403, and -404; ARM §§ 36.15.216, -601 through -606, -701 and -703.

Floodplain and floodway management, these provisions outline uses prohibited and permitted within floodway, flood fringe, and floodplain. It is not expected that any portion of this remedial action will take place within a floodplain.

2. ARM § 16.44.702, incorporating by reference 40 C.F.R. § 264.18(a) and (b).

Facilities where hazardous waste is stored, treated or disposed may not be placed within 200 feet of a fault. Facilities located within a 100 year floodplain must meet the requirements of this section. It is not expected that any portion of this remedial action will take place within a 100 year floodplain.

III. Action Specific ARARs.

A. ARARs pertinent to areas from which flue dust will be removed, including the waste piles, the flue dust storage area, and the main flue.

1. 40 C.F.R. 264 Subpart G, and 40 C.F.R. § 264.258, as incorporated by ARM § 16.44.702. Closure and post closure care for waste piles.

The areas from which waste is removed shall be "closed" with flue dust removed. Waste residues, and contaminated container system components, subsoils, structures, and equipment must be removed and managed as hazardous waste. Concentrations of contaminants in subsoils may not be greater than contaminant concentrations in surrounding soils. Final closure is beyond the scope of this remedial action and will occur at the time of the Smelter Hill remedial action.

2. Requirements of the Montana Strip and Underground Mine Reclamation Act, MCA § 82-4-201, et seq., and regulations promulgated thereunder.

The substantive portions of the following regulatory provisions, to the extent they deal with grading requirements, erosion control, and stabilization measures that will be useful in securing the excavation sites in the period before final remedial action is taken are hereby identified as ARARs. Revegetation and final reclamation of the excavated areas will occur at the time of the Smelter Hill remedial action. The provisions are deemed to be ARARs for the Flue Dust Operable Unit: MCA § 82-4-231, ARM §§ 26.4.501, -501A, -520, -631, -633, -636, -638, -640, -641, -642, -644, -719, and -761. All regulatory requirements under MCA §§2-4-201 will be ARARs for the Smelter Hill Operable Unit. These are set forth in Section IV. C.

B. ARARs pertinent to excavation, treatment, and transport of flue dust to the waste repository.

1. Air requirements.

Clean Air Act, 42 U.S.C. § 7401, et seq.

Montana's delegated air program, see the Clean Air Act of Montana, M.C.A. § 75-2-101, et seq., is authorized under the Clean Air Act, 42 U.S.C. 7409, as part of a State Implementation Plan approved by EPA. See 52 C.F.R. Part 52 Subpart BB. MCA § 75-2-102 provides, among other things, that air quality is to be maintained so as to protect human health and safety and prevent injury to animal and plant life. Montana air requirements closely parallel federal requirements. Because the state standards are part of a delegated or authorized program under the Clean Air Act, the state requirements are identified as the ARARs to be complied with. The following requirements must be complied with during excavation, treatment, and transport of flue dust.

a. ARM § 16.8.1401(2), (3), and (4).

Airborne particulate matter. There shall be no production, handling, transportation, or storage of any material, use of any street, road, or parking lot, or operation of a construction site or demolition project unless reasonable precautions are taken to control emissions of airborne particles. emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 minutes. This provision must be complied with at the excavated areas as well as at the waste repository.

b. ARM § 16.8.1404(2).

Visible Air Contaminants. Emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over 6 consecutive minutes. This provision must be complied with at the excavated areas as well as at the waste repository.

c. ARM § 16.8.1427.

Nuisance or odor bearing gases. Gases, vapors and dusts must be controlled such that no public nuisance is caused. Compliance with this provision at the excavated areas and the waste repository will assure that no public nuisance occurs.

d. ARM § 26.4.761.

Fugitive dust control measures such as 1) watering, stabilization, or paving of roads, 2) vehicle speed restrictions, 3) stabilization of surface areas adjoining roads, 4) restriction of travel on other than authorized roads, 5) enclosing, covering, watering, or otherwise treating loaded haul trucks, 6) minimizing area of disturbed land, and 7) revegetation must be planned and implemented. This provision must be complied with at the excavated areas as well as at the waste repository.

2. Transportation requirements

a. ARM § 16.44.512.

Discharges of flue dust or treated flue dust discharged during transportation shall be cleaned up to the extent they no longer present a hazard to human health or the environment.

b. ARM § 16.44.525.

Entry of persons or animals to any area where flue dust or treated flue dust is transferred or temporarily stored shall be prevented.

c. ARM § 16.527(2).

Any containers used for transporting flue dust or treated flue dust must be handled in a way which minimizes the risk of leaks or spills.

3. RCRA Subtitle C requirements.

- a. ARM § 16.44.324.

Treated flue dust material shall not exhibit the characteristic of toxicity.

- b. ARM § 16.44.702, incorporating by reference, 40 C.F.R. § 264.144

Access to the treatment unit shall be controlled.

- b. ARM § 16.44.702, incorporating by reference, 40 C.F.R. Part 264 Subpart XX

The treatment unit must be designed to prevent any releases that may have adverse effects on human health or the environment due to migration of waste constituents into groundwater, surface water, wetlands, or air.

C. ARARs pertinent to design, construction, and operation of the waste repository. The waste repository shall be designed to meet the requirements set forth below.

- 1. Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. 6901, et seq., ARARs.

- a. ARM § 16.44.702, incorporating by reference, 40 C.F.R. Part 264.257 . Criteria for Classification of Solid Waste Disposal Facilities and Practices.

- i. 40 C.F.R. § 257.3-1.

Washout of solid waste in facilities in a floodplain posing a hazard to human life, wildlife, or land or water resources may not occur.

- ii. 40 C.F.R. § 257.3-2.

Facilities may not contribute to the taking of endangered species or the endangering of critical habitat of endangered species.

iii. 40 C.F.R. § 257.3-3.

A facility may not cause a discharge of pollutants, dredged or fill material, into waters of the United States in violation of sections 402 and 404 of the Clean Water Act, as amended, and may not cause nonpoint source pollution, in violation of section 208 of the Clean Water Act, as amended.

iv. 40 C.F.R. § 257.3-4.

A facility may not contaminate an underground source of drinking water beyond the solid waste boundary.

v. 40 C.F.R. § 257.3-8(d).

Access to a facility shall be controlled so as to prevent exposure of the public to potential health and safety hazards at the site.

b. RCRA Subtitle C ARARs.

It is expected that the treated flue dust will not be a characteristic hazardous waste. However, if treated flue dust remains a characteristic hazardous waste, then EPA reserves the right to reexamine all RCRA Subtitle C requirements.

1. ARM § 16.44.702, incorporating by reference, 40 C.F.R. 264 Subpart F. General Facility Standards.

The waste repository must be designed consistent with the following requirements. Final compliance with these standards will be required at the time of the Smelter Hill Operable Unit.

a. ARM § 16.44.702, incorporating by reference, 40 C.F.R. §§ 264.92, .93. and .94. Groundwater protection standards at 40 C.F.R. 264.94 shall be complied with.

b. ARM § 16.44.702, incorporating by reference, 40 C.F.R. § 264.97. General groundwater monitoring requirements shall be complied with.

c. ARM § 16.44.702, incorporating by reference, 40 C.F.R. § 264.98. Requirements for monitoring and detecting indicator parameters shall be complied with.

2. Closure requirements.

a. ARM § 16.44.702, incorporating by reference, 40 C.F.R. 264.111, This provides that the owner or operator of a hazardous waste management facility must close the facility in a way that minimizes the need for further maintenance, and controls or eliminates the leaching or escape of hazardous waste or its constituents, leachate, or runoff to the extent necessary to protect human health and the environment.

b. ARM § 16.44.702, incorporating by reference, 40 C.F.R. § 264.117, This provision incorporates monitoring requirements in Part 264, including those mentioned at Part 264.97 and Part 264.303. It governs the length of the post-closure care period, permits a lengthened security period, and prohibits any use of the property which would disturb the integrity of the management facility.

c. ARM § 16.44.702, incorporating by reference, 40 C.F.R. § 264.310; This specifies requirements for caps, maintenance, and monitoring after closure.

3. 40 C.F.R. 264.301, as incorporated by ARM § 16.44.702. Design and operating requirements for landfills.

- a. 40 C.F.R. 264.301(a). This provides for a single liner and leachate collection and removal system.
- b. 40 C.F.R. 264.301(f). This requires a run-on control system.
- c. 40 C.F.R. 264.301(g). This requires a run-off management system.
- d. 40 C.F.R. 264.301(h). This requires prudent management of facilities for collection and holding of run-on and run-off.
- e. 40 C.F.R. 264.301(i). This requires that wind dispersal of particulate matter be controlled.

2. State of Montana solid waste requirements.

MCA § 75-10-212, and ARM §§ 16.14.505, -520, and -523.

Disposal of solid waste except as provided by the Montana Solid Waste Management Act is prohibited; solid waste disposal sites must be located outside of 100-year floodplain and in areas that will prevent pollution of ground and surface waters and public and private water supplies; drainage structures must be installed where necessary to prevent surface runoff from entering disposal areas; solid waste disposal must be in areas which can be effectively maintained; and solid waste must be transported in such a way as to prevent its discharge, dumping spilling or leaking from the transport vehicle.

3. Water quality requirements.

a. Surface water.

1. Montana Water Quality Act, MCA § 75-5-303, and implementing regulations at ARM 16.20.604, -618, -631, -632, -633, -702, and -703.

These provisions establish Montana's surface water standards and nondegradation policy. The waste repository must be designed so as to comply with these requirements.

2. MCA § 75-5-605.

The waste repository must be designed so as not to cause pollution of state waters.

b. Groundwater.

The waste repository may not violate the requirements below.

1. MCA § 85-2-505.

Wasting or contamination of groundwater is prohibited.

2. ARM §§ 16.20.1002, -1003, and -1011.

These sections, among other things, adopt MCLs as standards for groundwater, and set out the state's nondegradation policy for groundwater.

c. Drinking water.

- MCA § 75-6-112, ARM §§ 16.20.203, and -205.

These prohibit discharges which cause pollution to state waters which are sources for public water systems, and set MCLs (maximum contaminant levels) for community water systems. The waste repository shall be designed so as not to violate these requirements.

4. Air quality requirements.

Clean Air Act, 42 U.S.C. § 7401, et seq.

Montana's delegated air program, see the Clean Air Act of Montana, M.C.A. § 75-2-101, et seq., is authorized under the Clean Air Act, 42 U.S.C. 7409, as part of a State Implementation Plan approved by EPA. See 52 C.F.R. Part 52 Subpart BB. Montana air requirements closely parallel federal requirements. Because the state standards are part of a delegated or authorized program under the Clean Air Act, the state requirements are identified as the ARARs to be complied with. The waste repository must be designed so as to be capable of meeting the following requirements.

a. ARM § 16.8.811.

The concentration of carbon monoxide in ambient air shall not exceed an hourly average of 23 parts per million or an 8 hour average of 9 parts per million. This provision must be complied with at the excavated areas as well as at the waste repository.

b. ARM § 16.8.815.

The concentration of lead in ambient air shall not exceed a 90 day average of 1.5 micrograms per cubic meter of air. This provision must be complied with at the excavated areas as well as at the waste repository.

c. ARM § 16.8.818.

Settled particulate shall not exceed a 30 day average of 10 grams per square meter. This provision must be complied with at the excavated areas as well as at the waste repository.

d. ARM § 16.8.821.

The concentration of PM-10 in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air. This provision must be complied with at the excavated areas as well as at the waste repository.

e. ARM § 16.8.822.

Visibility; the scattering coefficient shall not exceed an annual average of 3×10^{-5} per meter in Class I areas. This shall be measured at the Class I area nearest to the location of the Flue Dust OU.

f. ARM § 16.8.925.

Ambient air increments. This sets the maximum allowable increases over baseline concentrations for particulate matter. For Class I and II areas, respectively, the maximum annual geometric mean is 5 and 19 $\mu\text{g}/\text{m}^3$, and the 24 hour maximums are 10 and 37 $\mu\text{g}/\text{m}^3$.

g. ARM § 16.8.926.

Ambient air limits. This provides that no concentration of a pollutant may exceed any state or federal ambient air quality standard.

h. During construction of the waste repository, the requirements set forth at Section III.B.1. must be met.

IV. List of Criteria, Advisories and Guidance To Be Considered

A. Chemical Specific Guidance - For the flue dust constituents listed at 1., below, based on detected levels and degree of toxicity, refer to the documents at IV. A. 2., below, for RfDs and cancer potency slope factors.

1. Flue dust constituents: antimony, arsenic, beryllium, bismuth, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, silver, and zinc.

2. Reference documents:

- Health Profiles. Agency for Toxic Substances and Disease Registry. U.S. Public Health Service.
- Integrated Risk Information Service (IRIS). EPA. Office of Research and Development.
- Health Effects Summary Table. EPA Environmental Criteria and Assessment Office. Published Quarterly.
- Health Effects Assessments and Health Advisory Documents. EPA. Office of Research and Development.
- Health Advisories for Drinking Water. EPA. Office of Water.
- Water Quality. EPA. Office of Water.

B. General EPA Policy Documents.

- Risk Assessment Guidance for Superfund. Human Health Evaluation Manual, Part A. July 1989. Office of Solid Waste and Emergency Response.
- Risk Assessment Guidance for Superfund. Environmental Evaluation Manual. 1989.
- RCRA Landfill Design - Liner Systems and Final Cover.
- EPA's Ground-Water Protection Strategy.
- Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites (draft, October 1986).
- Management of Hazardous Waste Leachate.
- Guide to Disposal of Chemically Stabilized and Solidified Waste.
- Evaluating Cover Systems for Solid and Hazardous Waste.
- Test Methods for Evaluating Solid Wastes.
- Solid Waste Leaching Procedure Manual.

- Guidance Manual on Closure and Post-Closure Interim Standards.
 - Handbook for Stabilization/Solidification of Hazardous Wastes.
- C. Regulations and standards which are not ARARs for the Flue Dust Operable Unit, but which may contain information to be considered towards the final site disposition or management of treated waste.
1. State of Montana statutory provisions.
 - MCA § 50-78-101, et seq., Employee and Community Hazardous Chemical Information Act.
 - MCA § 87-5-501, et seq., Stream Protection Act.
 - MCA § 75-10-401, et seq., Montana Hazardous Waste and Underground Storage Tank Act.
 - MCA § 75-10-201, et seq., Montana Solid Waste Management Act.
 - MCA § 85-2-501, et seq., Groundwater.
 - MCA § 75-20-101, et seq., Montana Major Facility Siting Act.
 2. State of Montana regulatory provisions.
 - ARM § 26.4.311, air monitoring for fugitive dust.
 - ARM § 26.4.312, plan for minimizing fish and wildlife impacts.
 - ARM § 26.4.313, establish a reclamation plan.
 - ARM § 26.4.314, establish informational needs to preserve and protect the hydrologic balance.
 - ARM § 26.4.725, establishes a period of performance when a bond covers revegetation plantings.
 - ARM §§ 36.7.2502, 2503, 2504 and 2505, setting siting criteria under the Montana Major Facility Siting Act.

3. The following provisions will be ARARs for the Smelter Hill Operable Unit. Actions taken at the Flue Dust Operable Unit shall not be inconsistent with these requirements.

- The Montana Strip and Underground Mine Reclamation Act, MCA § 82-4-201, et seq., and regulations promulgated thereunder.

Final backfilling, contouring, and revegetation is expected to occur at the time of the Smelter Hill Operable Unit and substantive portions of the following regulatory provisions will therefore be ARARs for the Smelter Hill Operable Unit. The provisions are: ARM §§ 26.4.501, -501A, -504, -505, -520, -631, -633, -634, -636, -638, -639, -640, -641, -642, -644, -703, -711, -713, -714, -716, -717, -718, -719, -721, -751, and -761.

ATTACHMENT 2
TREATABILITY TESTING DATA RESULTS

TREATABILITY TESTING DATA RESULTS

STABILIZATION/FIXATION TESTING

Cement- and silicate-based stabilization/fixation technologies have been demonstrated to be effective in reducing the toxicity and mobility of metals-containing materials similar to the flue dust of the operable unit. Process- and material-specific treatability data were required to confirm that the TCLP and EP Toxicity characteristics can be removed from the flue dust materials through stabilization/fixation treatment.

Cement-based treatment was evaluated by HAZCON Engineering, Inc. (HAZCON) in Brookshire, Texas; Dames & Moore in Denver, Colorado; and MSE, Inc. (MSE) in Butte, Montana. Silicate-based treatment was evaluated at CHEMFIX Environmental Services, Inc. (CES) in Metairie, Louisiana.

HAZCON Stabilization/Fixation Technology

Cement-based stabilization/fixation treatment involves mixing excavated flue dust material with a combination of portland cement (PC) or cement kiln dust (CKD), hydrated lime (HL), and deionized water. The HAZCON process includes the addition of HAZCON's patented chemical reagent "Chloranan" to the cement mixture. Formulations can be adjusted to produce either a treated product resembling a crumbly soil-like material or a monolithic solid. Metals are chemically bound and microencapsulated within the cement matrix.

Results confirm that the technology can effectively remove the EP Toxicity characteristics from the flue dust and that the treated material, in general, exhibits acceptable UCS and hydraulic conductivity characteristics for land disposal (Tables 1 and 2).

Optimum formulations have been identified for each of the four flue dust material types tested (Table 3). Samples of the treated materials were not submitted for TCLP analysis during treatability testing. Optimum formulations, with the exception of CPT formulations, produced materials with unconfined compressive strength (UCS) values of greater than 50 psi. Optimum formulations produced materials with hydraulic conductivities of less than 1×10^{-5} cm/s. Testing was not adequate for evaluating the effectiveness of the treatment when applied without the HAZCON patented additive Chloranan.

TABLE 1 HAZCON STABILIZATION/FIXATION PHASE II
TESTING CLP-EP TOXICITY RESULTS

CLP Sample ID	HAZCON Sample ID	O. R. Report Number	As	Na	Cd	Ce	Pb	Hg	Se	Ag
56	BP-C-2	11848	0.394	0.435	0.02 U	0.030	0.25 U	0.002 U	0.305 U	0.015 U
61	BP-D-2	11845	0.216 U	0.495	19.9	0.025 U	4.78	0.021	0.305 U	0.032
31	IP-C-2	11848	0.406	0.370	0.02 U	0.028	0.25 U	0.002 U	0.305 U	0.015 U
36	IP-D-2	11848	0.16 U	0.302	19.2	0.025 U	17.8	0.062	0.305 U	0.015 U
46	CPT-C-2	11848	0.16 U	0.192	0.026	0.025 U	0.25 U	0.014	0.305 U	0.015 U
41	CPT-A2-2	11848	0.16 U	0.511	0.02 U	0.070	0.919	0.002 U	0.305 U	0.015 U
51	CPT-D-2	11848	0.16 U	0.303	2.74	0.026	0.386	0.043	0.314	0.036
21	FDS-C-2	11848	0.878	0.307	0.02 U	0.031	0.25 U	0.002 U	0.305 U	0.015 U
26	FDS-D-2	11848	0.884	0.271	2.50	0.025 U	0.25 U	0.010	0.305 U	0.032
EP Toxicity Criteria			5.0	100.0	1.0	5.0	5.0	0.2	1.0	5.0

TABLE 2 HAZCON STABILIZATION/FIXATION PHASE II TESTING
PHYSICAL CHARACTERIZATION RESULTS

HAZCON Sample ID	UCS Test			Permeability Test			Freeze/Thaw Test		
	Moisture Content(%)	Unit Dry Weight (pcf)	UCS (psi)	Post-test Moisture Content(%)	Post-test Dry Weight (pcf)	Hydraulic Conductivity (cm/sec)	Unit Dry Weight (pcf)	Loss(%)	Cycle
BP-C-2	26.6	85.3	180	32.7	88.5	3.9 x10 ⁻⁷	84.5	84	7
BP-D-2	26.3	88.7	115	28.5	95.0	1.1 x10 ⁻⁶	89.5	10	2
IP-C-2	32.2	81.7	215	39.8	83.8	1.4 x10 ⁻⁶	81.7	75	6
IP-D-2	38.4	81.6	75	42.8	82.4	3.7 x10 ⁻⁶	79.5	51	1
CPT-A2-2	31.5	76.8	14	45.7	76.3	3.8 x10 ⁻⁶	75.3	12	2
CPT-C-2	44.0	57.6	6	60.8	63.9	4.9 x10 ⁻⁵	63.2	100	1
CPT-D-2	37.6	70.5	10	48.1	73.7	2.5 x10 ⁻⁶	77.8	52	3
FDS-C-2	26.2	80.8	198	39.3	82.1	2.8 x10 ⁻⁶	79.2	68	3
FDS-D-2	30.0	85.4	127	33.2	90.7	1.0 x10 ⁻⁶	84.5	70	2

pcf = pounds per cubic foot
psi = pounds per square inch

TABLE 3 OPTIMUM CEMENT-BASED STABILIZATION/FIXATION
TREATMENT FORMULATIONS

Flue Dust Type	Formulation Number	Removes EP Toxicity	USC >50psi	Hydraulic Conductivity <1x10 ⁻⁵ cm/s
BP	BP-C-2	YES	YES	YES
IP	IP-C-2	YES	YES	YES
CPT	CPT-A2-2	YES	NO	YES
	CPT-C-2	YES	NO	YES
FDS	FDS-C-2	YES	YES	YES

MSE Stabilization/Fixation Technology Description

Cement-based stabilization/fixation treatment involves mixing excavated flue dust material with a combination of PC, HL, and water. As described for the testing conducted by HAZCON and Dames and Moore, contaminants are chemically bound and microencapsulated within the cement crystalline matrix.

Additional testing of cement-based treatment was required to confirm treatment effectiveness of previously tested stabilization/fixation formulation with locally available materials and without the use of proprietary chemical additives. Additional stabilization/fixation tests were conducted from February 26 through June 1990 by MSE, Inc. in Butte, Montana. Stabilization/fixation formulations were evaluated for the various flue dust piles: BP, IP, CPT, and FDS.

Optimum formulations were developed by MSE based on the ability of the sample to meet TCLP and EP Toxicity criteria. Formulations that meet these criteria are given in Table 4. Addition of unscreened slag showed variable success in increasing the UCS of the treated flue dust and, as a result, the slag was screened to remove the -200 mesh fines present in the material. Results of TCLP analyses for the optimum blends are given, with qualifiers, in Table 5, and were obtained using CLP documentation and protocol. These data are intended for use as enforcement quality data. Physical testing which included UCS, hydraulic conductivity, and freeze/thaw tests were also performed on the optimum formulations. Physical results for these formulations are provided in Table 6.

Two long-term leach tests were performed on the optimum formulations. The multiple extraction procedure (MEP) used a sulfuric and nitric acid leach extracted according to the EP Toxicity method. The test is intended to simulate leaching conditions the treated materials would undergo from repetitive acid rain precipitation. Similarly, the American Nuclear Society (ANS) test method 16.1 is a long-term leach in which the treated material is suspended in distilled, deionized (DI) water. The water is replaced at specified intervals, and is filtered and analyzed for dissolved metals.

Results of the MEP and ANS 16.1 tests are given in Tables 7 and 8, respectively. Both tests were performed using CLP documentation and protocol, and are intended to be used as enforcement quality data. In addition to analyzing for the eight RCRA metals in the ANS stability testing, copper was analyzed to determine if it would leach from the stabilized/fixated flue dust. Results indicate copper concentrations of up to 156 mg/l, although most extractions contained a copper concentration below the detection limit.

TABLE 4

Optimum Stabilization/Fixation Formulations

Flue Dust Type	Portland Cement (%)	Hydrated Lime (%)	Screened Slag (%)
Iron Ponds	25	0	27
Bradley Ponds	20	0	26
Flue Dust Storage	20	20	30
Coal Pile Tracks	20	20	30

TABLE 5

**Enforcement Quality TCLP and EP Toxicity Results
Optimum Stabilization/Fixation Formulations**

TCLP Toxicity (mg/l)

Analyte	CLP Sample IP-TCLP	CLP Sample BP-TCLP	CLP Sample FDS-TCLP	CLP Sample CPT-TCLP	TCLP Criteria
Arsenic	0.67	1.28	0.88	0.10 U	5.0
Barium	0.00	3.88	0.214	0.22	100.0
Cadmium	0.005 U	0.005 U	0.005 U	0.005 U	1.0
Chromium	0.028 U	0.008 U	0.018	0.008 U	5.0
Lead	0.069 U	0.069 U	0.069 U	0.069 U	5.0
Mercury	0.0004	0.008	0.009	0.002 U	0.2
Selenium	0.12 U	0.15	0.16	0.26	1.0
Silver	0.010 U	0.096 U	0.010 U	0.096 U	5.0

TABLE 6

**Physical Test Results
Optimum Stabilization/Fixation Formulations**

Sample Type	Bulk Density (lb/ft ³)	Hydraulic Conductivity (cm/s)	28-day USC (psi)
Iron Ponds	92.2	4.7 X 10 ⁻⁵	34.7
Bradley Ponds	94.2	2.9 X 10 ⁻⁶	38.9
Flue Dust Storage	86.6	2.3 X 10 ⁻⁴	59.6
Coal Pile Tracks	81.0	1.1 X 10 ⁻⁵	52.9

TABLE 7
ENFORCEMENT QUALITY MULTIPLE EXTRACTION PROCEDURE RESULTS TREATED FLUE DUST
OPTIMUM STABILIZATION/FIXATION FORMULATIONS (mg/l)
QC REPORT NO. 12812

Source	Extraction Number	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Bragley Ponds (BP-MEP-1)	1	0.697 JD109	0.477	0.015 U	0.030 U	0.005 JCD200868	0.002 U	0.121	0.020 U
	2	0.924 JD40	0.124	0.003 U	0.006 U	0.019 JCD11868	0.002 U	0.018	0.004 U
	3	0.659 JD51	0.048	0.003 U	0.006 U	0.020 JCD102868	0.002 U	0.017	0.004 U
	4	0.882	0.047	0.003 U	0.006 U	0.013 JC	0.002 U	0.017 JS46	0.004 U
	5	0.882	0.049	0.003 U	0.006 U	0.008 JC	0.002 U	0.018 JS46	0.004 U
	6	1.03	0.041	0.003 U	0.006 U	0.005 JCA	0.002 U	0.025 JS46	0.004 U
	7	0.988	0.032	0.003 U	0.006 U	0.001 U	0.002 U	0.019 JD45846	0.004 U
	8	1.12	0.039	0.003 U	0.006 U	0.002 JG	0.002 UJD200	0.018 JS46	0.004 U
	9	1.46	0.042	0.003 U	0.006 U	0.001 JG	0.002 U	0.019 JS16	0.004 U
	10	0.622 JD51	0.041	0.003 U	0.006 U	0.001 JG	0.002 U	0.022 JS16	0.004 U
Iron Ponds (IP-MEP-1)	1	0.782 JD109	0.472	0.015 U	0.033	0.005 JCD200868	0.002 U	0.085	0.020 U
	2	0.344 JD109	0.124	0.003 U	0.010	0.010 JCD11868	0.002 U	0.025 JMD.9941	0.004 U
	3	0.343 JD51	0.090	0.003 U	0.006 U	0.014 JCD102868	0.002 U	0.044	0.004 U
	4	0.390	0.065	0.003 U	0.006 U	0.008 JC	0.002 U	0.024 JS46MD.993	0.004 U
	5	0.412	0.050	0.003 U	0.006 U	0.005 JC	0.002 U	0.018 JS46	0.004 U
	6	0.434	0.037	0.003 U	0.006 U	0.003 JCB	0.002 U	0.024 JS46	0.004 U
	7	0.492	0.025	0.003 U	0.006 U	0.001	0.002 U	0.018 JS46	0.004 U
	8	0.790	0.024	0.003 U	0.006 U	0.002 JG	0.002 UJD200	0.026 JS46	0.004 U
	9	0.705	0.023	0.003 U	0.006 U	0.001 U	0.002 U	0.032 JS16	0.004 U
	10	0.784 JD51	0.022	0.003 U	0.006 U	0.003 JG	0.002 U	0.030 JS16	0.004 U
ICLP Toxicity Criteria		5.0	100	1.0	5.0	5.0	0.20	1.0	5.0

TABLE 7 (CONT'D)
ENFORCEMENT QUALITY MULTIPLE EXTRACTION PROCEDURE RESULTS TREATED FLUE DUST
OPTIMUM STABILIZATION/LIXATION FORMULATIONS (mg/l)
QC REPORT NO. 12812

Source	Extraction Number	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Flue Dust Storage (FDS-MEP-1)	1	0.024 JD109	0.333	0.015 U	0.030 U	0.001 WJCD2008688	0.002 U	0.227	0.020 U
	2	0.065 JD4J	0.082	0.004	0.009	0.001 WJCD1118688	0.002 U	0.174	0.004 U
	3	1.02 JD51	0.037	0.003 U	0.006 U	0.002 JCD1028688	0.002 U	0.154	0.005 UBS.9
	4	0.291	0.030	0.003 U	0.008 U	0.001 JCG	0.002 U	0.126 J846	0.006 U
	5	1.41	0.023	0.003 U	0.008 U	0.001 WJG	0.004	0.117 J846	0.004 U
	6	1.58	0.018	0.003 U	0.008 U	0.001 U	0.004	0.076 J846	0.004 U
	7	1.77	0.013	0.003	0.008 U	0.001 U	0.002	0.075 JD45846	0.004 U
	8	1.97	0.016	0.003 U	0.006 U	0.001 WJG	0.006	0.061 J816	0.004 U
	9	2.47	0.014	0.003	0.006 U	0.001 WJG	0.008	0.054 J516	0.004 U
	10	2.48 JD51	0.013	0.003 U	0.006 U	0.001 WJG	0.010	0.034 J516	0.004 U
Coal Pile Tracks (CPT-MEP-1)	1	0.036 JD109	0.335	0.015 U	0.030 U	0.001 WJCD2008688	0.002 U	0.148	0.020 U
	2	0.041 JD40	0.095	0.003 U	0.008	0.004 JCD1118688MSD.0881	0.002 U	0.127	0.004 U
	3	0.018 JD51	0.120	0.003 U	0.006 U	0.003 JCD1028688	0.002 U	0.088	0.004 U
	4	0.017	0.102	0.003 U	0.006 U	0.002 JCG	0.002 U	0.073 J846	0.004 U
	5	0.011	0.081	0.003 U	0.006 U	0.001 WJG	0.002 U	0.064 J846	0.004 U
	6	0.014	0.073	0.003 U	0.006 U	0.001 WJG	0.002 U	0.050 J846	0.004 U
	7	0.013	0.064	0.003 U	0.006 U	0.001 U	0.002 U	0.035 JD45846	0.004 U
	8	0.023	0.058	0.003 U	0.006 U	0.001 WJG	0.002 JD200	0.052 J846	0.004 U
	9	0.020	0.053	0.003 U	0.006 U	0.001 WJG	0.002 U	0.050 J816	0.004 U
	10	0.019 JD51	0.044	0.003 U	0.006 U	0.001 WJG	0.002 U	0.033 J816	0.004 U
TCLP Toxicity Criteria		5.0	100	1.0	5.0	5.0	0.20	1.0	5.0

TABLE 8
ENFORCEMENT QUALITY AMERICAN NUCLEAR SOCIETY 16.1 PROCEDURE RESULTS
OPTIMUM STABILIZATION/FIXATION FORMULATIONS (mg/l)*

Source	Extraction Time (days)	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Silver
Bradley Ponds (BP-ANS-1)	0.08	0.097	0.017	0.0001	0.008 U	0.033	0.0002 U	0.012 UR2.4	0.0002U	0.010 U
	0.29	0.041	0.013	0.0003	0.008 U	0.032	0.0002 U	0.009	0.0002U	0.010 U
	1	0.088	0.034	0.0001	0.010	0.089	0.0002	0.017	0.036	0.010
	2	0.094	0.032	0.0001	0.008	0.091	0.0002	0.015	0.0002U	0.010 JS70
	3	0.093	0.026	0.0004	0.008 U	0.100	0.0002 U	0.014	0.0002U	0.010 U
	4	0.082	0.023	0.0002	0.008 U	0.051	0.0002 U	0.011	0.0002U	0.010 U
	5	0.077	0.021 JS33	0.0003	0.008 U	0.076	0.0002 U	0.006	0.0002U	0.010 U
	19	0.175	0.073 JS33	0.0001	0.014 UR8.8	0.219	0.0002 U	0.032	0.079	0.010 U
	47	0.194	0.067	0.004 U	0.007 U	0.291	0.0002 U	0.028 JS60	0.156	0.005 U
	90	0.186	0.108	0.004 U	0.006 U	0.266	0.0002 U	0.011 JS60	0.058	0.005 U
Iron Ponds (IP-ANS-1)	0.08	0.018	0.010	0.0002	0.008 U	0.011	0.0002 U	0.005 UR2.4	0.0002U	0.010 U
	0.29	0.014	0.012	0.0001	0.008 U	0.018	0.0002 U	0.005 UR2.4	0.0002U	0.010 U
	1	0.020	0.028	0.0001	0.008	0.051	0.0002	0.007	0.024	0.010
	2	0.027	0.094	0.0001	0.008	0.049	0.0002	0.006	0.0002U	0.010
	3	0.025	0.023	0.0002	0.008 U	0.035	0.0002 U	0.003	0.0002U	0.010
	4	0.027	0.024	0.0002	0.008 U	0.035	0.0002 U	0.005 JG118	0.0002U	0.010
	5	0.024	0.020 JS33	0.0002	0.008 U	0.029	0.0002 U	0.001	0.0002U	0.010 U
	19	0.068	0.069 JS33	0.0001	0.008 U	0.136	0.0002 U	0.011	0.056	0.010 U
	47	0.080	0.080	0.004 U	0.006 U	0.149	0.0002 U	0.007 JS60	0.107	0.005 U
	90	0.057	0.066	0.005	0.006 U	0.099	0.0002 U	0.004 JS60	0.050	0.005 U

* QC Report Nos.
 BP-ANS-1-1
 BP-ANS-1-3
 BP-ANS-1-5
 BP-ANS-1-7

TABLE 8 (CONT'D)
ENFORCEMENT QUALITY AMERICAN NUCLEAR SOCIETY 16.1 PROCEDURE RESULTS
OPTIMUM STABILIZATION/FIXATION FORMULATIONS (MG/L)

Source	Extraction Number	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Silver
Fiber Dust Storage (FDS-ANS-1)	0.08	0.012	0.007	0.0001 U	0.008 U	0.002	0.0002 U	0.010 UB2.4	0.0002U	0.010 U
	0.29	0.026	0.009	0.0001 U	0.008 U	0.008	0.0002 U	0.015	0.0002U	0.010 U
	1	0.082	0.026	0.0001 U	0.008 U	0.017	0.0002 U	0.025	0.0002U	0.010
	2	0.088	0.024	0.0001 U	0.008 U	0.018	0.0002 U	1M40.994	0.0002U	0.010 U1570
	3	0.070	0.016	0.0001	0.008 U	0.012	0.0002 U	0.019	0.0002U	0.010 U1570
	4	0.071	0.018	0.0001	0.008 U	0.010	0.0002 U	0.016	0.0002U	0.010 U1570
	5	0.065	0.014 JS33	0.0001	0.008 U	0.009	0.0002 U	0.010	0.0002U	0.010 U
	19	0.296	0.063 JS33	0.0001 U	0.008 U	0.057	0.0002 U	0.058	0.047	0.010 U
	47	0.323	0.069	0.004 U	0.006 U	0.037	0.0002 U	1M40.992	0.069	0.005 U
	90	0.328	0.075	0.004 U	0.006 U	0.046	0.0002 U	0.048 JS60	0.041	0.005 U
Coal Fly Tracks (CFT-ANS-1)	0.08	0.001	0.005	0.0001	0.008	0.011	0.0002	0.009 UB2.4	0.0002U	0.010 U
	0.29	0.001	0.008	0.0001	0.008	0.018	0.0002	0.012	0.0002U	0.010 U
	1	0.007	0.020	0.0001	0.008	0.053	0.0002	0.026	0.0002U	0.010
	2	0.007	0.019	0.0001	0.008	0.045	0.0002	0.022	0.0002U	0.010 U1570
	3	0.006	0.014	0.0002	0.008	0.050	0.0002	0.018	0.0002U	0.010 U1570
	4	0.005	0.013	0.0001	0.008	0.022	0.0002	0.015	0.0002U	0.010 U
	5	0.007	0.013	0.0001	0.008	0.023	0.0002	0.011	0.0002U	0.010 U
	19	0.078	0.054	0.0002	0.006	0.202	0.0002	0.061	0.066	0.005 U
	47	0.037	0.060	0.0002	0.006	0.135	0.0002	0.077 JS60	0.053	0.005 U
	90	0.016	0.051	0.004	0.006	0.083	0.0002	0.062 JS60	0.031	0.005 U
TCLP Toxicity Criteria		5.0	100	1.0	5.0	5.0	0.20	1.0	NA	5.0

NA Not Applicable

CHEMFIX Technology

Silicate-based stabilization/fixation involves mixing excavated flue dust with a combination of soluble silicates, silicate setting agents, and water. Metal ions in the flue dust either react with soluble silicates forming metal silicates or precipitate as metal hydroxides and are entrapped within the treated matrix structure. The treated product is a friable soil-like material.

CHEMFIX Environmental Services (CES) conducted testing of the CHEMFIX process for treatment of Smelter Hill flue dust. The CHEMFIX process is a patented silicate-based stabilization/fixation technology used to immobilize inorganic constituents within a waste matrix by chemical and physical means. The treatment process is based on the use of proprietary CHEMSET (trademark) poly-silicates, calcium-containing reagents. These reactions produce a gel structure. The third involves a combination of hydrolysis, hydration, and neutralization reactions occurring with the calcium reagent, flue dust and water. Through these series of reactions, flue dust is chemically converted to a clay-like soil material.

Three types of chemical reactions occur during treatment. The first involves reactions between polysilicates, reaction promoters, and metal ions present in the flue dust. These reactions produce metal silicates. The second involves reactions between polysilicates and calcium-containing reagents. These reactions produce a gel structure. The third involves a combination of hydrolysis, hydration, and neutralization reactions occurring with the calcium reagent, flue dust, and water. Through these series of reactions, flue dust is chemically converted to a clay-like soil material.

Silicate-based treatment testing conducted by CES was not effective in removing the EP Toxicity characteristic from each of the four major flue dust types. The CHEMFIX process was effective in removing the EP Toxicity characteristic from BP material, but data indicate that the treated material exhibits low strength. Treatment effectiveness of the CHEMFIX process could not be confirmed for IP, CPT, and FDS material due to inconsistent results from the testing performed by CES.

HYDROMETALLURGICAL TESTING

Hydrometallurgical processes have been demonstrated to be effective in extracting and selectively recovering metals from ores, concentrates, and other metal-bearing materials using wet chemical processes. These processes usually involve dissolution of the metal with subsequent recovery from solution. Treatability testing was performed for three hydrometallurgical process technologies: (1) Cashman Process; (2) Sulfide Precipitation; and, (3) Ambient Acid Leach process. Result of testing the Cashman and Ambient Acid Leach process is described below.

Cashman Process Technology

The Cashman process is a patented chloride acid leach process designed to extract selected metals from arsenical flue dust while converting arsenic trioxide to a stable ferric arsenate residue. The theoretical objective of the Cashman process for Anaconda flue dust is to remove metal values for recovery and resale, and to fix the remaining toxic constituents of flue dust in a stable leach residue. The process is conducted in an autoclave under elevated temperature and pressure conditions, and is followed by a series of metal-recovery unit operations to reclaim other metals present in the flue dust.

Early pilot tests of the Cashman process (1987) on Anaconda flue dust at Skykomish, Washington have produced residues that contained arsenic in the form of scorodite ($\text{FeAsO}_4 \cdot 2\text{H}_2\text{O}$) and coprecipitated arsenic with ferric hydroxide. The residue from these early tests passed the EPTox test for the leachability of metals. (Table 9). However, the process conditions and the composition of the flue dust used in the early tests may not have been representative of conditions and compositions that would exist during full-scale treatment by the Cashman process.

Pilot-scale operational data were needed to demonstrate that a non-hazardous leach residue, consisting primarily of gypsum, could be generated on a continuous basis by the Cashman process. Arsenic was found to be present primarily in the form of ferric arsenate (PTI, 1990). Additional testing of the subsequent metal recovery unit operations was needed to determine the effectiveness of these unit operations in recovering metals in saleable forms.

The objectives of the test work were to demonstrate the operability of the Cashman process on a continuous basis and to obtain data concerning the chemical and physical characteristics of the autoclave leach residue, metal precipitate products, and potential waste streams generated. Testing involved a combination of pilot-scale and bench-scale tests. Autoclave leaching, copper metathesis, and zinc precipitation were the only unit operations which was tested on a continuous basis. Feed preparation and metal recovery operations were tested on a batch basis.

Samples of the autoclave leach residue were obtained for EP Toxicity analyses using CLP methodology and documentation protocols. The CLP EP Toxicity data sets are presented in Table 10. The CLP data indicate that the leach residue generated during Campaign No. 6 passed EP Toxicity criteria.

In general, metal recoveries were improved at pH values between 0.8 and 1.6. Observations indicated that mild steel and wetted stainless steel surfaces were corroded under typical operating conditions. The autoclave experienced localized corrosion under certain operating conditions despite the use of titanium for construction.

TABLE 9 MEAN EPTOX ANALYTICAL RESULTS FOR THE FLUE DUST PILOT TEST SOLID SAMPLES

SAMPLE TYPE	RUN-SERIES	As	Cd	Cr	Pb (ug/L)	Hg	Se	Ag
LIMITS		5000	1000	5000	5000	200	1000	5000
FLUE DUST	FD-100-SERIES	250	3200	10	350	0.5	68	50
FLUE DUST	FD-200-SERIES	210	50000	50	1600	0.5	216	50
FILTER CAKE BEFORE WASH	1-100	10000	4227	50	1100	328	41	78
FILTER CAKE AFTER WASH	1-100	10333	57	33	150	0.2	52	30
FILTER CAKE AFTER WASH	2-100	171	77	20	98	0.2	23	10
FILTER CAKE AFTER WASH	3-100	76	90	10	50	0.2	4	10
FILTER CAKE NO WASH	4-200	104	165	11	50	0.2	8	10
FILTER CAKE AFTER WASH	4-200	50	100	10	50	0.2	8	10

TABLE 10 LEACH RESIDUE CLP EP TOXICITY RESULTS EP TOXICITY (mg/l)

Analyte	CLP Sample 34-A	CLP Sample 34-B	CLP Sample 34-C	CLP Sample 34-D	EP Toxicity Criteria
Arsenic	0.3	0.45	0.46	0.3	5.0
Barium	0.008 UJB	0.008 UJB	0.008 UJB	0.01 UJB	100
Cadmium	0.022	0.033	0.069	0.282	1.0
Chromium	0.005 U	0.005 U	0.005 U	0.005 U	5.0
Lead	2.04 JS0	2.31 JS0	2.2 JS0	2.43 JS0	5.0
Mercury	0.002 U	0.002 U	0.002 U	0.002 U	0.20
Selenium	0.027 JS62*58	0.026 JS62*58	0.023 JS62*58	0.022 JS62*58	1.0
Silver	0.004 UJS12	0.004 UJS12	0.004 UJS12	0.004 UJS12	5.0

Additional tests were designed to determine the stability and leachability of metals, especially arsenic and cadmium, from Cashman process residue under conditions that may simulate disposal within the boundaries of the Anaconda Smelter National Priorities List (NPL) site. Residues from two tests of the Cashman process, the batch-reactor test (June 1989) and the continuous-reactor test (October 1989), were investigated.

Figures 1 and 2 show concentrations of arsenic and cadmium in the column filtrate as a function of pore volumes. Batch residue results are also shown in these figures for comparative purposes. The arsenic concentration increased in the continuous autoclave residue to approximately 0.70 mg/l within the first 0.3 pore volumes and reached an equilibrium of 1.0 to 1.4 mg/l between 3 and 10.3 pore volumes. The cadmium concentration was initially measure at approximately 3.0 mg/l and fell to approximately 0.50 mg/l after 10 pore volumes passed through the column.

The CLP data indicate the operating conditions of Campaign No. 6 produced a leach residue that passed the EP Toxicity test. Results of stability testing on the batch autoclave residue indicate the long-term concentration of arsenic in the leachate was approximately 0.30 mg/l, and the cadmium concentration in the leachate was less than 0.030 mg/l.

The objective of producing an autoclave leach residue that passes the EP Toxicity test was met according to the CLP analytical results. However, recently obtained results of TCLP analysis of two samples of autoclave leach residue show the residue to exceed TCLP toxicity criteria for lead, with concentrations of 7.9 mg/l and 13.8 mg/l, respectively. In addition, the copper oxide, bismuth oxychloride, cadmium cement, and lead sulfate precipitate products failed EP Toxicity criteria.

Ambient Acid Leach Process Technology

The ambient acid leach process uses a sulfuric acid leaching approach for treatment of Smelter Hill flue dust. The sulfuric acid leach can be preceded by a water leaching step to selectively leach a portion of the copper, cadmium, and zinc without leaching arsenic, lead, or iron. Components of the processing scheme have been demonstrated to be effective in separating and recovering select metals from ores, concentrates, and other metal-bearing materials. Process- and material-specific treatability data were required to evaluate the effectiveness of the process in recovering copper from the flue dust material.

The ambient acid leach process involves sulfuric acid leaching of flue dust at ambient temperature and pressure conditions, solid/liquid separation, filter cake washing, copper solvent extraction (SX) of the filtrate, recovery of the extracted copper through electrowinning, and treatment/recycle of the raffinate (barren solution) from SX.

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The CLP data indicate the operating conditions of Campaign No. 6 produced a leach residue that passed the EP Toxicity test. Results of stability testing on the batch autoclave residue indicate the long-term concentration of arsenic in the leachate was approximately 0.30 mg/l, and the cadmium concentration in the leachate was less than 0.030 mg/l.

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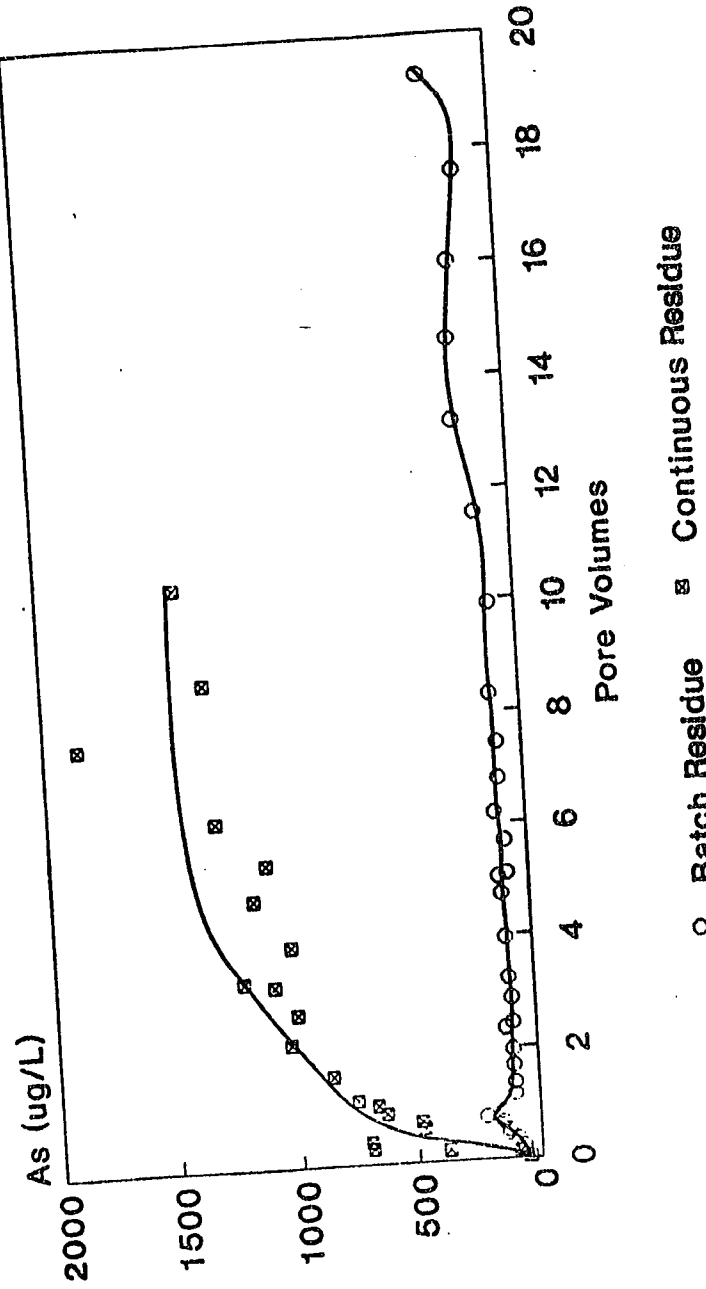
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The ambient acid leach process involves sulfuric acid leaching of flue dust at ambient temperature and pressure conditions, solid/liquid separation, filter cake washing, copper solvent extraction (SX) of the filtrate, recovery of the extracted copper through electrowinning, and treatment/recycle of the raffinate (barren solution) from SX.

FIGURE 1

Autoclave Residue : Batch and Continuous Comparison
Leach Test Type : Column
Analyte : Arsenic

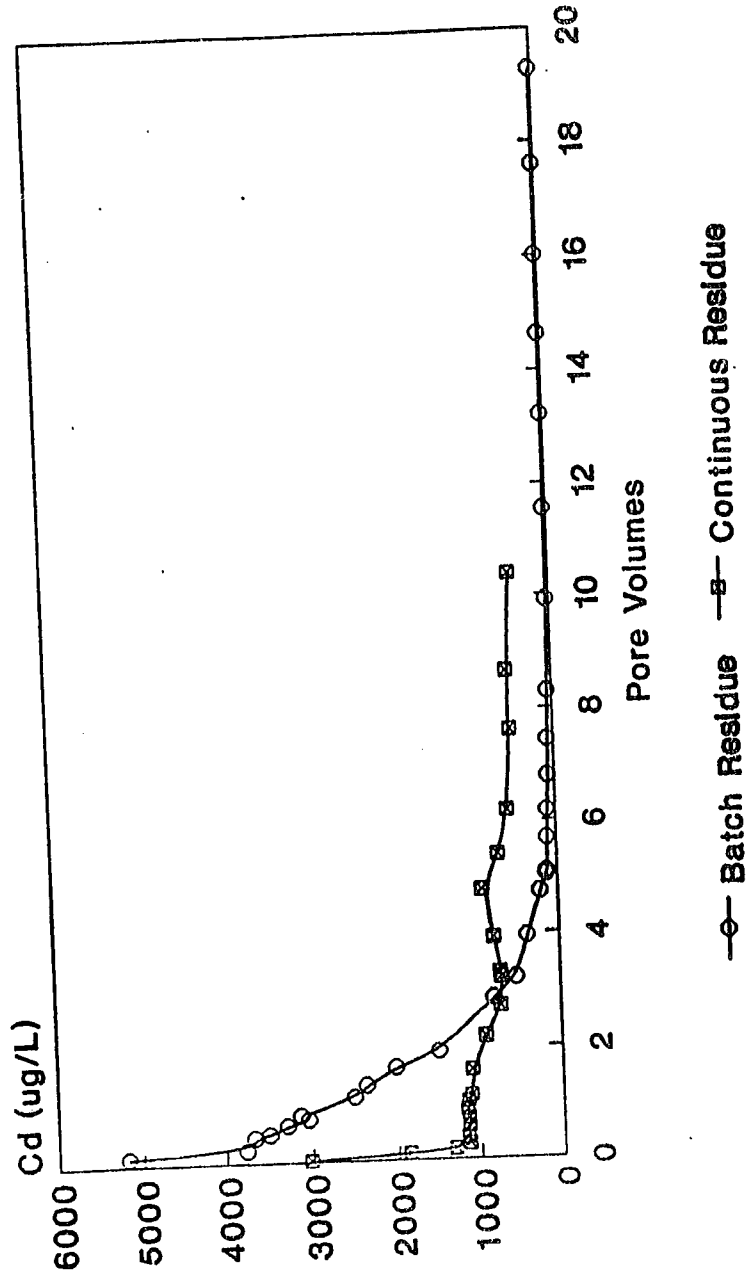


Adapted From: Anaconda Smelter Fine Dust
Cashman Process Residue
Long-Term Stability Study,
PTI, 1990

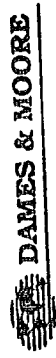


FIGURE 2

Autoclave Residue : Batch and Continuous Comparison
Leach Test Type : Column
Analyte : Cadmium



Adapted From: Anasconda Smelter Fine Dust
Cashman Process Residue
Long-Term Stability Study,
PTI, 1990



A feedstock composed of a weighted composite of the four major flue dust types was processed by Metcon using the above-treatment sequence. The acid leach residue and the raffinate lime precipitate were submitted to MSE for TCLP analyses. Results of the TCLP analyses are given in Table 11. These tests were performed using CLP documentation and protocol, and intended to be used as enforcement quality data. Both the leach residue and lime precipitate failed TCLP criteria for cadmium, and the leach residue failed for lead.

Since both solid residuals from the ambient acid leach process failed TCLP toxicity criteria, they were composited and stabilized/ fixed with PC, HL, and water. Twenty five percent of PC and HL were added to produce the stabilized/ fixed material. Results of TCLP testing on this treated residue composite are given in Table 12. These tests were performed using CLP documentation and protocol, and are intended to be used for enforcement quality data. The treated material passed TCLP toxicity criteria with the following results:

- 62 to 99 percent leachate concentration reductions were observed for arsenic, 99.9+ percent reductions for cadmium and 90 to 99+ percent reductions for lead.

Results of the Multiple Extraction Procedure (MEP) showed the following:

- 56 to 99 percent leachate concentration reductions were observed for arsenic, 99.9+ percent reductions for cadmium and 97 to 99+ percent reductions for lead over the life of the test.

Results of the American Nuclear Society Leach Test (ANS-16.1) gave the following:

- 95.6 to 99.9+ percent leachate concentration reductions of the EP TOX criteria metals were observed over the 90-day test life.

In addition, a 28 day UCS test on the stabilized/ fixed leach residue/ lime precipitate composite showed a measurement of 143 psi, meeting the EPA guideline of 50 psi.

Of the seven unit operations tested on Smelter Hill flue dust materials, only the ambient acid leach, copper recovery using solvent extraction/ electrowinning, and lime precipitation of the solvent extraction raffinate steps appeared to be effective. Ambient water leach, flotation, roasting, and zinc solvent extraction operations were not effective in separating and recovering specific metals from all flue dust materials.

TABLE 11
Enforcement Quality TCLP Results
Untreated Acid Leach Residue and Lime Precipitate
QC Report No. COMB-0-0

TCLP Toxicity (mg/l)

Analyte	CLP Sample LR-0-0	CLP Sample PPT-0-0	TCLP Criteria
Arsenic	0.46	2.68	5.0
Barium	0.010 UB128	0.003 U	100.0
Cadmium	6.06	2.05	1.0
Chromium	0.006 U	0.006 U	5.0
Lead	19.1	0.040 U	5.0
Mercury	0.0002 U	0.0008	0.2
Selenium	0.080	0.11	1.0
Silver	0.005 UJS34	0.005 UJS34	5.0

TABLE 12
Enforcement Quality TCLP Results
Stabilized/Fixed Acid Residue and Lime Precipitate
QC Report No. MET-25-25-1

TCLP Toxicity (mg/l)

Analyte	CLP Sample MET-25-25-1	CLP Sample MET-25-25-2	TCLP Criteria
Arsenic	0.42	0.44	5.0
Barium	0.62 JE12	0.60 JE12	100.0
Cadmium	0.005 U	0.005 U	1.0
Chromium	0.036 UB10	0.013 UB10	5.0
Lead	0.16 UB91	0.11 UB91	5.0
Mercury	0.0002 U	0.0002 U	0.2
Selenium	0.12 U	0.12 U	1.0
Silver	0.01 UJS59	0.01 UJS59	5.0

RECORD OF DECISION

PART III: THE RESPONSIVENESS SUMMARY

**ANACONDA CO. SMELTER NPL SITE
FLUE DUST OPERABLE UNIT
ANACONDA, DEER LODGE COUNTY, MONTANA**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 1991

RECORD OF DECISION

PART III: RESPONSIVENESS SUMMARY

EPA prepared this responsiveness Summary to document and respond to issues and comments raised by the public regarding the Remedial Investigation/Feasibility Study (RI/FS) and the Proposed Plan for the Flue Dust Operable Unit of the Anaconda Smelter NPL site. During the public comment period, from June 5, 1991 to July 31, 1991, many comments were received. These comments, and responses to them, are outlined in this responsiveness summary.

A responsiveness summary is required by CERCLA to provide EPA, the state and the public with a summary of concerns about the site, and responses to those concerns. EPA and the State must consider such public input before making a final decision on a cleanup remedy, which is then documented in the Record of Decision.

1.0 OVERVIEW

In 1884, processing of copper ore from mines in Butte commenced in the Anaconda, Montana area. Since that date, ore and concentrates have been processed using a variety of techniques at the Old Works, Washoe Smelter and Arbiter Plant. The smelting and concentrating operations at the Washoe Smelter on Smelter Hill began in 1902.

Smelting operations ceased at the site in 1980. The flue dust was removed from the small, subsidiary flues, baghouses, and precipitators and deposited at five locations on Smelter Hill. Construction and placement of some flue dust in the Flue Dust Storage (FDS) Facility commenced in May 1983. The FDS flue dust and scattered dust piles on Smelter Hill, along with flue dust deposited in the 1970's from the Arbiter plant, make up most of the flue dust material. Total volume of flue dust is estimated at 316,500 cubic yards.

The site was added to EPA's National Priorities list of hazardous waste sites in 1983. The site is divided into the following operable units: Flue Dust, Old Works/Arbiter, Smelter Hill, Regional Surface and Groundwater/Tailings, Mill Creek, Regional Soils and Community Soils. Since flue dust is a principal threat waste and source material, the Flue Dust Operable Unit is considered a priority unit. In September 1988, ARCO entered into an agreement with EPA and MDHES to evaluate cleanup alternatives for the flue dust.

The Flue Dust RI/FS evaluated six alternatives for dealing with the human health and environmental problems caused by flue dust. These alternatives are:

1. No Action
2. Disposal of untreated flue dust in an onsite repository.
3. Offsite disposal of untreated flue dust.
4. Onsite stabilization/fixation, disposal in an onsite engineered repository.
5. Onsite metal removal/chemical fixation, disposal in an engineered onsite repository.
6. Onsite metal removal, stabilization, disposal in an engineered onsite repository.

The Preferred Alternative (#4), as outlined in the Proposed Plan, is onsite stabilization/fixation with disposal in an onsite engineered repository. Alternative 4 would stabilize flue dust at each of the nine pile locations with a mobile crusher and cement batch plant. Flue dust would be stabilized to meet RCRA regulatory limits. Processed material would then be transported to an onsite repository for disposal using standard cement trucks. Design requirements for the repository would meet all Montana Solid Waste Management Act and RCRA Subtitle D provisions and some relevant and appropriate MHW and RCRA Subtitle C provisions. At a minimum, the repository would include a liner, leak detection and collection system, groundwater monitoring wells upgradient and downgradient from the repository, and a cap. Long-term maintenance and monitoring and institutional controls limiting site access and use would be required.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT

Community involvement in Anaconda Smelter site activities began early at the site, with the development of the community relations plan in 1984 and meeting with interested community groups. The Anaconda Smelter site has drawn much community interest in the past. Community interest was very intense in 1986-1987 when site contamination required the relocation of the entire community at Mill Creek (37 residents). Public meetings and citizen committee gatherings often became highly emotional encounters between concerned residents and public officials. Media coverage was extensive including coverage by state and national newspapers and local and state television stations.

State legislators and Congressional staff members have recently taken great interest in site activities throughout the Clark Fork basin with the focus on expediting cleanups. Their efforts brought Administrator William Reilly to Anaconda in 1990.

From the beginning of the RI/FS process for the Smelter site, EPA and MDHES have conducted community relation activities and sought the involvement of potentially responsible parties (PRP). These activities have included correspondence with PRPs and members of the public, preparation of press releases and fact sheets, and periodic meetings with elected officials and the community to discuss the Superfund process and the status of site activities. EPA has also contracted an Anaconda community relations liaison to assist the community with information requests. The community of Anaconda is also represented on the Clark Fork Coordinating Forum, an advisory committee for Superfund activities in the Clark Fork Basin.

During the course of the Flue Dust RI/FS (September 1988 - June 1991), EPA held several public meetings and solicited comments on the RI/FS Work Plan, Sampling and Analysis Plan, data reports and the risk assessment. EPA and state officials met regularly with the Anaconda-Deer Lodge Reclamation Advocates as well as with community public officials.

To further fulfill the requirements of CERCLA Section 113(k)(2)(b)(i-v) and Section 117, the Administrative Record file was established at EPA's Helena, Montana office. In addition, important site documents are also kept at the Hearst Free Library in Anaconda.

The RI/FS and Proposed Plan were issued on June 3, 1991 with announcements in the Anaconda Leader and Montana Standard. Copies of the Proposed Plan were also mailed to several hundred people on the Anaconda mailing list. Because of initial requests, the RI/FS and Proposed Plan were available for a 60 day public comment period rather than 30 days. Two public meetings were held in Anaconda at the Copper Village Art Center; 1) an informational meeting, on June 19, 1991, was attended by approximately 40 people; 2) a public hearing, on July 23, 1991, was attended by approximately 45 people. A transcript of the public meeting is included in Administrative Record.

Eleven oral comments were received at the public hearing and 22 written comments were submitted to EPA. The majority of comments from the local community were in support of the selected remedy with most wanting an expedient cleanup of the flue dust. Responses to comments received during the public comment period are included in this responsiveness summary, which is part of this Record of Decision.

The Record of Decision presents the selected remedial action for the Flue Dust Operable Unit of the Anaconda Smelter Site, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. This decision is based on the administrative record.

3.0 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD FROM THE GENERAL PUBLIC, ARTECH AND ARCO

From June 5 to July 31, 1991, EPA and MDHES received public comments on the RI/FS Report and the Proposed Plan. All written comments received from the public, including ARTECH and ARCO's written comments, will be summarized in this section (Parts A, B and C). On July 23, 1991, a formal public meeting was held to describe the preferred alternative to the public. About 45 people attended the formal meeting and 11 of those chose to present their comments and concerns orally. This section also summarizes those verbal comments from the July 23rd meeting and responses where appropriate.

PART A: GENERAL PUBLIC COMMENTS/RESPONSES

A-1 General Public Written Comments

All but three of the 22 comments received by mail were from residents of Anaconda. All of the local residents wrote in support of the preferred alternative for various reasons which are outlined below. Many of the comments were survey forms from an independent advertisement placed in the Anaconda Leader during the public comment period. The advertisement suggested that Alternative 4 be supported as the selected remedy.

<u>Name of Commenter</u>	<u>Reason for support of Alt.#4</u>
1. Mrs. Nicki Leiss	Most expedient alternative
2. Mr. Charles Haeffner	Most expedient and safe alternative
3. J. Vauthier	Checked YES in newspaper ad
4. "Hearthstone"	Checked YES in newspaper ad
5. Mabel Tuchscherer	Checked YES in newspaper ad
6. Clawsons	Checked YES in newspaper ad
7. Dick Hafer	Quickest remedy resulting in less worker exposure and less health risk
8. F.R. Bennett, Co-Chairman of Anaconda-Deer Lodge Reclamation Advocates	Protective of human health and the environment; in compliance with ARARs; provides for a long-term, effective and permanent remedy; reduces handling and transport of flue dust

- | | |
|---|---|
| 9. Oswald G. Eide | Best alternative |
| 10. Don Clark | Uses a proven technology,
quick |
| 11. Robert M. Meredith | Most economical and
practical alternative; help
cleanup Anaconda |
| 12. John M. Stephens | Fastest and most feasible
and permanent |
| 13. Barbara A. Cook | Fastest, most permanent |
| 14. Edward D. Eck | Safest, best long term
approach |
| 15. Floyd H. Capps | Effective long-term approach |
| 16. William P. Finnegan | Most cost effective, timely
and permanent solution |
| 17. Shirley Mason | Long-term protection of
human health and the
environment, best balance of
nine criteria |
| 18. Don R. Stoecher
(Clark Fork Coalition) | Best Option |
| 19. Bob Vine | Best Option |
| <u>Other Three (Non-local) Commenters:</u> | |
| 20. Lafarge Corporation
Missoula, Montana | Wrote suggestions for
repository construction |
| 21. David F. Hume
Oakland, California | Wanted a copy of Dr. Robins
(EPA consultant) reports and
wanted to know who would be
responsible for groundwater
cleanup: also requested
another sixty day comment
period |
| 22. EM Tech Services, Inc
Pasadena, Texas | Vender with solidification
suggestions |

Response: EPA responded to Mr. Hume by providing copies of the requested reports. EPA also indicated that the public comment period had already been extended and that additional extensions were not necessary. No other responses are necessary.

A-2 Oral Comments/Responses from July 23, 1991 Public Meeting

Eleven people gave verbal comments at the July 23 meeting. Most commenters were in favor of alternative 4. Their comments are summarized below:

Comment: Mel Stokke, Anaconda resident and ex-smelter employee, stated that "We've had a great amount of experience with the treatment of dust." He stated that after years of research they never did come up with a process for treatment of flue dust. He said he thought that metals recovery is prudent. He favors stabilization because of the lower percentage of metals in the dust and that the economics for metals recovery are not there. He also gave suggestions on the placement of the treated materials in the repository.

Response: No response necessary.

Comment: Mr. Huestis, Anaconda resident, questioned the acid in the flue dust and its effects on concrete.

Response: The treated flue dust will have a pH of about 12 after treatment. Most of the sulfurous/sulfuric acid will have been converted to gypsum.

Comment: Mr. Patashnik, Artech, stated that ARCO has helped Artech out a lot in doing the pilot test work and stability tests for the Cashman Process. He expressed that ARCO wanted to obtain a licence for the Cashman process last year. He announced that there is "a lot of the documents that are behind the RI/FS that most people don't see." He remarked that Dr. Bob Robbins, a world-known expert on arsenic stability, was opposed to the building of a Cashman plant for many different reasons. Mr. Patashnik expressed that he thinks that flue dust should be processed, hydrometallurgical would be most appropriate. "Some value should be recovered but not necessarily arsenic. Residues from the treatment process should not be assessed by the conventional EP toxicity or TCLP procedures." He advocates a slow release of arsenic from a suitable residual material. He conveyed that Dr. Robbins has looked at calcium arsenic type wastes and said that those are not stable, that is "its only going to create future problems."

Dr. Twidwell, from Montana Tech, has been consulted by the State of Montana. Mr. Patashnik quoted Dr. Twidwell as saying, "There is presently general agreement within the mining industry that calcium arsenic waste is not a proper means for disposing of arsenic." Mr. Patashnik then related that he has not seen any consultant from the EPA in which they have received the advice that this is a suitable form of disposing of arsenic.

Mr. Patashnik declared at this point of the hearing that "there is admission that this repository could fail, earthquakes or other catastrophic events." He then asserted his concern of releases of contaminants in the future by stating "I don't think anyone wants to go back and dig up solidified flue dust and then have to figure out how to treat that."

Mr. Patashnik went on to state that EPA's Waste Treatment Branch, out of Washington, D.C., has decided that ferric arsenic wastes are significantly more stable than calcium arsenic. "They have also made the decision that the preferred method of dealing with waste waters that contain arsenic is to precipitate the arsenic out as ferric arsenic."

Mr. Patashnik maintained that he would like to "see sound, scientific evidence that shows that this method is going to be long-term stable and I would like to see an expert that the EPA has consulted with that's offered that kind of opinion." He stated he believes metal extraction is the best way to go, although it's a complex problem. He concluded by saying that there are still a lot of unanswered questions about solidification and that he feels there is a lot of test information that the public should have.

Response: Comments which were also submitted in writing are responded to in Part B. Additional responses are noted below.

Mr. Patashnik expresses concerns about repository failure due to catastrophic events. In the spring of 1990, ARCO, with the assistance of EPA and MDHES, conducted an extensive study on the suitability evaluation for the Anaconda NPL Repository Siting. The efforts include suitability rating and ranking of 24 alternative locations for a repository site. A panel of 12 experts (engineers, hydrogeologists, social scientists and biologists) from throughout the country evaluated the potential areas for a repository from the following criteria: Geology, Topography, Surface Water, Groundwater, Social and Life Sciences. As a result of the work performed on the Anaconda Smelter NPL Site Repository Siting Study, the east side of Smelter Hill was identified as a suitable site for a repository because of the depth to groundwater, low transportation impacts and good ratings on institutional controls. The siting was intended to identify areas that would not be susceptible to catastrophic events.

Mr. Patashnik states that the preferred method of dealing with waste waters that contain arsenic is to precipitate the arsenic out as ferric arsenic. It should also be noted that comments made by Drs. Robins and Twidwell were in reference to arsenic wastes in aquatic, alkaline conditions and do not necessarily represent conditions found in flue dust. Treated flue dust for the most part would not form a pure calcium arsenate. Tests have indicated that the stabilized material will

be stable even in an environment that is subject to acid leaching conditions. Placement of treated materials in a repository should provide a dry stable environment.

Comment: Mr. Malee, a Deer Lodge County resident, wanted to go on record "as fully supporting the EPA-recommended alternative of solidification by concrete encasement of all flue dust within the operable unit. In my opinion, this appears to meet all Superfund criteria for public health and safety, environmental containment and economics." He continues by stating the citizens of Deer Lodge County do not need a test for unproven technologies. He feels that short-term jobs, that would result in metal recovery, would do little for developing a solid economic base for the Anaconda area. He asserted that "a person would be working with deadly levels of contamination."

He also said that "individuals representing EPA, ARCO, and Department of Health and Environmental Sciences should give the citizens of Deer Lodge County a larger role than they currently have." He asked that they be allowed to "have some control over our own backyards."

Response: No response necessary.

Comment: Mr. Snow, Anaconda resident, expressed preference for off-site disposal alternative for flue dust so it wouldn't "spread downstream."

Response: Treatment and containment of flue dust on site will reduce the risk of release of flue dust to the community of Anaconda as well as not increasing risk to other communities in transporting the flue dust out-of-state.

Comment: Mr. Kunter, Artech, stated that Dr. Robbins asked him to summarize a couple of his comments regarding Alternative 4. The first comment involved the use of the cement lime method for immobilizing the Anaconda flue dust, "I do not think it is appropriate for two reasons: firstly, that the final material would certainly not be water stable and at least copper in the short-term and others in the long-term." Mr. Kunter continued by stating Dr. Robbins feels that "some of the values, particularly copper, should be recovered. He's not particularly necessarily in favor of Artech's system, which he believes is a little too complex, but believes in simple leaching system."

Response: Metals recovery was evaluated during the RI/FS. Simple leaching technologies were given considerable consideration. Because any of the treatment technologies will release some contaminants through leaching, the treated residue material will be placed in an engineered repository. Treatability tests indicated contaminants would leach at very low controlled rates.

Comment: Ms. Tuchsherer, Anaconda resident, "fully agrees with the EPA and ARCO method to remove flue dust." Ms. Tuchscherer feels that alternative 4 is the safest for the health of workers and the community. She continues by stating "because of our dry climate, it is entirely possible that the combination will not break down." Ms. Tuchsherer is a retired physician and discussed the cancer risks in Montana and expressed her view that health risk due to arsenic is overstated.

Response: No response necessary.

Comment: Mr. Bedel, Artech, focused on the long-term stability test performed for Alternative 4 in the RI/FS. He expressed concern about errors in the ANS 16.1 tests performed and concern about the leachability of arsenic in a flooded condition. Mr. Bedel said, "The mistakes that were made in the performing of these tests, I firmly believe, are honest laboratory mistakes. The mistake the EPA has made is in not analyzing, not doing this test." He concludes by stating "why go to the added expense of going through solidification, it doesn't help arsenic."

Response: Response to ANS 16.1 concerns are responded to in Part B. Stabilization reduces the mobility of arsenic by 62% - 99% and renders the material non-hazardous by RCRA definition.

Comment: Ms. Leiss, Anaconda resident, stated her support Alternative 4.

Response: No response necessary.

Comment: Ms. Stash, ARCO, stated that ARCO has "spent roughly \$4 to \$5 million on a very exhaustive look at this problem. The work that was done, I feel, was flawless. Anaconda (company) and then ARCO looked very hard for a solution that would include extraction of metal from this material." She stated that 14 hydrometallurgical and 6 pyrometallurgical processes were looked at in the remedial investigation and only the Cashman process and an acid leach process survived the screening. She explained that a Hazard and Operating Study, required by OSHA, "found over 700 safety-related accident scenarios that could occur in over 100 design modifications that would need to be made to the Cashman Process."

Ms. Stash concluded by stating that "We feel very strongly that it (stabilization) is the best option. The comparative analysis clearly shows it to be the best alternative. It's safe, simple, quick, and permanent. We are ready and willing to proceed with this alternative immediately."

Response: No response necessary.

Comment: Ms. Snow, Anaconda resident, asked Sandy Stash what is the cost of removing the flue dust to another location. Ms. Stash answered "I believe it was \$60 to \$70 million."

Response: The estimated cost of Alternative 3, off-site disposal, is \$71,933,000.

PART B: ARTECH COMMENTS/RESPONSES

The following section provides responses to the comments provided by Artech, a company with interest in the Cashman process. Artech worked closely with ARCO to further develop the Cashman process for use on the Anaconda flue dust. ARCO conducted bench-scale testing in Skykomish, Washington, in cooperation with Artech and with EPA oversight. Additional pilot-scale studies were conducted by ARCO in Colorado to provide information for the evaluation of the process in the Flue Dust RI/FS. Extensive work was performed evaluating this technology. In addition to the treatability testing conducted by ARCO for the RI/FS, ARCO conducted additional optimization studies to determine the financial feasibility of the process at a full-scale operation. Artech continued to be involved with the process and conducted parallel studies with those of ARCO.

In response to the data results and conclusions formed by ARCO, and approved by EPA, on the process, Artech conducted additional independent studies. Artech generally disagreed with the conclusions documented in the RI/FS and the Proposed Plan and has provided numerous comments during the public comment period. Below is a general summarization of Artech's concerns and comments with a general EPA response. The sections following address the specific Artech comments submitted in eleven documents during the public comment period. The significant comments have been organized by categories.

B-1 General Summarization of Comments/Responses

Comment: Artech generally took issue with the EPA's approach in evaluating the treatability testing information provided by ARCO and EPA's evaluation of alternatives in the feasibility study. Artech questioned the role of the PRP in conducting the studies and EPA's oversight role. Artech also insisted that they should have had a greater role than that of the general public. Artech expressed concern with EPA's general lack of expertise and thoroughness of review of the RI/FS information.

Artech criticized the results of treatability testing that were conducted during the RI/FS, especially the results of testing on the Cashman process which Artech had been involved with for several years. Artech suggested that the additional optimization testing conducted by ARCO for design purposes should

have had greater consideration than those conducted for the purpose of the RI/FS. Artech also identified a number of discrepancies between those tests and tests conducted for the RI/FS. Artech also presented data and information from testing that they conducted after completion of the preliminary draft RI/FS.

Artech claimed that EPA did not objectively review the information provided by them on the Cashman process. Artech requested that such information be considered in the remedy selection process. Artech indicated that if such information were considered, EPA's selection of the preferred remedy would have been the Cashman process. Artech received several EPA consultant reports, through FOIA requests, and noted differing opinions and suggestions for the remedy selection and suggested that they did not support EPA's preferred remedy. Artech requested that the consultants statements be added to the administrative record and that EPA fully respond to their remarks.

Artech generally disagreed with EPA's selection of the preferred remedy citing that stabilization was not an effective treatment for the flue dust materials, especially arsenic contamination. Artech suggested that stabilization of arsenic wastes is not supported by EPA or industry.

Artech indicated that they spent considerable time and money to develop the Cashman process and was concerned that EPA had not presented an accurate (favorable) representation of the process. Artech claimed that the information in the RI/FS and Proposed Plan could be damaging to the marketability of their process in the future. Artech suggested that innovative technologies be given greater consideration in remedy selection. Artech believed that EPA had a responsibility to conduct additional testing on the Cashman process to provide the public a determination or conclusion in respect to the feasibility of the Cashman process to treat flue dust or other metal contaminated wastes.

Response: The Flue Dust RI/FS was conducted as a PRP lead, with EPA and the State of Montana providing oversight. The RI/FS was authorized by an administrative order on consent under sections 104 and 122 of CERCLA. It is EPA's policy to allow the PRP to conduct the RI/FS when the PRP:

- o Is technically qualified or otherwise capable of performing the necessary activities within the time constraints;
- o Agrees to conduct the RI/FS in accordance with the terms and conditions of the administrative order; and

- o Reimburses the Superfund for all EPA and qualified oversight assistant costs associated with oversight of the project.

Under section 104(a)(1) of CERCLA, the agency is responsible for providing oversight of the PRP-conducted RI/FS. In general, EPA is responsible for accomplishing four primary objectives:

- 1) Verifying that the work complies with the administrative order, statements of work, work plans and sampling and analysis plans;
- 2) Verifying that the RI/FS complies with CERCLA, the NCP and relevant agency guidance;
- 3) Verifying that all work is performed according to generally accepted scientific and engineering methods; and
- 4) Verifying that sufficient data of acceptable quality is being collected and analyzed to enable EPA to characterize the site, identify site risks, develop a range of alternatives, select a preferred remedial alternative and write the ROD.

Achievement of these objectives depends, in part, upon the terms of the agreement between EPA and the PRP, guidance and direction provided to the PRP, and effective project review. The level of oversight is determined site-specifically based upon technical considerations and agency expectations related to the quality and timeliness of PRP field work, laboratory analysis and deliverables.

Under section 104(a)(1) of CERCLA, EPA generally procures the services of a qualified person to assist the agency in overseeing PRP conducted activities. The oversight assistants role is to provide assistance to EPA in overseeing PRP-conducted RI/FS activities. Procurement is typically obtained through the Alternative Remedial Contracts Strategy (ARCS) contracts. EPA may also seek assistance from other federal and state agencies.

The oversight assistants have limited authority. It is not the role of oversight assistants to direct or control any aspect of the RI/FS. It is EPA's responsibility to control the amount of direct communication between the agency, oversight assistants and the PRP's. This communication is generally recorded in the administrative record.

EPA and the State were assisted by several consultants for the Flue Dust RI/FS. EPA's ARCS contractor for the Anaconda site was Fluor Daniel, Inc. (FDI). Because of the nature of the RI/FS, additional consultants with expertise in the metallurgical

field were also sought. Drs. Bob Robins and Larry Twidwell were contracted through MDHES through the Montana College of Mineral Science and Technology. Dr. Robins has extensive metallurgical knowledge and is considered a leading arsenic expert. Dr. Twidwell has had considerable experience (metallurgical and stabilization) with flue dust from Anaconda. FDI provided knowledgeable personnel on a number of issues including metallurgical processes. The US Bureau of Mines in Reno, NV were also consulted. EPA also relied on the services of the Regional office and the Office of Research and Development in Cincinnati OH.

EPA, in consultation with the State, and assisted by contract support, thoroughly reviewed all documents required of ARCO by the Administrative Order on Consent. EPA's comments to the ARCO deliverables are contained in the Administrative Record. Additional information provided by the public, including Artech, was also reviewed and included in the administrative record.

EPA and MDHES consultants often provided additional opinions or information which were not necessarily in response to the deliverables reviewed and were intended only for internal communication with EPA. EPA met frequently with the consultants to discuss the progress of the project. Both oral and written comments, opinions and other information from consultants were reviewed by EPA. Relevant comments were incorporated into the EPA's response to ARCO deliverables and were included in the administrative record.

The PRP's were encouraged to identify the need for treatability studies early in the process. Treatability studies are designed to provide information that EPA uses in the detailed analysis of alternatives to the maximum extent practicable. Several studies were identified and initiated on a number of technologies including the Cashman process. The decision on the type and extent of the treatability testing depended on uncertainties of the treatment and the amount of work that could be deferred to the remedial design (RD) phase.

A treatability testing work plan was developed and agreed to by EPA, MDHES and ARCO. The work plan identified the data necessary to evaluate the effectiveness and implementability of the various technologies. The data required primarily focused on the residue products or waste streams to be produced by the different technologies. The testing was done to screen technologies and to provide sufficient data to evaluate remaining technologies in the detailed analysis of alternatives.

Data provided for the evaluation of technologies are of two basic types (screening quality and enforcement quality). Enforcement quality data, that is data that are authentic (proven to be collected and analyzed as per the established protocols and

procedures, i.e defensible in court) and accurate (reliably represents concentrations of hazardous substances, etc.) is used as the basis for agency decisions. Screening quality data are used to assist in characterizing the site or the performance of technologies. Screening quality data are not intended to be used to directly base decisions upon. Some data not meeting required quality assurance/control criteria may be rejected all together. To ensure that data were of enforcement quality, the data underwent data validation. This was performed by ARCO. EPA then reviewed the data validation and indicated whether the data were acceptable for the intended use. Some data not meeting the enforcement quality criteria were justified by ARCO for enforcement use, as provided by rationale, and were approved by EPA.

ARCO provided the required data in the treatability testing reports for the various technologies. This data underwent data validation review and were deemed usable by EPA for its intended uses. In addition, ARCO also conducted tests on the Cashman process to determine the financial feasibility of the process at full-scale operation. These data were not required by the order or work plan and the data were not intended to be of enforcement quality. The data, however, were provided to EPA upon request and included in the administrative record. Because the data were not of enforcement quality, it was not intended to be used to base remedy selection decisions upon. The information, however, did supplement the enforcement data in the RI/FS.

Information was also provided by Artech on the Cashman process. These data were collected to refute the results of the treatability testing. These data were not collected following the protocols or procedures established for this project and were not considered to be of enforcement quality. It is not known whether these data would even be acceptable as screening quality data since they did not undergo data validation. This information was, however, reviewed, considered and used to supplement enforcement data in the RI/FS.

The results of the treatability testing were presented in the RI/FS, however, only the enforcement quality data were used to evaluate the alternatives against the nine criteria. The RI/FS and Proposed Plan provided the results of the evaluation and conclusions based upon the enforcement data. It should be noted that the Draft RI/FS was revised in a number of areas after review of the Artech information. Mainly, this resulted in the addition of two subalternatives under Alternative 5. The two subalternatives took into consideration the data results provided by Artech on the Cashman testing.

It should be noted that the RI/FS process does not select a specific stabilization process but rather stabilization. Although treatability studies were conducted on representative

processes the specific process will be determined in the Remedial Design phase after additional testing is done. The intent of the treatability testing is to provide sufficient information to evaluate the alternatives against the nine criteria. In many cases, although the results of the tests were not conclusive, there was sufficient information to evaluate the alternatives. EPA determined that additional testing was not required of the Cashman process in order to evaluate the technology type against the criteria.

For the flue dust RI/FS, there were basically two primary technology types (i.e. stabilization and metals removal) under consideration. Alternatives 4, 5 and 6 each involved various stabilization and/or metals removal technologies. Because of the different metals removal technologies, Alternatives 5 and 6 were evaluated separately. In comparing the alternatives with metals removal components (Alternatives 5 and 6) to the nine criteria, EPA found that Alternative 6 would provide a better balance of tradeoffs. The uncertainties in implementation (including the ability of the process to produce a product meeting regulatory limits) and cost favored Alternative 6 over 5. EPA consultants also concurred with this evaluation. The consultants indicated that metals recovery in the simplest approach would be preferred over that of the Cashman process. They noted that the Cashman process was too complex and costly. They suggested that simple leaching of flue dust would be the most cost effective method of removing the saleable metals.

EPA and the State went through an extensive deliberation process to arrive at the decision to select Alternative 4 as the preferred remedy. EPA and the State were aware of the additional benefits that metals recovery would add to the remedy. EPA had considered Alternative 6 to be an attractive remedy and made attempts to support Alternative 6 as the preferred remedy. But after a thorough analysis of the alternatives against the nine criteria, it was evident to both EPA and the State that Alternative 4 would provide the best balance of trade-offs among the criteria.

EPA consultants also acknowledged the trade-offs and indicated that stabilization and containment of flue dust would be a protective remedy. The EPA consultants were not critical of the selection of stabilization, but indicated their preference was to recover saleable metals from flue dust and suggested that additional testing be done. To develop an effective metal recovery process would however, take several years.

Several stabilization technologies were shown to be effective in reducing the mobility of contaminants in flue dust to regulatory limits. Stabilization is recognized as a proven technology for most inorganic compounds and has been selected as the remedy at several Superfund sites. Stabilization has been

identified as a best demonstrated available technology (BDAT) for addressing inorganic contaminants. In addition to the stabilization of flue dust, the remedy calls for placing the residue materials in an engineered repository. This remedy has been determined to be protective of human health and the environment, meets all regulatory standards, will provide for a long-term and cost effective remedy and will be consistent with the overall cleanup strategy for the site.

EPA believes that stabilization will be long-term effective. Leach studies performed by ARCO indicate that the contaminants of concern will not leach easily and that they will meet regulatory limits over the long term. Uncertainties are addressed with the disposal of treated residues in an engineered repository.

Concerns over long-term testing procedures have been evaluated and EPA believes the data provided by ARCO is usable for enforcement purposes. EPA does not have a standard test for determining the long-term stability of fixed residues and TCLP is commonly used as a remediation goal.

In summary, ARCO performed the RI/FS activities as required in the Administrative Order and work plans in an adequate manner and provided EPA and the State sufficient information to evaluate alternatives and select the preferred remedy. EPA believes that an extensive amount of information was available in order to make these decisions. EPA and the State provided adequate oversight of the RI/FS process including the treatability testing with the services of highly qualified people. The data evaluated was valid and deemed usable for making enforcement decisions. Additional information produced by ARCO and Artech was fully considered within its intended use.

It was not the intent of this RI/FS to bring to conclusion a determination of whether the Cashman process worked on flue dust or not. The testing did, however, provide sufficient information to evaluate the alternative against the nine criteria, compare alternatives and select the preferred alternative. EPA recognizes the effort made by Artech and believes that the Cashman process may be appropriate for treating wastes in a different situation.

B-2 Specific Comments

B-2.1 General

Comment: Artech expressed concern that the RI/FS process was delayed by more than one year and that ARCO was granted numerous extensions without being penalized by EPA. Artech stated that these delays caused the taxpayers and Artech additional expense and that the Anaconda citizens were needlessly exposed to recognized health risks.

Response: Completion of the RI/FS did take longer than expected. One reason was the extensive treatability testing done to evaluate the many technologies under consideration. All extensions to the schedule were approved by EPA or were the result of EPA-controlled deliverables. ARCO did not violate the intent of the Order. Continued spraying of the flue dust piles minimized the release of contaminants during the conduct of the RI/FS.

Comment: Artech suggested that completing the ROD by September 1991 was more important than a thorough review of the data and analyses presented.

Response: Based on the schedule, EPA anticipated a ROD completion by September 1991. EPA and Congress considers projected ROD dates to be very important and strives to meet them. All information collected during the RI/FS and additional information received during the public comment period has been thoroughly reviewed by EPA. EPA is confident that all information has been adequately reviewed and that the selection of the remedy is supportable.

Comment: Artech expressed concern that ARCO addressed a number of technical questions during the informational meeting, and questioned why EPA did not have its contractors at the meeting.

Response: EPA conducted both the informational and public hearing meetings. EPA responded to most questions, but did defer some technical questions to ARCO, who conducted the work in question. EPA contractors were not requested to attend.

Comment: Artech expressed concern that innovative technologies were given less consideration, during the evaluation of alternatives, because they were innovative technologies (i.e. not proven technologies).

Response: EPA gave innovative technologies more consideration during the evaluation of criteria rather than less. Innovative technologies were carried through to the detailed analysis for several alternatives. The preferred alternative, although using a more proven technology, is considered innovative for flue dust. Innovative technologies were neither given special preference nor penalized during the evaluation of alternatives.

Comment: Artech expressed concern that the Cashman process was unfairly evaluated because it was innovative, not a commercial process, would take too long, be too complex, that long-term effectiveness was not considered and that cost would be the major factor. In short, Artech suggested that the remedy selection was influenced more by cost and speed of implementation than by long-term environmental effectiveness.

Response: All alternatives were evaluated equally against the nine criteria. The nine criteria are classified as either threshold, balancing or modifying criteria and as such have different importance. Of the balancing criteria (long-term effectiveness and permanence, short-term effectiveness, reduction of toxicity, mobility or volume through treatment, implementability and cost) they generally were given equal weighting. The factors noted by Artech are in fact considered as required under the balancing criteria.

Comment: Artech suggested that the Cashman process would need to be commercial before it would be selected. Artech also suggested that the only way the Cashman process would have been selected would be if it provided enough profit to ARCO to want to use it.

Response: Alternative 4, the preferred alternative, is not a commercial process. Cost was not the sole criteria used to select the preferred remedy, but rather all nine criteria. See above response.

B-2.2 Cashman Process Residue Toxicity

Comment: Artech stated that EPA required the EP Toxicity testing during the time continuous pilot testing was being run. Subsequently, the leachability criterion was changed to the TCLP procedure. Artech argues that had they known that the TCLP procedure would be required, they would have designed the process flowsheet accordingly. In support of this argument, Artech prepared a report entitled "Report on TCLP Tests for Lead on Smelter Flue Dust Residues from Anaconda Montana and Other Residues Produced Using the Cashman Process", dated March 13, 1991. Artech also suggested that the data provided to EPA, be included in the administrative record and, although not verified by the Contract Laboratory Program, be considered good data.

Response: The decision to collect TCLP data was necessitated by changes in the RCRA regulations. ARCO, aware of the changes, agreed to collect the TCLP data. Additional data received by Artech was reviewed and included in the administrative record. This data was not validated and did not have an intended use in the RI/FS. However, the data was reviewed and noted in the RI/FS (see general response).

In this study, Artech asserted that the Cashman Process residue failed the TCLP procedure because (1) the acidulated reactor feed slurry was held in a storage tank prior to introduction into the autoclave, thereby enabling formation of unstable ferrous lead compounds, and (2) the chloride concentration of the brine was too low, thereby minimizing the amount of lead chloride reporting to the residue.

The graphs taken from the Artech report were offered in support of the first argument. Artech concluded that, if the acidulated slurry is fed immediately to the autoclave, the residue will pass the TCLP criterion of 5 PPM for lead, whereas delays of 24 and 48 hours result in failure. Artech's data interpretation is flawed in several respects:

(1) Trend lines based on only three scattered data points are questionable.

(2) On the graph for 497 lb. H_2SO_4 , the lowest lead concentration occurred after a 24-hour delay, not after immediate introduction into the autoclave.

(3) On the graph for 452 lb. H_2SO_4 , the passing residue nearly failed the TCLP test and failing residues exceeded the threshold by as much as 2 PPM.

(4) The results are based on batch residues, rather than those produced during continuous pilot testing using recycled solutions and reflecting the short-circuiting which influences continuous reactor performance.

It is important to bear in mind that batch tests set a standard which reflects ideal conditions; continuous testing is done to simulate the upsets, control variability, and short-circuiting which are encountered in full-scale operation. The pilot plant program accurately reflected some of these limitations. Continuous leaching results are rarely superior to batch results run under the same conditions and for the same retention time.

B-2.3 Supplemental Treatability Testing

Comment: Artech expressed concern with uncertainties regarding the long-term effectiveness of the cement-based fixation/stabilization (CFS) treatment of the Anaconda flue dust which are provided below. Artech expressed concern that EPA did not engage any expert on cement based solidification to review and comment on the Supplemental Treatability Testing Report prepared by MSE, Inc. for ARCO. Artech provided the following six exhibits supporting their arguments:

Exhibit A Internal Artech Memo describing deviations from ANS 16.1 test prescribed procedures.

Exhibit B Calculation of long-term stability of solidified flue dust based on ANS 16.1 tests.

Exhibit C Graph on MEP tests for theoretical composite flue dust material.

Exhibit D Graph on MEP test for flue dust storage facility flue dust.

Exhibit E Artech mineralogical characterization of untreated flue dust.

Exhibit F Artech letter to EPA on ANS 16.1 test deficiencies.

Response: The supplemental treatability testing report was reviewed and approved by EPA and their consultants and comments are provided in the administrative record.

Comment: Item #1 and Exhibits A and B - Artech expressed concern over the results of the ANS 16.1 long-term testing and claimed the following:

- o There were six deviations from the proper ANS 16.1 test procedures;
- o One of the deviations was so serious as to invalidate the data;
- o The ANS 16.1 test requires specific calculations on which stability conclusions are to be based; and
- o The calculations, even when performed on the unrealistically good results, show that arsenic will leach from some of the solidified flue dust in as little as 11 years.

Response: The ANS 16.1 Procedure was developed as a means for predicting the long-term leachability of radioactive material from solid repositories under adverse exposure conditions. The last step in the procedure prescribes against filtering the leachate, yet failing subsequently to analyze the filter cake.

The reason for this precaution is that there may be both soluble and insoluble radionuclides; the leachate produced from radioactive materials may contain both. The latter, although radioactive, will generally be judged of lesser potential health/safety risk, but must be included to present a quantitative measure of total mobilized radioactivity. Determination of risk requires a distinction between the two.

The ANS 16.1 Procedure applied to nonradioactive heavy metal-bearing material may produce a leachate wherein very fine particulate are suspended. If so, these will be flue dust constituents which have not dissolved, but are simply too small to settle out during the time allowed in the procedure. They should be removed from the leachate and not assayed because they represent heavy metal sources which have not leached. Inclusion

in the total assay would overstate the dissolved heavy metal concentration.

Artech stated that filtering the leachate and not analyzing the filter media seriously biases the test results. This is not true. The ANS 16.1 procedure has been extended to test other materials "...so that it (ANS 16.1) more nearly represents anticipated conditions under which a solidified waste form may be stored, transported, or disposed.: (Chemical Fixation and Solidification of Hazardous Wastes, Chapter 14.)

Other agencies, including the State of Florida, with EPA concurrence, have modified the ANS 16.1 procedure by filtering the leachate and not analyzing the filter media. This is done to more accurately represent the disposal conditions. In Anaconda, the residue will be placed in an engineered repository. Although it is unlikely that significant metal leaching will occur, the physical conditions within the repository would be such that even small particulate matter would not become entrained in the leachate. To analyze the particulate that would be filtered from the leachate would not represent conditions expected in the repository and would not accurately describe the test results.

The ANS 16.1 test is used by the EPA as an indication of stability of a residue by calculating a Leachability Index. Serious deviations from the ANS 16.1 procedures did not occur. MSE, Inc. calculated a Leachability Index for each representative residue. The calculation of a Leachability Index requires that the initial weight of the specimens be determined. The Leachability Index, calculated by Artech, confirms that calculated by MSE, Inc. All of the indices are well above 10, indicating very slow diffusion and stability.

Comment: Item #2 and Exhibits C and D - Artech alleged that the data from the MEP tests performed by MSE, Inc. do not indicate long-term stability.

Response: The MEP test is commonly used by the EPA as a method for determining if hazardous wastes can be delisted. The results obtained by the MEP test are also used by the EPA to determine the maximum leachate concentrations occurring under acidic conditions.

The results from MEP tests performed on flue dust residues show that the leachate does not contain metals in excess of EPA toxicity standards, suggesting stability of the residue.

Artech's Exhibits C and D use either a free hand or "Least Squares" statistical analysis to support their proposal that increasing amounts of metal are leaching from the residues through time. Three problems exist in Artech's evaluation.

1. The MEP test is not designed to predict at what point a leachate might contain a certain amount of metal. The MEP test only determines the metal concentrations in leachate within the time frame of the test. In the case of flue dust residues, the metal concentrations do not exceed toxicity standards.
2. The extrapolation of the MEP results are unjustified as there are too few points. Also the rate of extraction could be dependent on several factors such as depletion of arsenic at the surface/solution interface or changing solution pH brought about by dissolution of cement/lime etc.
3. Artech attempts to force a linear trend on data that should be evaluated by more sophisticated curvilinear methods. The data logically does not fit a straight line.

Comment: Item #3 and Exhibit E - Artech suggested that there are metallurgical deficiencies in the mineralogical examinations.

Response: Mineral identification work conducted subsequent to the MSE, Inc. report show that chemical reactions have taken place during the chemical fixation of the flue dust. The results of this work indicated that minerals are not simple compounds of arsenic but are complex formulas of multiple-metal arsenates. Such minerals, or perhaps pseudo amorphous substances, are likely to be much more stable than the simple metal arsenates. This stability is confirmed by the leaching tests which are accurate indicators of actual metal solubility in the complex metal compounds.

Comment: Item #3, bullets 2 and 3 - Artech questioned the results of physical stability testing in the MSE report in comparison to EPA guidelines.

Response: Parameters such as Unconfined Compressive Strength, Hydraulic Conductivity, and Freeze-Thaw tests are EPA guidelines and are evaluated depending on the circumstances encountered in the field. All of these guidelines will be further evaluated and refined during the Remedial Design phase of the study. However, testing thus far shows no indication that any problems will be encountered in these parameters.

Comment: Item #3, bullet 4 - Artech questioned why optimization testing was not performed for the CFS optimum blend.

Response: Optimization of stabilization/fixation technology will be addressed in the Remedial Design phase. Tests performed thus far do not indicate that problems will be encountered.

Comment: Item #3, bullet 5 - Artech questioned why column leach tests for the CFS blend, which were soil-like, were not required.

Response: The more standard MEP and ANS 16.1 tests were substituted for the column leaching tests. These tests are generally recommended in EPA's Handbook for Stabilization/Solidification of Hazardous Wastes (EPA/540/2-86/001).

Comment: Item #3, bullet 6 - Artech questioned why there were no CFS tests conducted on the Main Flue flue dust which Artech considered the most difficult.

Response: Flue dust from the Main Flue was, in the past, excavated and placed in the FDS Facility. Results from the testing of material in the FDS Facility adequately represent that expected from the Main Flue.

Comment: Item #3, bullet 7 - Artech asked how debris, which they consider highly toxic, will be handled.

Response: Handling of the debris is briefly discussed in the RI/FS which suggests that miscellaneous debris such as metal and wooden scraps would be placed in the repository along with flue dust. Large debris not capable of being crushed may require separation to prevent potential damage to repository liner systems. This will be further evaluated in the Remedial Design phase.

Comment: Item #3, bullet 8 - Artech questioned how the leachate will be addressed.

Response: In the event that a leachate is produced and collected, a variety of standard treatment methods can be employed to resolve this problem. Such issues will be addressed in the Remedial Design phase of the study.

Comment: Item #3, bullet 9 - Artech questioned who will be responsible for the long-term maintenance and monitoring of the repository.

Response: EPA will determine the party responsible for the maintenance, care, and financial responsibility of the repository. However, ARCO is considered the primary potentially responsible party for this operable unit.

B-2.4 Optimization Testing

Comment: Artech expressed concern that EPA had neither received nor reviewed what Artech considered critical data based on detailed test information developed from pilot scale testing on the Cashman Process. Artech noted that this information was developed by Hazen Research, the same firm which developed data used in the RI/FS report. Artech acknowledged that this work was performed as part of an optimization study by ARCO. Artech specifically noted results pertaining to cost provided in the optimization data by Bechtel that showed the Cashman process costing only \$29 million.

Response: The optimization data was performed by ARCO for their own purposes and not required by EPA through the Treatability Study Work Plan. The data were not of enforcement quality nor intended to be used to base decisions upon. However, the data, requested by EPA, was reviewed and made part of the administrative record. EPA's remedy selection decisions were not based on the optimization information, but rather the enforcement data provided to EPA under an administrative order (see general response).

According to ARCO, after it became obvious that the Cashman Process, as tested during the continuous pilot test, was complex and expensive, Hazen Research conducted a brief, bench-top, evaluation of method to improve the Cashman technology. The resulting technology recovered copper metal using a solvent extraction/electrowinning approach. Although this bench-scale test suggested that operating costs could be lowered slightly, and revenue somewhat increased, the exceptionally large capital cost remained unchanged. To test this new approach would require a large additional pilot testing program that might produce a flowsheet that Hazen described as "risky". In light of Hazen's comment on risk, the substantial additional time and cost required for another continuous pilot test, and the continuing exceptionally high capital cost, no further study was warranted.

B-2.5 Phase II Treatability Testing Report

Comment: Artech claimed that numerous errors were made in the Phase II treatability Testing Report on the Cashman Process dated June 29, 1990. Artech previously submitted comments on March 18, 1991 and these are noted below. Artech expressed particular concern with statements about waste streams from the Cashman process and metal product design criteria.

Response: None of the bench or pilot programs that evaluated the Cashman Process tested a flowsheet that did not have a waste stream. According to ARCO, both Bechtel, Inc. and Hazen Research, Inc. have stated that it may be possible to develop a flowsheet that would not have a liquid waste stream. Although

flow sheets without a waste stream have been drawn on paper there has not been a continuous pilot test that would confirm that such a flow sheet be completed without a waste stream.

Hazen's full scale product design criteria was developed after the pilot test was completed and is Hazen's estimate of the metal products that would be produced. The product quality provided by Hazen is based on their engineering judgement.

Comment: Note #1 - Pg 68 -Section 3.1.1. Artech noted that no mention was made of the objective of recovering and purifying metal products to determine their marketability. Artech claimed that there were metals of significant quantity to confirm marketability, except for mercury.

Response: EPA's primary objective was to evaluate the residue product and any associated waste streams.

Comment: Note #2 - Pg 70 - Section 3.1.3. Artech noted that bleed streams identified in the report may not be necessary in a commercial operation and were not identified in ARCO's optimization studies.

Response: A Hazen quote from correspondence with Artech states "However if a bleed stream was required...". This quote shows that Hazen is uncertain about the need for a bleed stream. Again, more pilot testing would be required to determine the need of a waste stream. The presence of a bleed stream is not important to the evaluation of the Cashman Process as it compares to other alternatives.

Comment: Note #3 - Pg 78 - Section 3.2.4. Artech noted that the 4% of flue dust that could not be ground to the appropriate size prior to treatment would, in practice, be recirculated in the grinding circuit till it was grounded.

Response: No response necessary.

Comment: Note #4 - Pg 79 - Section 3.2.4. Artech noted that the pump cited as failing did not fail, but rather an internal rotor and the stainless steel tubes failed as expected. Artech noted that after the titanium tubes were used the tubes did not fail. Artech noted that the corrosion of the ball mill was the result of a broken ceramic liner around the access port which allowed water to enter with the flue dust.

Response: The Moyno pump rotor, made of stainless steel, failed because of the corrosive effects of the autoclave feed solutions. This demonstrates the extreme corrosive character of the feed solution and the need to use special alloys in construction of parts of Cashman plant.

Comment: Note #5 - Pg 100 - Section 3.4.1. Artech noted that the original scheme was discontinued before Campaign No. 5, not after, as cited in the report, but noted by ARCO's contractor.

Response: Clarification noted. EPA does not disagree

Comment: Note #6 - Pg 102 - Figure 3.4-1. Artech noted that the figure was inaccurate and that the BiOCl filtrate advances to the bismuth/lead precipitation, hydrochloric acid is added to the silver leach and the silver filtrate is recycled and is not a disposal stream.

Response: Clarification noted. EPA does not disagree.

Comment: Note #7 - Pg 111 - Section 3.5.2. Artech noted that hydrated lime was not used for atacamite to copper oxide metathesis, only CaO.

Response: Clarification noted. EPA does not disagree.

Comment: Note #8 - Pg 115, Section 3.5.5. Artech noted that work performed during the optimization testing suggested that 100% lime was needed for optimal operation, and with that approximately 66.3% copper product recovery could be expected.

Response: Clarification noted. EPA does not disagree.

Comment: Note #9 - Pg 127 - Section 3.7.5. Artech noted that the data results for the zinc analysis (61.2%) were based on a "bad" test run and that later test runs provided better zinc precipitate values (64.8% - 68.9%).

Response: Clarification noted. EPA does not disagree.

Comment: Note #10 - Pg 128 - Section 3.8.4. Artech noted that the 50 mg/l value cited should have been 50 grams/liter.

Response: Clarification noted. EPA does not disagree.

Comment: Note #11 - Pg 130 - Section 3.8.5. Artech suggested that the statement "The bleed stream represents a liquid discharge from the process" is inaccurate. Artech noted that the objective of the study was to identify any impurities from the process. Artech, supported by ARCO's contractor, believe that there would not be a bleed stream in a commercial operation.

Response: Addressed by previous response.

Comment: Note #12 - Pg 130 - Section 3.9. Artech noted that no mention was made of satisfying the overall objective of recovering and purifying metal products to determine their marketability. Artech notes that markets were found for all

metal products.

Response: Production of a stable residue material was EPA's primary objective.

B-2.6 Long-Term Stability Study

Comment: Artech provided a number of comments to the June 1990 PTI Long-Term Stability Study dated April 3, 1991 which are responded to below. Specifically, Artech 1) asked why EPA did not report the findings of the report in the RI/FS or Proposed Plan; 2) alleged that preacidulation of the flue dust immediately before it is fed to the autoclave will consistently produce a residue that passes the TCLP test for lead; and 3) stated that PTI Environmental Services, Inc. stated that testing would confirm Artech's favorable test results.

Response: First, the RI/FS (page 73) did indicate "that autoclave leach residue meeting EP-Toxicity characteristic limits could be produced (PTI 1988)".

Second, Artech's statement that the Cashman Process residue produced immediately preacidulated feed that showed "outstanding" long-term stability features is not supported by the facts. There are at least five flaws in Artech's test.

1. Artech conducted only three tests using various preacidulation times. The results from the tests were widely scattered. Trend lines based on only three, widely scattered, data points are questionable.
2. In the 497-pound sulfuric acid test, the lowest lead concentration occurred after a twenty-four hour delay, not after immediate preacidulation. The immediately preacidulation feed produced a residue that leached 4.53 ppm lead, nearly failing the TCLP test.
3. In the 452-pound sulfuric acid test, the lowest lead concentration did not occur when the feed was immediately preacidulated, but the residue leached 3.89 ppm lead, approaching the TCLP limit.
4. The tests were conducted under controlled laboratory conditions. It is unlikely that the test results could be consistently reproduced in full-scale plant conditions, considering the upsets commonly experienced in such facilities.
5. The results from Artech's tests are based on batch residues, not the more representative residues produced from the continuous test that used recycled leaching solutions.

Third, Artech states that PTI Environmental Services, Inc. "... expressed opinion..." that testing would confirm Artech's favorable test results. PTI's opinion would have been confirmed with additional pilot tests, causing delay in implementing a remedy.

Comment: Note #1 - Pg xv - Executive Summary. Artech believed that the major factor affecting the differing arsenic solubility rates between the continuous and batch produced residue was the amount of time the flue dust was pre-acidified before treatment.

Response: Although not confirmed, EPA does not disagree.

Comment: Note #2 - Pg 38 - Section 6.3.2. Artech suggested that the steady state arsenic concentration levels would be achieved for the continuous reactor FDWC and would continue to decrease to an equilibrium level at a lower level.

Response: See above response.

Comment: Note #3 - Pg 39 - Section 6.3.3. Artech suggested that the oxidation of sulfides would also contribute to maintaining a lower pH in the column until the sulfides completely oxidized with time.

Response: See above response.

Comment: Note #4 - Pg 39 - Section 6.3.3. Artech suggested that the more efficient rinsing of the continuous produced residue was probably the cause for differing cadmium leaching behavior.

Response: See above response.

Comment: Note #5 - Pg 39 - Section 6.3.3. Artech suggested that the higher lead concentration in the continuous reactor FDWC are primarily due, as noted by ARCO's contractor, to a solid phase with greater solubility. Artech also suggested that conditions for the test were not optimum and that tests performed by Artech indicated that lead solubility is a function of chlorine strength in the flue dust slurry and temperature.

Response: See above response.

Comment: Note #6 - pg 40 - Section 6.4 - Substrate Performance. Artech noted that the objective of the study was to determine the stability and leachability of metals from the Cashman process under natural conditions, but noted that infiltration rates in the column tests were much higher than natural conditions. Artech asked why one would need to place treated material in a repository when the substrate material, which could be more contaminated than the treated material, will not be placed in the repository. Artech also asked whether the leachability of the

Cashman waste residue was overstated by the "much higher" infiltration rate and how this infiltration rate compared to other rates used to test the long-term stability of other treatment alternatives.

Response: The tests were designed to look at the long-term leaching potential of the treated residues and the potential attenuation ability of on-site soils. This information would be used to formulate disposal options. Based on the data, ARARs and risk assessment information, the RI/FS evaluated disposal of treated and untreated flue dust in either a RCRA C or engineered repository. The stabilization alternatives were evaluated against other tests (MEP, ANS 16.1) as suggested by the stabilization guidance. Since no guidance was available to test the type of residue produced by the Cashman process, the long-term stability testing was performed to predict the long-term leachability of the Cashman process.

Comment: Note #7 - pg 41 - Section 7. - Summary and Conclusions. Artech asked whether the conclusion that stated it would take 4 to 8 million years to leach all the arsenic in a three meter thick pile was too low because of the much higher infiltration rates noted in Note #6.

Response: Infiltration rates probably would not influence the conclusion.

B-2.7 Remedial Investigation/Feasibility Study

Artech expressed concern with statements presented in the RI/FS, both specific and general. Below are specific comments followed by more general concerns.

Comment: Volume I - page 110-111 - Artech expressed concern that information was mislabeled Confidential Business Information (CBI) and that EPA did not take steps to verify the CBI material.

Response: The CBI claim was made by ARCO and was honored by EPA. EPA did make attempts to verify which information was CBI. EPA and ARCO attorneys did manage to release some CBI information for release in the RI/FS for public review.

Comment: Volume I - page 111 - Copper Precipitate/Atacamite Metathesis - Artech noted that this reaction process was not developed from initial campaign testing, but rather developed by Artech/CSS well before the test program.

Response: Clarification noted. EPA does not disagree.

Comment: Volume II - page 57, Section 9.5.2.6 - Artech stated that Cashman type plants are operating successfully in the world (Falconbridge plant in Kristiansand, Norway) and that this was not mentioned in the RI/FS report.

Response: Falconbridge's Kristiansand plant is an excellent example of the complexity of chloride leach facility. This plant is now operating successfully but it required more than fifteen years to develop the flowsheet, construct the plant, and solve the problems that arose during the long breaking in period.

Comment: Volume II, page 58, Section 9.5.2.6 - Artech suggested that the statement that the Cashman process would require additional unit processes be accompanied by the recognition that these unit processes are to recover additional metals, including lead and cadmium.

Response: Clarification noted. EPA does not disagree.

Comment: Volume II, page 98-99 - Artech expressed concern over the statement that one of the precipitate products (mercury) was not successfully produced. Artech stated that no mercury product was produced because of the small amount in flue dust.

Response: An effort was made to recover a mercury product. However, as Artech states, the amount of mercury in the flue dust was too small to determine if mercury recovery would be successful. Large scale testing would be required to evaluate if mercury could be successfully separated from the other products.

Comment: Volume II, page 98-99 - Artech expressed concern that the information from the extensive PTI long-term stability study was not included in the RI/FS. Artech noted that the results indicated that the product would be stable for over a million years.

Response: The long-term stability tests conducted by PTI Environmental Services, Inc. did indicate that the Cashman Process residues were stable, if the leaching solution was deionized water. The TCLP test, required by EPA to determine the hazardous characteristics of a material, showed that the residue failed for lead. In this case, stability is not the issue. The residue possesses hazardous characteristics and must be handled as such. Enforcement quality pilot-scale test data better represents the expectation of a full-scale operation over that of the bench-scale testing.

Comment: Volume II, page 111, Section 10.3.5.5 - Artech noted that no mention was made that liquid wastes, process vapors and off gases were thoroughly evaluated and that no problems were encountered or expected in a commercial plant.

Response: None of ARCO's metallurgical consultants stated that "...no problems would be expected in a Cashman Process commercial plant."

Comment: Volume II, page 115, Section 10.3.6.5 - Artech expressed concern over the statement that the Cashman process was generally unable to achieve steady state or equilibrium conditions at pilot-scale operations.

Response: This comment was previously responded to.

Comment: Volume II, page 115, Section 10.3.6.5 - Artech expressed concern over the statement that the pilot scale plant was unable to produce precipitate products which would meet expected design criteria, that the design criteria were established after the pilot-scale tests, and that products were produced while the conditions were being varied and not at optimum conditions.

Response: The issue of product quality has been previously discussed.

Comment: Volume II, page 116, Section 10.3.6.5 - Artech expressed concern over the statement that "comparatively exotic construction materials" would be needed for a Cashman plant. Artech suggested that most materials needed for the plant would be readily available and that titanium would not be needed.

Response: Titanium is not required in most metallurgical facilities and the use of it in the Cashman Process tests, by both Artech and Hazen, indicates the corrosive character of the process solutions. The use of titanium would add cost and uncertainty to the project from the standpoint of purchase of the metal and its fabrication.

Comment: Volume II, page 116, Section 10.3.6.5 - Artech expressed concern with the statement that grinding of flue dust could be a problem in a full-scale operation. Artech noted that ball mills are specifically sized to take into account the recirculating load.

Response: No response necessary.

Comment: Volume II, page 116-117, Section 10.3.6.5 - Artech expressed concern with the suggestion that titanium would be needed and that autoclave off gases were not fully characterized.

Response: See above response on titanium.

Comment: Artech noted that Hazen's optimization study determined that the best copper recovery would be through SX-EW. Artech notes the copper recovery work on the Cashman process by Henkel.

Response: No response necessary.

Comment: Artech believed that the Cashman process provided much better economics, operability and environmental effectiveness than that presented in the RI/FS and Proposed Plan. Artech expressed concern that ARCO had biased the RI/FS in favor of their preferred alternative at the expense of other alternatives.

Response: Information contained in the RI/FS was provided by ARCO and reviewed by EPA and MDHES and is believed to be representative of the studies conducted. The data was sufficient to evaluate the alternatives against the nine criteria. The data was not intended to be a judgement of whether the Cashman process worked or not.

Comment: Artech expressed concern that the approach used to compare alternatives in the RI/FS, specifically the rating table, was not recommended by EPA guidance and is often discouraged.

Response: EPA did use a rating table in the RI/FS. Such tables are often discouraged because they are subjective. EPA felt the rating table would graphically present the results of the comparative analysis that were discussed in the text and be useful to the public. Although the tables were not shown in the Proposed Plan or in this ROD, they are still useful for demonstration purposes.

B-2.8 Proposed Plan

Artech expressed concern with portions of the Proposed Plan for the Flue Dust Operable Unit dated June 1991 which are noted below as well as general concerns with the selection of the preferred remedy as noted in several of the Artech comment letters.

Comment: Scope and Role of Action - Artech expressed concern that the statement "Cleanup of the Flue Dust Operable Unit will be consistent with the overall cleanup for the site." is inconsistent with previous EPA statements. Artech suggested that selecting a cleanup for the flue dust operable Unit will set a precedent for future cleanups. Artech also asked what is EPA's overall cleanup strategy.

Response: EPA believes that the selected remedy will be consistent with the overall cleanup for the site. Which implies that principal threat wastes such as flue dust will be treated to the maximum extent practicable and that low threat wastes such as the treated residues will be contained on site. The selected remedy does not necessarily set a precedent for addressing all wastes on the site in the same manner, but similar wastes may be addressed in a similar manner if determined to be appropriate.

Comment: Summary of Alternatives, paragraph 4 - Artech questioned EPA's statement that "Alternative 5 evaluated a chloride leach process, under high temperature and pressure which theoretically would also produce a stabilized waste residue not requiring additional stabilization". Artech noted that the Cashman process is actually operated at conditions of approximately 110°C and 50psi. Artech noted that data collected for the long-term stability tests indicated that a stabilized waste residue could be produced and that this was approved by EPA.

Response: It would be more accurate to say "chloride leach process under elevated temperature and pressure". Bench scale tests performed on the Cashman process did produce residue products meeting the EP Toxicity leach test and long-term leachability tests. This was noted in the RI/FS. Data provided on the Cashman process in pilot scale testing produced a product which failed the TCLP leach test for lead.

Comment: Summary of Alternatives - Artech expressed concern with EPA's statement regarding the uncertainties of the Cashman process to produce a stable waste product that wouldn't require additional stabilization, especially in light of the Artech data submitted to EPA. Artech suggested that correction of an operating error by ARCO and a minor adjustment to the process would provide data that would meet the TCLP regulatory limits. Artech asked why additional tests were not performed or why the factors were not reviewed.

Response: This was previously discussed. The determinations were based on the enforcement quality data provided in the RI/FS. Artech data was not used for this purpose and was not intended to be used for making decisions. However, this data was reviewed and referenced where appropriate to support the enforcement quality data in the RI/FS.

Comment: Summary of Alternative, paragraph 4 - Artech suggested that the cost uncertainty analysis did not take into account the failure of Alternative 4 to produce a stable product and the additional cost of placing material in a RCRA Subtitle C facility.

Response: The cost uncertainty analysis was intended to show the unknowns or uncertainties in the cost of building a facility for the particular technology. Whether a RCRA C or an engineered repository is required, the cost of constructing either are fairly well known.

Comment: Item 5 - Artech expressed concern with the quantity of information used to base decisions upon (Cashman v.s. stabilization).

Response: Information provided in the RI/FS was sufficient to evaluate the alternatives (technology types) against the nine criteria. Testing objectives are often different for different technologies with some technologies not requiring any data at all. In general, the more unknown about a technology the more testing that is required.

Comment: Page 7 - Artech asked why data produced by ARCO for the optimization tests were not used to calculate the expected volume of stabilized flue dust material, given that the were 10% higher. Artech also noted that optimization data for the Cashman process was not used to calculate the volume decrease.

Response: This was previously discussed. The calculations and determinations were based on the enforcement quality data provided in the RI/FS. Optimization data was not used for this purpose and was not intended to be used for making decisions. However, this data was reviewed and referenced where appropriate to support the enforcement quality data in the RI/FS.

Comment: Page 7 - Artech asked why cost figures from the ARCO's optimization tests were not used to calculate cost for the proposed Plan, given that the Cashman process would be decreased by \$20 million. Artech also asked why this information was not available to the public.

Response: See previous response. The optimization data was included to the Administrative record.

Comment: Page 9, paragraph 2 - Artech expressed concern with EPA's statement "However, EPA believes that the metals removal alternatives (5 & 6) would require additional stabilization to provide the equivalent protection and permanence as provided in Alternative 4...". Artech suggested that the stability of the Cashman process was uncertain and that definitive statements should not be made. Artech suggested that Alternative 5 be removed from this statement.

Response: It would have been more accurate to state that Alternatives 5B and 6 would require additional stabilization. However the Proposed Plan did not summarize Alternative 5 as 5A and 5B for the simplicity of providing information to the public.

Comment: Page 10, Overall Protection - Artech expressed concern with the Preferred Alternative being referred to as a demonstrated technology, given that 1) solidification has never been successfully applied on materials containing such simultaneous high levels of copper, lead zinc, arsenic and cadmium; 2) demonstrated technology as used here should not be equivalent to the definition used by EPA in BDAT determinations; 3) Many of the non-optimum flue dust formulations tested by ARCO failed TCLP, physical strength and hydraulic conductivity tests; 4) even after treatability testing ARCO has been unable to

produce optimum blends for all major flue dust types; and 5) pilot testing of the solidification alternative will be conducted to demonstrate its performance before it will be implemented. Artech then asked what makes EPA believe that solidification is a demonstrated and easily implemented technology.

Response: The Superfund program's definition of innovative technologies includes:

- o "New" technologies that have been demonstrated at the bench- or pilot-scale for a limited number of applications, and
- o "Demonstrated" or "available" technologies used in various industries but for which limited data are available for Superfund site application.

By the above definition (Publ.9380.3-05FS, Feb. 1991), Alternative 4 is considered a demonstrated technology since stabilization of inorganics has been used by industry and on a number of Superfund sites, but not on flue dust specifically. Alternative 4 would be considered a proven technology since immobilization of inorganics is generally considered a proven technology for which EPA has extensive experience. However, immobilization of some inorganic compounds (i.e. arsenic) is considered less proven and would also fall into the realm of innovative treatment.

Comment: Page 10, Overall Protection - Artech expressed concern with the statement that the Preferred Alternative " provides the greatest overall protection through the use of a demonstrated technology to produce a permanent stable material...". Artech suggests that the use of the term permanent is wrong and misleading and suggested that the results of the ANS16.1 and MEP tests clearly show that arsenic is not permanently stable nor is it immobilized. Artech suggested that the repository provides more long-term protection than the solidification treatment process. Artech also suggested that using the phrase "permanently immobilizing the hazardous constituents" when used in reference with stabilization is wrong, misleading and should be eliminated.

Response: Effectiveness and permanence are relative terms used to compare the alternatives under consideration. Generally, alternatives are either more or less effective or permanent than other alternatives. The Superfund program uses a guideline for effective treatment as being the range of 90% - 99% reduction in the concentration or mobility of contaminants of concern. The 90-99 percent reduction in contaminant concentration is a general guideline and may be varied within a reasonable range considering the effectiveness of the technology and clean up goals for the site.

Alternative 4 provides an equal or greater degree of effectiveness and permanence as compared to the other alternatives given the enforcement data available. Immobilization under Alternative 4 is also considered to be an effective treatment given the 90 - 99 percent reduction of arsenic, cadmium and lead contaminants. Because it is anticipated that there will be some mobility of contaminants, the treatment may not be totally permanent. However, Alternative 4 combines treatment with containment to provide a higher degree of overall effectiveness and permanence. This combination of treatment and containment would achieve overall effectiveness and permanence for the remedy.

Comment: Page 10, paragraph 2 - Overall Protection - Artech expressed concern with EPA's conclusion that the Cashman process will require stabilization.

Response: Addressed in previous responses.

Comment: Page 10, paragraph 2 - Overall Protection - Artech suggested that the sentence should only refer to Alternative 6 since the Cashman process does remove cadmium and lead which does reduce the toxicity of flue dust.

Response: It would have been more accurate to state that Alternative 5 would also remove cadmium and lead but would not remove the arsenic constituents.

Comment: Page 10 - Long-term effectiveness and Permanence - Artech noted that the MEP tests were not mentioned in the proposed plan for indicating the long-term effectiveness. Artech also noted that MEP data indicated that arsenic leaching was increasing in the results and suggested that this was not an indication of a material labeled by EPA as permanently stable.

Response: The MEP test results were inadvertently deleted from the proposed plan. EPA believes that the MEP data indicate that the stabilized material will not leach contaminants above the TCLP regulatory limits. Also addressed in previous responses.

Comment: Page 11, Paragraph 2 - Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment - Artech expressed concern that data from the optimization tests were not used to identify the volumes increased or decreased.

Response: Addressed in previous responses.

Comment: Page 11, Paragraph 3 - Reduction of Toxicity... - Artech expressed concern with the statement that the Cashman process did not produce a stable residue material. Artech suggested that the PTI testing report would conclude that the Cashman process does produce a long-term stable residue, but that

short-term stability with respect to lead is uncertain, although it is believed that a residue would pass the TCLP limits for lead consistency.

Response: EPA does not disagree. Addressed in previous responses.

Comment: Page 12, Paragraph 2 - Implementability - Artech suggested that EPA downplayed any difficulties associated with implementing the stabilization technology, including the effects of wind, temperature, humidity fluctuations and precipitation.

Response: EPA evaluated several stabilization technologies during the RI/FS. In general, stabilization appeared to be effective in producing a stable flue dust material. EPA believes that sufficient information is available to evaluate the technology against the nine criteria. Stabilization testing has been conducted on several Superfund sites, including those with inorganics. Although there has not been much study of the stabilization of flue dust, the data collected during the RI/FS was sufficient to base decisions. Other EPA testing on high arsenic materials is being mainly with high alkaline materials in an aqueous solution, not flue dust. The specific stabilization process will be selected in the Remedial Design phase. Detailed information such as the impacts due to factors identified will be addressed.

Comment: Page 12, Paragraph 2 - Implementability - Artech expressed concern with the statement that "exceptionally expensive construction materials would be needed in a Cashman process plant. Artech noted that few components would require titanium and most materials would be easily replaceable. Artech provided an example of a hydrochloric acid leaching process that did not require exotic materials and that corrosivity was dealt with acid proof bricks or rubber linings. Artech asked what information did EPA have to make their statement.

Response: Addressed in previous responses.

Comment: Page 13, Table 1 - Cost - Artech expressed concern that EPA used the cost information provided in the RI/FS and not the cost information provided in the hazen optimization reports. Artech asked what variables were used to consider cost.

Response: See previous responses on the use of optimization data. Cost information was derived from the treatability testing and cost information provided by ARCO contained in the RI/FS. The elements of cost are shown in the appendix of the RI/FS.

Comment: Artech expressed concern that EPA and the State had changed their mind regarding the selection of the preferred alternative. Artech also expressed concern that this change occurred without a reasonable degree of deliberation and coincided with a meeting with ARCO.

Response: As stated in previous responses and in the Proposed Plan, EPA gave serious consideration to metals removal alternatives. EPA and the State even considered Alternative 6 as the preferred alternative while drafting the Proposed Plan. There was much deliberation with the State, EPA Regional and Headquarter personnel and ARCO. After review of all the information, arguments made by ARCO, input from Regional Counsel, and evaluation based on the nine criteria, EPA determined that Alternative 4 would provide the best balance of trade-offs among the nine criteria.

PART C: ARCO COMMENTS/RESPONSES

The following section presents comments provided by ARCO and responses to the comments where appropriate.

C-1 General Comments

ARCO strongly supports EPA's selection of Alternative 4, Onsite Stabilization/Fixation, Disposal in an Onsite Repository, as the preferred alternative for the Flue Dust Operable Unit. In further support of the preferred alternative ARCO provided the following documents:

ARCO's July 23, 1991 letter to EPA supporting EPA's decision in the Proposed Plan and providing comments regarding the nine criteria.

ARCO's July 31, 1991 letter regarding Calcium Arsenate, XRD and Hazard and Operability assessments. Also, summary of EPA's July 23, 1991 formal public meeting.

ARCO's July 31, 1991 letter regarding the ANS 16.1 testing results.

Response: EPA generally agrees with or has no comment on the information provided above to support the selection of Alternative 4 as the preferred alternative.

In addition, ARCO resubmitted the following documents as comments:

ARCO's May 22, 1991 letter to EPA and the State regarding the Identification of Stabilization/Fixation as the Preferred Alternative for the Flue Dust Operable Unit.

ARCO's May 9, 1991 letter to EPA providing a sensitivity analysis of the net present costs for Alternatives 4, 5, and 6.

ARCO' April 29, 1991 letter to EPA, "Evaluation of Innovative and Resource Recovery Technologies under CERCLA and the NCP for the Flue Dust Operable Unit.

The above documents have been included as Attachment 1 to the responsiveness summary.

Response: Responses to ARCO's May 22, 1991 letter include the following:

I, page 2: No response necessary.

II.a, page 3: No response necessary - EPA agrees that fixation/stabilization (F/S) is at least as protective as other alternatives.

II.b, page 4: No response necessary - EPA agrees that F/S, along with other alternatives, meets ARARs.

III.A.1, page 4: The quote here is actually from the NCP, not the proposed NCP. EPA agrees that where short-term effectiveness is being considered, F/S is best.

III.A.2, page 5: No response necessary - EPA agrees.

III.A.3, page 6: No response necessary - EPA agrees.

III.A.4, page 6: No response necessary - EPA agrees.

III.A.5, page 7: EPA changed the rating for the cost criteria for the ambient acid leach process to neutral. ARCO picks this up in the last sentence of the section. In general therefore, EPA agrees with this comment.

III.B, page 7: EPA generally agrees with this comment.

IV, page 8 (Determination Regarding Cost-Effectiveness): No response necessary, as EPA agrees with this comment. It should be noted that the ambient acid leach process now receives a neutral cost ranking.

IV, page 9 (Determination Regarding the Use of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable): Again, EPA agrees.

IV, page 11 (The NCP's Preference for Treatment and Bias Against Off-Site Land Disposal of Untreated Waste): Again,

EPA agrees.

IV, page 12 (Net Ranking of Alternatives): EPA agrees.

Response: EPA has responded to ARCO's May 9, 1991 letter by incorporating the appropriate information into the final RI/FS and Proposed Plan.

Response: Responses to the ARCO's April 29, 1991 letter include the following:

I (Conclusion): EPA agrees with ARCO's conclusion.

II.A (Innovative Technologies): EPA does not disagree.

II (Resource Recovery Alternatives): EPA does not disagree.

C-2 Risk Assessment

Comment: ARCO disagreed with the conclusions set forth in the Summary of Site Risks section of the Proposed Plan. ARCO referenced the following documents as support:

Scoping Document, August, 1989

ARCO's comments on EPA's Risk Assessment - August, 1990

Response: During the time that the baseline risk assessment was being prepared for the Flue Dust Operable Unit, ARCO submitted to EPA a Scoping Document that presented ARCO's views and recommendations on a number of technical and tactical issues regarding the risk assessment. EPA agreed with and incorporated many of ARCO's recommendations. However, other suggestions were considered to be too speculative or too lacking in conversations, and these were not followed. A detailed description of ARCO's comments and EPA's responses are provided in Attachment 2 to the responsiveness summary.

After release of the draft risk assessment, ARCO reviewed the document and provided detailed comments. EPA carefully considered each of ARCO's suggestions. However, EPA did not agree with a number of other comments or suggestions. A detailed summary of ARCO's comments and EPA's responses are provided in Attachment 2.

C-3 ARARs

Comment: ARCO expressed concern that only those requirements that clearly are within the scope of the Flue Dust Operable Unit be identified as ARARs. ARCO also suggested that RCRA Subtitle C ARARs should not be identified for Alternative 4, since the treated material should pass TCLP. Rather the repository should be based upon best engineering judgement in the Remedial Design

phase. ARCO submitted the following documents to provide additional comments:

ARCO's May 20, 1991 letter to EPA regarding EPA's Screening and Description of Potential ARARs for the Flue Dust Operable Unit, Anaconda Smelter Site, January, 1991.

ARCO's May 16, 1990 letter updating ARCO's ARARs Scoping Document.

ARCO's August 31, 1989 ARARs Scoping Document.

Response: Response to ARCO's May 20, 1991 letter include the following:

1. Characterization of Flue Dust Materials as K064: EPA does not disagree.

2. Only Those Requirements that are Within the Scope of the Flue Dust Operable Unit Can Be ARARs: EPA does agree that it is permissible to limit the scope of an operable unit (OU) and therefore to limit the ARARs which may be pertinent to that OU. EPA also agrees that final compliance with groundwater, surface water, air, and reclamation requirements is beyond the scope of the Flue Dust OU. However, EPA does not necessarily agree with the conclusion that groundwater, surface water, air and reclamation ARARs are entirely beyond the scope of the Flue Dust OU. First, these requirements come into play for the limited purpose of securing the sites from which Flue Dust is excavated, pending final remedial action at Smelter Hill. Second, these requirements may come into play at the Waste Repository. It is expected that the Waste Repository will be a permanent facility. Therefore, it should be designed now to meet all groundwater, surface water, reclamation and air requirements. It would be impractical to upgrade the Waste Repository at some later date to meet these requirements.

3. OSHA Requirements Are Not ARARs: EPA does not disagree. These requirements apply directly.

4. ARARs for Treated Flue Dust Residues: EPA agrees that the treated flue dust is not expected to be a RCRA hazardous waste. However, the treated material may still be similar enough to a hazardous waste that portions of RCRA Subtitle C may be relevant and appropriate.

5. Major Facility Siting Act: EPA agrees that this should not be an ARAR. These requirements are for power generating plants, etc. which are nothing like the Flue Dust storage facility.

6. RCRA Land Disposal Restriction Requirements: EPA agrees with the ultimate conclusion expressed by ARCO that Land Disposal Restrictions (LDRs) are not applicable or relevant and appropriate for the remedial alternative chosen. EPA agrees, however, only because first, the waste to be disposed of, fixated, stabilized flue dust, is not expected to be a RCRA hazardous waste. Untreated flue dust is a characteristic hazardous waste under RCRA. The expectation is that treated, it will no longer exhibit the characteristic of leachability, and thus, will no longer be a RCRA waste. Second, as a former Beville waste, flue dust is a "newly identified" waste. No LDRs for these newly identified wastes have yet been promulgated. Thus, there are no LDR's for the Flue Dust OU. It is unnecessary to determine whether the action constitutes "placement".

7. Current Waste Locations: ARCO correctly states that RCRA Subtitle C requirements are not applicable for the excavated areas. Also, ARCO correctly states that final closure of these areas is beyond the scope of the Flue Dust OU. However, EPA believes that certain closure requirements, particularly those at 40 CFR § 264.258, are relevant and appropriate for the purpose of assuring that debris and contaminated soils, such that concentrations of contaminants remaining may not be greater than concentrations of contaminants in surrounding soils and that the areas are stabilized. The purpose of 40 CFR § 264.258 is to assure that hazardous waste does not escape and endanger human health and the environment. That is precisely what the Flue Dust OU seeks to accomplish.

Response: Response to comments on ARCO's Scoping Document which also include the update as appropriate.

1. Volume I, page 10, paragraph II.D.

ARCO is incorrect where it argues that ARARs should be met at the completion of remedial actions "and not before." While the statute does require compliance with ARARs at the completion of remedial actions, it does not address whether ARARs should be complied with before. It does not forbid EPA from requiring compliance with ARARs before completion of remedial action, however, and 40 C.F.R. 300.435(b)(2) now specifically requires that ARARs be met during RD/RA. The preamble to the NCP explains the rationale for this requirement at 55 Fed. Reg. 8755. Therefore, ARCO will be required to comply with ARARs during RD/RA, prior to the completion of remedial action at the Flue Dust operable unit ("OU").

2. Volume I, pages 10-11, paragraph II.E.

EPA agrees in general with ARCO's comment concerning waivers contained within a relevant and appropriate requirement. However, even if such a requirement contains a waiver or exception which corresponds to the circumstances at a CERCLA site, it might still be a relevant and appropriate requirement for purposes of the CERCLA cleanup. See 55 Fed. Reg. 8744.

3. Volume I, page 11, paragraph II.F.

ARCO argues that where two or more standards address the same chemical, location, or action, EPA should not necessarily select the most stringent as an ARAR, but rather, should select the most "appropriate" one which is protective of health and the environment. At 40 C.F.R. 300.400(g)(4), however, EPA is required to identify the more stringent requirement.

4. Volume I, pages 12-15, paragraph II.H.

In general EPA agrees that ARARs "freeze" at the time a ROD is signed. In certain circumstances, however, it should be understood that requirements enacted or promulgated after a ROD is signed may be ARARs. 40 C.F.R. 300.430(f)(1)(ii)(B) provides that requirements which come into being after a ROD is signed will be ARARs if they are applicable or relevant and appropriate and "necessary to ensure that the remedy is protective of human health and the environment." Also, if a ROD is amended or a new component to a ROD is identified, provisions which are applicable or relevant and appropriate at that time will be ARARs. These could include provisions promulgated and identified both before and after the date of the original ROD. See 55 Fed. Reg. 8758. It should be noted that EPA reserves the right to invoke ground and surface water ARARs for unforeseen impacts by the cleanup action.

The framework for identifying ARARs after ROD signing is usually thought to be the five year review period. However, the review may come more often than every five years, particularly if there is reason to think the remedy is no longer protective. See 55 Fed. Reg. 8758. The regulation uses the term "no less than every five years." See 40 C.F.R. 400.430(f)(4)(ii). Thus, a requirement which is promulgated post-ROD and which is necessary to ensure a protective remedy could become an ARAR immediately after the signing of the ROD, during implementation of the remedy.

Finally, EPA disagrees with ARCO's use of the word "exempt" in the first full paragraph on page 14 of its Scoping Document. Section 121(d)(2)(A) does not "exempt" remedial actions from potential ARARs. The section simply provides that state requirements may become ARARs if, among other things, the state

ARARs are identified in a "timely" manner. "Timely" is not defined and has not been raised as an issue here.

5. Volume I, pages 15-17, paragraph III.A.1.a.

EPA generally agrees that RCRA MCLs are not applicable or relevant and appropriate requirements for areas from which flue dust is excavated. This is because final cleanup of groundwater at those areas is beyond the scope of the Flue Dust remedial action. Although final cleanup of groundwater at the excavated areas is beyond the scope of this action, EPA will not permit degradation of groundwater arising from excavation. This would be inconsistent with a final remedy. See 40 C.F.R. 300.430(a)(1)(ii)(B). ARARs addressing nondegradation are discussed below, at Comment No. 29.

6. Volume I, pages 17-18, paragraph III.A.1.b.

Because on-site disposal of untreated flue dust was not chosen as the remedial alternative, EPA does not discuss ARARs for this alternative here or below. ARCO's discussion in the paragraph at the bottom of page 17 as to whether flue dust is subject to regulation under RCRA Subtitle C is discussed below at Comments No. 7 and 20.

7. Volume I, pages 18-19, paragraph III.A.1.c.

EPA agrees that RCRA MCLs are not applicable requirements for disposal of treated flue dust in an on-site repository. However, these MCLs are relevant and appropriate. While final cleanup of groundwater is outside the scope of this action, design of the waste repository so as not to contribute to groundwater contamination at any time, and so as to be capable of meeting all RCRA MCLs is not outside the scope of this action. See 40 C.F.R. 300.430(a)(1)(ii)(B).

The 8 factors for determining whether a requirement is relevant and appropriate are set out at 40 C.F.R. 300.400(g)(2). They are discussed below.

a) The first factor compares the purpose of the requirement and the purpose of the CERCLA action. The RCRA MCLs are meant to groundwater from contamination by RCRA facilities. This CERCLA action seeks to protect groundwater from contamination by releases from treated flue dust disposed in the waste repository.

b) The second factor compares the medium addressed by the requirement with the medium addressed by the CERCLA action. The medium addressed by the RCRA MCLs, groundwater, is among the media which the waste repository will be designed to protect.

ARARs are identified in a "timely" manner. "Timely" is not defined and has not been raised as an issue here.

5. Volume I, pages 15-17, paragraph III.A.1.a.

EPA generally agrees that RCRA MCLs are not applicable or relevant and appropriate requirements for areas from which flue dust is excavated. This is because final cleanup of groundwater at those areas is beyond the scope of the Flue Dust remedial action. Although final cleanup of groundwater at the excavated areas is beyond the scope of this action, EPA will not permit degradation of groundwater arising from excavation. This would be inconsistent with a final remedy. See 40 C.F.R. 300.430(a)(1)(ii)(B). ARARs addressing nondegradation are discussed below, at Comment No. 29.

6. Volume I, pages 17-18, paragraph III.A.1.b.

Because on-site disposal of untreated flue dust was not chosen as the remedial alternative, EPA does not discuss ARARs for this alternative here or below. ARCO's discussion in the paragraph at the bottom of page 17 as to whether flue dust is subject to regulation under RCRA Subtitle C is discussed below at Comments No. 7 and 20.

7. Volume I, pages 18-19, paragraph III.A.1.c.

EPA agrees that RCRA MCLs are not applicable requirements for disposal of treated flue dust in an on-site repository. However, these MCLs are relevant and appropriate. While final cleanup of groundwater is outside the scope of this action, design of the waste repository so as not to contribute to groundwater contamination at any time, and so as to be capable of meeting all RCRA MCLs is not outside the scope of this action. See 40 C.F.R. 300.430(a)(1)(ii)(B).

The 8 factors for determining whether a requirement is relevant and appropriate are set out at 40 C.F.R. 300.400(g)(2). They are discussed below.

a) The first factor compares the purpose of the requirement and the purpose of the CERCLA action. The RCRA MCLs are meant to groundwater from contamination by RCRA facilities. This CERCLA action seeks to protect groundwater from contamination by releases from treated flue dust disposed in the waste repository.

b) The second factor compares the medium addressed by the requirement with the medium addressed by the CERCLA action. The medium addressed by the RCRA MCLs, groundwater, is among the media which the waste repository will be designed to protect.

c) The third factor compares the substance regulated by the requirement and those at the CERCLA site. Treated flue dust is not expected to exhibit a characteristic and therefore is not expected to be a RCRA hazardous waste. However, treated flue dust will still contain high concentrations of arsenic, lead, and cadmium, substances for which there are specific concentration limits. See 40 C.F.R. 264.94. Though the mobility of flue dust will be reduced through treatment, flue dust will still leach. Therefore, EPA finds that treated flue dust is sufficiently similar to a RCRA hazardous waste that the RCRA MCLs are relevant and appropriate for the design of the waste repository.

d) The fourth factor compares the activities regulated by the requirement and the actions at the CERCLA site. RCRA regulations govern treatment, storage and disposal of hazardous waste. The actions at this site include the treatment of a characteristic hazardous waste, flue dust, and disposal of treated hazardous waste in a disposal facility.

e) The fifth factor relates to variances of the provision in question and whether these are available for circumstances at the CERCLA site. Under 40 C.F.R. 264.94(b), the Regional Administrator may establish alternate concentration limits so long as these alternate limits do not pose substantial threats to human health or the environment. These factors have not been fully considered at this time.

f) The sixth and seventh factors compare the type of "place" and the type and size of structure regulated under the requirement and the type of place or structure affected or contemplated by the CERCLA action. RCRA regulates hazardous waste disposal facilities and places on which they are located. The facility and its location as contemplated by this CERCLA action will be similar if not identical to a RCRA disposal facility in terms of size and type of construction. It will involve a repository for waste which will have a liner and cap. This is similar to a RCRA disposal facility.

g) The eighth factor compares the resource use affected by the requirement and the potential resource use at a CERCLA site. The RCRA MCLs are meant to protect groundwater for drinking purposes. The same consideration applies to groundwater at the site for the waste repository.

Again, it should be understood that RCRA MCLs are not identified as ARARs for the purpose of final cleanup of groundwater. They are identified simply for purposes of designing the waste repository. EPA recognizes that the Flue

Dust OU does not address final groundwater cleanup. However, the waste repository will be permanent. Its design must therefore take into account the fact that it cannot at any time contribute to existing groundwater contamination and must at some point be capable of complying with RCRA MCLs. Its design must not be inconsistent with any final remedy at the site. See 40 C.F.R. 300.430(a)(1)(ii)(B).

8. Volume I, pages 18-19, paragraph III.A.1.d.

An interim measures waiver for the waste repository is improper. The repository itself is to be permanent. It would make no sense to grant a waiver of RCRA MCLs now, and design the repository to relaxed standards. That would necessitate a redesign and rebuilding of the repository once the waiver had expired. This would violate the requirements of 40 C.F.R. 300.430(a)(1)(ii)(B).

9. Volume I, pages 19-21, paragraph III.A.2.

EPA agrees that Safe Drinking Water Act ("SDWA") requirements are not applicable requirements for the Flue Dust OU. However, they are relevant and appropriate for the purpose of assuring that the repository does not contribute to the contamination of groundwater and assuring that the repository is capable of meeting SDWA requirements in the future. See 40 C.F.R. 300.430(a)(1)(ii)(B). Thus, while final cleanup of groundwater is not part of the Flue Dust OU, design of the waste repository to meet SDWA requirements is part of this action.

10. Volume I, pages 21-23, paragraph III.A.3.

EPA agrees that final cleanup of surface water according to Clean Water Act ("CWA") and associated regulatory and state requirements is beyond the scope of the Flue Dust OU. However, these provisions are relevant and appropriate for the purpose of assuring that the repository does not contribute to the contamination of surface water. See 40 C.F.R. 300.430(a)(1)(ii)(B). Thus, while final cleanup of surface water is not part of the Flue Dust OU, design of the waste repository to meet CWA and associated requirements is part of this action.

11. Volume I, pages 23-24, paragraph III.A.4.

EPA disagrees with ARCO's conclusion that CWA requirements will not be applicable. Construction of the waste repository could well result in a "discharge" from a "point source" to "waters of the United States," particularly if EPA requires that runoff from the repository be controlled and channeled. EPA believes that the stormwater regulations, 55 Fed. Reg. 48062, and other ARARs may require control of runoff. Thus, if waters are collected because of these requirements and thereafter

discharged, requirements under the CWA and 40 C.F.R. 122 could be applicable. EPA agrees that only substantive requirements under the CWA need be complied with and that no permit under the CWA or associated state requirements will be required.

12. Volume I, page 30, paragraph III.B.4.

EPA agrees with ARCO that the Fish and Wildlife Coordination Act is probably not an ARAR, provided that there are no structural modifications to natural bodies of water. If there are such modifications, then this provision will be an applicable requirement.

13. Volume I, pages 31-32, paragraph III.B.5.

EPA agrees with ARCO that the Endangered Species Act is probably not an ARAR, provided that there are no endangered species at the Flue Dust OU. If there are any such species, then this provision will be an applicable requirement.

14. Volume I, page 33, paragraph III.B.7.

EPA agrees with ARCO that the Executive Order on Protection of Wetlands is probably not an ARAR, provided that there is nothing done as part of the Flue Dust OU to affect wetlands. However, there is a wetland at the site near the Coal Pile tracks. If actions affecting this wetland are taken, then this provision will be an applicable requirement.

15. Volume I, page 34, paragraph III.C.1.

At page 36, ARCO states that because placement of flue dust residues in a repository is not expected to result in a discharge of pollutants to waters of the United States, the requirements at 40 C.F.R. 257.3-3 are neither applicable nor relevant and appropriate. Just because ARCO claims these provisions will not be violated does not mean they are not ARARs. These provisions represent standards of control for solid waste disposal facilities. The waste repository to be constructed as part of this action will in fact be a solid waste disposal facility. These requirements are therefore applicable.

At page 37, ARCO argues that 40 C.F.R. 257.3-4, pertaining to groundwater contamination, is not an ARAR because it fails to address site-specific circumstances and because final cleanup of groundwater is beyond the scope of this action. EPA disagrees. This provision does address the circumstances of this CERCLA site. First, 40 C.F.R. 257.3-4(C)(2) in effect prohibits incremental contamination of underground drinking water sources. Though final cleanup of groundwater contamination is not a goal of this OU, EPA will not allow the waste repository, which does qualify as a solid waste facility under this provision, to

aggravate already existing contamination. This would be inconsistent with the final remedy. See 40 C.F.R. 300.430(a)(1)(ii)(B). Second, the waste repository will be permanent, and therefore should be designed to meet all ARARs. Given that the repository is permanent, EPA will expect it to contribute to final remediation of groundwater even though that will likely not occur until the time of the Smelter Hill remedial action. Id. Because this provision represents standards of control for solid waste disposal facilities and because the waste repository to be constructed as part of this action will in fact be a solid waste disposal facility, this requirement is applicable.

At the top of page 38, ARCO argues that if 40 C.F.R. 257-4(a) is an ARAR, that a waiver should apply. As mentioned above, however, EPA is not expecting final cleanup of groundwater as a result of this remedial action. A waiver is therefore unnecessary.

16. Volume I, pages 40-44, paragraph III.C.2.a.

This discussion, generally correct when originally submitted, has since been updated in ARCO's letter of May 16, 1990. The May 16, 1990 letter should also be updated to reflect the fact that the State of Montana has amended its regulations such that the flue dust now at issue is now a hazardous waste. See ARM 16.44.303 and -304, as amended effective December 17, 1990. ARCO argues at page 42 of its Scoping Document and its May 16, 1990 letter that the Montana revisions are not applicable until approved by EPA. EPA disagrees. The regulations are presently effective in Montana whether approved by EPA or not. See 55 Fed. Reg. 2347. As such they may be ARARs.

EPA disagrees with the assertion at page 44 of the Scoping Document that RCRA Subtitle C ARARs in general are not relevant and appropriate for consolidation of treated flue dust in a waste repository. It is true that once treated, flue dust will no longer be a characteristic hazardous waste. This fact in itself should not prevent all RCRA Subtitle C requirements from being relevant and appropriate. Given the qualities of a particular non-hazardous waste, a few RCRA Subtitle C requirements might well be relevant and appropriate. The nature of the waste, site characteristics, and the nature of the requirement must all be considered in determining whether a given provision is relevant and appropriate. See 55 Fed. Reg. 8763.

EPA has discussed above at Comment No. 7 and will discuss below at Comment No. 20 whether specific Subtitle C provisions are relevant and appropriate to the deposition of treated flue dust in a waste repository.

17. Volume I, pages 44-52, paragraph III.C.2.b.

At page 45 of its Scoping Document, ARCO argues generally that RCRA Subtitle C treatment requirements are not applicable. This argument is based on the assumption that flue dust is not a hazardous waste under RCRA. However, as stated at No. 16, above, flue dust is now a hazardous waste in Montana. Therefore, whatever treatment requirements may be found under RCRA Subtitle C could be applicable.

ARCO discusses RCRA Subtitle C storage requirements beginning at page 46 of its Scoping Document. EPA agrees that flue dust left in place is not subject to RCRA storage requirements. However, because flue dust is now hazardous waste in Montana, once it is moved, it is subject to storage requirements. EPA does not agree with ARCO's comment at the bottom of page 47 that compliance with storage ARARs only has to occur at the completion of the remedial action. See the discussion above at Comment No. 1. In any event, it is not expected that flue dust will be "stored" as part of this remedial action as treatment is expected to take place at each of the areas in which flue dust is now piled.

ARCO argues at the top of page 48 that storage requirements will not be relevant and appropriate for treated flue dust. EPA agrees, but will continue to maintain that certain other RCRA Subtitle C requirements are relevant and appropriate for treated flue dust.

At page 48, ARCO discusses the meaning of the term "disposal." ARCO has updated this discussion at page 4 of its letter of May 16, 1991. A determination as to the definition of "disposal" is probably moot at this point, since, for other reasons, there will be no disposal or land disposal of a RCRA hazardous waste (because treated flue dust is not a characteristic hazardous waste) as part of this remedial action. Nevertheless, ARCO's discussion as to the meaning of the term "disposal" bears some comment. ARCO concludes that the term "land disposal" as defined at section 3004(k) of the Resource Conservation and Recovery Act, 42 U.S.C. 6924(k), governs not only the operation of the land ban as set forth at RCRA 3004(d), but also the operation of the general RCRA Subtitle C requirements at section 3004(a).

EPA does not agree. The broader term "disposal" governs the requirements of 3004(a). First, "disposal" is the term used there. If Congress had wanted to use the term "land disposal," it could easily have done so. Second, the regulations which implement the general RCRA hazardous waste requirements at 3004(a), 40 C.F.R. 260-265, use the term "disposal" as defined at RCRA section 1004(3). See 40 C.F.R. 260.10. "Disposal," therefore, is the operative term when considering the general

RCRA hazardous waste provisions, 40 C.F.R. Parts 260-265. "Disposal" is broad enough to include any movement of hazardous waste within a unit as well as across unit boundaries. See 55 F.R. 8759. This is obviously broader than the term "land disposal" which EPA agrees does require movement of waste across unit boundaries. Thus, while movement of waste within a unit could be "disposal" and could trigger the operation of requirements at 40 C.F.R. Part 264, only "land disposal," movement of waste across a unit boundary, would trigger the requirements of the land ban, 40 C.F.R. 268. (This clarifies the discussion at page 3-20 of the Screening and Description of Potential Applicable or Relevant and Appropriate Requirements (ARARs) for the Flue Dust Operable Unit, Anaconda Smelter NPL Site, January 1991.)

ARCO discusses land disposal of treated flue dust at page 50. EPA agrees that there will be no "land disposal" because there will be no hazardous waste and therefore, no placement of a hazardous waste. Thus, these requirements will not be applicable.

At pages 51-52, ARCO discusses whether consolidation of the flue dust piles and placement without treatment into a repository would constitute movement into a "unit." Discussion of this point is moot, as there will be no disposal of untreated flue dust as part of this remedial action. Nevertheless, ARCO's comment bears some discussion. EPA agrees that the Flue Dust OU is a unit but does not necessarily agree that all of Smelter Hill is a unit. First, Smelter Hill is very large, 5-10 square miles in size. It is simply too big to be treated as one unit. Second, EPA recognizes that "where there are discrete, widely separated areas of contamination, the RCRA 'unit' will not always encompass an entire CERCLA site." 55 Fed Reg. 8760. The flue dust piles consist of discrete "areas of contamination," which are far away from other parts of Smelter Hill. Finally, the Flue Dust remedial action does not address Smelter Hill as a whole. It is unnecessary at this time to decide whether all of Smelter Hill should be considered a "unit" for the purposes of deciding whether "land disposal" has occurred and whether the requirements of RCRA section 3004(d) are applicable to the Flue Dust OU.

18. Volume I, page 54, paragraph III.C.2.c.

ARCO discusses the applicability of 40 C.F.R. 262 at page 54. As discussed above, the conclusions drawn by ARCO in the first paragraph on page 54 are no longer true. Flue dust is presently a hazardous waste in Montana. See Comment No. 16, above.

At the bottom of page 54 and top of page 55, ARCO concludes that pre-transport and accumulation requirements at 40 C.F.R. 262 Subpart C need not be complied with until the conclusion of the remedial action. If untreated flue dust is transported or accumulated, however, then these provisions could be applicable before conclusion of this action. ARARs must be complied with during and at the conclusion of remedial actions. See Comment No. 1, above.

19. Volume I, page 60-63, paragraph III.C.2.c.e.iii.

EPA agrees that 40 C.F.R. Subpart F is not applicable to areas from which flue dust will be excavated nor is it relevant and appropriate to areas from which flue dust will be excavated, given that this action does not address final cleanup of groundwater. EPA does not agree, however, with the assertion at the middle of page 62 that Subpart F requirements are not relevant and appropriate to disposal of treated flue dust in the waste repository. Specifically, Subpart F requirements at 40 C.F.R. 264.90 through 264.100 are relevant and appropriate at the waste repository for the same reasons the RCRA MCLs are deemed relevant and appropriate. See discussion at Comment No. 7, above.

ARCO argues at the bottom of page 62 and top of page 63 that it will request an interim measures waiver if EPA determines 40 C.F.R. Subpart F is an ARAR. For the reasons discussed at Comment No. 8, above, EPA believes that an interim measures waiver for 40 C.F.R. Subpart F as it applies to the waste repository would be improper.

20. Volume I, page 63-67, paragraph III.C.2.e.iv.

EPA agrees that closure requirements at 40 C.F.R. Subpart G, and requirements at 40 C.F.R. 264.228 and 264.310 are not applicable or relevant and appropriate to areas from which flue dust will be excavated. These requirements are not applicable to the waste repository. However, EPA believes that certain of these requirements are relevant and appropriate for the waste repository. These include the requirements at 40 C.F.R. 264.111, 264.117, and 264.310. These requirements are relevant and appropriate, see 40 C.F.R. 300.400(g)(2)(i)-(viii), for reasons similar to those set out at Comment No. 7, above. The eight factors are discussed below.

a) The first factor compares the purpose of the requirement and the purpose of the CERCLA action. The closure requirements applicable to landfills are meant to assure that hazardous constituents, wastes, or leachate are not released from closed landfills. This action will attempt to assure that the waste repository, which meets the definition of a RCRA "landfill," see 40 C.F.R. 260.10, will not release

hazardous constituents, once all treated flue dust has been disposed there.

b) The second factor compares the medium addressed by the requirement with the medium addressed by the CERCLA action. The closure requirements seek to protect human health and the environment from contamination from landfills. That is precisely what this CERCLA action will seek to do.

c) The third factor compares the substance regulated by the requirement and those at the CERCLA site. Treated flue dust is not expected to exhibit a characteristic and therefore is not expected to be a RCRA hazardous waste. However, treated flue dust will still contain high concentrations of arsenic, lead, and cadmium, substances for which there are specific concentration limits. See 40 C.F.R. 264.94. Though the mobility of flue dust will be reduced through treatment, flue dust will still leach. Therefore, EPA finds that treated flue dust is sufficiently similar to a RCRA hazardous waste that the RCRA MCLs are relevant and appropriate for the waste repository.

d) The fourth factor compares the activities regulated by the requirement and the actions at the CERCLA site. The closure requirements regulate the closure of landfills, assuring that they are closed in a way which will minimize contamination of the environment. This remedial action will seek to assure that contamination of the environment by the waste repository is also minimized.

e) The fifth factor relates to variances of the provision in question and whether these are available for circumstances at the CERCLA site. There are no variances under the closure requirements.

f) The sixth and seventh factors compare the type of "place" and the type and size of structure regulated under the requirement and the type of place or structure affected or contemplated by the CERCLA action. RCRA regulates hazardous waste disposal facilities and places on which they are located. The facility and its location as contemplated by this CERCLA action will be similar if not identical to a RCRA disposal facility in terms of size and type of construction. It will involve a repository for waste which will have a liner and cap. This is similar to a RCRA disposal facility.

g) The eighth factor compares the resource use affected by the requirement and the potential resource use at a CERCLA site. The closure requirements are meant to protect natural resources and human health in the vicinity of landfills. The same considerations apply to the waste repository.

21. Volume I, page 73-75, paragraph III.C.2.e.x.

For the reasons discussed at Comment No. 20, EPA finds that portions of 40 C.F.R. Subpart N are relevant and appropriate for design of the waste repository. Specific provisions deemed relevant and appropriate are 40 C.F.R. 264.301(a), (b), (f), (g), (h), (i), and 264.303. Again, see 40 C.F.R. 300.400(g)(2)(i)-(viii), which outlines the factors to be considered in determining whether a requirement is relevant and appropriate. The closure requirements discussed above at Comment No. 20 are intended to prevent releases from landfills. The requirements discussed here pertaining to leachate collection, erosion control, control of wind dispersion and inspections are intended to accomplish the same objectives.

22. Volume I, page 94, paragraph III.C.7.

ARCO argues that BMP requirements as set forth at 40 C.F.R. 125.100 are not applicable because the Flue Dust OU will not involve a point source discharge. EPA agrees that this provision is not an ARAR, but only because the specific pollutants at 40 C.F.R. 125.102 will not be discharged. It is entirely possible that this OU will involve a point source discharge resulting from runoff control. In that case, there would be a "point source discharge" which would have to meet certain Clean Water Act requirements.

23. Volume II, page 2, paragraph I.

ARCO indicates that Volume II incorporates by reference sections I and II of Volume I. Therefore, EPA incorporates by reference its responses to sections I and II of Volume I as outlined above at Comments 1-4.

24. Volume II, pages 4-5, paragraph II.A.1.

At page 4, ARCO states that MCA 75-2-102 is not an ARAR because it is a narrative requirement. EPA disagrees. The provision sets out a substantive standard where it requires that air quality be maintained. While this provision is a general one, since it can be enforced by regulations, it can be an ARAR. See 55 Fed. Reg. 8746.

24. Volume II, pages 5-9, paragraph II.A.2.

ARCO points out at page 6 that because ARM 16.8.815 and .821 are not more stringent than the federal requirements, they are not ARARs. These are applicable provisions, however, as they are part of an authorized program under the Clean Air Act, are at least as stringent as the federal requirements, and are the provisions in effect in Montana. See 40 C.F.R. Part 52, Subpart BB, see also, Compliance With Other Laws Manual, Volume II,

August 1989, page 7-7.

At page 7, ARCO discusses Montana's PSD program. EPA agrees that the PSD provisions are not applicable. However, ARM 16.8.925 and .926 are relevant and appropriate. They are designed to assure that emissions do not result in increases in pollutants in ambient air beyond the limits prescribed.

At page 8, ARCO discusses ARM 16.8.1427, which relates to odor bearing gases and vapors which create a public nuisance. ARCO argues that this provision is not an ARAR since it does not define a standard of control. EPA finds that the limitation on "gases or vapors which create a public nuisance" is an adequate standard of control and that the provision is therefore an ARAR.

25. Volume II, pages 9-11, paragraph II.A.3.

EPA agrees with ARCO that final cleanup of surface water and groundwater is beyond the scope of the Flue Dust OU. However, this does not mean that there are no ARARs relating to water. Remedial action at the Flue Dust OU should in no way negatively impact state waters or exacerbate whatever contamination might already exist. To provide otherwise would be inconsistent with implementation of the final remedy. This is prohibited. See 40 C.F.R. 300.430(a)(1)(ii)(B). Thus, MCA 75-5-303 along with implementing regulations is an applicable requirement for areas from which flue dust will be excavated as well as for the waste repository.

26. Volume II, pages 12-13, paragraph II.A.4.

EPA agrees that Montana's drinking water requirements are not applicable requirements. As mentioned above, EPA also agrees that final cleanup of groundwater is not within the scope of this action. Nevertheless, the drinking water requirements are relevant and appropriate for this action with respect to the waste repository. First, Montana's drinking water requirements are part of an approved program under the Safe Drinking Water Act ("SDWA") and are thus the equivalent of MCLs under the SDWA. Second, MCLs are recognized as being relevant and appropriate for in situ treatment of groundwater which is or may be used for drinking water. See Compliance With Other Laws Manual, Volume II, August 1989, page 4-8. Finally, as explained above, the waste repository is to be permanent. Although MCLs for groundwater at the Flue Dust OU may not be met until some later date, the waste repository, because it is permanent, must be designed and built now so as to be capable of meeting them. See 40 C.F.R. 300.430(a)(1)(ii)(B).

27. Volume II, pages 13-14, paragraph II.A.5.

EPA agrees that final compliance with surface water quality standards is not within the scope of this OU. However, EPA finds that these requirements are nevertheless applicable requirements for the design of the waste repository. The repository may well involve control of runoff and discharge into state waters. Even though this OU will not attempt to remediate surface water, potential runoff from the waste repository must not interfere with state water quality requirements.

28. Volume II, page 14, paragraph II.A.6.

The requirements referred to by ARCO should be ARARs for the reasons referred to at Comment 25, above.

29. Volume II, pages 14-17, paragraph II.A.7.

EPA agrees that Montana's groundwater standards, in general, are not ARARs for areas from which flue dust is excavated but are applicable requirements for design of the waste repository. Drinking water standards already discussed at Comment No. 26, above, apply to drinking water at the tap and were found as being relevant and appropriate for groundwater. These requirements apply directly to groundwater. While final cleanup of groundwater is not an objective of this OU, design of the repository so as to meet these requirements is an objective of this OU. See 40 C.F.R. 300.430(a)(1)(ii)(B).

ARCO discusses groundwater nondegradation requirements at page 16. EPA finds that these requirements are applicable for the repository as well as for the areas from which flue dust is excavated. To allow either the repository or excavated areas to exacerbate already existing contamination would violate 40 C.F.R. 300.430(a)(1)(ii)(B).

30. Volume II, pages 18-19, paragraph II.A.9.

At page 19, ARCO concludes that MCA 75-6-112 should not be relevant and appropriate for the Flue Dust OU. While EPA does agree that cleanup of groundwater is beyond the scope of this action, the waste repository must nevertheless be designed in a manner consistent with the protection of groundwater. Therefore, this requirement is relevant and appropriate.

31. Volume II, page 24-25, paragraph II.B.6.

ARCO discusses MCA 75-7-102 at page 24. EPA believes that this provision is an ARAR. First, although it is narrative and general in nature, such provisions can be ARARs if they are directive and if they are implemented through more specific regulations. See 55 Fed. Reg. 8746. This provision is

implemented through more specific requirements. Second, the fact that impact to streams and rivers is not planned does not mean that this provision is not an ARAR. In building the waste repository, it is possible that such an impact could occur. Therefore, this provision is a ARAR.

32. Volume II, page 30-50, paragraph II.C.4

In this section ARCO discusses various regulatory provisions promulgated under the Strip and Underground Mine Reclamation Act, MCA 82-4-201, et seq., and concludes, concerning most of the provisions, that they are neither applicable or relevant and appropriate at the Flue Dust OU. EPA agrees that none of these provisions are applicable for the Flue Dust OU. However EPA disagrees as to whether some of the provisions are relevant and appropriate. For specific provisions where EPA disagrees with ARCO's conclusion, comments are set forth below.

a) ARM 26.4.501 and 501A. These require backfilling and grading to the original contour of the land to minimize adverse effects on groundwater. EPA finds that these provisions are relevant and appropriate for the Flue Dust OU. These provisions are designed to assure that land disturbed by strip mining is returned to original contours. This OU will attempt to assure that lands disturbed by deposition and excavation of flue dust are returned to original contours. It should be noted that final reclamation and recontouring of disturbed lands will not be required by this OU. This OU seeks only to stabilize disturbed areas pending final remedial action.

b) ARM 26.4.631. This provision identifies measures to be taken to minimize changes to the hydrologic balance which could result from mining or reclamation activities. ARCO argues that remedial action at the Flue Dust OU will not result in the sorts of disturbances to the surface which could impact groundwater. EPA does not agree. Considerable excavation will have to be done at the site of the main flue, in particular, as well as at the other flue dust piles. These excavations could result in flows to surface or groundwater with resulting adverse impacts to those waters in violation of 40 C.F.R. 300.430(a)(1)(ii)(B). This provision is therefore relevant and appropriate.

c) ARM 26.4.633. This section provides that surface drainage from disturbed areas must be treated using the best technology currently available. Sediment must be controlled. The areas from which flue dust will be removed, particularly the main flue, are similar to areas disturbed by mining in that these areas will affect the flows of surface waters. EPA therefore disagrees with ARCO's conclusion that this provision is not relevant and

appropriate.

d) ARM 26.4.636. If temporary diversion structures are built, this requires that they be built so as to safely pass runoff from peak precipitation events. ARCO argues that such structures are not envisioned for the Flue Dust OU. However, given the very large disturbances to the surface which will result from excavation of flue dust from the main flue in particular, but also from the waste piles, such diversion structures may be necessary to stabilize the site. Therefore, EPA finds that this provision is relevant and appropriate if diversion structures are built.

ATTACHMENT 1

ARCO COMMENTS

ARCO

A-1
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ENVIRONMENTAL PROTECTION
AGENCY

JUL 25 1991

MONTANA OFFICE

July 23, 1991

Mr. Charles Coleman
U.S. Environmental Protection Agency
Region VIII, Montana Office
Federal Building
301 S. Park, Drawer 10096
Helena, Montana 59626-0096

Dear Charlie:

The EPA's Proposed plan for the remediation of the Flue Dust Operable Unit at the Anaconda Smelter Site has been reviewed by ARCO, and we agree with EPA's analysis. Accordingly, we will support the decision to use onsite solidification/fixation.

Also, we would like to add the following comments regarding the criteria employed by EPA to select the preferred alternative.

Long-term Effectiveness and Performance. Two leaching methods were used to predict the long-term stability of the fixed and solidified flue dust samples. There are no procedures which will unequivocally predict long-term stability. However, the Multiple Extraction Procedure (MEP) and the ANS 16.1 have been proposed by EPA in the publication, "EPA/624/6-89/122" as methods for determining maximum leachate concentrations which could occur under acidic environments. The results obtained from such tests are thought to simulate long-term leaching behavior.

However, since a degree of uncertainty remains, part of EPA's proposed plan is containment of the treated material in an enlarged repository which will (1) prevent inward leakage of any fluid - acidic or not, (2) minimize outward leakage of leachate, and (3) preserve protective alkalinity. We submit that these precautionary measures should be used for any flue dust residues containing high levels of potentially leachable heavy metals.

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Reduction of Toxicity, Mobility, and Volume. Residues which resulted from the treatment of flue dust by fixation and solidification consistently passed TCLP tests, whereas residues produced with Cashman and acid leach technology failed. Proponents of the Cashman technology have pointed out that most of their testwork was conducted with EP Toxicity as the leachability criterion and have alleged that their technique could be modified to pass TCLP tests. However, their "Report on TCLP Tests for Lead on Smelter Flue Dust Residues from Anaconda, Montana..." dated March 13, 1991 shows that Cashman residues produced under closely-controlled laboratory conditions passed the TCLP tests by very small margins. The results were variable, and it is doubtful that they would be readily reproducible under typical continuous operating conditions in a plant. This suggests at the very least that the residues may have to be solidified and contained in an engineered containment structure.

Short-term Effectiveness. The use of a mobile batch plant to solidify the flue dust would eliminate the potential that small amounts of flue dust would contaminate the haul roads connecting the storage piles. Processing the dusts for metals recovery, at elevated temperatures and pressures with corrosive reagents will inevitably expose operating personnel to hazards of the workplace. (See comments regarding Hazards and Operability in the next section). We believe that the simple and proven methods which would be used during fixation/solidification would eliminate such worker hazards except for those related to rotating equipment.

Implementability. A mobile batch plant is simple to build, operate, and move. Concrete making is probably the most well-known of material processing technologies. The equipment is reliable, parts are easily obtained, and exotic construction materials are not required. The operating flexibility of a batch plant would enable rapid suspension and restart of operations in response to harsh winter conditions. More complex processing plants do not have this flexibility; moreover, process efficiency always suffers from shutdown and upsets.

Mobile batch plants commonly are available for lease, resulting in ready availability of knowledgeable plant owners and operators. This would obviate the expensive, time-consuming, and potentially dangerous training programs needed for operators and supervisors of complex chemical processing plants. Quick and simple batch plant startup promises maximum initial throughput, minimum total time to project completion, and minimal piloting of the treatment process.

The complexity and potentially hazardous nature of the Cashman technology as applied to flue dust is illustrated by the outcome of a Hazard and Operating Study (HazOp) conducted for ARCO by a team of consultants in September, 1990. The subject was Bechtel's design of a Cashman plant to treat Anaconda flue dust, and the object of the study was to identify hazards to operators and to the environment, as well as operability problems which could compromise the plant's ability to achieve and sustain design throughput and required residue leachability. The principal intent was to reveal safety hazards and to develop accident scenarios, while only limited attention was given to operability problems and economic consequences. A much more detailed study subsequent to further piloting would be needed to quantify the latter.

Over 600 safety-related accident scenarios were developed and over 100 design modifications were identified which needed correction to meet either OSHA regulations or to comply with the operating principles of responsible plant managers.

For example, the design suffers from many examples of highly potential spills of hot liquids and slurries, generation and release of hydrogen/air mixtures, and the like. There also is a significant potential for autoclave explosions.

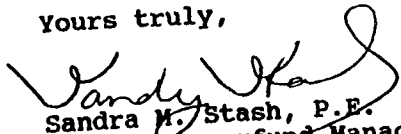
The HazOp Study concluded with the following paragraph: "...Although each individual unit operation in the process is relatively simple, the combined process is very complex. It requires extensive recycling and careful control of process parameters through every step of the treatment. The process is operator-intensive, thereby being prone to human errors and operability problems. Addition of interlocks to improve the safety of the system by reducing the potential for human error could make the system even more difficult to operate. From an economic perspective, numerous accidents were identified which were not safety-related but would cause contamination of products. It should be assumed that a significant portion of the facility life is (would be) spent reprocessing these contaminated products."

Cost. The operating cost uncertainties of a batch plant are small, reflecting mainly fluctuations in cement price and the rental rates of equipment and operators. Both capital and operating cost estimates for the first commercial application of a complex processing technology are very uncertain - even when based on very detailed plant design, which has not yet been done for the Cashman Process. Invariably, these estimates grow as more is learned about a process and more detailed engineering has been completed. Early "optimism" with regard to costs

usually reflects failure to consider fully the engineering obstacles which must be overcome. It is likely that satisfaction of the HazOp findings alone could add 50 to 100 percent to the preliminary capital cost estimate and increase operating costs significantly.

In summary, ARCO believes that the data provided in the Flue Dust RI/FS accurately portray the problem and define the remedial alternatives which are currently available. The Comparative Analysis of Alternatives provided by the EPA clearly shows that Solidification/Fixation is the preferred remedy, as it can be accomplished quickly using a simple process to eliminate the problem permanently.

Yours truly,


Sandra M. Stash, P.E.
Montana Superfund Manager

SMS/mk

cc: Greg Mullen
Pam Sbar, Esq.
Bob Lawrence, Esq.
Robin Bullock
Terry McNulty

A-2



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July 31, 1991

VIA FAX

RECEIVED
JUL 31 1991
MONTANA OFFICE

Charlie Coleman
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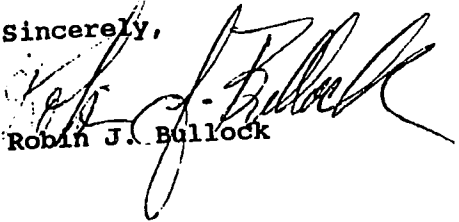
Re: ARCO's Comments on Anaconda Smelter Site, Flue Dust Operable Unit, Proposed Plan

Dear Mr. Coleman:

ARCO submits the following attachments in support of EPA's June 1991 Anaconda Smelter Site, Flue Dust Operable Unit Proposed Plan.

ARCO respectfully requests that EPA consider the attached comments in selecting the final remedy for this Operable Unit.

Sincerely,


Robin J. Bullock

JUL 31 1991

DR. TERRY MCNULTY

FRANCO 0000 0000

TO: ROBIN BULLOCK
SUPERFUND COORDINATOR
ARCO
(406) 563-8269

FROM: TERRY MCNULTY
7/31/91

RE: SOLIDIFICATION/FIXATION OF ANACONDA SMELTER FLUE DUSTS
COMMENTS REGARDING CALCIUM ARSENATE, XRD, HAZOP.

CALCIUM ARSENATE AND XRD
X-ray diffractometer (XRD) scans have disclosed that the untreated dusts already contain arsenic principally as calcium arsenate. The calcium arsenate apparently formed when lime and water were added to the acidic dusts which contained arsenic trioxide and, possibly, arsenic acid. The XRD pattern lines for pure calcium arsenate correspond well with some of the pattern lines for the four untreated dusts which were studied. However, some of those lines are missing from the XRD patterns for the treated dusts. Moreover, many new lines are generated by the treated dusts and some do not correspond either to patterns for untreated dust or for common cement curing compounds such as calcium silicate and calcium aluminum silicate. Direct comparisons of XRD patterns for untreated and treated dusts unfortunately are impossible to make because the analyses were made at different times with different levels of background correction. Furthermore, a considerable amount of line broadening and peak attenuation accompanied treatment - indicative of a reduced degree of crystallinity, increased compound complexity (perhaps nonstoichiometric compound formation), and possibly the formation of semi-amorphous compounds. While this makes precise comparisons and compound identification nearly impossible, it is highly suggestive that new and stable compounds formed.

The ANS 16.1 leachability test is, in effect, a stringent determination of multi-component solubility in de-ionized water. The solubility of calcium arsenate as a function of pH is well documented and it is 130 ppm in de-ionized water at 25 degrees Celsius. The ANS 16.1 solubility for arsenic and even the MEP solubility using an acidic medium are lower by a factor of 100 to 1000 than the published solubility of calcium arsenate.

These two pieces of evidence indicate very strongly that arsenic in treated flue dust is present as one or more species which may contain other metals such as copper, lead, and zinc in addition to arsenic. This is supported by one of Dr. R.G. Robins' observations, "...copper, zinc, lead, barium, and mercury may be the actual stabilizing influence in many disposal situations.

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HazOp

Hazard and Operability ("HazOp") assessments are becoming commonplace in the processing industries and are policy requirements in some corporations. A HazOp conducted on a preliminary design provides a cost-effective way of identifying changes which must be incorporated in the final design. Usually the final design is subjected to a second HazOp in order to disclose problems which were missed the first time around or were introduced during detailed engineering. The total cost of the two HazOps on a complex plant costing in the range of \$50-100 million to build will typically be \$75000 to \$125000, compared with an engineering fee in the range of \$4-10 million. Hence, the HazOp at any level is a cheap "insurance policy" and is a good way of estimating the operability of a plant.

JUL-31-91 WED 10:42

DR. TERRY HOROLTI

FRA NO. 0000 0000

TO : Robin Bullock
Superfund Coordinator
Atlantic Richfield Company

FROM: T. P. McNulty and F. N. Ramseler
T. P. McNulty and Associates, Inc.
July 31, 1991

RE : ANACONDA FLUE DUST OPERABLE UNIT
Comments on July 23, 1991 Public Meeting in Anaconda.

The following comments are in approximate chronological order. Some names may not be correctly spelled and most comments have been abbreviated and editorialized; we feel, however, that they accurately convey the spirit of the statements which were made. Neither Joe Cashman nor Dr. L. G. Twidwell was present. Reactions by Ramseler and McNulty to individual comments are presented in italics after each public comment, although neither consultant offered observations until after the formal meeting was closed.

Charlie Coleman (EPA) The deadline for written comments will be the end of July, with a ROD scheduled for the end of September.

Ethan Patashnik (Artech) Requested that a Question and Answer period precede the Comment period, but was told by Coleman that the June meeting provided the opportunity for questions and that discussion would be encouraged after the formal hearing.

Melvin A. Stokke (Citizen) He was supportive of the Solidification and Fixation proposal and commented that Anaconda's Research Department worked on flue dusts for 15 years without ever finding a successful solution. This work included an acid leaching process followed by solvent extraction and electrowinning. He cited the Arbiter Plant as an example of the difficulty of commercializing new technology. He expressed concern regarding the hauling of fixed material to the repository and the movement of vehicles on the material after placement. He suggested casting concrete blocks and stacking them in the repository. Mel misunderstood the manner in which the flue dusts will be mixed with lime, Portland cement, and water, but his other comments were absolutely correct.

Ed Huestis (Citizen) He observed that sulfurous and sulfuric acids would have formed when water was added to the flue dust (and reacted with the sulfur dioxide contained in the dust) and wondered if ARCO's contractors had taken this into account. The flue dusts were all limed before being placed in the existing temporary impoundments. Then, fixation will bring the final alkalinity to about pH 12. All of the original sulfurous/sulfuric acid will have been converted to gypsum.

T. P. MCNULTY AND ASSOCIATES, INC.

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Ethan Patashnik (Artech) He said that reviewing the proposal was a tough job, that he could understand how many laymen simply do not understand it, but that Artech's staff of research people had studied it in great detail. He pointed out that ARCO had attempted to obtain a license from Artech and that this vindicated the process. He said that Dr. Robins is in favor of metals recovery and that we should not leave problems for our grandchildren. Earthquakes could cause the repository to fail. The residue will be unstable because calcium arsenate is unstable. The preferred fixation method in industry is oxidation to form ferric arsenate. Dr. Robins favors metal recovery because he hates to "waste" resources. The engineering profession is skilled in designing structures to withstand earthquakes. As discussed in a separate writeup, the arsenic probably forms a very complex and very insoluble compound, not simply calcium arsenate. In fact, because of the liming done during the early 1980s, the arsenic in the existing dusts has already been converted to calcium arsenate. Solidification and fixation in the presence of copper, lead, etc. probably converts the original calcium arsenate to other compounds. Industry does not have a preferred procedure for treating arsenical solids.

Con Malee (Citizen) He fully supports Solidification and Fixation because it meets all criteria. The citizens do not want a test site in Anaconda. He does not want his children working in a plant which treats arsenic and beryllium. "Please allow us some control over what happens in our backyard."

Lee Snow (Citizen) Offsite disposal is best because we cannot afford to have hazardous materials at the headwaters of a large river. No containment is good enough.

Richard Kunter (Artech) He explained that he was a standin for Dr. Robins. He said that long-term stability of the residue is in question because copper will leach. Metal recovery is the preferred route. He also noted that Robins is not necessarily in favor of the Cashman Process.

Dr. Mabel Tuchsherer (Citizen) She agrees with the EPA recommendation, but believes that the toxicity of arsenic has been grossly exaggerated.

Bill Badal (Artech) He feels that the ANS 16.1 procedure is a simple one, but that there were honest errors and omissions on the part of the contractor who performed them. Diffusion coefficients were not calculated. Although not important, recommended surface area/liquid ratios were not followed. He finds it "appalling" that EPA did not review the conclusions more carefully. He calculates that Pb and Cd will be stable for millions of years, but that significant arsenic will leach from the Iron Pond dust in 57 years, from the Bradley Pond dust in 11 years, from the Coal Pile Tracks dust in 1000 years, and from the Flue Dust Storage dust in 135 years. This issue will be dealt with in a separate writeup. Mr. Badal is incorrect.

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10/10/78, WED 10:44 AM TERRY HONOLULU 10/10/78 0000 0000

Nicki Leiss (Citizen) She supports the EPA recommendation because it will solve the problem quickly.
Sandy Stash (ARCO) The S/F study was flawless and ARCO is ready and willing to proceed.
Maggie Snow (Citizen) How much would it cost to haul the dust offsite and dispose of it? Sandy Stash answered that the range would be \$60-70 million.

The formal meeting was closed by Charlie Coleman and it was re-opened for informal discussion.

Dr. Mabel Tuchsherer If the material were moved offsite, where would it go?
Charlie Coleman There are few such places and it would be better for all concerned to leave the dust in Montana.
Bill Bedal Was the HazOp a part of the RI/FS? Was it used for AAL?
Sandy Stash HazOps are a part of the ARCO decision making process.
Bill Bedal It would be better to conduct a HazOp on the final design.
Sandy Stash There will be one for S/F.
Ethan Patashnik The Artech consultant says that, as a result of the HazOp, the cost will be less, not more. The ANS 16.1 data cannot be supported and are not useable.
Terry McNulty In fact, the HazOp indicated that the Bechtel estimate was low by a factor of 50% or more. He explained that the ANS 16.1 was developed for radionuclides and that the precautionary statement at the end of the procedure (about analyzing filtered solids if filtration is employed) has to do specifically with soluble radionuclides which undergo decay to insoluble daughter products. Following the procedure blindly for heavy metals will introduce errors. Earlier comments about instability of calcium arsenate are not appropriate because the fixation product formed from treatment of multicomponent flue dusts appears to be a very complex arsenate with much lower solubility than any of the simple arsenates produced from pure systems.
Charlie Coleman Proper QA/QC was followed during ANS 16.1 tests. Usability may indeed be an issue and it is under review, but he does not expect a problem. There is no definitive long-term stability test. The RD/RA will refine the S/F method and will derive optimum formulas.
Ed Huestis Did Arco look at physical methods of concentration, e.g. a wind tunnel which would separate particles by specific gravity?
Rick Ramseier Yes, many techniques were investigated, including gravity and volatilization.
Ed Huestis The government should sponsor a 100-year field laboratory in the Anaconda area to study waste treatment and

metal recovery. He noted, however, that it would never make money, just provide jobs.
Charlie Coleman Protection of the environment and human health is most important, not recovery of metals.
Lee Snow Is there now a problem with release of flue dusts into the environment?
Sandy Stash and Charlie Coleman A surfactant is applied which minimizes the problem.



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CERTIFIED - RETURN RECEIPT REQUESTED
July 31, 1991

Mr. Charles Coleman
Anaconda Project Manager
U.S. Environmental Protection Agency
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301 S. Park, Drawer 10096
Helena, MT 59626-0096

Mr. Gregory Mullen
Solid & Hazardous Waste
Montana State Department of
Health & Environmental
Sciences
Cogswell Building
Helena, MT 59620

Re: ARCO's Comments on Anaconda Smelter Site, Flue Dust
Operable Unit, Proposed Plan

Dear Mr. Coleman and Mr. Mullen:

ARCO submits the following comments on EPA's June 1991
Anaconda Smelter Site, Flue Dust Operable Unit Proposed Plan.

I. ANS 16.1 LEACH TEST

The ANS 16.1 Procedure was developed by the American Nuclear Society as a means for predicting the long-term leachability of radioactive materials from solid repositories under adverse exposure conditions as a function of time. The ANS 16.1 method has been extended to test other materials "...so that it (ANS 16.1) more nearly represents anticipated conditions under which a solidified waste form may be stored, transported or disposed." (Chemical Fixation and Solidification of Hazardous Wastes, Chapter 14). The ANS 16.1 Procedure applied to nonradioactive heavy metal-bearing materials may produce a leachate wherein fine particulates are suspended. If so, these will be flue dust constituents which have not dissolved, but are simply too small to settle out during the time allowed in the Procedure. These particulates should be removed from the leachate and not assayed because they represent heavy metal sources which have not leached. Inclusion in the total assay would overstate the dissolved heavy metal concentration. Since the objective of the test was to determine the concentration of metals which may become mobile during the leaching process, and not to determine the metals concentrations in the sediment, a decision was made to filter the leachate. This modification more accurately represents the disposal conditions which would exist for the stabilized Anaconda Flue Dust. This decision was also consistent with previous ANS 16.1 tests performed for long-term stabilization determination in other EPA Regions (i.e. EPA Region IV).

The ANS 16.1 test produces a leachate which is sampled and replaced at designated intervals. Analysis of the samples for the element(s) of interest is used to calculate effective diffusivity

using a standard equation. The leachability index is then calculated as the negative logarithm of the average effective diffusivity. The leachability index is defined as a parameter that characterizes the resistance of the solid waste to leaching of constituents. Scientific literature does not describe it as a method to estimate when an element has been totally leached.

Within the attached information you will find the following information:

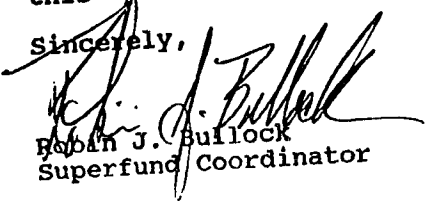
1. The mean time interval (American National Standards)
2. Dissolved metal concentrations (mg/l)
3. Delta T (Change in time from sampling to sampling)
4. Metal concentrations (converted to mg/kg from #1)
5. Total concentrations from raw flue dust
6. The effective diffusivity for each sampling
7. The leachability index

The EPA uses the leachability index as an indication of the diffusion rates of an element as it is leached from a solid waste. A leachability index of 5 to 10 indicates rapid diffusion, whereas an index of 10 to 15 suggests very slow diffusion (Stabilization/Solidification of CERCLA and RCRA Wastes, EPA/625/6-89/022). The Anaconda flue dust leachability index for arsenic, as reported in the attached documentation, ranges from 10.6 to 14.3, depending on the sample location, thus indicating a very slow diffusion rate of arsenic, lead and cadmium from the residue.

These comments set forth above are intended to supplement our previous communications and correspondence with the Agency pertaining to the Flue Dust Operable Unit.

ARCO respectfully requests that EPA carefully consider the additional information provided in selecting the final remedy for this Operable Unit.

Sincerely,


Robin J. Bullock
Superfund Coordinator

ARCO - ANSI LONG TERM LEACHING STUDY
- LEACHABILITY INDEX

MEAN TIME INTERVAL (FOR DIFFUSIVITY CALC.)

INT#1	INT#2	INT#3	INT#4	INT#5	INT#6	INT#7	INT#8	INT#9	INT#10
7200	25200	86400	172800	259200	345600	432000	1573200	3978000	7885560
7200	25200	86400	172800	259200	345600	432000	1573200	3978000	7885560
7200	25200	86400	172800	259200	345600	432000	1573200	3978000	7885560
7200	25200	86400	172800	259200	345600	432000	1573200	3978000	7885560
7200	25200	86400	172800	259200	345600	432000	1573200	3978000	7885560

t#1 1/2	t#2 1/2	t#3 1/2	t#4 1/2	t#5 1/2	t#6 1/2	t#7 1/2	t#8 1/2	t#9 1/2	t#10 1/2
84.85	158.75	293.94	415.69	509.12	587.88	657.27	1254.27	1994.49	2808.12
84.85	158.75	293.94	415.69	509.12	587.88	657.27	1254.27	1994.49	2808.12
84.85	158.75	293.94	415.69	509.12	587.88	657.27	1254.27	1994.49	2808.12
84.85	158.75	293.94	415.69	509.12	587.88	657.27	1254.27	1994.49	2808.12
84.85	158.75	293.94	415.69	509.12	587.88	657.27	1254.27	1994.49	2808.12

X T#1	X T#2	X T#3	X T#4	X T#5	X T#6	X T#7	X T#8	X T#9	X T#10
1800.0	14835.0	51230.7	125894.0	213818.0	300849.2	387596.3	913496.1	2638619	5766281
1800.0	14835.0	51230.7	125894.0	213818.0	300849.2	387596.3	913496.1	2638619	5766281
1800.0	14835.0	51230.7	125894.0	213818.0	300849.2	387596.3	913496.1	2638619	5766281
1800.0	14835.0	51230.7	125894.0	213818.0	300849.2	387596.3	913496.1	2638619	5766281
1800.0	14835.0	51230.7	125894.0	213818.0	300849.2	387596.3	913496.1	2638619	5766281

Concentrations in mg/L - Sampling #1 (n=1)

SAMP WT	SAMPLE#	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.097	0.017	0.0001	0.008	0.017	0.033	0.0002	0.012	0.010
115.7	X4821	0.018	0.010	0.0003	0.008	0.017	0.011	0.0002	0.005	0.010
129.8	X4822	0.018	0.007	0.0001	0.008	0.017	0.003	0.0002	0.010	0.010
135.2	X4823	0.010	0.008	0.0001	0.008	0.017	0.002	0.0002	0.012	0.010
114.6	X4824	0.001	0.005	0.0001	0.008	0.017	0.011	0.0002	0.009	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #2 (n=2) Concentrations in mg/L

SAMP WT	SAMPLE#	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.041	0.013	0.0003	0.008	0.017	0.032	0.0002	0.009	0.010
115.7	X4821	0.014	0.012	0.0001	0.008	0.017	0.018	0.0002	0.005	0.010
129.8	X4822	0.026	0.009	0.0001	0.008	0.017	0.008	0.0002	0.015	0.010
135.2	X4823	0.020	0.010	0.0001	0.008	0.017	0.003	0.0002	0.016	0.010
114.6	X4824	0.001	0.008	0.0001	0.008	0.017	0.018	0.0002	0.012	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #3 (n=3) Concentrations in mg/L

SAMP WT	SAMPLE#	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.088	0.035	0.0001	0.010	0.036	0.089	0.0002	0.017	0.010
115.7	X4821	0.029	0.028	0.0001	0.008	0.024	0.051	0.0002	0.007	0.010
129.8	X4822	0.082	0.026	0.0001	0.008	0.017	0.017	0.0002	0.027	0.010
135.2	X4823	0.066	0.022	0.0001	0.008	0.073	0.010	0.0002	0.028	0.010
114.6	X4824	0.007	0.020	0.0001	0.008	0.017	0.053	0.0002	0.026	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010



Sampling #4 (n=4) Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.095	0.032	0.0001	0.008	0.017	0.091	0.0002	0.015	0.010
115.7	X4821	0.027	0.034	0.0001	0.008	0.017	0.049	0.0002	0.006	0.010
129.8	X4822	0.088	0.024	0.0001	0.008	0.017	0.018	0.0002	0.025	0.010
135.2	X4823	0.068	0.022	0.0001	0.008	0.017	0.010	0.0002	0.026	0.010
114.6	X4824	0.007	0.019	0.0001	0.008	0.017	0.045	0.0002	0.022	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #5 (n=5) Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.169	0.026	0.0004	0.008	0.017	0.100	0.0002	0.014	0.010
115.7	X4821	0.025	0.023	0.0002	0.008	0.017	0.035	0.0002	0.003	0.010
129.8	X4822	0.070	0.016	0.0001	0.008	0.017	0.012	0.0002	0.019	0.010
135.2	X4823	0.055	0.021	0.0001	0.008	0.017	0.007	0.0002	0.018	0.010
114.6	X4824	0.006	0.014	0.0002	0.008	0.017	0.030	0.0002	0.018	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #6 (n=6) Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.082	0.023	0.0002	0.008	0.017	0.051	0.0002	0.011	0.010
115.7	X4821	0.027	0.024	0.0002	0.008	0.017	0.035	0.0002	0.005	0.010
129.8	X4822	0.071	0.018	0.0001	0.008	0.017	0.010	0.0002	0.016	0.010
135.2	X4823	0.053	0.018	0.0003	0.008	0.017	0.006	0.0002	0.013	0.010
114.6	X4824	0.005	0.013	0.0001	0.008	0.017	0.022	0.0002	0.015	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #7 (n=7) Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.077	0.021	0.0003	0.008	0.017	0.076	0.0002	0.006	0.010
115.7	X4821	0.024	0.020	0.0002	0.008	0.017	0.029	0.0002	0.001	0.010
129.8	X4822	0.065	0.014	0.0001	0.008	0.017	0.009	0.0002	0.010	0.010
135.2	X4823	0.049	0.016	0.0001	0.008	0.017	0.006	0.0002	0.011	0.010
114.6	X4824	0.007	0.013	0.0001	0.008	0.017	0.023	0.0002	0.011	0.010
125.7	Ex. Blank	0.001	0.005	0.0001	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #8 (n=8) Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.175	0.073	0.0001	0.014	0.080	0.219	0.0002	0.032	0.010
115.7	X4821	0.068	0.069	0.0001	0.008	0.066	0.136	0.0002	0.011	0.010
129.8	X4822	0.296	0.063	0.0001	0.008	0.047	0.037	0.0002	0.058	0.010
135.2	X4823	0.226	0.057	0.0001	0.008	0.045	0.022	0.0002	0.062	0.010
114.6	X4824	0.078	0.054	0.0002	0.008	0.066	0.202	0.0002	0.061	0.010
125.7	Ex. Blank	0.001	0.005	0.0010	0.008	0.017	0.001	0.0002	0.001	0.010

Sampling #9 (n=9) Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.194	0.089	0.0041	0.007	0.156	0.291	0.0002	0.028	0.005
115.7	X4821	0.080	0.080	0.0041	0.006	0.107	0.149	0.0002	0.007	0.005
129.8	X4822	0.323	0.069	0.0041	0.006	0.068	0.037	0.0002	0.041	0.005
135.2	X4823	0.245	0.074	0.0041	0.006	0.050	0.025	0.0002	0.128	0.005
114.6	X4824	0.034	0.060	0.0054	0.006	0.053	0.135	0.0002	0.077	0.005
125.7	Ex. Blank	0.001	0.006	0.0041	0.006	0.010	0.005	0.0002	0.001	0.005



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Sampling #10 (n=10)

Concentrations in mg/L

SAMP WT	SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
133.0	X4820	0.186	0.108	0.0041	0.006	0.058	0.266	0.0002	0.011	0.005
115.7	X4821	0.057	0.086	0.0053	0.006	0.050	0.099	0.0002	0.004	0.005
129.8	X4822	0.328	0.075	0.0041	0.006	0.042	0.046	0.0002	0.048	0.005
135.2	X4823	0.224	0.073	0.0041	0.006	0.040	0.017	0.0002	0.034	0.008
114.6	X4824	0.018	0.051	0.0041	0.006	0.031	0.083	0.0002	0.062	0.005
125.7	Ex. Blank	0.001	0.006	0.0041	0.006	0.010	0.002	0.0002	0.001	0.005



ARCO - ANSI LONG TERM LEACHING STUDY
- LEACHABILITY INDEX

EFFECTIVE DIFFUSIVITY (DELTA T)

INT#1	INT#2	INT#3	INT#4	INT#5	INT#6	INT#7	INT#8	INT#9	INT#10
7200	18000	61200	86400	86400	86400	86400	1141200	2404800	3907560
7200	18000	61200	86400	86400	86400	86400	1141200	2404800	3907560
7200	18000	61200	86400	86400	86400	86400	1141200	2404800	3907560
7200	18000	61200	86400	86400	86400	86400	1141200	2404800	3907560
7200	18000	61200	86400	86400	86400	86400	1141200	2404800	3907560
7200	18000	61200	86400	86400	86400	86400	1141200	2404800	3907560

ELEMENTAL CONCENTRATIONS (FROM LEACH EXPERIMENT) An
Concentrations in mg/kg -Sampling #1 (n=1)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.073	0.012	0.0001	0.006	0.013	0.025	0.0001	0.009	0.007
X4821	0.016	0.008	0.0002	0.007	0.015	0.010	0.0001	0.004	0.008
X4822	0.014	0.005	0.0000	0.006	0.013	0.002	0.0001	0.008	0.007
X4823	0.007	0.006	0.0001	0.006	0.013	0.001	0.0001	0.009	0.007
X4824	0.001	0.005	0.0001	0.007	0.015	0.010	0.0001	0.008	0.008
Ex. Blank	0.001	0.004	0.0000	0.006	0.014	0.001	0.0001	0.001	0.008

Sampling #2 (n=2) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.031	0.010	0.0002	0.006	0.013	0.024	0.0001	0.007	0.007
X4821	0.012	0.010	0.0001	0.007	0.015	0.016	0.0001	0.004	0.008
X4822	0.020	0.007	0.0001	0.006	0.013	0.006	0.0001	0.011	0.007
X4823	0.015	0.008	0.0000	0.006	0.013	0.002	0.0001	0.012	0.007
X4824	0.001	0.007	0.0001	0.007	0.015	0.016	0.0001	0.011	0.008
Ex. Blank	0.001	0.004	0.0000	0.006	0.014	0.001	0.0001	0.001	0.008

Sampling #3 (n=3) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.066	0.026	0.0001	0.007	0.027	0.067	0.0002	0.013	0.007
X4821	0.025	0.025	0.0001	0.007	0.021	0.044	0.0002	0.006	0.008
X4822	0.063	0.020	0.0001	0.006	0.013	0.013	0.0002	0.021	0.007
X4823	0.048	0.016	0.0001	0.006	0.054	0.008	0.0001	0.021	0.007
X4824	0.006	0.017	0.0001	0.007	0.015	0.047	0.0002	0.023	0.008
Ex. Blank	0.001	0.004	0.0001	0.006	0.014	0.001	0.0002	0.001	0.008

Sampling #4 (n=4) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.071	0.024	0.0001	0.006	0.013	0.068	0.0002	0.011	0.007
X4821	0.023	0.030	0.0001	0.007	0.015	0.043	0.0002	0.005	0.008
X4822	0.068	0.019	0.0001	0.006	0.013	0.014	0.0002	0.019	0.007
X4823	0.050	0.016	0.0001	0.006	0.013	0.007	0.0001	0.019	0.007
X4824	0.006	0.017	0.0001	0.007	0.015	0.040	0.0002	0.019	0.008
Ex. Blank	0.001	0.004	0.0001	0.006	0.014	0.001	0.0002	0.001	0.008

Sampling #5 (n=5) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.127	0.019	0.0003	0.006	0.013	0.075	0.0002	0.010	0.007
X4821	0.021	0.020	0.0002	0.007	0.015	0.030	0.0002	0.003	0.008
X4822	0.054	0.013	0.0001	0.006	0.013	0.009	0.0002	0.014	0.007
X4823	0.041	0.015	0.0001	0.006	0.013	0.005	0.0001	0.014	0.007
X4824	0.005	0.012	0.0001	0.007	0.015	0.026	0.0002	0.015	0.008
Ex. Blank	0.001	0.004	0.0001	0.006	0.014	0.001	0.0002	0.001	0.008



Sampling #5 (n=5) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.127	0.019	0.0003	0.006	0.013	0.075	0.0002	0.010	0.007
X4821	0.021	0.020	0.0002	0.007	0.015	0.030	0.0002	0.003	0.008
X4822	0.054	0.013	0.0001	0.006	0.013	0.009	0.0002	0.014	0.007
X4823	0.041	0.015	0.0001	0.006	0.013	0.005	0.0001	0.014	0.007
X4824	0.005	0.012	0.0001	0.007	0.015	0.026	0.0002	0.015	0.008
Ex. Blank	0.001	0.004	0.0001	0.006	0.014	0.001	0.0002	0.001	0.008

Sampling #6 (n=6) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.062	0.017	0.0002	0.006	0.013	0.038	0.0002	0.008	0.007
X4821	0.024	0.020	0.0002	0.007	0.015	0.030	0.0002	0.004	0.008
X4822	0.055	0.014	0.0001	0.006	0.013	0.008	0.0002	0.012	0.007
X4823	0.039	0.013	0.0002	0.006	0.013	0.004	0.0001	0.010	0.007
X4824	0.004	0.012	0.0001	0.007	0.015	0.019	0.0002	0.013	0.008
Ex. Blank	0.001	0.004	0.0001	0.006	0.014	0.001	0.0002	0.001	0.008

Sampling #7 (n=7) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.058	0.015	0.0002	0.006	0.013	0.057	0.0002	0.004	0.007
X4821	0.021	0.017	0.0002	0.007	0.015	0.025	0.0002	0.001	0.008
X4822	0.050	0.011	0.0001	0.006	0.013	0.007	0.0002	0.008	0.007
X4823	0.036	0.012	0.0001	0.006	0.013	0.004	0.0001	0.008	0.007
X4824	0.006	0.012	0.0001	0.007	0.015	0.020	0.0002	0.010	0.008
Ex. Blank	0.001	0.004	0.0001	0.006	0.014	0.001	0.0002	0.001	0.008

Sampling #8 (n=8) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.132	0.055	0.0001	0.010	0.060	0.165	0.0002	0.024	0.007
X4821	0.059	0.060	0.0001	0.007	0.057	0.118	0.0002	0.010	0.008
X4822	0.228	0.048	0.0001	0.006	0.037	0.028	0.0002	0.045	0.007
X4823	0.167	0.042	0.0001	0.006	0.033	0.016	0.0001	0.046	0.007
X4824	0.068	0.047	0.0001	0.007	0.058	0.176	0.0002	0.053	0.008
Ex. Blank	0.001	0.004	0.0008	0.006	0.014	0.001	0.0002	0.001	0.008

Sampling #9 (n=9) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.146	0.067	0.0031	0.005	0.117	0.219	0.0002	0.021	0.004
X4821	0.069	0.069	0.0035	0.006	0.092	0.129	0.0002	0.006	0.004
X4822	0.249	0.053	0.0032	0.005	0.052	0.029	0.0002	0.032	0.004
X4823	0.181	0.055	0.0030	0.005	0.037	0.018	0.0001	0.095	0.003
X4824	0.030	0.052	0.0047	0.006	0.046	0.118	0.0002	0.067	0.004
Ex. Blank	0.001	0.005	0.0033	0.005	0.008	0.004	0.0002	0.001	0.004

Sampling #10 (n=10) Concentrations in mg/kg

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	0.140	0.081	0.0031	0.005	0.043	0.200	0.0002	0.008	0.004
X4821	0.049	0.075	0.0046	0.006	0.043	0.086	0.0002	0.003	0.004
X4822	0.253	0.057	0.0032	0.005	0.032	0.035	0.0002	0.037	0.004
X4823	0.166	0.054	0.0030	0.005	0.029	0.012	0.0001	0.025	0.006
X4824	0.016	0.045	0.0036	0.006	0.027	0.073	0.0002	0.054	0.004
Ex. Blank	0.001	0.005	0.0033	0.005	0.008	0.002	0.0002	0.001	0.004

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Total Elemental Concentrations (Fixed Solid): Ao (mg/kg)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	13700	0	1250		69400	16100	8.3		106
X4821	22300		1310		103000	21300	25		154
X4822	79200		1700		157000	20300	218		219
X4823	79200		1700		157000	20300	218		219
X4824	78400		2940		166000	32300	59.3		240
Ex. Blank	54560	0	1780	0	130480	22060	105.72	0	187.6



ARCO - ANSI LONG TERM LEACHING STUDY
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EFFECTIVE DIFFUSIVITY

ELEMENTAL CONCENTRATIONS (FROM LEACH EXPERIMENT) An
-Sampling #1 (n=1)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	3.6E-13		ERR 7.9E-17		ERR 4.4E-16	3.1E-14	2.7E-12		ERR 6.0E-11
X4821	7.5E-15		ERR 4.1E-16		ERR 3.1E-16	3.1E-15	4.6E-13		ERR 4.4E-11
X4822	3.7E-16		ERR 8.3E-18		ERR 8.4E-17	1.1E-16	3.8E-15		ERR 1.4E-11
X4823	9.1E-17		ERR 1.1E-17		ERR 7.3E-17	4.9E-17	3.3E-15		ERR 1.2E-11
X4824	2.7E-18		ERR 1.4E-17		ERR 1.0E-16	1.2E-15	7.2E-14		ERR 1.6E-11
Ex. Blank	3.9E-18		ERR 7.3E-18		ERR 1.2E-16	2.4E-17	1.6E-14		ERR 1.8E-11

Sampling #2 (n=2)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	8.8E-14		ERR 5.2E-16		ERR 5.8E-16	3.8E-14	3.6E-12		ERR 7.9E-11
X4821	6.2E-15		ERR 1.1E-16		ERR 4.1E-16	1.1E-14	6.1E-13		ERR 5.8E-11
X4822	1.0E-15		ERR 1.4E-17		ERR 1.1E-16	1.5E-15	5.1E-15		ERR 1.8E-11
X4823	5.2E-16		ERR 8.9E-18		ERR 9.6E-17	1.6E-16	4.4E-15		ERR 1.6E-11
X4824	3.6E-18		ERR 5.1E-18		ERR 1.4E-16	4.1E-15	9.5E-14		ERR 2.1E-11
Ex. Blank	5.2E-18		ERR 9.7E-18		ERR 1.5E-16	3.2E-17	2.1E-14		ERR 2.4E-11

Sampling #3 (n=3)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	1.2E-13		ERR 1.8E-17		ERR 7.6E-16	8.9E-14	1.7E-12		ERR 2.4E-11
X4821	7.4E-15		ERR 2.6E-17		ERR 2.5E-16	2.6E-14	2.9E-13		ERR 1.7E-11
X4822	3.0E-15		ERR 9.7E-18		ERR 3.3E-17	2.1E-15	2.4E-15		ERR 5.4E-12
X4823	1.7E-15		ERR 8.5E-18		ERR 5.3E-16	6.3E-16	2.1E-15		ERR 4.7E-12
X4824	3.4E-17		ERR 4.5E-18		ERR 4.1E-17	1.1E-14	4.4E-14		ERR 6.2E-12
Ex. Blank	1.5E-18		ERR 8.6E-18		ERR 4.6E-17	9.4E-18	9.7E-15		ERR 7.1E-12

Sampling #4 (n=4)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	1.7E-13		ERR 2.3E-17		ERR 2.1E-16	1.1E-13	2.1E-12		ERR 2.9E-11
X4821	7.8E-15		ERR 3.2E-17		ERR 1.5E-16	3.0E-14	3.5E-13		ERR 2.1E-11
X4822	4.3E-15		ERR 1.2E-17		ERR 4.1E-17	2.8E-15	2.9E-15		ERR 6.7E-12
X4823	2.2E-15		ERR 1.0E-17		ERR 3.5E-17	6.9E-16	2.5E-15		ERR 5.8E-12
X4824	3.6E-17		ERR 5.5E-18		ERR 5.0E-17	9.5E-15	5.5E-14		ERR 7.7E-12
Ex. Blank	1.9E-18		ERR 1.1E-17		ERR 5.7E-17	1.2E-17	1.2E-14		ERR 8.8E-12

Sampling #5 (n=5)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	9.2E-13		ERR 4.7E-16		ERR 3.6E-16	2.3E-13	3.5E-12		ERR 5.0E-11
X4821	1.1E-14		ERR 3.1E-16		ERR 2.5E-16	2.5E-14	6.0E-13		ERR 3.6E-11
X4822	4.6E-15		ERR 3.4E-17		ERR 6.9E-17	2.2E-15	5.0E-15		ERR 1.1E-11
X4823	2.5E-15		ERR 3.5E-17		ERR 6.0E-17	5.6E-16	4.3E-15		ERR 9.8E-12
X4824	4.9E-17		ERR 2.4E-17		ERR 8.5E-17	7.0E-15	9.3E-14		ERR 1.3E-11
Ex. Blank	3.2E-18		ERR 1.8E-17		ERR 9.7E-17	2.0E-17	2.0E-14		ERR 1.5E-11



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Sampling #6 (n=6)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	3.0E-13		ERR 3.1E-16		ERR 5.1E-16	8.5E-14	4.9E-12		ERR 7.0E-11
X4821	2.0E-14		ERR 3.7E-16		ERR 3.6E-16	3.6E-14	8.4E-13		ERR 5.1E-11
X4822	6.7E-15		ERR 4.1E-17		ERR 9.7E-17	1.9E-15	7.0E-15		ERR 1.6E-11
X4823	3.3E-15		ERR 1.8E-16		ERR 8.4E-17	5.3E-16	6.1E-15		ERR 1.4E-11
X4824	3.9E-17		ERR 1.9E-17		ERR 1.2E-16	5.4E-15	1.3E-13		ERR 1.8E-11
Ex. Blank	4.5E-18		ERR 2.5E-17		ERR 1.4E-16	3.2E-17	2.9E-14		ERR 2.1E-11

Sampling #7 (n=7)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	3.4E-13		ERR 4.4E-16		ERR 6.6E-16	2.5E-13	6.4E-12		ERR 9.0E-11
X4821	1.9E-14		ERR 4.4E-16		ERR 4.6E-16	3.1E-14	1.1E-12		ERR 6.6E-11
X4822	7.3E-15		ERR 4.5E-17		ERR 1.3E-16	2.2E-15	9.0E-15		ERR 2.1E-11
X4823	3.6E-15		ERR 3.2E-17		ERR 1.1E-16	8.1E-16	7.8E-15		ERR 1.8E-11
X4824	1.0E-16		ERR 3.3E-17		ERR 1.5E-16	7.4E-15	1.7E-13		ERR 2.4E-11
Ex. Blank	5.9E-18		ERR 3.3E-17		ERR 1.8E-16	3.6E-17	3.7E-14		ERR 2.7E-11

Sampling #8 (n=8)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	2.4E-14		ERR 9.5E-19		ERR 1.9E-16	2.7E-14	8.6E-14		ERR 1.2E-12
X4821	2.2E-15		ERR 1.3E-18		ERR 9.4E-17	9.3E-15	1.5E-14		ERR 8.9E-13
X4822	2.0E-15		ERR 5.0E-19		ERR 1.3E-17	4.7E-16	1.2E-16		ERR 2.8E-13
X4823	1.0E-15		ERR 4.3E-19		ERR 1.0E-17	1.4E-16	1.1E-16		ERR 2.4E-13
X4824	2.0E-16		ERR 6.7E-19		ERR 3.2E-17	7.8E-15	2.3E-15		ERR 3.2E-13
Ex. Blank	7.9E-20		ERR 4.4E-17		ERR 2.4E-18	4.8E-19	5.0E-16		ERR 3.7E-13

Sampling #9 (n=9)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	1.9E-14		ERR 1.0E-15		ERR 4.9E-16	3.1E-14	5.6E-14		ERR 1.9E-13
X4821	1.9E-15		ERR 1.4E-15		ERR 1.6E-16	7.0E-15	9.2E-15		ERR 1.3E-13
X4822	1.6E-15		ERR 5.5E-18		ERR 1.8E-17	3.1E-16	7.9E-17		ERR 4.3E-14
X4823	7.8E-16		ERR 4.7E-16		ERR 8.3E-18	1.2E-16	6.9E-17		ERR 3.8E-14
X4824	2.5E-17		ERR 4.4E-16		ERR 1.3E-17	2.3E-15	1.5E-15		ERR 5.0E-14
Ex. Blank	5.2E-20		ERR 4.8E-16		ERR 5.3E-19	4.1E-18	3.2E-16		ERR 5.7E-14

Sampling #10 (n=10)

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	1.5E-14		ERR 8.6E-16		ERR 5.5E-17	2.2E-14	4.6E-14		ERR 1.6E-13
X4821	8.1E-16		ERR 2.0E-15		ERR 2.9E-17	2.7E-15	7.9E-15		ERR 1.1E-13
X4822	1.3E-15		ERR 4.5E-16		ERR 5.5E-18	3.9E-16	6.5E-17		ERR 3.6E-14
X4823	5.4E-16		ERR 3.9E-16		ERR 4.3E-18	4.6E-17	5.7E-17		ERR 7.9E-14
X4824	5.8E-18		ERR 2.1E-16		ERR 3.7E-18	7.1E-16	1.2E-15		ERR 4.1E-14
Ex. Blank	4.3E-20		ERR 4.0E-16		ERR 4.4E-19	5.6E-19	2.7E-16		ERR 4.7E-14



ARCO - ANSI LONG TERM LEACHING STUDY
 - LEACHABILITY INDEX

LEACHABILITY INDEX

SAMPLE#:	As	Ba	Cd	Cr	Cu	Pb	Hg	Se	Ag
X4820	10.6	ERR	13.42	ERR	13.4	11.0	9.60	ERR	8.39
X4821	12.1	ERR	13.29	ERR	13.6	11.7	10.4	ERR	8.53
X4822	12.5	ERR	13.93	ERR	14.2	12.9	12.5	ERR	9.04
X4823	12.8	ERR	13.94	ERR	14.0	13.4	12.5	ERR	9.10
X4824	14.3	ERR	14.12	ERR	14.1	12.3	11.2	ERR	8.98
Ex. Blank	15.6	ERR	13.98	ERR	14.1	14.8	11.8	ERR	8.92





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CERTIFIED MAIL -- RETURN RECEIPT REQUESTED
July 31, 1991

Mr. Charles Coleman
Anaconda Project Manager
U.S. Environmental Protection Agency
Region VIII, Montana Office
Federal Building
301 S. Park, Drawer 10096
Helena, MT 59626-0096

Mr. Gregory Mullen
Solid & Hazardous Waste Bureau
Montana State Department of
Health & Environmental
Sciences
Cogswell Building
Helena, MT 59620

Re: ARCO's Comments on Anaconda Smelter Site, Flue Dust Operable Unit, Proposed Plan

Dear Mr. Coleman and Mr. Mullen:

ARCO submits the following comments on EPA's June 1991 Anaconda Smelter Site, Flue Dust Operable Unit Proposed Plan (the "Proposed Plan"). These comments supplement our July 23, 1991 comments to Mr. Coleman, which are attached hereto as Exhibit A and incorporated by reference.

I. GENERAL COMMENTS

ARCO strongly supports EPA's selection of Alternative 4, Onsite Stabilization/Fixation, Disposal in an Onsite Repository, as the preferred alternative for the Flue Dust Operable Unit. The final draft RI/FS clearly requires identification of Alternative No. 4 as the preferred alternative under the NCP remedy evaluation criteria and CERCLA's statutory mandates. In further support of Alternative No. 4 as the preferred alternative, ARCO incorporates by reference the following documents into these comments:

- 1) the above-referenced July 23, 1991 letter to EPA;
- 2) ARCO's May 22, 1991 letter to EPA and the State regarding the "Identification of Stabilization/Fixation as the Preferred Alternative for the Flue Dust Operable Unit", attached hereto as Exhibit B;
- 3) ARCO's May 9, 1991 letter to EPA providing a sensitivity analysis of the net present costs for Alternatives 4, 5 and 6, attached hereto as Exhibit C.
- 4) ARCO's April 29, 1991 letter to EPA, "Evaluation of Innovative and Resource Recovery Technologies under CERCLA and the NCP for the Flue Dust Operable Unit", attached hereto as Exhibit D.

Mr. Charles Coleman
Mr. Gregory Mullen
July 31, 1991
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II. SPECIFIC COMMENTS

ARCO has the following specific comments:

A. Summary of Site Risks. The Proposed Plan contains a section entitled "Summary of Site Risks." ARCO disagrees with the conclusions set forth in this section, and incorporates by reference the following documents into these comments:

- 1) Scoping Document - August, 1989
- 2) ARCO's Comments on EPA's Risk Assessment - August, 1990

B. ARARS. Appendix B, Vol. II of the Final Draft RI/FS contains EPA's "Screening and Description of Potential ARARS for the Flue Dust Operable Unit, Anaconda Smelter NPL Site, January 1991." ARCO provided EPA with comments on this document by letter dated May 20, 1991, attached hereto and incorporated herein as Exhibit E.

The Proposed Plan also indicates that "design requirements for repository would meet . . . some relevant and appropriate MHLA and RCRA Subtitle C requirements." We stress that only those requirements that clearly are within the scope of the Flue Dust Operable Unit should be identified as ARARS. Additionally, ARCO continues to believe that RCRA Subtitle C requirements should not be identified as ARARS for Alternative 4, where the treated flue dust will not exceed TCLP regulatory limits. Rather, design of the repository should be based upon best engineering judgment in the design phase.

ARCO incorporates by reference our previous comment on ARARS, including:

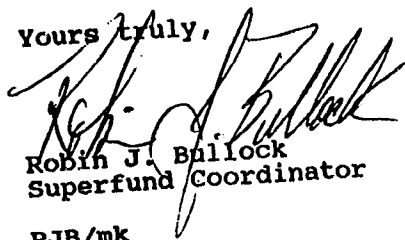
- 1) ARCO's May 16, 1990 letter updating ARCO's ARARS Scoping Document, attached hereto as Exhibit F.
- 2) ARCO's August 31, 1989 ARARS Scoping Document For the Flue Dust Operable Unit.

The specific documents and comments set forth above are intended to supplement and not in any way to limit or supersede our previous communications and correspondence with the Agency pertaining to the Flue Dust Operable Unit.

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ARCO respectfully requests that EPA carefully consider the above-
comments in selecting the final remedy for this Operable Unit.

Yours truly,



Robin J. Billock
Superfund Coordinator

RJB/mk

cc: S. M. Stash
P. S. Sbar, Esq.
R. W. Lawrence, Esq.

ARCO

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July 23, 1991

Mr. Charles Coleman
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Dear Charlie:

The EPA's Proposed plan for the remediation of the Flue Dust Operable Unit at the Anaconda Smelter Site has been reviewed by ARCO, and we agree with EPA's analysis. Accordingly, we will support the decision to use onsite solidification/fixation.

Also, we would like to add the following comments regarding the criteria employed by EPA to select the preferred alternative.

Long-term Effectiveness and Performance. Two leaching methods were used to predict the long-term stability of the fixed and solidified flue dust samples. There are no procedures which will unequivocally predict long-term stability. However, the Multiple Extraction Procedure (MEP) and the ANS 16.1 have been proposed by EPA in the publication, "EPA/624/6-89/122" as methods for determining maximum leachate concentrations which could occur under acidic environments. The results obtained from such tests are thought to simulate long-term leaching behavior.

However, since a degree of uncertainty remains, part of EPA's proposed plan is containment of the treated material in an enlarged repository which will (1) prevent inward leakage of any fluid - acidic or not, (2) minimize outward leakage of leachate, and (3) preserve protective alkalinity. We submit that these precautionary measures should be used for any flue dust residues containing high levels of potentially leachable heavy metals.

The complexity and potentially hazardous nature of the Cashman technology as applied to flue dust is illustrated by the outcome of a Hazard and Operating Study (HazOp) conducted for ARCO by a team of consultants in September, 1990. The subject was Bechtel's design of a Cashman plant to treat Anaconda flue dust, and the object of the study was to identify hazards to operators and to the environment, as well as operability problems which could compromise the plant's ability to achieve and sustain design throughput and required residue leachability. The principal intent was to reveal safety hazards and to develop accident scenarios, while only limited attention was given to operability problems and economic consequences. A much more detailed study subsequent to further piloting would be needed to quantify the latter.

Over 600 safety-related accident scenarios were developed and over 100 design modifications were identified which needed correction to meet either OSHA regulations or to comply with the operating principles of responsible plant managers.

For example, the design suffers from many examples of highly potential spills of hot liquids and slurries, generation and release of hydrogen/air mixtures, and the like. There also is a significant potential for autoclave explosions.

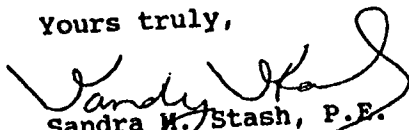
The HazOp Study concluded with the following paragraph: "...Although each individual unit operation in the process is relatively simple, the combined process is very complex. It requires extensive recycling and careful control of process parameters through every step of the treatment. The process is operator-intensive, thereby being prone to human errors and operability problems. Addition of interlocks to improve the safety of the system by reducing the potential for human error could make the system even more difficult to operate. From an economic perspective, numerous accidents were identified which were not safety-related but would cause contamination of products. It should be assumed that a significant portion of the facility life is (would be) spent reprocessing these contaminated products."

Cost. The operating cost uncertainties of a batch plant are small, reflecting mainly fluctuations in cement price and the rental rates of equipment and operators. Both capital and operating cost estimates for the first commercial application of a complex processing technology are very uncertain - even when based on very detailed plant design, which has not yet been done for the Cashman Process. Invariably, these estimates grow as more is learned about a process and more detailed engineering has been completed. Early "optimism" with regard to costs

usually reflects failure to consider fully the engineering obstacles which must be overcome. It is likely that satisfaction of the HazOp findings alone could add 50 to 100 percent to the preliminary capital cost estimate and increase operating costs significantly.

In summary, ARCO believes that the data provided in the Flue Dust RI/FS accurately portray the problem and define the remedial alternatives which are currently available. The Comparative Analysis of Alternatives provided by the EPA clearly shows that Solidification/Fixation is the preferred remedy, as it can be accomplished quickly using a simple process to eliminate the problem permanently.

Yours truly,


Sandra M. Stash, P.E.
Montana Superfund Manager

SMS/mk

cc: Greg Mullen
Pam Sbar, Esq.
Bob Lawrence, Esq.
Robin Bullock
Terry McNulty

1-44.711-58.a

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May 22, 1991

VIA FEDERAL EXPRESS

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Laura Bassein, Esq.
Legal Division
Montana Department of Health
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Subject: Identification of Stabilization/Fixation as the Preferred
Alternative for the Flue Dust Operable Unit

Gentlemen and Ms. Bassein:

This letter addresses ARCO's identification of a preferred remedial alternative for the Flue Dust Operable Unit at the Anaconda Smelter Site (the "Site"). In an April 29, 1991 letter to Mr. Lensink from ARCO's counsel, Mr. Lawrence, ARCO agreed to delete the preferred alternative section that was included in the March 1, 1991 Preliminary Draft Flue Dust Operable Unit Remedial Investigation/Feasibility Study ("RI/FS"), with the understanding that ARCO could identify the preferred alternative in a separate submittal. The Preliminary Draft RI/FS identified stabilization/fixation as the preferred alternative for the Flue Dust Operable Unit. The comparative analysis in the Final Draft RI/FS demonstrates that stabilization/fixation must be the preferred alternative for the site under the evaluation criteria and remedy selection process set forth in the National Contingency Plan ("NCP"), 40 CFR Part 300.

EPA is required under the NCP to develop a proposed plan which identifies the preferred alternative for the Site. 40 CFR §300.430(f)(2) ("The proposed plan"). EPA must also discuss in the proposed plan the rationale that supports the preferred

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alternative. 40 CFR § 300.430(f)(2)(ii). The following discussion identifies stabilization/fixation as the preferred alternative for the Site and sets forth the rationale for its selection.

I. The Remedy Selection Process.

The National Contingency Plan ("NCP") mandates a comparative remedy selection process using nine specific criteria:

A detailed analysis shall be conducted on the limited number of alternatives that represent viable approaches to remedial action after evaluation in the screening stage The detailed analysis consists of an assessment of individual alternatives against each of nine evaluation criteria and a comparative analysis that focuses upon the relative performance of each alternative against those criteria.

40 CFR § 300.430(e)(9)(i) and (ii) ("Detailed analysis of alternatives"); see also 40 CFR § 300.430(e)(9)(iii) ("Nine criteria for evaluation").

The NCP discusses the nine criteria and their relative weight as follows:

The [nine criteria] are used to select a remedy. These criteria are categorized into three groups.

(A) Threshold criteria. Overall protection of human health and the environment and compliance with ARARs . . . are threshold requirements that each alternative must meet in order to be eligible for selection.

(B) Primary balancing criteria. The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

(C) Modifying criteria. State and community acceptance are modifying criteria that shall be considered in remedy selection

40 CFR § 300.430(f)(1)(i) ("Selection of remedy").

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The detailed analysis of remedial alternatives for the Site under the threshold and balancing criteria has been completed and is discussed in detail in Volume II of the April 30, 1991 Final Draft. The alternatives that were analyzed are: (1) no action; (2) onsite disposal; (3) off-site disposal; (4) stabilization/fixation; (5) (A) Cashman Process with stabilization/fixation; (5) (B) Cashman Process without stabilization/fixation; and (6) ambient acid leach process. Table 10.3-9 in the FS summarizes the evaluation of these alternatives under the threshold and balancing criteria and is attached for your reference as Attachment A. Alternatives 4, 5A and 6 all rely upon treatment with cement based stabilization/fixation to produce a stable, non-toxic material for disposal in a designed on-site repository.

As discussed below, a comparative analysis of these alternatives under the two threshold and five balancing criteria (the modifying criteria have not yet been applied) clearly results in selection of alternative number 4, stabilization/fixation, as the preferred alternative for the Site.

II. COMPARISON OF ALTERNATIVES UNDER THE THRESHOLD CRITERIA

A comparative analysis of alternatives is set forth in Section 10.4 of the FS, based upon the detailed analysis of alternatives in Section 10.3. The discussion below is intended to supplement the discussion in the FS.

A. Stabilization/Fixation Provides Equivalent or Greater Protection of Human Health and the Environment Than Other Alternatives. The NCP requires that the remedial action selected "shall be protective of human health and the environment." 40 CFR § 300.430(f)(1)(ii)(A). This is the first of the two threshold criteria. See 40 CFR § 300.430(f)(1)(i)(A). Only stabilization/fixation received a positive ranking relative to the other alternatives for protection of human health and the environment. The No Action alternative received a negative ranking, and all of the other alternatives received a neutral ranking. See Table 10.4-1, Comparative Analysis of Alternatives, RI/FS at 142 ("Comparative Analysis Table") (attached hereto as Attachment B).

Stabilization/fixation's positive ranking for protection of human health and the environment reflects the fact that it received high rankings under the other evaluation criteria. As the NCP explains, "[o]verall protection of human health and the environment

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draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs." 40 CFR § 300.430(e)(9)(iii)(A). The comparative rankings under the other evaluation criteria are discussed below. In brief, however, stabilization/fixation is superior in its overall protection of health and the environment because it uses "a standard, proven [treatment] technology to produce a stable, non-toxic material for onsite disposal in a timely manner." RI/FS at 143.

B. Stabilization/Fixation Attains ARARs. The NCP also requires that the selected alternative "attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver" 40 CFR § 300.430(f)(1)(ii)(B). This is the second threshold criterion. See, 40 CFR § 300.430(f)(1)(i)(A). All of the alternatives attain ARARs, except for the No Action alternative which received a negative ranking under the second threshold criterion.

To summarize, Stabilization/Fixation attains ARARs and provides the highest degree of short and long-term protection of human health and the environment relative to the other remedial alternatives for the site.

III. Comparison of Alternatives Under the Balancing Criteria.

A. Stabilization/Fixation Prevails Over Other Alternatives Under The Balancing Criteria. Stabilization/fixation received the highest combined ranking under the five balancing criteria, with four positive rankings and one neutral ranking for cost. Relative to the other alternatives, it provides greater or equivalent long-term effectiveness and permanence, reduction of toxicity, mobility, or volume, short-term effectiveness and implementability. See Comparative Analysis Table.

1. Short-term effectiveness. The time taken until protection is achieved is a key component of the short-term effectiveness evaluation. See 40 CFR § 300.430(e)(9)(iii)(E). ARCO projects in the FS that stabilization/fixation would have a three year implementation period, compared with a minimum seven year period for implementation of the Cashman Process or the ambient acid leach process. The actual time periods for implementation of Cashman and the ambient acid leach process are likely to be substantially longer than seven years given

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uncertainties associated with the development and operation of these technologies at full-scale.

The preamble to the proposed NCP expressly provides that when "one alternative would require more time to complete and would have greater short-term impacts on human health and the environment. the decision-maker would focus on the distinctions between the alternatives under the short-term effectiveness criterion." 55 Fed. Reg. 8725 (March 8, 1990) (emphasis added.) ARCO believes that the time taken until protection is achieved under the short-term effectiveness criterion weighs heavily in favor of stabilization/fixation, particularly in light of the implementability concerns associated with the other treatment alternatives. Additionally, stabilization/fixation involves the fewest number of untreated flue dust handling steps when compared with the Cashman Process or the ambient acid leach process, resulting in less potential short-term impacts on human health.

2. Implementability. A comparison of alternatives under the implementability criterion is especially instructive and clearly favors stabilization/fixation over other the other treatment alternatives. Stabilization/fixation technology is well-known, and is simple to construct and operate. This process mixes cement and other additives with the flue dust using standard, readily available equipment to make a stable concrete and is quite similar to the methods used for making structural concrete. The Cashman and ambient acid leach processes, on the other hand, are complex both to construct and to operate. There remain significant unknowns associated with the construction, operation and reliability of these technologies.

For example, the Cashman Process has yet to be proven at full scale for treating flue dust materials. Optimization of the unit operations would be necessary prior to design of a full scale facility. In general, the pilot-scale plant was unable to produce precipitate products which would meet expected design criteria. Due to pressure and temperature requirements and composition of solutions throughout the Cashman Process, comparatively exotic construction materials likely would be necessary. Significant uncertainty still exists with respect to the basic question of whether the process can produce a residue that does not exceed TCLP regulatory limits.

Similarly, while several currently operating commercial plants use acid leach technology, flue dust has never been processed with

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this technology at a full scale. Specific concerns related to the implementability of ambient acid leach process include concerns with acid leaching, solvent extraction, and lime precipitation. Optimization pilot testing would be necessary to address the unknowns associated with the operation and reliability of the ambient acid leach process.

Under the Cashman Process with stabilization and the ambient acid leach process alternatives, the residues and materials from these processes would still require stabilization/fixation prior to disposal in a repository. It defies common sense to spend at least seven years implementing these technologies only to generate residues that would continue to exceed TCLP limits and would still require stabilization/fixation, when the same end result (disposal of treated, stable material in an on-site repository) could be achieved in under three years with a simple, proven treatment technology like stabilization/fixation.

3. Reduction of toxicity, mobility, or volume through treatment. The stabilization/fixation, Cashman Process and ambient acid leach alternatives are comparable under this criterion only because the final step for alternative 5A (Cashman Process with stabilization/fixation) and the ambient acid leach process is stabilization/fixation followed by disposal in a designed repository. We have assumed for purposes of Alternative 5B that the Cashman Process can produce a residue that does not exceed TCLP regulatory limits. It should be noted that substantial uncertainty exists with respect to this assumption at full scale operation. RI Phase II treatability data indicate that the Cashman Process potentially may produce a leach residue exceeding TCLP regulatory limits for lead. The ambient acid leach process also is expected to produce residues and precipitate exceeding TCLP regulatory limits for lead and cadmium. In the event that residues and other materials exceed TCLP regulatory limits, further treatment with stabilization/fixation will be necessary to reduce the toxicity and mobility of these materials. The onsite and offsite disposal alternatives for untreated flue dust would not result in reduction of toxicity, mobility or volume through treatment.

4. Long-term Protectiveness and Permanence. Stabilization/fixation provides equivalent or greater long-term protectiveness and permanence than the other alternatives evaluated.

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5. Cost. Cost is the only criterion for which Stabilization/fixation did not receive a ranking equal to or higher than all of the other alternatives in the comparative analysis of alternatives. Stabilization/fixation received a neutral ranking for cost, while the onsite disposal and ambient acid leach process alternatives received positive rankings. *Id.* However, the onsite disposal alternative does not address CERCLA's and the NCP's preference for alternatives involving treatment. See 40 CFR § 300.430(f)(1)(ii)(E) ("The balancing shall also consider the preference for treatment as a principal element. . ."). Moreover, the cost sensitivity analysis that ARCO provided to EPA on May 9, 1991 (attached hereto as Attachment C) shows that the degree of variation for the net present value cost at a 10% discount rate for the ambient acid leach process is almost a factor of six, ranging from a low of \$6.5 million under a best case scenario to a high of \$34.7 million under a worst case scenario. This reflects the high degree of uncertainty that exists regarding the capital construction costs for the ambient acid leach process, and potential variability in the price of copper. ARCO expects that the worst case scenario is more likely to occur than the best case scenario. Although the ambient acid leach process and stabilization/fixation alternatives have comparable expected costs (\$19.2 million and \$21 million respectively), the ambient acid leach process exhibits much more uncertainty in its upper and lower range. The stabilization/fixation alternative shows the least variation amongst treatment alternatives in net present value at a 10% discount rate, indicating that process parameters for this alternative are well known. Based upon: 1) the uncertainty and degree of variation of the net present value cost for the ambient acid leach process; 2) the relative certainty and very limited variation of the net present value cost for stabilization/fixation; and 3) the comparable expected net present values of both the ambient acid leach process and stabilization/fixation, ARCO has revised Table 10.4-1 to reflect a neutral cost ranking for the ambient acid leach process relative to other alternatives.

B. Summary of Comparison of Alternatives Under the Balancing Criteria. To summarize, with a total of four positive rankings under long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, and implementability, and a neutral cost ranking, stabilization/fixation is by far the superior alternative under the five balancing criteria.

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B. Summary of Comparison of Alternatives Under the Balancing Criteria. To summarize, with a total of four positive rankings under long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, and implementability, and a neutral cost ranking, stabilization/fixation is by far the superior alternative under the five balancing criteria.

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IV. Determination of Cost-Effectiveness.

Section 121(b) of CERCLA requires that EPA select a remedial action that is cost-effective. The NCP explains the method EPA is to use to make a cost-effectiveness determination:

Each remedial action selected shall be cost-effective ... [which] is determined by evaluating the following three of the five balancing criteria ... to determine overall effectiveness: 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.

40 CFR § 300.430(f)(1)(ii)(D). The preamble to the NCP further explains that, in determining cost-effectiveness, the reliability of treatment technologies are to be considered under the criterion of reduction of toxicity, mobility or volume through treatment, and that the reliability of long-term management controls to address treatment residuals [such as a repository] is to be considered under long-term effectiveness and permanence. 55 Fed. Reg. 8727.

Stabilization/fixation is clearly the cost-effective alternative for the Flue Dust Operable Unit. Stabilization/fixation alone among the alternatives evaluated received a positive ranking under each of the three balancing criteria listed above in the NCP for determining overall effectiveness. The ambient acid leach process and Cashman Process with stabilization received positive rankings for long-term effectiveness and permanence and reduction of toxicity, mobility or volume; but the former received only a neutral ranking for short-term effectiveness and the latter received a negative ranking for that criterion. Furthermore, there is much uncertainty regarding the reliability of the ambient acid leach process and the Cashman Process as they apply to flue dust. Each of the remaining remedial alternatives received just one or no positive rankings under the three criteria used to measure overall effectiveness. See Comparative Analysis Table.

Stabilization/fixation received a neutral ranking for the cost criterion relative to the other alternatives. The onsite disposal and ambient acid leach process alternatives received positive rankings; however, the cost ranking for the ambient acid leach

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process should be revised to neutral for the reasons discussed above. Offsite disposal and the Cashman Process received negative rankings for cost.

When comparing stabilization/fixation's ranking for cost to its superior ranking for overall effectiveness, stabilization/fixation best meets the cost-effectiveness requirement, *i.e.*, its costs are highly proportional to its overall effectiveness. EPA uses the term "proportional" because "it intends that in determining whether a remedy is cost effective, the decision-maker should both compare the cost to effectiveness of each alternative individually and compare the cost and effectiveness of alternatives in relation to one another." 55 Fed. Reg. 8728. "If the difference in effectiveness is small, but the difference in cost is very large, a proportional relationship between the alternatives does not exist." *Id.* Stabilization/fixation among all of the alternatives most offers "a reasonable value for the money in light of the results [it] achieves." 55 Fed. Reg. 8729.

IV. Determination Regarding the Use of Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable. Section 121(b) of CERCLA also requires that EPA select a remedy that "utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable." See also 40 CFR § 300.430(f)(1)(ii)(E). The NCP explains that,

This requirement shall be fulfilled by selecting the alternative that satisfies [the two threshold criteria] and provides the best balance of trade-offs among alternatives in terms of the five balancing criteria The balancing shall emphasize long-term effectiveness and reduction of toxicity, mobility or volume through treatment. The balancing shall also consider the preference for treatment as a principal element and the bias against off-site land disposal of untreated waste.

Id.

In short, the NCP provides that the determination of whether the selected remedy utilizes permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable must be addressed in terms of the two threshold and five balancing criteria. No separate criterion exists for making

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this determination. See Preamble to the NCP, 55 Fed. Reg. 8719 (March 8, 1990) ("EPA is not adding as a criterion the . . . mandate to utilize permanent solutions and alternative treatment technologies or resource technologies to the maximum extent practicable. The analysis performed pursuant to the nine criteria concludes with selection of a remedy that meets the mandate.") ARCO provided EPA with a letter dated April 29, 1991, attached hereto as Attachment D, which explains how the statutory directive is to be implemented with respect to resource recovery technologies.

Of all the alternatives, stabilization/fixation best satisfies this statutory mandate as implemented in the NCP. Stabilization/fixation is a permanent solution that utilizes treatment technologies to the maximum extent practicable. Stabilization/fixation satisfies the two threshold criteria and in fact received the highest net ranking for those criteria in the comparative analysis in the FS. Stabilization/fixation, the Cashman Process, and the ambient acid leach process all received positive rankings with respect to the long-term effectiveness and permanence and reduction of toxicity, mobility or volume through treatment criteria¹, two of the five balancing criteria which require emphasis under the NCP in the balancing process. See Comparative Analysis Table. In such circumstances, the preamble to the proposed NCP expressly provides that,

When the alternatives provide similar long-term effectiveness and permanence, and reduction of toxicity, mobility or volume, the other balancing criteria rise to distinguish the alternatives and play a more significant role in selecting the remedy. For example, if two alternatives offer similar degrees of long-term effectiveness and permanence and reduction of toxicity, mobility or volume through treatment, but one alternative would require more time to complete and would have greater short-term impacts on human health and the environment, the decision-maker would focus on the

¹ The Cashman Process without stabilization/fixation alternative received a neutral ranking for long term effectiveness and permanence because of uncertainties concerning the characteristics of the residuals produced by the process. Stabilization/fixation, Cashman followed by stabilization/fixation, and the ambient leach process received positive rankings because the fine dust or residual materials will be stabilized/fixed using a standard, proven technology, and because the stabilized/fixed material does not exceed TCLP regulatory limits. Placement of treated materials in a designed repository under alternatives 4, 5 and 6 provides additional assurance of long term effectiveness and permanence.

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distinctions between the alternatives under the short-term effectiveness criterion.

55 Fed. Reg. 8725 (March 8, 1990) (emphasis added.) Stabilization/fixation and onsite disposal were the only alternatives that received a positive ranking for both short-term effectiveness and implementability. The Cashman Process and the ambient acid leach process alternatives, on the other hand, received negative rankings for short-term effectiveness and implementability. Both of these alternatives would take substantially more time to complete and would have greater short-term impacts on human health and the environment than the stabilization/fixation alternative. The Cashman Process also received a negative ranking for cost. As discussed above, the cost ranking for the ambient leach process will be revised to a neutral ranking to reflect the large variability and uncertainty in the net present worth estimate. Thus, in terms of balancing of tradeoffs among alternatives under the five balancing criteria, stabilization/fixation strongly prevails. Additionally, stabilization/fixation satisfies the statutory preference for treatment. Finally, EPA expressly states in the NCP that it must take into account the implementability of the remedy in the determination of practicability under the Section 121(b) mandate. See 55 Fed. Reg. 8727 and 8729. As discussed above and in the FS, both the Cashman Process and the ambient acid leach process raise serious implementability concerns. Implementability concerns are nearly absent for stabilization/fixation.

Finally, it should be noted that the mandate in Section 121(b) of CERCLA to select a treatment technology or resource recovery technology to the maximum extent practicable is stated in the disjunctive; either a treatment technology or a resource recovery technology can satisfy this mandate. There is no preference under CERCLA or the NCP for resource recovery over treatment.

D. The NCP's Preference for Treatment and Bias Against Off-Site Land Disposal of Untreated Waste.

Aside from the five balancing criteria, the balancing process "shall also consider the preference for treatment as a principal element and the bias against off-site land disposal of untreated waste." 40 CFR § 300.430(f)(1)(ii)(E). As discussed above, stabilization/fixation is a treatment alternative and does not involve off-site land disposal of untreated waste. Thus the

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preference and bias cited above further support the selection of stabilization/fixation as the preferred remedial alternative.

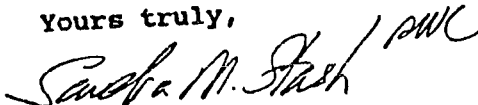
IV. Net Ranking of Alternatives.

As illustrated by the above discussions, stabilization/fixation received the highest net ranking under the threshold and balancing criteria with a total of 5 positive rankings. The onsite disposal and ambient acid leach process alternatives received the next highest net rankings with a total of 2 positive rankings (assuming the cost ranking for ambient acid leach is revised to a neutral ranking). Those alternatives, however, are plagued by several serious problems, discussed above and in the FS. Each other alternative received a negative net ranking. See Comparative Analysis Table.

In addition to having the highest net ranking under the threshold and balancing criteria, stabilization/fixation also (1) is the most cost-effective alternative, (2) fully satisfies the directive to utilize permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable, and (3) meets the NCP's explicit preference for treatment alternatives. Finally, remedial activities under the stabilization/fixation alternative would be consistent with the remediation efforts for the remaining operable units at the Smelter Hill site. Stabilization/fixation is the clear choice for the preferred alternative to be included in the proposed plan.

If you have any questions concerning this analysis, please do not hesitate to call. ARCO respectfully requests that EPA carefully consider this analysis in preparing the proposed plan. Please include this letter in the administrative record for the Flue Dust Operable Unit.

Yours truly,

 PWC

Sandra M. Stash, P.E.
Montana Superfund Manager

SMS:jb
Attachments

cc: Robert W. Lawrence, Esq.
Pamela S. Sbar, Esq.

TABLE 10.3-9

Individual Evaluation of Final Alternatives
 Alternatives 1 Through 4

CRITERIA	ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 ONSITE DISPOSAL	ALTERNATIVE 3 OFFSITE DISPOSAL	ALTERNATIVE 4 STABILIZATION/ FIXATION
OVERALL PROTECTIVENESS	Does not provide adequate protection of human health and the environment.	Protection of human health and the environment achieved through placement of Flue Dust in a RCRA Subtitle C repository.	Protection of human health and the environment achieved through placement of Flue Dust in a permitted RCRA TSD facility.	Protection of human health and the environment achieved through production of a stable non-characteristic material and placement in an engineered repository.
CONFORMANCE WITH ARARS	Would not attain ARARS.	Would attain ARARS.	Would attain ARARS.	Would attain ARARS.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Existing risk would remain and may increase.	Risk of contaminant releases effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCRA Subtitle C repository.	Risk of contaminant releases effectively reduced; but will be dependent on long-term integrity, maintenance and monitoring of a RCRA TSD facility.	Risk of contaminant release effectively reduced; but will be dependent on the long-term stability of treated material, and long-term integrity, maintenance and monitoring of an engineered repository.

TABLE 10.3-9 (continued)
Individual Evaluation of Final Alternatives
Alternatives 1 Through 4

CRITERIA	ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 ON-SITE DISPOSAL	ALTERNATIVE 3 OFF-SITE DISPOSAL	ALTERNATIVE 4 STABILIZATION FIXATION
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	No reduction in toxicity, mobility, or volume.	No reduction in toxicity, mobility, or volume through treatment.	No reduction in toxicity, mobility, or volume through treatment.	Reduction of toxicity and mobility to below noncharacteristic (TCLP) levels. Increase of volume by approximately 15 percent.
SHORT-TERM EFFECTIVENESS	Not applicable.	Dust controls required to reduce worker and community risk. Two year implementation.	Dust controls required to reduce worker and community risk. Additional handling and transportation would increase potential for release. Six month implementation.	Dust controls required to reduce worker and community risk. Additional controls required for treatment. Three year implementation.
IMPLEMENTABILITY	Not applicable.	Simple to construct and operate. Services, equipment and technology are readily available.	Simple to operate. No construction. Services, equipment and technology are readily available.	Simple to construct, somewhat complex, but proven, to operate to meet AKARA. Services equipment and technology are readily available.
PRESENT WORTH COST AT 10% DISCOUNT	Not applicable.	\$6,911,000	\$71,933,000	\$21,866,000

TABLE 10.3-9 (continued)
 Individual Evaluation of Final Alternatives
 Alternatives 5A Through 6

CRITERIA	ALTERNATIVE 5A CASHMAN PROCESS WITH STABILIZATION	ALTERNATIVE 5B CASHMAN PROCESS WITHOUT STABILIZATION	ALTERNATIVE 6 AMBIENT ACID LEACH WITH STABILIZATION
OVERALL PROTECTIVENESS	Protection of human health and the environmental achieved through removal of some contaminants, stabilization of non-characteristic material in an engineered repository.	Protection of human health and the environment achieved through removal of some contaminants, production of a stable non-characteristic residue, and placement in an engineered repository.	Protection of human health and the environment achieved through removal of some contaminants, stabilization of residues, and placement of non-characteristic material in an engineered repository.
COMPLIANCE WITH ARARS	Would attain ARARS.	Would attain ARARS.	Would attain ARARS.
LONG-TERM EFFECTIVENESS AND PERMANENCE	Risk of contaminant release effectively reduced; but will be dependent on long-term stability of treated material, and long-term integrity, maintenance and monitoring of an engineered repository.	Risk of contaminant release effectively reduced; but will be dependent upon the ability to produce a long-term stable non-characteristic residue, and the long-term integrity, maintenance, and monitoring of an engineered repository.	Risk of contaminant release effectively reduced, but will be dependent on long-term integrity, maintenance and monitoring of an engineered repository.

Individual Evaluation of Final Alternatives
 Alternatives 5A Through 6

CRITERIA	ALTERNATIVE 5A CASEMAN PROCESS WITH STABILIZATION	ALTERNATIVE 5B CASEMAN PROCESS WITHOUT STABILIZATION	ALTERNATIVE 6 AMBIENT ACID LEACH WITH STABILIZATION
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	Reduction of toxicity and mobility to below non-characteristic (TCLP) levels. Increase of volume by approximately 15%.	Reduction of toxicity and mobility, although possibly not to below non-characteristic (TCLP) levels. Reduction of volume by approximately 4%.	Reduction of toxicity and mobility to below non-characteristic (TCLP) levels. Increase of volume by approximately 13%.
SHORT-TERM EFFECTIVENESS	Dust controls required to reduce worker and community risk. Controls also needed for treatment operations. Seven to eight-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for treatment operations. Approximate seven-year implementation.	Dust controls required to reduce worker and community risk. Controls also needed for treatment operations. Seven to eight-year implementation.
IMPLEMENTABILITY	Complex to construct and operate. Some exotic equipment needed. Training of personnel required. Technology not proven at full scale, except for stabilization stage.	Complex to construct and operate. Some exotic equipment needed. Training of personnel required. Technology not proven at full scale.	Complex to construct and operate. Services, equipment technology are available. Training of personnel may be required. Technology proven in commercial operations.
PRESENT WORTH COST AT 10% DISCOUNT	<<CONFIDENTIAL>>	<<CONFIDENTIAL>>	\$19,189,000

TABLE 10.4-1
COMPARATIVE ANALYSIS OF ALTERNATIVES*

CRITERIA	1 No Action	2 On-site Disposal	3 On-site Disposal	4 Subsided Facility	5A Custom Process	5B Custom Process	6 Ambed Acid Leach Process
Long-term Effectiveness and Performance	-	0	0	+	+	0	+
Reduction of Toxicity, Mobility, or Volume	-	0	+	+	-	-	0
Short-term Effectiveness	-	+	0	+	-	-	0
Implementability	0	+	-	0	0	0	0
Cost	0	0	0	+	0	0	0
ASARS	-	0	0	+	0	0	0
Overall Protection of Persons, Health and the Environment	-	0	0	5+	1-	2-	1+
Not Ranking	NA	3+	0				

* 1 is a process making relative to other alternatives
 0 is a neutral ranking relative to other alternatives
 + is a positive ranking relative to other alternatives
 - is a negative ranking relative to other alternatives
 NA Not Applicable

RCO

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May 9, 1991

Mr. Charles Coleman
US Environmental Protection Agency
Region VIII
Montana Office
301 South Park, Drawer 10096
Helena, Montana 59629

Dear Charlie:

ARCO has reviewed the economics of the treatment alternatives included in the flue dust RI/FS. Based on this review a sensitivity analysis of the net present value costs of three of the alternatives was performed.

The accompanying Tables 1 and 2 summarize the sensitivity analysis of the net costs of three processing alternatives included in the Anaconda Smelter Site - Flue Dust Operable Unit Remedial Investigation/Feasibility Study. These alternatives are the Cashman, Acid Leach, and Stabilization/Fixation processes. The variables evaluated were those with significant economic impact, and also characterized by substantial uncertainty. They include the capital costs for the construction of the processing plant and residue repository, plant operating costs, repository operating costs, and the price of copper and any associated revenue. For each alternative, these variables were assigned an "expected" cost or price, and a "best" and "worst" case value. In this way, a range of net present value cost was computed for each of the three technical processes. Note the "expected" figures are those taken from the RI/FS, and represent the work of Dames and Moore; and the "best" and "worst" cases are the lowest and highest projected costs (and highest and lowest prices for recovered copper) respectively. Table 1 shows all the important variables and their projected values, and Table 2 summarizes the sensitivity analysis results.

CASHMAN PROCESS. The Cashman Process was evaluated for two process variations for each scenario. These are designated in Table 1 as: (A) stabilization of the process residue with subsequent placement of the stabilized material in a repository; and (B) placement of the process residue in a repository without additional treatment. The first option would be required only if the residue did not pass TCLP toxicity tests.

ATTACHMENT C

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The expected capital cost for plant construction for the Cashman Process is \$43.7 million. This figure was provided by Dames and Moore in the RI/FS. The amount assumes all new equipment. Thus some savings might result from the use of used apparatus. Even so we believe the best case scenario would still require capital costs no less than 20 percent lower, or about \$35 million. For the worst case scenario these capital costs are assumed to be 35 percent higher or \$60 million, because each more detailed study of plant costs that has occurred has shown these costs to be substantially increased from the preceding one, and because of the absence of an historical record of actual costs for such a facility.

Plant operating costs for the Cashman process include large amounts for labor, fuel, power and water, and reagent charges. We believe it is unlikely that all of these costs would decrease at the same time and therefore the best case scenario maintains the expected costs. Although such costs may be expected to rise, all are not expected to rise at the same time and therefore the worst case scenario includes only a 10 percent increase over the expected amount.

Repository operating costs would vary widely depending on the toxicity of the process residue and the need for additional treatment of this material. As further treatment is required additional costs will be incurred. This is reflected in the analysis through consideration of Cashman alternatives both with (A) and without (B) stabilization. In both cases the important repository operating costs are equipment rental rates and fuel prices. Equipment rental rates are not expected to decrease and anticipated stable oil prices may minimize the changes in fuel costs. Therefore the same rationale used in estimating best and worst case scenarios for plant operating costs explained above was also employed for repository operating costs.

Copper and certain other metals will be recovered in the Cashman Process. Within the last 10 years copper has varied in today's prices between \$.70 per pound and \$1.50. These are the prices used in the worst and best case scenarios respectively. Also, in the worst case scenario, the revenue is lowered further by assuming

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that only copper can be sold and that the other metal-bearing products must be disposed. The best case scenario includes revenue for all metal-bearing products.

ACID LEACH. The Acid Leach process results in a toxic residue and all such material must be stabilized and placed in a repository.

The estimated capital costs for construction of an acid leach facility have not been evaluated as thoroughly as were the costs for a Cashman Process plant. Because of this, capital costs under the best case scenario were taken to be only 10 percent less than the expected amount, whereas, in the worst case scenario, capital costs were increased by 50 percent.

The expectations for operating costs followed those for the Cashman Process. Namely, costs in the best case scenario were not decreased from the expected costs, and in the worst case event, costs were increased by 10 percent.

The range in copper prices used is the same as for the Cashman Process. Note that only copper is recovered using the acid leach method. All other metal is disposed in the stabilized residue.

STABILIZATION/FIXATION. This process mixes cement and other additives with the flue dust to make a stable concrete and is quite similar to the methods used for producing structural concrete. The stabilization/fixation technology is therefore well known and the uncertainties of the cost parameters are small.

In the evaluation of this alternative in the RI/FS, it is assumed an outside contractor would be used to provide the batch plant and the operating personnel. This results in no construction capital costs, and since metal is not recovered, the price of copper is not a consideration. Thus the economic evaluation is based on operating costs that would arise over a three year period. Because the method for making concrete is well known and the price of the additives have been rather stable we are suggesting that the best and worst case scenarios should vary from the expected amount by only 10 percent and 20 percent, respectively.

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NET PRESENT VALUE ANALYSIS. As summarized in Table 2, from best to worst case, the Cashman Process NPV₁₀ varies by a factor of more than four, ranging from a low of negative \$18.7 million to a high of negative \$88.4 million. This high degree of variability is a result of the relatively high capital cost, and the uncertainty of such costs because a Cashman Process plant has never been built; by the wide range in copper price and the uncertainty regarding the marketability of all metal-bearing products; and due to the fact stabilization of the residue may be required. Note the exceptionally high capital construction and operating costs cannot be offset by the revenue, even under the best case scenario. This results in the best case Cashman Process NPV₁₀ being approximately the same as the NPV₁₀ of the expected (or possibly even the worst case) scenarios for the acid leach and the stabilization/fixation alternatives. However, in the worst case, Cashman net present value costs are very much higher than any anticipated costs for the other two alternatives. See Table 2.

The degree of variation of the NPV₁₀ from the best to worst case for the acid leach alternative is even larger than that for the Cashman Process, almost a factor of six. This reflects the relatively large uncertainty regarding the capital construction costs and potential variability in the future price of copper. However, the absolute range in dollars of the NPV₁₀ for the acid leach alternative is much less than the Cashman Process and in fact in all cases, the best, expected and worst, the NPV₁₀ figures are much better than those for the Cashman alternative.

On the other hand, compared with the stabilization/fixation technology, the acid leach is lower cost in the best case, but 50 percent higher cost in the worst case. Although acid leach and stabilization/fixation have comparable expected costs, acid leach exhibits much more uncertainty in its upper and lower ranges.

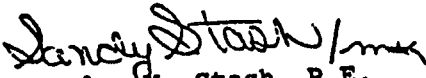
The stabilization/fixation alternative shows the least variation in NPV₁₀, indicating that the process parameters are well known. Although NPV₁₀ for the best scenario in the stabilization/fixation alternative is greater than that for the acid leach method, the worst

Mr. Charles Coleman
May 9, 1991
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case scenario for the acid leach is approximately one and one-half times that of the stabilization/fixation. As shown in the tables, the expected costs of these two alternatives are comparable.

The NPV₁₀ costs are summarized for all three processes in Table 2.

Yours truly,


Sandra W. Stash, P.E.
Montana Superfund Manager

SMS/mk

cc: P. S. Sbar, Esq.
R. W. Lawrence, Esq.

Table 2

NET PRESENT VALUE COST AT 10% DISCOUNT

	<u>Best Case</u>	Expected (DAMES & MOORE)	<u>Worst Case</u>
Shuman Process with stabilization)	\$27.8 million	50.2 million	88.4 million
Shuman without stabilization)	18.7 million	40.1 million ¹	78.4 million
Mid Leach	6.5 million	21.7 million	34.7 million
Stabilization	19.1 million	21.9 million	24.9 million

¹ Calculated by authors for this report

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ARCO

Legal
450 Seventeenth St. N
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Pamela Sbar
Senior Attorney

Chron

April 29, 1991

Andrew Lensink, Esq.
Office of Regional Counsel
U.S. Environmental Protection Agency
One Denver Place, 999 18th Street
South Tower, 7th Floor
Denver, Colorado 80202

RE: EVALUATION OF INNOVATIVE AND RESOURCE RECOVERY
TECHNOLOGIES UNDER CERCLA AND THE NCP FOR THE FLUE DUST
OPERABLE UNIT

Dear Andy:

This letter addresses two questions pertinent to the evaluation and selection of remedial alternatives for the Flue Dust Operable Unit at the Anaconda Smelter Site. First, should innovative technologies be given preference over conventional technologies during the remedial alternative evaluation and remedy selection process? Second, how does the statutory directive in Section 121(b) of CERCLA that EPA select a remedial action that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable interrelate with the nine criteria for evaluation of remedial alternatives set forth in 40 CFR § 300.430(e)(9)(ii) ("nine remedy evaluation criteria").

I. CONCLUSION

Innovative technologies should not be given any special preference under CERCLA or the NCP during the detailed analysis of alternatives in the feasibility study or during selection of the remedy.

CERCLA's mandate to select a remedy that utilizes resource recovery technologies to the maximum extent practicable must be addressed through the evaluation of alternatives under the nine remedy evaluation criteria. No separate criterion exists for determining that a remedy utilizes resource recovery technologies to the maximum extent practicable.

ATTACHMENT D

Mr. Andrew Lensink
April 29, 1991
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II. ANALYSIS

A. Innovative Technologies

Innovative technologies should not be given any special preference during the detailed analysis of alternatives in the feasibility study ("FS") or in remedy selection. In the National Contingency Plan ("NCP"), EPA does encourage the development and consideration of innovative technology alternatives. However, EPA makes clear in the NCP and elsewhere that in selecting a final remedy, all alternatives must be evaluated under the nine remedy evaluation criteria. See 40 CFR §300.430(e)(9)(iii) ("Nine criteria for evaluation"); 40 CFR §300.430(f)(1)(i) ("Selection of remedy") ("The [nine] criteria noted in paragraph (e)(9)(iii) of this section are used to select a remedy."). EPA explains the evaluation and selection process as follows:

A detailed analysis shall be conducted on the limited number of alternatives that represent viable approaches to remedial action after evaluation in the screening stage....The detailed analysis consists of an assessment of individual alternatives against each of nine evaluation criteria and a comparative analysis that focuses upon the relative performance of each alternative against those criteria.

40 CFR § 300.430(e)(9) ("Detailed analysis of alternatives").

EPA also discusses the treatment of innovative technology in 40 CFR § 300.430 ("Remedial investigation/feasibility study and selection of remedy"). Nowhere in those discussions does EPA give innovative technology alternatives a preference in the remedy selection process. The first mention of innovative technology is found in EPA's list of expectations for developing appropriate remedial alternatives:

EPA expects to consider using innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability, fewer or lesser adverse impacts than other available approaches, or lower costs for similar levels of performance than demonstrated technologies.

40 CFR §300.430(a)(1)(iii)(E) ("Expectations").

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Three things must be understood about this expectation. First, "[EPA's] expectations are not ... binding requirements." 55 Fed. Reg. 8702 (March 8, 1990).
Second:

The fact that a proposed remedy may be consistent with the expectations does not constitute sufficient grounds for the selection of that remedial alternative. All remedy selections must be based on an analysis using the nine criteria.

Id. And third, the expectation by its terms limits consideration of innovative technologies to cases in which the innovative technology "offers [1] the potential for comparable or superior treatment performance or implementability, [2] fewer or lesser adverse impacts than other available approaches, or [3] lower costs for similar levels of performance than demonstrated technologies." 40 CFR §300.430(a)(1)(ii)(E) ("Expectations").

In sum, while the expectation cited above evidences EPA's intent to encourage consideration of innovative technology alternatives, it does not alter the rule that alternatives must be judged based upon the nine remedy evaluation criteria.

The next reference to innovative technology in 40 CFR § 300.430 is as follows:

The lead agency shall develop one or more innovative treatment technologies for further consideration if those technologies offer the potential for comparable or superior performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies.

40 CFR §300.430(e)(5) ("Feasibility study"). This provision pertains only to the development of remedial alternatives prior to screening, and then, only to those innovative technologies that offer similar or superior advantages as compared with other alternatives.

It is also important to understand the comments on the proposed NCP that led to this provision. As EPA explained in the preamble to the NCP, "commentators stated that the proposed approach for the development and screening of alternatives is biased against innovative technologies." 55 Fed. Reg. 8714. (March 8, 1990). EPA thus sought "to clarify that it does not intend to inhibit the development of innovative technologies ... [and so] deleted the requirement in the final rule that innovative

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technologies must offer "better" performance than proven technologies." Id. In short, like the expectation cited earlier, this provision was designed to put innovative technologies on equal footing with other alternatives, not elevate their status.

A third means by which EPA seeks to provide equal treatment for innovative technologies is through the use of treatability studies. EPA recognizes that "because of the limited data on innovative technologies, it may not be possible to evaluate these process options on the same basis as other demonstrated technologies." Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, OSWER Directive 9355.3-01 ("Guidance") at 4-16. EPA thus "emphasizes the need for performing treatability studies earlier in the remedial process." 55 Fed. Reg. 8714 (March 8, 1990). See also 40 CFR §300.430(d)(1) ("Remedial investigation") ("To characterize the site, the lead agency shall, as appropriate, conduct field investigations, including treatability studies...").

After treatability studies are completed, "[t]he results of bench and pilot tests [conducted during the studies] can be used to ensure that conventional and innovative technologies can be evaluated equally with non-treatment alternatives during the detailed analysis phase of the FS." Guidance at 5-11 through 5-12 (emphasis added). Again, the goal is equal, not preferential, treatment for innovative technologies.

The only point at which innovative technologies may be said to receive favored treatment is during the early screening stage. EPA has stated that "innovative technologies would normally be carried through the screening phase if there were reason to believe that the innovative technology would offer significant advantages." Guidance at 4-26. This makes sense, because at the screening stage an innovative technology might be disadvantaged by the lack of opportunity to conduct a treatability study. Any advantage given to innovative technologies, however, disappears once the initial screening stage is over. As the authorities cited above make clear, during the detailed analysis phase all alternatives must be evaluated equally based upon the nine remedy evaluation criteria.

Had Congress intended a preference for innovative technologies in the remedy evaluation and selection process, it would have made that preference explicit, as it did in the case of treatment technologies. See Section 121(b) of CERCLA; see also 40 CFR § 300.430(f)(1)(ii)(E) ("The balancing shall also consider the preference for treatment ..."); 40 CFR § 300.430(f)(5)(ii)(F) ("The ROD shall describe "whether the preference for remedies employing treatment ... is or is not satisfied by the selected remedy."); Guidance at 6-8 ("[The Reduction of Toxicity, Mobility, or Volume Through Treatment]

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criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies ..."). No such preference exists for innovative technologies.

An EPA Memorandum dealing with the subject of innovative technologies supports the above analysis. See generally Memorandum Re: Advancing the Use of Treatment Technologies for Superfund Remedies, OSWER Directive 9355.0-26 ("Memorandum") (February 21, 1989). There, EPA (1) discusses its intent to encourage the use of innovative technologies that offer potential benefits over conventional technologies; (2) states that innovative technologies would be carried through the technology screening phase; and (3) encourages the use of treatability studies. *Id.* pp. 2, 4. Again, however, EPA reiterates in the Memorandum that during the final selection process, "[t]he innovative technology should provide advantages similar to those provided by other technologies evaluated, with respect to the nine evaluation criteria." *Id.* at p. 4.

In sum, while EPA has stated its desire to encourage consideration of innovative technology alternatives, it does not intend by that encouragement to sacrifice in any way the larger goal of choosing the remedy that best meets the nine remedy evaluation criteria.

II. Resource Recovery Alternatives

Section 121(b)(1) of CERCLA provides:

The President shall select a remedial action that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Id.; 42 U.S.C. § 9621(b). The critical question for our purposes is how the mandate to select remedial action that utilizes resource recovery technologies to the maximum extent practicable relates to the detailed analysis of alternatives under the nine remedy evaluation criteria. The NCP directly addresses this question:

Each remedial action shall utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This requirement shall be fulfilled by selecting the alternative that satisfies paragraph (D)(1)(ii)(A) and (B) of this section [relating to the "threshold criteria" of protection of human health and the environment and attaining ARARs] and provides the best balance of trade.

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offs among alternatives in terms of the five primary balancing criteria noted in paragraph (f)(1)(i)(B) of this section (long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment, short-term effectiveness; implementability; and cost). The balancing shall emphasize long-term effectiveness and reduction of toxicity, mobility or volume through treatment. The balancing shall also consider the preference for treatment as a principal element and the bias against off-site land disposal of untreated waste. In making the determination under this paragraph, the modifying criteria of state acceptance and community acceptance shall also be considered.

40 CFR § 300.430(f)(1)(ii)(E) ("Selection of remedy").

In short, the NCP provides that CERCLA's mandate to select a remedy that utilizes resource recovery technologies to the maximum extent practicable must be addressed through the nine remedy evaluation criteria. No separate criterion exists for determining that a remedy utilizes resource recovery technologies to the maximum extent practicable. Rather, EPA evaluates whether a remedy is protective and attains APARs, and provides the best balance of trade-offs among alternatives in terms of the five primary balancing criteria.

The preamble to the NCP verifies that CERCLA's statutory mandates are reflected in the nine remedy evaluation criteria and do not require a separate analysis beyond an evaluation of the alternatives in terms of such criteria. EPA states explicitly in the preamble that:

EPA developed the nine evaluation criteria to give effect to the numerous statutory mandates of section 121. ... EPA is not adding as a criterion the statutory mandate to utilize permanent solutions and alternative treatment technologies or resource technologies to the maximum extent practicable. The analysis performed pursuant to the nine criteria concludes with selection of a remedy that meets the statutory mandates.

55 Fed. Reg. 8719 (March 8, 1990). The preamble further explains:

Although generally supporting the use of the nine criteria in remedy selection, several commentators expressed concern over whether the balancing process ensures selection of remedies that comply with the statutory mandates of CERCLA. In response, EPA believes that the remedy selection process promulgated today effectively harmonizes the

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somewhat competing requirements of CERCLA and ensures that remedial actions will fulfill each statutory mandate.

55 Fed. Reg. (March 8, 1990).¹

In fact, EPA specifically rejected a proposal that the statutory mandate in section 121 of CERCLA be made a criterion for detailed analysis of remedial alternatives:

Several commentators addressed specifically the statutory mandate to utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. One commentator suggested establishing this statutory mandate as a threshold criterion.

¹ The preamble to the NCP contains the following additional language supporting the conclusion that the statutory mandate to select a remedy that utilizes resource recovery technology to the maximum extent practicable is met through evaluation of remedial alternatives under the nine remedy evaluation criteria:

The determination of which alternative utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable takes into account (the factors of) [1] long-term effectiveness and permanence; [2] reduction of toxicity, mobility, or volume through treatment; [3] short-term effectiveness; [4] implementability; [5] cost; [and] [6] state and community acceptance [with each factor being one of the nine criteria listed in the NCP].

55 Fed. Reg. 8725 (March 8, 1990). Additionally:

EPA notes that the final balancing by which the remedy is selected decides, from among protective, cost-effective alternatives, the extent to which permanent solutions and treatment are practicable for the site. EPA must select an alternative providing the maximum permanence and treatment practicable. EPA uses the balancing and modifying criteria to determine what is practicable.

55 Fed. Reg. 8729 (March 8, 1990).

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55 Fed. Reg. 8729 (March 8, 1990). EPA, however, disagreed:

EPA believes that it has established an appropriate process for addressing these provisions, first by identifying protective, ARAR-compliant alternatives eligible for selection, and then by balancing tradeoffs among alternatives with respect to the other pertinent criteria to identify a cost effective alternative that utilizes permanent solutions and alternative treatment technologies or resource recovery techniques to the maximum extent practicable. EPA does not believe that it is possible or appropriate to address the mandate to utilize permanent solutions and treatment to the maximum extent practicable as an evaluation criterion because this mandate represents a conclusion reached about a remedy on the basis of several evaluation factors.

Id. (emphasis added).

To summarize, the relationship between (1) the mandate in section 121 of CERCLA regarding resource recovery technologies, and (2) the nine remedy evaluation criteria, is simple. The latter reflects, incorporates and fully accounts for the former.

Please include this letter in the administrative record for the Fine Dust Operable Unit and the Upper Clark Fork River. If you have any questions concerning our analysis or would like to discuss this further, please do not hesitate to call Bob Lawrence or me.

Sincerely,



Pamela S. Sbar

PSS/mlh

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RE: Initial Comments on Final Screening Document, Flue Dust Operable Unit,
Anaconda Smelter

Dear Andy and Laura:

This letter provides ARCO's initial comments on the final "Screening and Description of Potential Applicable or Relevant and Appropriate Requirements ("ARARs") for the Flue Dust Operable Unit, Anaconda Smelter NPL Site, January 1991" ("Screening Document") prepared by EPA and the State of Montana. These comments are based on Section 121(d) of CERCLA, EPA's August 8, 1988, interim final guidance entitled "CERCLA Compliance With Other Laws," OSWER Directive 9234.1-01 (the "Compliance With Other Laws Manual"), EPA's August 1989 guidance entitled "CERCLA Compliance

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With Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes and State Requirements," OSWER Directive 9234.1-02 (the "Compliance With Other Laws Manual: Part II"), and the Final National Contingency Plan, 40 C.F.R. Part 300, 55 Fed. Reg. 8666 ("NCP").

For the purpose of preparing these comments, we have relied primarily on the Screening Document's text rather than its ARARs tables. During our review of the Screening Document, we found that there was not complete correspondence between the ARARs tables and the accompanying text regarding whether specific requirements are ARARs. In particular, the discussion presented in Section 3.4 of the Screening Document of whether RCRA Subtitle C requirements are applicable or relevant and appropriate requirements for certain remedial alternatives did not correspond to the "Summary of Screening Analysis of Federal ARARs" specified in Table 5.1. For example, while p. 3-20 of the Screening Document states that "Subtitle C requirements are not applicable" to Alternative 3 (On-Site Disposal of Untreated Flue Dust Materials), Table 5-1 indicates that RCRA Subtitle C requirements are "A/RA," i.e., applicable/relevant and appropriate, for certain remedial alternatives, including Alternative 3. Similarly, while p. 3-25 of the Screening Document states that EPA has not determined whether treated flue dust associated with remedial alternatives 5-7 is sufficiently similar to hazardous waste for RCRA requirements to be ARARs, Table 5-1 indicates that RCRA Subtitle C requirements are "A/RA." ARCO is concerned that the Agency's attempt to reduce the Screening Document's text to tables could result in confusion regarding whether certain requirements are applicable or relevant and appropriate. Therefore, ARCO requests that the final ARARs for the Flue Dust Operable Unit be presented as clearly as possible.

ARCO requests that the comments provided in this letter be considered by EPA and the State in the development and identification of final ARARs for the Flue Dust Operable Unit. It is ARCO's understanding that final ARARs for the Flue Dust Operable Unit will be identified in the Record of Decision for the Flue Dust Operable Unit.

1. Characterization of Flue Dust Materials as K064.

On page 2-13 of the Screening Document, EPA identifies flue dust sludges in the Bradley and Iron Ponds as hazardous wastes because "the sludge at the two pond locations is categorizable as K064 waste."

ARCO believes that EPA has incorrectly characterized the regulatory status of K064 waste for the purpose of categorizing flue dust sludges as K064. K064 is not a

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currently listed hazardous waste because EPA has not relisted K064 following the U.S. Circuit Court of Appeals for the District of Columbia Circuit's ("D.C. Circuit") remand in AMC v. EPA, 31 ERC 1935. On July 10, 1990, the D.C. Circuit remanded the listing of K064 to EPA because EPA failed to adequately address in the record challenges to EPA's data, offer discussion of its studies and explain why its decision to list K064 was reasonable absent such studies.

On February 7, 1991, we contacted Ed Abrams of EPA's Office of Solid Waste, Waste Identification Branch to discuss the current status of the K064 relisting. Mr. Abrams indicated that EPA has not relisted K064. Further, he indicated that EPA considers the relisting to be a low priority item given EPA's belief that the TCLP characteristic is "likely to pick up" K064 type wastes. Mr. Abrams confirmed that K064 is not a currently listed waste. He was unable to estimate when EPA might relist K064.

Because EPA has not relisted K064, EPA should not characterize flue dust as K064 for the purposes of identifying ARARs for the Flue Dust Operable Unit. The K064 listing has not been promulgated. Under CERCLA, ARARs must be promulgated, i.e., requirements of general applicability which are legally enforceable. See Preamble to NCP, 55 Fed. Reg. 8746. The K064 listing does not meet these requirements.

Even if EPA ultimately relists K064 under the same description utilized by EPA prior to the D.C. Circuit's remand, the flue dust sludges do not fall within the scope of the K064 listing description because the flue dust sludges were not generated from the same industrial process and are not the same type of wastes as identified in the K064 listing description.¹

2. Only Those Requirements that are Within the Scope of the Flue Dust Operable Unit Can be ARARs.

¹ EPA's description of K064 in the September 13, 1988 Final Rule is as follows: Acid plant blowdown slurry/sludge, resulting from the thickening of blowdown slurry, is a waste stream generated at facilities where primary copper is smelted in a reverberatory furnace. The waste arises from the acid plant, which constitutes the principal controller for removal of sulfur dioxide from furnace and converter off gases. The blowdown slurry from the acid plant is often thickened and the bulk of the solids content recycled to the reverberatory furnace. The overflow from the thickener contains both suspended and dissolved solids. The suspended solids are settled in surface impoundments and recycled to the smelter; the dissolved solids are discharged with the surface impoundment effluent, often to a tailings pond. It is the thickened slurry, the settled suspended solids from the thickener, and the sludges that form from the dissolved solids in the thickener overflow that are the subject of this listing.

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In the Screening Document, EPA discusses the limited nature of the Flue Dust Operable Unit and states that final compliance with air quality, ground and surface water requirements will occur at the time of completion of remedial action on the Smelter Hill Operable Unit:

The scope of the remedy in this matter is limited, particularly where compliance with ground and surface water requirements and final compliance with air requirements is concerned. For the most part, final compliance with these requirements will be expected to occur at the time of completion of remedial action on the Smelter Hill Operable Unit. Though the expectation is that these requirements will be implemented later, they are nevertheless identified in this document as ARARs pertinent to the Flue Dust Operable Unit. Screening Document, p. 1-2.

While ground and surface water and air requirements may be ARARs for the Smelter Hill Operable Unit, only those requirements that fall within the limited scope of the Flue Dust Operable Unit should be identified as ARARs for the Flue Dust Operable Unit. For example, on page 3-6 of the Screening Document, EPA identifies the water quality criteria specified in 40 C.F.R. Part 131 as relevant and appropriate to the Flue Dust Operable Unit. Identifying these requirements as ARARs overlooks the limited nature of the Flue Dust Operable Unit and the fact that groundwater remediation is not an objective of the operable unit. Similarly, EPA has identified federal and state surface mining reclamation requirements as relevant and appropriate requirements for the Flue Dust Operable Unit. Reclamation activities contemplated by these requirements are outside the scope of the Flue Dust Operable Unit and should be addressed in a subsequent operable unit of the Anaconda Smelter Site. EPA should revise its ARARs list to identify only those requirements that fall within the limited scope of the Flue Dust Operable Unit.

3. OSHA Requirements Are Not ARARs.

The last sentence on page 3-12 of the Screening Document states "Therefore, the OSHA standards are not applicable to the Flue Dust Operable Unit, but are designated as applicable."

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The Preamble to the NCP clearly states that OSHA requirements are not ARARs.

[T]here are two principal reasons for the treatment of OSHA standards as non-ARARs in the NCP. First, . . . Congress appears to have intended that certain OSHA standards apply directly to all CERCLA response actions. Second, EPA believes that OSHA is more properly viewed as an employee protection law rather than an "environmental" law, and thus the process in CERCLA 121(d) for the attainment or waiver of ARARs would not apply to OSHA standards. . . . Thus, OSHA standards are no longer included on the list of potential ARARs. The Final NCP package (§ 300.150) has been modified to reflect this approach, which EPA believes is consistent with both OSHA and CERCLA. 55 Fed. Reg. 8679-80.

ARCO reiterates that it intends to comply with applicable OSHA requirements at the Flue Dust Operable Unit.

4. ARARs for Treated Flue Dust Residues.

In previous submittals, ARCO has provided EPA with information that certain treated flue dust products, e.g., stabilization/fixation products, pass the TCLP characteristic test and are stable. EPA's discussion of RCRA as a source of potential ARARs for the Flue Dust Operable Unit overlooks this information. Stable treated flue dust residues which pass TCLP are not sufficiently similar to hazardous wastes for RCRA Subtitle C requirements to be relevant and appropriate requirements for the design of a repository for treated flue dust residues that do not exceed TCLP regulatory limits. We believe that this position is consistent with 40 C.F.R. § 300.400(g)(2) of the NCP, and the preamble discussion concerning when RCRA may be relevant and appropriate for wastes similar to RCRA hazardous wastes. 55 Fed. Reg. 8763-8764.

ARCO recognizes that design requirements for an on-site repository for treated flue dust materials could include a leak detection system and groundwater monitoring wells, and has identified these design requirements as appropriate in the Preliminary Draft RI/FS. See, e.g., p. 71, paragraph 1. The specific design requirements will be determined in the remedial design phase and will be based on best engineering judgment. Certain design requirements may resemble design requirements in RCRA

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Subtitle C. However, this does not make such RCRA Subtitle C requirements "relevant and appropriate" as that term is defined in the NCP. Thus, ARCO believes that the final ARARs determination for the Flue Dust Operable Unit should clearly indicate that RCRA Subtitle C requirements are not relevant and appropriate requirements for treated flue dust residues.

5. Major Facility Siting Act.

ARCO disagrees with EPA's identification of the Major Facility Siting Act as an ARAR for the Flue Dust Operable Unit. The Major Facility Siting Act applies to energy generation or conversion facilities. The ARARs document notes that "no energy related facility as defined by the law is anticipated for the Flue Dust Operable Unit areas. However, the siting criteria are relevant and appropriate." The document further states on page 4-16 that "although the act and its implementing regulations are not applicable, they are relevant and appropriate. The act and regulations are intended to prevent the siting of major facilities with the potential to disrupt the environment or cause damage to the environment from being located in environmentally sensitive areas. These regulations address situations sufficiently similar to the removal action and their use is well fitted to the site."

The Major Facility Siting Act addresses large scale geothermal/hydroelectrical/coal fired power plants and/or transmission lines. These facilities are nothing like the on-site repository or the other remedial alternative which may be constructed pursuant to the Flue Dust Operable Unit. Furthermore, none of the sensitive areas and areas of concern identified pursuant to the act are similar to the Flue Dust Operable Unit. For these reasons, ARCO requests that EPA delete the Major Facility Siting Act from the list of potential ARARs for the Flue Dust Operable Unit.

6. RCRA Land Disposal Restriction Requirements.

On Table 5.1 of the Screening Document, EPA identifies the land disposal restrictions in 40 C.F.R. Part 268 as applicable or relevant and appropriate requirements for the Flue Dust Operable Unit.

The land disposal restrictions should not be potential ARARs for the Flue Dust Operable Unit for several reasons.

EPA's "Policy for Superfund Compliance with RCRA Land Disposal Restrictions," OSWER Directive 9347.1-02 (April 17, 1989) (the "Land Disposal Restrictions Policy")

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reiterates and clarifies EPA's policy on the applicability of RCRA land disposal restrictions to CERCLA cleanups set forth in the Compliance with Other Laws Manual, pp. 2-18, 2-21 through 2-23. Under the Land Disposal Restrictions Policy, RCRA land disposal restrictions are only applicable to a CERCLA cleanup when three criteria are met: 1) the CERCLA action constitutes placement (i.e., land disposal); 2) the CERCLA waste is a RCRA hazardous waste; and 3) the RCRA hazardous waste is restricted from land disposal at the time of placement. As discussed in previous submittals, RCRA LDRs should not be applicable to the Flue Dust Operable Unit because these criteria for applicability of RCRA LDRs are not met.

With respect to the first criterion, the NCP has deferred any final decision on activities that constitute land disposal. Preamble to NCP, 55 Fed. Reg. 8762. However, placement of flue dust or flue dust treatment residues in a repository on the Anaconda Smelter Site would not constitute "land disposal" under any of the definitions of that term set forth in EPA's Supplemental Notice on the Applicability of the Land Disposal Restrictions to CERCLA Actions 54 Fed. Reg. 41566 (October 10, 1989), the Land Disposal Restrictions Policy, or ARCO's Comments on the October 10 Supplemental Notice that ARCO submitted with its ARARs Scoping Document. Furthermore, the Screening Document recognizes that RCRA requirements are not applicable to remedial alternatives that contemplate on-site disposal of flue dust waste materials within the existing contaminated area. "While flue dust is hazardous waste, Subtitle C requirements are not applicable to this alternative [on-site disposal of untreated flue dust], since there will be no treatment, storage or disposal outside the existing contaminated area." Screening Document p. 3-20. Thus, the first criterion for applicability of RCRA LDRs (i.e., the CERCLA activity constitutes land disposal) is not met.

With respect to the third criterion, EPA considers wastes such as flue dust to be "newly identified" wastes for purposes of establishing LDRs under § 3004(g) of RCRA. 55 Fed. Reg. 22520, 22530. EPA has stated that newly identified mineral processing wastes are not subject to the BDAT standards promulgated for characteristic hazardous wastes. 55 Fed. Reg. 22530. Instead, such wastes would be subject to further study before BDAT is established for such wastes. 55 Fed. Reg. 22667. EPA has expressly acknowledged that it "has not yet performed the technical analyses necessary to determine if the treatment standards promulgated today as BDAT for EP toxic hazardous wastes can be achieved in treating the various mineral processing wastes." 55 Fed. Reg. 22667. Furthermore, EPA recently confirmed this position in "Superfund Guide to RCRA Management Requirements for Mineral Processing Wastes," OSWER No. 9347.3-12FS (November 1990).

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All mineral processing wastes that now are considered RCRA hazardous wastes (i.e., non-excluded mineral processing wastes that are characteristic or listed) are considered to be "newly identified" wastes and will not have treatment standards under the land disposal restrictions (LDRs) until EPA completes a separate LDR rulemaking. Furthermore, no other LDR restrictions (e.g., soft hammer requirements, California list requirements) apply to these newly identified wastes.

Finally, ARCO notes that EPA has recognized in the Preamble to the NCP that,

EPA has determined that, until specific standards for soils and debris are developed, current BDAT standards are generally inappropriate or unachievable for soil and debris from CERCLA response actions.

Preamble to the NCP, 55 Fed. Reg. 8761.

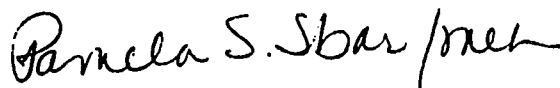
7. Current Waste Locations.

On page 3-16 of the Screening Document, EPA states that RCRA Subtitle C regulations would govern cleanup of the current waste locations, including the possible stabilization and disposal of wastes in an on site repository. ARCO believes that EPA should clarify this statement to indicate that RCRA requirements are not applicable or relevant and appropriate to the current disposal locations, in part because the flue dust at these locations was disposed of before the effective date of the RCRA requirements. The Compliance with Other Laws Manual indicates that a necessary jurisdictional prerequisite for RCRA applicability is disposal after the effective date of the pertinent RCRA regulations. See Compliance with Other Laws Manual, p.2-8. Furthermore, with respect to the cleanup of the current waste locations, EPA has defined the scope of cleanups at the current waste locations such that "adjacent soils containing equivalent concentrations of flue dust contaminants will be excavated as well." EPA Comments on Preliminary Draft RI/FS, p. 68, paragraph 3. Based upon the defined scope of the response action and EPA's position in the guidance document, the capital RCRA should not be an ARAR for the excavation of flue dust materials from their current location.

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ARCO appreciates the opportunity to present these comments on the Screening Document. If you have any questions regarding these comments, please contact Bob Lawrence or me.

Sincerely,



Pamela S. Sbar

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May 16, 1990

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Gentlemen:

The purpose of this letter is to update the ARARs Scoping Document for the Flue Dust Operable Unit (the "Scoping Document") which the Atlantic Richfield Company ("ARCO") submitted on August 31, 1989 pursuant to paragraph IX.A.6 of the Anaconda Smelter Site RI/FS Consent Order, Docket No. CERCLA VIII-88-16. Since the Scoping Document was submitted, EPA has promulgated regulations which directly affect issues raised by ARCO in the Scoping Document. In particular, on March 8, 1990, EPA promulgated the new National Contingency Plan ("New NCP"), 55 Fed. Reg. 8666 et seq., as well as regulations further interpreting the applicability of the RCRA Subtitle C hazardous waste regulations to mineral processing wastes.

As you know, ARCO's analysis of RCRA as an ARAR in the Scoping Document was based, in part, on EPA's April 17, 1989 Proposed Rule regarding mineral processing wastes excluded by the Bevill Amendment. 54 Fed. Reg. 15316. In the cover letter to the Scoping Document, ARCO indicated that it might submit a supplemental Scoping Document analyzing the impacts, if any, of new mineral processing waste regulations on the RCRA analysis provided in the Scoping Document. This letter provides such an analysis. We also informed Andy Lensink and Tom Eggert at the Anaconda Smelter Annual Meeting that we would be providing an update to the Scoping Document.

This letter identifies issues and arguments raised by ARCO in the Scoping Document that have been affected by regulations promulgated subsequent to the Scoping Document's submittal date. In particular, this letter addresses the impact of the New NCP,

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EPA's September 1, 1989 Final Rule retaining certain mineral processing wastes within the Beville Exclusion, 54 Fed. Reg. 36592 et seq. ("the September 1, 1989 Final Rule") and EPA's January 23, 1990 Final Rule retaining certain mineral processing wastes that were conditionally retained by the September 1, 1989 Final Rule within the Beville Exclusion. 55 Fed. Reg. 2322 et seq. (the "January 23, 1990 Final Rule").

ARCO requests that the Agency consider the updated sections of the Scoping Document presented in this letter in its analysis of RCRA ARARs for the Flue Dust Operable Unit. Where a section of the Scoping Document has not been specifically updated, ARCO requests that the Agency retain and utilize the original Scoping Document in its ARARs analysis for the Flue Dust Operable Unit. The citations in parentheses below are references to the Scoping Document.

1. ARARs Must be Promulgated or Enacted and Effective as of the Date of the Record of Decision (Vol. 1, Section II.H).

In Section II.H. of the Scoping Document, ARCO made the general comment that in order for a law or regulation to be an ARAR, it must be duly enacted or promulgated, and it must be effective, as of the date of the Record of Decision ("ROD"). EPA has explicitly adopted this position in the New NCP:

Once a Record of Decision is signed and a remedy chosen, EPA will not reopen that decision unless the new or modified requirement calls into question the protectiveness of the selected remedy. EPA believes that it is necessary to "freeze ARARs" when the Record of Decision is signed rather than at initiation of remedial action because continually changing remedies to accommodate new or modified requirements would . . . disrupt CERCLA cleanups . . . If ARARs were not frozen at this point, promulgation of a new or modified requirement could result in a reconsideration of the remedy and a restart of the lengthy design process, even if protectiveness is not compromised. This lack of certainty could adversely affect the operation of the CERCLA program, would be inconsistent with Congress' mandate to expeditiously cleanup sites and could adversely affect PRP negotiations . . . The policy of freezing ARARs will help avoid constant interruption, reevaluation, and redesign during implementation of selected remedies.

Preamble to New NCP. 55 Fed. Reg. 8757.

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2. Flue Dust May Not Be Regulated as a Hazardous Waste Until EPA Approves Montana Program Revisions (Vol. 1, Section III.C.2.a).

In Section III.C.2.a of the Scoping Document, ARCO asserted that because "flue dust and flue dust residues are currently exempt from regulation as a mineral processing waste pursuant to § 3001(b)(3)(A)(ii), of RCRA," regulations promulgated pursuant to Subtitle C of RCRA could not be applicable requirements because a necessary jurisdictional prerequisite for applicability, the presence of a listed or characteristic hazardous waste, was not satisfied at the Flue Dust Operable Unit. ARCO then noted that, for processing wastes other than 39 wastes specifically retained within the Bevill Exclusion by the April 17 Proposed Rule, 54 Fed. Reg. 15317, the Proposed Rule provided that,

when this rule is promulgated in final form, mineral processing wastes that have been temporarily excluded from regulation under Subtitle C of RCRA since 1980, except the 39 special wastes . . . , may now be subject to Subtitle C requirements beginning, at the latest, on or about February 23, 1990 (i.e., six months after publication of the Final Rule) (approximately August 23, 1989) in those states that do not have authorization to administer their own hazardous waste program in lieu of EPA. . . This proposal, if promulgated, will not be automatically effective in authorized states, since the requirements will not be imposed pursuant to the hazardous and solid waste amendments of 1984 . . . In authorized states, the reinterpretation and the regulation of nonexcluded processing wastes will not be applicable until the state revises its program to adopt equivalent requirements under state law. (Emphasis added.) 54 Fed. Reg. 15345.

The September 1, 1989 and January 23, 1990 Final Rules confirm ARCO's position in the Scoping Document that flue dust is not subject to RCRA Subtitle C regulation in Montana until Montana revises its hazardous waste program and EPA approves the program revisions. The September 1, 1989 and January 23, 1990 Final Rules state that they are "not effective in authorized states, because [their] requirements are not being imposed pursuant to the Hazardous and Solid Waste Amendments of 1984." 54 Fed. Reg. 36633; 55 Fed. Reg. 2347. In authorized states, such as Montana, "the reinterpretation of the regulation of nonexcluded processing wastes will not be applicable until the state revises its program to adopt equivalent requirements under state law and receives authorization for these new requirements." 55 Fed. Reg. 2347. States are required to revise their programs to adopt equivalent standards to those set forth in EPA's September 1, 1989 and January 23, 1990 Final Rule by July 1, 1991 if regulatory changes only are necessary, or by July 1, 1992 if statutory changes are necessary. *Id.* These deadlines can be extended by up to six months. Thus, in authorized states such

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as Montana, mineral processing wastes such as flue dust that were previously included within the Bevill Exclusion but are no longer retained within the Bevill Exclusion by the September 1, 1989 and January 23, 1990 Final Rules are not regulated as hazardous wastes. See 53 Fed. Reg. 2343 ("If a previously Bevill excluded mineral processing waste material is not yet a hazardous waste in the [authorized] state to which it is sent for treatment, storage, or disposal, no Subtitle C requirements apply.") Such wastes will not be regulated as hazardous wastes until Montana revises its program to address such wastes and receives approval the program revisions from EPA. Soil and debris containing such wastes also would not be subject to regulation under RCRA Subtitle C since such soil and debris would not be derived from a hazardous waste. ARCO does not anticipate that program revisions to address previous Bevill-excluded mineral processing wastes and EPA approval of such program revisions will occur until after the ROD date. The New NCP confirms that requirements must be promulgated and effective as of the ROD date in order to be ARARs. See Preamble to New NCP, 55 Fed. Reg. 8757. Therefore, RCRA Subtitle C requirements should not be applicable requirements for the Flue Dust Operable Unit.

3. RCRA Subtitle C Disposal Regulations Should not be Applicable Requirements for the Flue Dust Operable Unit (Vol 1, Section III.C.2.b).

In Section III.C.2.b. of the Scoping Document, ARCO asserted that because activities at the Flue Dust Operable Unit did not constitute treatment, storage or disposal, a necessary jurisdictional prerequisite for RCRA regulations to be applicable requirements was not satisfied. Therefore, RCRA Subtitle C regulations could not be applicable requirements for the Flue Dust Operable Unit. In particular, the Scoping Document discussed why activities contemplated for the Flue Dust Operable Unit did not constitute "disposal" as defined by RCRA. ARCO believes that the New NCP and other documents which became available after the Scoping Document's submittal date provide additional support for ARCO's position that RCRA disposal regulations should not be applicable requirements for the Flue Dust Operable Unit.

The Preamble to the New NCP contains a detailed explanation of activities that do and do not count as "disposal." See Preamble to New NCP, 55 Fed. Reg. 8758-8760. In the Supplemental Notice to the Proposed NCP, 54 Fed. Reg. 41566 (October 10, 1989) (the "October 10 Supplemental Notice"), EPA proposed two alternative interpretations of "land disposal." Under the Agency's second alternative, hazardous wastes could be excavated and redeposited either within the original unit or area of contamination, or elsewhere at the site in a new or existing unit, without triggering "disposal" and thus RCRA Subtitle C requirements. See 54 Fed. Reg. 41566, 41569.

On November 9, 1989, ARCO submitted extensive comments to the Agency on the October 10, Supplemental Notice, which are attached and incorporated herein by reference. In its comments, ARCO suggested the following definition of "land disposal" for purposes of determining RCRA Subtitle C applicability:

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The terms "unit" or "area of contamination" for purposes of determining the applicability of LDRs to CERCLA of remedial actions include: (1) the areal extent of contamination and all suitable areas in close proximity to the contamination necessary for implementation of the response action; (2) all areas within the meaning of the term "facility" as defined in Section 101(9) of CERCLA; and (3) noncontiguous facilities that are reasonably related on the basis of geography, or on the basis of the threat or potential threat to the public health, welfare or the environment.

This definition would be consistent with EPA's definition of "on-site" for permitting purposes. See New NCP 40 C.F.R. §§ 300.5 and 300.400(e)(1); Preamble to New NCP, 55 Fed. Reg. 8688-90.¹ ARCO strongly believes that its proposed definition of disposal in its November 9, 1989 comments is appropriate for determining when RCRA Subtitle C requirements are applicable at CERCLA sites including the Flue Dust Operable Unit.

In the Preamble to the New NCP, EPA specifically defers its final decision addressing the interpretation of "land disposal" pending "review of the lengthy and complex issues raised by comments on the Supplemental Notice." Preamble to New NCP, 55 Fed. Reg. 8760. As described in the New NCP, "land disposal" only occurs when RCRA hazardous waste is moved from one unit and placed in another. Preamble to New NCP, 55 Fed. Reg. 8759. However, what constitutes a "unit" "is not always self-evident." As EPA notes in the Preamble to the New NCP,

EPA generally equates the CERCLA area of contamination with a single RCRA land based unit, usually a landfill. . . . The reason for this is that the RCRA regulatory definition of "landfill" is generally defined to mean a land disposal unit which does not meet the definition of any land disposal unit, and thus is a general "catch all" regulatory definition for land disposal units. As a result, a RCRA "landfill" could include a non-discrete land area on or in which there is generally disbursed contamination. Thus, EPA believes that it is appropriate generally to consider CERCLA areas of contamination as a single RCRA land based unit, or "landfill." (Emphasis added.)

Preamble to New NCP, 55 Fed. Reg. 8760.

¹ In addition, Section 104(d)(4) of CERCLA authorizes EPA to treat noncontiguous facilities as one facility in circumstances where, "two or more noncontiguous facilities are reasonably related on the basis of geography, or on the basis of the threat, or potential threat to the public health or welfare or the environment."

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This discussion in the New NCP of what constitutes a "unit" further supports ARCO's position in the Scoping Document that all of Smelter Hill clearly could be considered as one "unit." See ARCO's discussion at Scoping Document, Vol. 1, p. 48-53. As noted in the Scoping Document, Smelter Hill is an area of contamination with different concentration levels and types of hazardous substances, pollutants or contaminants. Therefore, placement of untreated flue dust or flue dust residues into a repository on Smelter Hill should not constitute placement of such materials into a unit, but rather a movement of materials within a unit.²

4. RCRA Land Disposal Restrictions Should not be Applicable Requirements for the Flue Dust Operable Unit (Vol. 1, Section III.C.3.i.).

In Section III.C.3.i. of the Scoping Document, ARCO states that it does not expect that any of the criteria for the applicability of RCRA land disposal restrictions ("LDRs") will be met at the Flue Dust Operable Unit. Documents which become available after the Scoping Document's submittal date confirm ARCO's expectation that LDRs should not be applicable requirements for the Flue Dust Operable Unit.

Under EPA's "Policy for Superfund Compliance with the RCRA Land Disposal Restrictions," OSWER Directive 9347.1-02 (April 17, 1989) ("the Land Disposal Restrictions Policy,") RCRA LDRs are only applicable to CERCLA cleanups when three criteria are met: (1) the CERCLA action constitutes placement (i.e., land disposal); (2) the CERCLA waste is a RCRA hazardous waste; and (3) the RCRA waste is restricted from land disposal at the time of placement. Land Disposal Restrictions Policy, p. 4.

In the October 10 Supplemental Notice, EPA discusses the types of activities that would constitute land disposal under the first criteria for LDR applicability. 54 Fed. Reg. 41566. As noted above, ARCO submitted comments to the Agency regarding the October 10, 1989 Supplemental Notice which are attached and incorporated herein by reference. While the New NCP has deferred any final decision on what types of activities constitute land disposal (Preamble to the New NCP, 55 Fed. Reg. 8762), under EPA's existing statements of what constitutes a "unit" for the purposes of land disposal, placement of flue dust in a repository at the Smelter Hill Site would not constitute "land disposal" as defined in the Proposed NCP, the October 10 Supplemental Notice, the Land Disposal Restrictions Policy, or ARCO's comments on the October 10 Supplemental Notice. Therefore, the first criterion of applicability of LDRs, i.e., CERCLA action constituting placement, is not satisfied by the Flue Dust Operable Unit.

² RCRA Subtitle C requirements would not be applicable in any case to the areas at the Flue Dust Operable Unit from which materials are removed. As stated in the Preamble to the Proposed NCP,

If some of the waste at a site is moved into another unit, but other waste is left behind in the original unit, "land disposal" applies only with regard to the waste that is moved into another unit. 53 Fed. Reg. 51444.

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With respect to EPA's second criterion for the applicability of LDRs, i.e., the CERCLA waste is a RCRA hazardous waste, flue dust is still not subject to regulation as a hazardous waste in Montana. As noted above, until Montana revises its authorized program to adopt the September 1, 1989 and January 23, 1990 Final Rules and EPA approves these revisions, flue dust is not subject to hazardous waste regulation in Montana. Therefore, the second criterion for RCRA LDR applicability, the presence of a hazardous waste, is not met.

Finally, the third criterion for RCRA LDR applicability, i.e., the RCRA waste is restricted from land disposal at the time of placement, is not satisfied by the Flue Dust Operable Unit. Wastes that are no longer retained within the Bevill Exclusion are considered by EPA to be "newly identified" wastes for purposes of establishing LDRs under § 3004(g) of RCRA. 54 Fed. Reg. 36624; 54 Fed. Reg. 48372, 48492; 55 Fed. Reg. 2346-2347. EPA has proposed that newly identified mineral processing wastes not be subject to the BDAT standards that the Agency proposed on November 22, 1989 for characteristic hazardous wastes. 54 Fed. Reg. 48492-48493; 55 Fed. Reg. 2346-2347. Instead, such wastes would be subject to further study before BDAT is established for such wastes. 54 Fed. Reg. 48493. EPA has expressly acknowledged that it "has not yet performed the technical analyses necessary to determine if the treatment standards proposed today as BDAT for EP toxic hazardous wastes can be achieved in treating the various mineral processing wastes." 54 Fed. Reg. 48493. ARCO is not aware of any technical analyses that the Agency has performed that would fully demonstrate that the BDAT standards proposed for characteristic wastes in the Agency's November 22, 1989 Proposed "Third-Third" rulemaking are appropriate for mineral processing wastes.

With respect to soil and debris, EPA determined in the Preamble to the New NCP that,

... until specific standards for soils and debris are developed, current BDAT standards are generally inappropriate or unachievable for soil and debris from CERCLA response actions.

Preamble to New NCP, 55 Fed. Reg. 8761.

Even if EPA ultimately establishes BDAT standards for mineral processing wastes such as flue dust, such standards would not be applicable in authorized states like Montana until the authorized state revises its program to include flue dust and EPA approves the revised program. See 54 Fed. Reg. 48493 ("Thus, in these [authorized] states, these mineral processing wastes would only be hazardous wastes if they are included within the scope of the states' authorized program. If they are not, they would not be hazardous wastes until an amended state's program including them is authorized.

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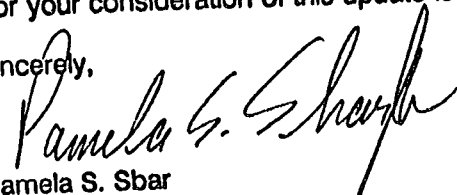
Only after authorization would the land disposal prohibitions apply in that state.)
(emphasis added).

5. Montana Hazardous Waste Management Act.

In Section II.C.4. of Volume 2 of the Scoping Document, ARCO analyzed Federal RCRA Subtitle C requirements because Montana's requirements are essentially equivalent to the Federal requirements and may not be more stringent. The Preamble to the New NCP provides that, "EPA notes that, in general, state regulations under federally authorized programs are considered federal requirements." 54 Fed. Reg. 8762. Therefore, ARCO reiterates that EPA should limit its consideration of potential RCRA ARARs for the Flue Dust Operable Unit to Federal RCRA Subtitle C requirements.

Please include this letter in the administrative record for the Flue Dust Operable Unit. As we discussed during the March 21, 1990 Anaconda Smelter meeting, we would be glad to meet with you at your convenience to discuss ARARs for the Flue Dust Operable Unit. If you have any questions, please don't hesitate to call me or Bob Lawrence at (303) 293-6508. Thank you for your consideration of this update letter.

Sincerely,



Pamela S. Sbar

PSS:lv

cc: Sandra M. Stash

F. N. Ramseier Consulting, Inc.

7030 South Windsor Street
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Telephone: (303) 979-0735
FAX: (303) 979-0735

July 16, 1991

Ms. Robin Bullock
Superfund Coordinator
Atlantic Richfield Company
P.O. Box 1491
Anaconda, MT 59711

By FAX

Dear Robin:

As you requested in your letter to Terry and me, dated June 28, 1991, I have talked to at least fourteen people that have worked on Superfund sites that have used, or intend to use, solidification/fixation as remedial technologies for their wastes. Most discussions were with members of the EPA staff, often those associated with project management or technology research.

Based on my review, I believe that ARCO has thoroughly studied the solidification/fixation of Anaconda flue dust, and has recommended a safe treatment method. The following comments have been selected from the notes that I have taken during my discussions.

Artech's attempt to discredit the ANS 16.1 test as an indicator of long-term stability may not be an important issue. As we have said before, EPA does not have a standard method for determining long-term stability of treatment residues. Paul DePercin, at the EPA Center for Environmental Research in Cincinnati, confirms that the TCLP is the only criteria used by his office to determine the success, or failure, of a treatment technology.

Garth Conner, EPA Project Manager at the Craig Farm Drum site in Pennsylvania, states that long-term stability is not an issue because the treatment residues at this site will be placed in an engineered repository, as will the residues at Anaconda.

Tony DeAngelo, when discussing the Smith's Farm site in Kentucky, again states that TCLP is the passing criteria, and that residues will be placed in a repository with a leachate collection system and a soil cap.

At the Pepper's Steel and Alloys site in Florida, Diane Scott, the EPA Project Manager, said that successful solidification/fixation was completed in 1989 on Pb and As contaminated soil, using a mixture of Portland Cement and fly ash. The soil was excavated, mixed with additives, and returned to the excavation, without an impermeable barrier, and covered with crushed limerock.

In Florida, the remediation of the Sapp Battery site is in the treatability stage. EPA's Martha Berry states that the passing criteria is, again, TCLP but that the state uses ANS 16.1 as an indicator of long-term stability. When using the ANS 16.1 test only the leachate is analyzed, because the fixed material ultimately will be a monolith. The solidified residue will be returned to the excavated site, not an engineered repository.

Chromium at the Industrial Waste Control site in Arkansas was stabilized using cement and fly ash. This project, completed in March, 1991, used a slightly different treatment method. The soil was mixed with fly ash and allowed to set for 14 days. Then the material was moved to the repository and mixed with cement just prior to placement. No long-term tests were required.

In summary:

1. The EPA does not have a standard test for determining the long-term stability of fixed residues;
2. TCLP is commonly used as the passing criteria for determination of hazardous characteristics;
3. At the one site where ANS 16.1 was used for testing the long-term stability, only the leachate was analyzed;
4. Long-term stability is not an issue if the fixed residue is placed in an engineered repository with a leachate detection system;
5. It is not uncommon for solidified residues that pass the TCLP to be returned to the original excavation without an extensive engineering system.

In my opinion, ARCO has thoroughly studied the solidification/fixation alternative and should be able to effectively counter any opposition from other alternatives.

Best regards,

F. N. Ramseyer

pc: Terry McNulty

ATTACHMENT 2

**EPA RESPONSES TO ARCO COMMENTS TO THE
RISK ASSESSMENT**

Submitted to:

Fluor Daniel, Inc.
18333 Preston Road
Suite 200
Dallas, TX 75252

Attention: Mark deLorimier (1 copy)
Bill Hall (1 copy)

TR-1165-30

EPA RESPONSES TO THE ARCO COAL COMPANY ENDANGERMENT ASSESSMENT
REVIEW COMMENTS FOR THE FLUE DUST OPERABLE UNIT

Risk Assessment Support For
The Anaconda Smelter Site

Prepared Under

Program No. 1541

for

Subcontract No. 619800-9-K003

Under

Contract No. 68-W9-0013

for

ICAIR Work Assignment No. 041541

EPA Work Assignment No. 02-8P18

Contact: Mr. Gregory E. Schiefer

Telephone: (216) 464-3291

November 1, 1990

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2.0 ARCO COMMENTS AND EPA RESPONSES	2-1
3.0 SUMMARY	3-1

LIST OF ACRONYMS

EPA	Environmental Protection Agency
GSD	Geometric Standard Deviation
IU/BK	Integrated Uptake/Biokinetic
RAGS	Risk Assessment Guidance for Superfund

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is currently pursuing evaluation and cleanup activities at the Anaconda Smelter site near Anaconda, Montana. Included among the concerns of this site are a number of piles of flue dust from past smelter operations. The risk posed by these piles has been evaluated in a Baseline Risk Assessment. This Risk Assessment has been reviewed by the ARCO Coal Company, and ARCO has supplied EPA with a document detailing their comments and recommendations. This current report summarizes ARCO's recommendations, and provides responses to those recommendations as part of EPA's responsiveness summary.

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is currently pursuing evaluation and cleanup activities at the Anaconda Smelter site near Anaconda, Montana. Included among the concerns of this site are a number of piles of flue dust from past smelter operations. The risk posed by these piles has been evaluated in a Baseline Risk Assessment. This Risk Assessment has been reviewed by the ARCO Coal Company, and ARCO has supplied EPA with a document detailing their comments and recommendations. This current report summarizes ARCO's recommendations, and provides responses to those recommendations as part of EPA's responsiveness summary.

2.0 ARCO COMMENTS AND EPA RESPONSES

1. ARCO stated that the use of models to estimate air exposures on-site were at least two orders of magnitude too high, based on comparison with recent monitoring data from an on-site station. ARCO recommended using the new monitoring data rather than the values calculated from the model.

Response:

EPA does not believe this is appropriate, since, under current conditions, flue dust piles on site have been treated with surfactant that significantly reduces air emissions. However, under the no-action (baseline) alternative, it must be assumed that spraying with surfactant is discontinued, and that the effects of the current surfactant disappears within several years. This would revert the site to conditions where air emissions would be much higher, as was the case in the past.

2. ARCO criticized the use of monitoring data to estimate risks from flue dust at off-site locations (East Anaconda), stating that this method overestimates the risk from flue dust since other sources also contribute to current air levels.

Response:

EPA agrees that all contaminants in air should not be attributed to flue dust. The assessment makes this point several times, and emphasizes that risks estimated from monitoring data represent an upper limit of the current risks from flue dust. On the other hand, the use of surfactant results in a decrease in air emissions compared to the baseline (no-action) alternative, so current monitoring data may underestimate this situation.

3. ARCO stated that measured values of contaminants in groundwater beneath the site should not be entirely attributed to flue dust. ARCO further stated that evaluation of groundwater was beyond the scope of this risk assessment, since it will be addressed in the RI/FS for Smelter Hill.

Response:

EPA agrees that all contaminants in groundwater should not be presumed to originate from flue dust, although EPA believes that flue dust is an important source of groundwater contamination. The Risk Assessment emphasizes several times that the total risk from groundwater should not be attributed to flue dust alone, but that it represents an upper bound for that risk. EPA does not agree that evaluation of groundwater is beyond the scope of this Risk Assessment, since flue dust does contribute to groundwater contamination at the site.

4. ARCO criticized the calculation of doses in the risk assessment, stating that the values employed were not in accord with the RAGS concept of a reasonable maximum exposure. ARCO provided specific recommendations for revised dose calculation parameters.

Response:

The Flue Dust risk assessment was prepared according to the guidance in the Superfund Public Health Evaluation Manual (SPHEM), prior to release of the RAGS. Nevertheless, the document has been revised to bring the methods used to calculate doses into accord with the RAGS guidance. The revised document provides specific justification or rationale for all parameters used in calculating dose.

5. ARCO specifically criticized the duration and frequency assumptions used to evaluate the exposure of dirt bike riders at the flue dust piles, stating that the values used were implausible.

Response:

The exposure duration and frequency terms were based on national average statistics for outdoor activities similar to dirt bike riding. EPA acknowledges that use of these values is uncertain and that the values might be overly conservative. In order to obtain more applicable data, EPA performed an informal survey on the actual frequency and duration of dirt bike riding or mountain bike riding at the Anaconda Smelter site. These data were used to develop a more accurate estimate of bike rider exposure. As ARCO had suggested, the survey data did indicate that bike riders were likely to visit the flue dust piles on Smelter Hill less frequently than previously assumed, so this term has been adjusted downward. Also, EPA agrees that not all the time spent on Smelter Hill will involve contact with flue dust, so an adjustment has been made for this. However, the survey also revealed that bike riders are likely to be exposed not for just six years (as was previously assumed), but for an indefinite period, so the exposure duration term has been increased accordingly.

6. ARCO criticized the use of the RfD approach for evaluating health risks from lead, and recommended using the IU/BK model instead.

Response:

EPA agrees, and has revised the document accordingly, using the LEAD4 computerized version of the IU/BK model.

7. ARCO stated that the Risk Assessment did not discuss the nonlethal nature of arsenic-induced skin cancer, and that there was inadequate discussion of factors such as a nonlinear dose-response curve and reduced bioavailability that tend to overestimate the risk of cancer from arsenic.

Response:

The nonlethal nature of skin cancer was already noted (see page 4-2 of the Endangerment Assessment dated 12/20/89). EPA has expanded the discussion of nonlethality and nonlinearity somewhat. The discussions of possible beneficial effects and bioavailability are judged to be adequate without expansion.

8. ARCO noted a typographical error in the critical renal concentration value for cadmium.

Response:

The error has been corrected.

9. ARCO stated that the Risk Assessment failed to adequately identify and discuss the impact of many uncertainties in the final risk estimate, including:

- o Use of an unverified RfD for lead
- o Use of inappropriate soil intake rates
- o Use of monitoring data
- o Use of modeled air values inconsistent with monitoring data
- o Overestimation of exposure duration and frequency

Response:

All of these uncertainties are discussed in Section 8.

10. ARCO recommended (see Appendix B) that the 95th percentile for dose estimates be calculated using the geometric standard deviation (GSD) for the entire data set and the equation $X_{95th} = X_{median} \cdot GSD^{1.65}$ rather than by using the approach specified in the RAGS.

Response:

EPA does not believe there is sufficient information on the shape of various dose distribution curves to know whether this equation is generally appropriate. Also, there are usually insufficient data on the value of the GSD for each of the input parameters to permit calculations of a GSD for the product.

11. ARCO criticized the soil ingestion rates of 200 and 100 mg/day for children and adults, respectively, as specified in the OSWER directive. ARCO stated that the most recent study (Calabrese et al. 1989) indicated the arithmetic mean and median soil ingestion rates for children were 87 and 39 mg/day, and that this was supported by the "best-fit" with the IU/BK model. The best value for adults was 10 mg/day, based on inferences drawn from studies on urinary arsenic levels at Mill Creek.

Response:

EPA believes that soil ingestion by children and adults is a complex function of numerous site-specific parameters (percent ground cover, rainfall, windspeed, number of snow-covered days, etc.) and human activity patterns (time spent playing or working outdoors, frequency of hand washing, etc.). Consequently, intake values are likely to vary widely between individuals and between sites. EPA believes that the current data, including the study by Calabrese et al. 1989, strongly support the conclusion that the values specified in the OSWER directive are within the likely range of upper 95th percentile intake values. The calculations recommended by ARCO to define mean or median values are not appropriate for use in calculation of reasonable maximum doses. Also, EPA does not agree that the mean value proposed by ARCO is appropriate for use at Clark Fork sites since it was based on measurements in Massachusetts. EPA believes that the best data set to employ in deriving an average intake level is the report of Binder et al. (1986), since this study was performed in East Helena.

12. ARCO stated that arsenic in soil is less bioavailable than arsenic ingested in other media.

Response:

EPA agrees that this might be true and will adjust dose calculations to account for this when reliable site-specific data become available. In the absence of such data, EPA believes it is reasonable and prudent to assume that the relative bioavailability of arsenic in soil (compared to that in other media) is 1.0.

13. ARCO stated that the "threshold" (i.e., cleanup goal) concentration for arsenic in soil should be calculated from the equation
- $$C = DT / (IR \times AF)$$

where

C = arsenic concentration (µg/g soil)
DT = detoxification threshold (µg As/day)
IR = Soil ingestion rate (gm/day)
AF = Absorbed fraction

Based on values of 75 µg/day for DT, 0.2 g/day for IR and 0.25 for AF, ARCO calculated a reasonable maximum "threshold" value of 3,330 µg/g for children exposed to arsenic.

Response:

EPA has not concluded that there is a nonzero threshold for cancer risk from arsenic, so this entire approach is not considered appropriate. Even if the equation were to be used, EPA does not agree with ARCO's input parameters: (1) the "threshold" (if there is one) has not been defined, and could easily be above 1,000 µg/day for adults; and (2) the absorption fraction is not a relevant term and should not be included in the equation unless the "threshold" is expressed as an absorbed dose (it is not).

3.0 SUMMARY

EPA thanks ARCO for its comments and suggestions regarding the evaluation of exposure and risk due to flue dust at the Anaconda Smelter. EPA agrees with some of ARCO's suggestions, and has revised the risk assessment accordingly. However, EPA does not agree with other of ARCO's suggestions for the reasons given in this report. Also, EPA has chosen to be somewhat more conservative than ARCO suggested with respect to several assumptions and values. EPA acknowledges that some of these decisions may lead to an overestimate of exposure and risk but, in view of the uncertainties associated with the risk assessment process, believes this is necessary and prudent in order to ensure protection of human health and the environment.

ENFORCEMENT CONFIDENTIAL: CATEGORY 1,
PRIVILEGED ATTORNEY WORK PRODUCT

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TR-1165-27

EPA RESPONSES TO THE ARCO COAL COMPANY ENDANGERMENT ASSESSMENT
SCOPING DOCUMENT FOR THE FLUE DUST OPERABLE UNIT

Risk Assessment Support For
The Anaconda Smelter Site

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LIST OF ACRONYMS

EPA	Environmental Protection Agency
IU/BK	Integrated Uptake/Biokinetic
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is currently pursuing evaluation and cleanup activities at the Anaconda Smelter site near Anaconda, Montana. Included among the concerns of this site are a number of piles of flue dust from past smelter operations. The risk posed by these piles has been evaluated in an Endangerment Assessment. During the time that this Endangerment Assessment was being proposed, the ARCO Coal Company submitted to EPA a Scoping Document that presented ARCO's views and recommendations regarding a number of issues relevant to the performance of the Endangerment Assessment. This current document summarizes ARCO's recommendations, and provides responses to those recommendations as part of EPA's responsiveness summary.

2.0 ARCO RECOMMENDATIONS AND EPA RESPONSES

1. ARCO recommended that the risk assessment focus on the incremental risks due specifically to flue dust, and not to combine this risk with risks from other sources.

Response:

EPA agrees, and has sought to do this where the data permit.

2. ARCO recommended that the risks associated with exposure to flue dust be compared to risks from background exposures in Montana.

Response:

EPA agrees that a comparison of site-specific risks to background risks (from the same chemicals) is useful in establishing perspective, and has provided this information where the data permit.

3. ARCO recommended that risks should be evaluated both for current conditions (including twice-yearly spraying of the flue dust and institution controls to limit access) and a base-line (no-action) case.

Response:

The Remedial Investigation/Feasibility Study (RI/FS) process requires preparation of a base-line (no-action) evaluation, and that is the purpose of the Endangerment Assessment. This evaluation assumes that access is not restricted and that remedial activities (such as spraying) are discontinued. If significant risk is associated with the no-action alternative, then the efficacy of current institutional controls may be evaluated along with other remedial alternatives. However, institutional controls do not meet the criterion of being a permanent solution.

4. ARCO recommended considering three potentially exposed populations:
 - Theoretical future on-site residents
 - Incidental on-site visitors
 - Current off-site residents

Response:

EPA agrees and has sought to evaluate exposure and risk for these groups.

5. ARCO stated that existing monitoring data were adequate to show that quantitative assessment of off-site risk is not necessary.

Response:

EPA agrees that existing monitoring data support the view that flue dust concentrations in air decrease as a function of distance from the source (as would be expected), but does not agree that it is unnecessary to evaluate off-site risk. Such an evaluation is important in fully characterizing the risk associated with the no-action alternative and is needed to characterize the efficacy of various remedial alternatives.

6. ARCO stated that air is expected to be the primary migration route, but that quantification of air migration is likely to be difficult due to the complex meteorology of the site. Direct measurements of contaminant levels in air cannot be used since they do not distinguish flue dust from other sources. If modelling is attempted, it must be validated against site monitoring data, using this as an absolute upper limit.

Response:

EPA agrees that air erosion and dispersion is the main route of contaminant migration. EPA also agrees that direct monitoring data are not specific for flue dust, and that mathematical modelling of flue dust dispersion is required to separate the risk of flue dust from other sources. EPA also agrees that application of models to this site is difficult. In fact, EPA's attempt to model air dispersion of flue dust did not appear to give reasonable results off-site. Consequently, those calculated values were not used to estimate flue dust-specific risk to off-site populations. Rather, as ARCO suggested, monitored values were used as an estimate of the upper limit of flue dust exposure.

7. ARCO states that migration of flue dust in groundwater and surface water is not expected to be as significant as air migration, and that consideration of groundwater is beyond the scope of the Flue Dust Operable Unit.

Response:

Whether surface water and/or groundwater transport are as significant as air is irrelevant; both pathways must be considered in assessing the risks posed by the flue dust piles. However, EPA believes current data are not adequate to quantify the specific impact of flue dust on either surface water or groundwater, and so has evaluated these pathways qualitatively. Also, EPA has chosen to include risk from groundwater directly beneath the site in the evaluation of risks to hypothetical future residents. It is made clear in the Endangerment Assessment that not all the risk due to groundwater may be due to flue dust, but that the fraction of the risk in groundwater that is specifically due to flue dust is not known.

8. ARCO provided an algorithm for calculating the concentration of contaminants in indoor air as a function of the concentration of contaminants in outdoor air and in indoor house dust. ARCO recommended this algorithm for evaluating indoor inhalation exposures to flue dust.

Response:

EPA agrees that it is important to consider inhalation exposure to flue dust in indoor air. However, for the purposes of the present evaluation, EPA believes this model is not sufficiently well-established to warrant inclusion. Rather, EPA prefers to make the conservative assumption that the concentration of contaminants in indoor air is equal to that in outdoor air. EPA acknowledges that this may lead to an overestimate of exposure, and has identified this as a source of uncertainty in its analysis.

9. ARCO provided algorithms for calculating the concentration to specific contaminants in house dust, based on the concentration in outdoor soil. ARCO recommended that these algorithms be used in evaluating exposures due to inhalation or ingestion of house dust.

Response:

EPA agrees that it is important to consider exposure to contaminated house dust. However, EPA considers that the algorithms proposed by ARCO are not sufficiently well-established or validated to be employed in the Endangerment Assessment. Rather, EPA prefers to make the conservative (and simplifying) assumption that the concentration of contaminants in house dust is equal to that in outdoor soil. EPA acknowledges that this may lead to an overestimate of exposure, and has identified this as a source of uncertainty.

10. ARCO stated that the exposure pathways of concern were inhalation and ingestion of flue dust, and that dermal exposure was not of concern, since metals are poorly absorbed through the skin.

Response:

EPA agrees that inhalation and ingestion of flue dust are important, and that dermal uptake of metals is sufficiently small to be neglected.

11. ARCO recommended that average lifetime exposures be calculated on the assumption that a person is exposed at the site for nine years (best case) or 30 years (worst-case) out of a lifetime of 75 years.

Response:

EPA agrees that many people will not reside near the site for their entire lifetimes. However, estimating cancer risks from less-than-lifetime exposure is problematic, since the magnitude of the risk from such an exposure depends on the mechanism of action of

the carcinogen. EPA prefers in this case to evaluate cancer risks based on the assumption that an individual is exposed their entire lifetime. This may result in an overestimate of risk to individuals who do not reside their whole life time near the site, and this has been identified as a source of uncertainty. In keeping with EPA guidance (Risk Assessment Guidance for Superfund, December 1989), a value of 70 years for a lifetime was used.

12. ARCO stated that exposure to flue dust in air should be assumed to occur only 247 days/year, to account for climatic factors.

Response:

EPA agrees that erosion of flue dust depends on climatic factors, and that erosion is likely to be minimal when the piles are frozen or snow-covered. EPA believes the most appropriate value to use for non-snow days is 215 days/year. This value will result in a somewhat lower estimate of exposure than the value recommended by ARCO.

13. ARCO recommended using the value of 3.07 hours/week spent outdoors (as described in the Exposure Factors Handbook) for evaluating inhalation of flue dust in air.

Response:

Since EPA has chosen to assume the concentration of flue dust is equal in outdoor air and indoor air (see discussion under 2.8), the distribution of time spent indoors and outdoors becomes irrelevant. If exposure indoors and outdoors were to be evaluated separately, it would be necessary to calculate average time outdoors based on site-specific assumptions, as described in the Exposure Factors Handbook. The value of 3.07 hours/week cited in the Exposure Factors Handbook is not intended to be a recommended value. Rather, it is the result of a sample calculation based on a hypothetical set of activity assumptions.

14. ARCO recommended that incidental visitors to the site be assumed to be teenagers and adults, and that a reasonable worst-case exposure assumption is two hours/month.

Response:

EPA agrees that it is reasonable to assume that site visitors are most likely to be teenagers or adults. EPA has chosen dirt bike riders to represent the maximally exposed site visitor. Based on data in the Exposure Factors Handbook for time spent in a similar activity, EPA has used 2.62 hours/week as a best case and 15.3 hours/week as an upper limit.

15. ARCO stated that the soil ingestion rates for children (200-800 mg/day) provided in the Exposure Factors Handbook are too high, and that recent studies not considered in developing these estimates indicate that a lower value is approximate. For adults, ARCO recommended a value of 10 mg/day.

Response:

EPA believes available data are not sufficient to establish clear-cut estimates of average soil intake by children or adults. For this reason, EPA has adopted as an interim policy the use of 200 mg/day (best estimate) or 800 mg/day (upper-bound) for soil intake by a child. EPA will use this estimate until a scientific consensus can be developed on this issue. For adults, no policy has been established. Data summarized in the Exposure Factors Handbook indicate values of 10-100 mg/day might be appropriate for average intake by an adult. In order to be conservative, a value of 100 mg/day has been assumed.

16. ARCO recommended that ingestion of soil for less than lifetime exposure should not be assumed to occur at a time in life when intake rates are highest. Instead, average lifetime intake rates should be used, which is equivalent to assuming that exposure is equally likely to begin at any age.

Response:

EPA does not agree that this is appropriate. When a less than lifetime exposure is considered, it is important to focus on the most sensitive subpopulation. In the case of soil ingestion, this is clearly young children, who ingest more soil than adults. Calculations of the average lifetime dose ignores this and would seriously underestimate risk to children.

17. ARCO noted that there is uncertainty regarding the cancer potency factor for arsenic, and that this must be addressed as a qualifying factor in the Endangerment Assessment.

Response:

EPA agrees, and has provided a discussion of the issues currently under debate regarding the carcinogenicity of arsenic.

18. ARCO recommended that the Reference Dose (RfD) for cadmium in food be used rather than the RfD for cadmium in water, asserting that it is likely the bioavailability of cadmium in soils will be even less than for cadmium in food.

Response:

EPA does not believe there are adequate data to establish that metals in flue dust are not readily bioavailable. EPA has included a bioavailability term in the calculation of dose for both inhalation and ingestion exposures, but the value of this term has been assumed to be 1.0. This may be revised if specific data on the bioavailability of flue dust become available.

19. ARCO recommended using the integrated uptake/biokinetic (IU/BK) model developed by Harley and Kneip for evaluating the health risks of lead at this site. This would include use of gastrointestinal absorption factors to account for differential absorption of different lead compounds. Specifically, ARCO recommended a bioavailability factor of 0.25 for lead at mining sites.

Response:

EPA agrees that the IU/BK model is useful in evaluating the health risks of lead, and has used a simplified version as one means of evaluating health risk from lead at this site. However, as noted above, EPA does not believe available data establish that lead in flue dust has low bioavailability, and has employed a value of 1.0 rather than 0.25 for this parameter.

(5)

3.0 SUMMARY

EPA thanks ARCO for its comments and suggestions regarding the evaluation of exposure and risk due to flue dust at the Anaconda Smelter. EPA agrees with many of ARCO's suggestions, and has acted accordingly. However, EPA has chosen to be somewhat more conservative than ARCO suggested with respect to several assumptions and values. EPA acknowledges that some of these decisions may lead to an overestimate of exposure and risk but, in view of the uncertainties associated with the risk assessment process, believes this is necessary and prudent in order to ensure protection of human health and the environment.

NOTICE

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TITLE "RECORD OF DECISION ANACONDA CO. SMELTER NPL SITE FIBRE DUST
OPERABLE UNIT ANACONDA CO., DEER LODGE COUNTY, MONTANA"
(SIGNED)

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