Remedial Action Contract
for Remedial Response, Enforcement Oversight, and Non-Time Critical Removal Activities at Sites of Release or Threatened Release of Hazardous Substances in EPA Region 8

Clark Fork Basin Superfund Sites

Quality Assurance Project Plan for the Use of Existing Data

U.S. EPA Contract EP-W-05-049
Work Assignment Numbers 302, 320, 341, 349, 350, 353, 358, 362, and 363

August 2019 (Revision 2)

Prepared for:

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A – Project Management

A1 Title and Approval Sheet

Title: Clark Fork Basin Superfund Sites, Quality Assurance Project Plan for the Use of Existing Data, Contract EP-W-05-049, Work Assignments (WAs) Numbers 302, 320, 341, 349, 350, 353, 358, 362, and 363, August 2019 (Revision 2).

Revision Log:

Revision No.	Revision Date	Description of Changes
0	05/13/14	---
1	12/29/16	Added new Work Assignment Number 358 (Anaconda Community Soils Remedial Action Oversight) to the QAPP. Updated signature page, distribution list, and key personnel. Inserted references to the updated QMP, Revision 4, dated July 31, 2016. Referenced new QP 5.4, Evaluating the Use of Existing Data. Using the most recent work assignment work plan, the tasks that may use existing data were updated in Section A6. Specified the qualifications for evaluators of existing data in Section A8. Revised Figure A-4 to be consistent with QP 5.4. Updated the links to project data in Section B10. Multiple minor text edits.
2	8/12/19	Added new Work Assignment Numbers 362 (Silver Bow Butte Mine Flooding Remedial Action Oversight) and 363 (Silver Bow West Side Soils Remedial Investigation/Feasibility Study) to the QAPP and added discussion of the existing data needs for these WAs in Section A6. Removed Work Assignment Number 311 (Silver Bow Creek/Butte Area Negotiation Support) since the project is closed. Inserted references to the updated QMP, Revision 5, dated July 31, 2017. Added a short discussion of historic mine maps in Section A7.3. Revised Figure A-1 (location map), to include WAs 353, 362, and 363, and Figure A-2 (project organization chart).

Approvals (CDM Federal Programs Corporation [CDM Smith]):

Terry Crowell — 8/12/19
Terry Crowell — Date
CDM Smith Quality Assurance (QA) Specialist

Gunnar Emilsson — 8/12/19
Gunnar Emilsson — Date
CDM Smith Project Manager (PM) – WAs 302, 320, 341, and 358

David Shanight — Date: 8/8/2019
CDM Smith PM – WAs 349 and 350

Chapin Storrar — Date: 8/12/2019
CDM Smith PM – WA 362 and 363

Greg Hayes — Date: 8/8/2019
CDM Smith PM – WA 353

Approvals (U.S. Environmental Protection Agency [EPA]):

Charlie Coleman — Date: 8/16/19
EPA Remedial Project Manager (RPM) – WAs 302, 320, 341, and 358
EPA QA Designee

Nikia Greene — Date: 8-19-19
EPA RPM – WAs 349, 350, 353, 362, and 363
EPA QA Designee

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Abbreviations and Acronyms

ARWW&S	Anaconda Regional Water, Waste & Soils
Atlantic Richfield	Atlantic Richfield Company
BPSOU	Butte Priority Soils Operable Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO	contracting officer
CDM Smith	CDM Federal Programs Corporation
CFRSSI	Clark Fork River Superfund Site Investigations
CSM	conceptual site model
DEQ	Montana Department of Environmental Quality
DM/DV	data management/data validation
DSR	data summary report
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FS	feasibility study
GIS	geographic information system
HHRA	human health risk assessment
KML	keyhole markup language
MBMG	Montana Bureau of Mining and Geology
NPL	National Priorities List
NRD	Natural Resource Damage Program
OU	operable unit
OW/EADA	Old Works/East Anaconda Development Area
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PDF	portable document format
PM	project manager
PO	project officer
PRAO	preliminary remedial action objective
PRP	potentially responsible party
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QMP	quality management plan
QP	quality procedure
RA	remedial action
RAC	Remedial Action Contract
RD	remedial design
RI	remedial investigation
ROD	record of decision
RPM	remedial project manager
SD	settling defendant
SOP	standard operating procedure
USGS	U.S. Geological Survey
WA	work assignment

WSSOU	West Side Soils Operable Unit

A2.1 Introduction

This document is a quality assurance project plan (QAPP) for the use of existing data applicable to nine CDM Smith WAs (302, 320, 341, 349, 350, 353, 358, 362, and 363), all of which are U.S. Environmental Protection Agency (EPA) National Priorities List (NPL) Superfund Sites located in the Clark Fork River Basin. There are four primary Superfund Sites in the Clark Fork River Basin:

- Anaconda Smelter Site
- Milltown Reservoir/Clark Fork River Site
- Montana Pole and Treating Plant Site
- Silver Bow Creek/Butte Area Site

These sites are shown on the attached Figure A-1. These sites were listed on the NPL to address the release or threat of release of contaminants as a result of historic mining and ore processing facilities in Butte and Anaconda and other mining related facilities in and along Silver Bow Creek and the upper Clark Fork River. The Milltown Reservoir Site is being worked on by others and Montana Pole essentially is complete; therefore, these sites are not included in this QAPP. CDM Smith is actively working at the Anaconda Smelter Site and the Silver Bow Creek/Butte Area Site for EPA. Work at the Anaconda and Silver Bow Creek/Butte Area sites is presently being conducted under the following WAs:

- WA 302 – Anaconda Technical Assistance
- WA 320 – Anaconda Regional Water, Waste & Soils (ARWW&S) and Old Works/East Anaconda Development Area (OW/EADA) Operable Units (OUs) Remedial Action Oversight
- WA 341 – Anaconda Montana Natural Resource Damage (NRD) Remedial Action Oversight
- WA 349 – Silver Bow Creek/Butte Area Remedial Design Oversight
- WA 350 – Silver Bow Creek/Butte Area Remedial Action Oversight
- WA 353 – Silver Bow Creek/Butte Area Rocker Timber Framing and Treating Plant OU
- WA 358 – Anaconda Community Soils OU Remedial Action Oversight
- WA 362 – Silver Bow Creek/Butte Area Mine Flooding OU Remedial Action Oversight
- WA 363 – Silver Bow Creek/Butte Area West Side Soils OU (WSSOU) Remedial Investigation/Feasibility Study (RI/FS)

This QAPP governs the use of existing data for these nine WAs under contract EP-W-05-049. All of these sites, except for the WSSOU, have a common primary potentially responsible party (PRP) (Atlantic Richfield Company [Atlantic Richfield]), are post-RI and have at least one record of decision (ROD) completed, and are in various stages of remediation and cleanup. Therefore, it is considered

appropriate for a single QAPP to govern the use of existing data for these sites. A separate QAPP will govern collection of new RI data for the WSSOU; however, considerable data exist for properties in the WSSOU that have been collected by others, primarily by Atlantic Richfield and the Montana Bureau of Mines and Geology. Thus, its inclusion in this QAPP for the use of existing data is consistent with the other Clark Fork Basin sites.

This QAPP has been prepared in accordance with EPA *Requirements for Quality Assurance Project Plans (QA/R-5)* (EPA 2001) and CDM Smith Quality Procedure (QP) 5.4, *Evaluating the Use of Existing Data,* detailed in CDM Smith's *Quality Management Plan* (QMP) Revision 5, July 31, 2017 (CDM Smith 2017) for the EPA Region 8 Remedial Action Contract (RAC). The QAPP is organized into four sections—project management, data acquisition and use, assessment and oversight, and data validation and usability—as they relate to the efforts required to assess and document the suitability of the data used in support of these WAs. Attachment 1 provides the completed EPA Region 8 QA document review crosswalk for this document.

A3 Distribution List

The following individuals will receive a copy of the approved QAPP and any amendments or revisions:

Recipient	Organization	Title	Email
Tia Gatling	EPA, Region 8	Contracting Officer (CO)	Gatling.tia@epa.gov
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Terry Crowell	CDM Smith	QA Specialist	crowelltl@cdmsmith.com

CDM Smith PMs are responsible for ensuring that all technical support staff have reviewed this QAPP.

A4 Project/Task Organization

Figure A-2 provides an organizational chart that identifies project managers, project team members, and reporting relationships between the project team.

The EPA CO and PO for the EP-W-05-049 contract are Tia Gatling and Jodi Powell, respectively. The EPA RPM for Anaconda Smelter WAs 302, 320, 341, and 358 is Charlie Coleman. The EPA RPM for Silver Bow Creek/Butte Area WAs 349, 350, 353, the Mine Flooding OU WA 362, and the WSSOU WA

363, is Nikia Greene. The EPA RPMs are responsible for reviewing the WA work plans and cost estimates, tracking project budgets, and reviewing project status reports and deliverables.

The following lists the key CDM Smith contract and administration individuals and identifies their roles and responsibilities:

- **Jo Nell Mullins** – The QA manager is responsible for overall management of the CDM Smith QA program, including CDM Smith projects under this contract, as described in the QMP (CDM Smith 2017). The QA manager is independent of the entities providing technical support for these WAs.
- **Kris Chapman** – The program manager is the senior manager responsible for the contract, including resource allocation; the performance, qualifications, and training needs of the contract personnel; and the implementation of the QA procedures described in the contract QMP.
- **Gunnar Emilsson, David Shanight, Chapin Storrar, and Greg Hayes** – PMs are responsible for the overall management and coordination of the WAs, including maintaining communications with EPA regarding project status, preparing project status reports, tracking planned budgets and schedules, managing project resources and staff, reviewing project deliverables, ensuring QA and relevant QP requirements are met, and devising necessary corrective actions. The PMs (or designees) are responsible for reviewing and updating this QAPP, as appropriate.
- **Talia Zaczkowski** – The contract administrator will be responsible for project administration, including set up, maintenance, invoice review and approval, and closeout. She will also be involved in reviewing monthly project costs, revenue, and accounts receivables.
- **Bob Alexander** – The QA specialist is responsible for implementing the QA program on work assignments. The QAS reports to the QA manager on QA issues, maintaining the independence of the QA function for the contract.

The following lists the key CDM Smith technical individuals that will be involved in these projects and identifies their roles and responsibilities:

- Curt Coover – hydrogeologist/hydrologist
- Kent Whiting – geochemist
- Angela Frandsen – environmental engineer
- Ben Simpson – ecological engineer/plant ecologist
- Bob Alexander – scientist/QA specialist (To maintain QA function independence, Terry Crowell will serve as QA specialist on any WAs where technical work is performed by Bob Alexander)
- Nick Anton – environmental engineer
- Connor Kelley – geologist

- Michelle Goldberg – geologist
- Winston Parker – environmental engineer

These key support staff will utilize a team of technical staff, scientists, and engineers to support the tasks described in the WAs statements of work. CDM Smith technical support staff will work in close contact with the EPA RPMs to ensure that work products and deliverables meet the objectives for the project.

A5 Problem Definition/Background

Together, the Anaconda Smelter, Milltown Reservoir/Clark Fork River, Montana Pole, and Silver Bow Creek/Butte Area Sites are included in what is referred to as the Clark Fork Basin Superfund Sites. The four Superfund sites in the Clark Fork Basin extend 140 miles from the headwaters of Silver Bow Creek north of Butte to the Milltown Dam on the Clark Fork River near Missoula (Figure A-1). Although the sites are interrelated, cleanup schedules and time frames are based on site-specific and OU-specific risk conditions.

Mining, milling, and smelting activities conducted for nearly 100 years resulted in the contamination of soils, surface water, and ground water, primarily through disposal practices and airborne emissions. The key contaminants of concern are arsenic, cadmium, copper, lead, mercury, and zinc. Sites in the Clark Fork Basin were originally added to the NPL in the early 1980s, under Superfund authority, with Atlantic Richfield identified as the primary PRP. Since then, Atlantic Richfield has been actively involved in the investigation and cleanup activities at all Clark Fork Basin Superfund Sites, and hundreds of data sets have been generated involving all media (e.g., soil, water, air). Regulatory information, applicable criteria, action levels, and remediation goals developed for each project are specified in the RODs for each site.

In the early 1990s, Atlantic Richfield and EPA agreed to use a set of protocols that would guide the design of sample collection, field procedures for sample collection, analytical procedures, validation methods, and reporting requirements for information being collected during Clark Fork River Superfund Site Investigations (CFRSSI). These protocols were contained in the following documents prepared by Atlantic Richfield and their subcontractors:

- *Laboratory Analytical Protocol* (Atlantic Richfield 1992a)
- *Quality Assurance Project Plan* (Atlantic Richfield 1992b)
- *Standard Operating Procedures* (SOPs) (Atlantic Richfield 1992c)
- *Data Management/Data Validation Plan* (DM/DV Plan) (Atlantic Richfield 1992d)
- *Pilot Data Report for Organic and Inorganic Data* (Atlantic Richfield 1993)
- *Laboratory Analytical Procedure for X-Ray Fluorescence Analysis of Solid Media* (Atlantic Richfield 1995)

In 2000, changes were made through addendums to the DM/DV Plan dated June (Atlantic Richfield 2000a) and the Pilot Data Report dated July 2000 (Atlantic Richfield 2000b). These addendums provided some updates (e.g., adding the use of data quality objectives [DQOs]) and validation

streamlining efforts. Presently, these documents still govern data collection activities at the Clark Fork Basin sites where CDM Smith performs work and data are being continually generated under the CFRSSI documents.

In addition, data sets generated by other entities, such as the U.S. Geological Survey (USGS) and the Montana Bureau of Mining and Geology (MBMG), may provide useful information and/or data at Clark Fork Basin sites. These existing data may be obtained from many sources and must be evaluated to ensure that the data meet the DQOs required to support Clark Fork Basin investigation and cleanup objectives.

As the primary PRP, Atlantic Richfield generally self performs the vast majority of remedial design (RD) and remedial actions (RA). CDM Smith, as directed by EPA, reviews documents prepared by the PRP and provides oversight to ensure the implementation of the RD and RA complies with the terms of the agreement under which the work is being conducted. In other assignments, CDM Smith has been tasked with interpreting site data and offering technical recommendations to EPA. This QAPP has been prepared to provide a framework for evaluating existing data for use in EPA's decision-making processes at Clark Fork Basin sites. EPA guidance regarding the use of existing data has been taken from EPA QA/R-5 (EPA 2001), QA/G-5 (EPA 2002), and *A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information* (EPA 2003).

A6 Project/Task Description

The EPA RAC Region 8 contract with CDM Smith is currently in effect until September 27, 2019. This QAPP is intended to be utilized until the RAC 8 contract ends and reviewed and updated annually as required. The support work under WAs 302, 320, 341, 349, 350, 353, 358, 362, and 363, in which CDM Smith may use existing data, is presented for each applicable WA task below. It is important to note that CDM Smith is not responsible for conducting any field work, sample collection, data management, or laboratory analysis under the WA tasks covered under this QAPP. Any primary data collection efforts will be addressed in separate QAPPs specific to that purpose. Estimated costs and deliverable schedules for performing these tasks were summarized in each WA work plan and cost estimate. CDM Smith will complete all technical work in accordance with the period of performance provided by EPA. The tasks listed in this QAPP may use existing data, but depending on the situation, other tasks within the work plans may also use existing data.

A6.1 WA 302 – Anaconda Technical Assistance

Work Plan: Amendment 6, March 30, 2019

Task 3 – Document Review

Subtask 2.2 Continued Preparation Support of EPA Decision Documents and Exhibits to be attached to the Consent Decree

Several submittals will be prepared for EPA under this subtask that may involve the use of existing data.

Subtask 3.1 Review of PRP Submittals

A range of documents will be reviewed that may contain existing data, including RD work plans, institutional control plans, operations and maintenance plans, management plans, and monitoring plans.

Task 4 – Consent Decree Technical Analysis

Subtask 4.1 Consent Decree Technical Analysis

Several submittals will be prepared for EPA under this subtask that may involve the use of existing data, specifically, the ongoing slag technical evaluations.

A6.3 WA 320 – Anaconda ARWW&S and OW/EADA OUs Remedial Action Oversight

Work Plan: Amendment 3, July 24, 2017

Task 8 – Review of PRP Submittals

Subtask 8.1 Review of PRP Submittals

Documents to be reviewed that may contain existing data include change reports, vegetation monitoring and maintenance reports, construction completion reports, and other technical documents.

A6.4 WA 341 – Anaconda Montana NRD Remedial Action Oversight

Work Plan: Original, August 5, 2010

Task 8 – Review of Settlement Submittals

Subtask 8.1 Review of Settlement Submittals

RA/restoration work plans and other technical documents that may contain existing data will be reviewed.

A6.5 WAs 349 and 350 – Silver Bow Creek/Butte Area Remedial Design and Remedial Action Oversight

Work Plans: Amendment 5, December 4 (WA 349) and September 12, 2018 (WA 350)

Task 8 – Review of PRP Submittals

Documents to be reviewed that may contain existing data include design reports, change reports, vegetation monitoring and maintenance reports, construction completion reports, and other technical documents.

Task 9 – Remedial Design/Remedial Action Oversight

This task includes oversight of PRP activities along with the development of a surface water characterization report and a groundwater characterization report, both of which will utilize existing data in their preparation.

A6.6 WA 353 – Silver Bow Creek/Butte Area Rocker Timber Framing and Treating Plant OU

Work Plan: Amendment 2, September 24, 2018

Task 7 – Data Evaluation

Subtask 7.1 Data Evaluation

A data usability report summarizing the sample results, the validation results, and the field quality control (QC) results, and a comparison, as appropriate, of the PRP and/or historical sample data against samples collected by CDM Smith will be prepared. A discussion of any discrepancies between the data set results will be provided.

Task 8 – Review of PRP Submittals

Subtask 8.1 Review of PRP Submittals

CDM Smith will support EPA by providing technical reviews of PRP plans, reports, and documents submitted to EPA for the Rocker OU work assignment. This support includes reviewing draft and/or

final versions of these documents, discussing the content with the EPA RPM, and providing written comments for the EPA RPM and the administrative record via technical memorandum. Documents to be reviewed may include an updated conceptual site model, quarterly operations and maintenance reports, annual monitoring reports, monitoring plans, QAPPs, and other decision and technical documents.

A6.7 WA 358 – Anaconda Community Soils OU Remedial Action Oversight

Work Plan: Amendment 1, April 3, 2018

Task 8 – Review of PRP Submittals

Documents to be reviewed that may contain existing data include change reports, data packages/reports, site work plans, construction completion reports, and other technical documents.

A6.8 WA 362 – Silver Bow Creek/Butte Area Mine Flooding OU

Work Plan: Amendment 1, September 12, 2018

Task 6 – Reuse Planning

CDM Smith will perform a reuse assessment of the site and prepare a reuse assessment report upon the request of the EPA RPM. The reuse assessment may include reviews of Settling Defendant (SD) plans, reports, and documents, as well as other historical documents.

Task 7 – Data Evaluation

A data usability report summarizing the sample results, the validation results, and the field QC results, and a comparison, as appropriate, of the SD and/or historical sample data against samples collected by CDM Smith will be prepared. A discussion of any discrepancies between the data set results will be provided.

Task 8 – Review of SD Submittals

CDM Smith will support EPA by providing technical reviews of SD plans, reports, and documents submitted to EPA for the Mine Flooding OU work assignment. This support includes reviewing draft and/or final versions of these documents, discussing the content with the EPA RPM, and providing written comments for the EPA RPM and the administrative record via technical memorandum. Documents to be reviewed may include work plans, basis of design and design criteria reports, lists of RA submittals, site management plans for remedial construction, operations and maintenance plans, as-built drawings, QAPPs, and other decision and technical documents.

Task 9 – Remedial Action Oversight

This task includes oversight of SD RA activities to ensure construction or monitoring activities are completed according to EPA-accepted work plans and technical specifications. CDM Smith will also prepare a final RA/oversight memorandum, which will include copies of the field logbook and oversight photographs and report any nonconformance issues to the EPA Work Assignment Manager and Contracting Officer Representative. The oversight tasks and the preparation of the final RA/oversight memorandum will utilize existing data.

A6.9 WA 363 – Silver Bow Creek/Butte Area West Side Soils OU

Work Plan: Original, September 28, 2018

Task 3 – Field Investigation/Data Acquisition

Subtask 3.3 Site Reconnaissance

Site reconnaissance will consist of field reconnaissance and desktop reconnaissance. The desktop reconnaissance will include:

- Performing a geotechnical survey, including visits to the Montana Bureau of Mines and Geology and the Butte-Silver Bow Public Archives to obtain historical mining maps and documents and reviewing historical data for use in planning the field investigation and completing the RI/FS.
- Collecting light detecting and ranging data of the subject area or purchasing and downloading existing aerial photographic data for use in reviewing and making determinations on individual parcels to create a geographic information system (GIS) hydrology layers. This data will also be used in the FS to help estimate the extent and volume of waste piles.
- Using Montana's Groundwater Information Center to determine the number of residential and/or monitoring wells within the WSSOU and reviewing any existing sampling data available for those wells.
- Conducting wetland and habitat search within the WSSOU, including a review of the National Wetlands Inventory mapping information.
- Reviewing Montana Cadastral parcel data and comparing the data to other available claim records to define the number of sites, size of sites, and property ownership. The Butte Silver Bow Land Records office will also be utilized to research parcels with no property ownership information available in the Cadastral database.
- Reviewing topographic data and storm sewer information to confirm which stormwater watersheds drain to the active mine area on Montana Resources property and which drain to Blacktail Creek, to inform the stormwater watershed sample locations as well as the Blacktail Creek sample locations.

Subtask 3.5 PRP Sampling Oversight

CDM Smith will provide oversight support of EPA of any PRP sampling activities. This will include technical reviews of QAPP/sampling and analysis plans, sampling plans, work plans, data summary reports (DSRs), and data validation documents, in addition to limited physical field sampling oversight to ensure sampling activities are completed in accordance with the EPA-accepted work plans and technical specifications.

Task 5 – Analytical Support and Data Validation

Subtask 5.2 Data Validation and Data Management

CDM Smith will perform standard data validation, including performing data management activities such as evaluation of all existing data in accordance with this document.

Task 6 – Data Evaluation

Subtask 6.1 Data Reduction and Tabulation

In addition to the reduction and tabulation of all newly collected data, CDM Smith will perform reduction, tabulation, and summarizing of data from previous investigations performed by EPA, other agencies, and other parties.

Subtask 6.2 Data Evaluation and Technical Memoranda

Following the reduction and tabulation of all data, CDM Smith will evaluate the data to determine the nature and extent of contamination for the RI report. This will include interpretation of the results for mine waste, adit discharge or other mine influenced water, surface water, pore water, and stream sediments; and performing reduction, tabulation, and summarizing of data from previous investigations performed by EPA, other agencies, and other parties.

Subtask 6.3 Environmental Fate and Transport

For the environmental media sampled but not addressed in the topic-specific memoranda, fate and transport analysis will be developed for inclusion in the RI report. A conceptual site model (CSM) for the site will be developed showing contaminants, exposure pathways, and receptors. This CSM will rely on newly collected as well as existing data.

Task 7 – Risk Assessment

Subtask 7.1 Human Health Risk Assessment Support

CDM Smith will review the historical human health risk assessment (HHRA) documents from the Butte Priority Soils Operable Unit (BPSOU), as well as the requirements and basis of the Residential Metals Abatement Program for the BPSOU and the most recent results of the medical monitoring program. A qualitative HHRA will be developed for the WSSOU, drawing upon risk conclusions and remedial strategies developed in support of the BPSOU to expedite the risk evaluation process for the WSSOU.

Task 9 – Remedial Investigation Report

CDM Smith will prepare a one draft and one final RI report based on the determinations found during data evaluation (Task 6) and in the risk assessments (Task 7). Both Tasks 6 and 7 utilize existing data.

Task 10 – Remedial Alternatives Screening

This task covers activities for the development and screening of remedial alternatives that will undergo full evaluation in Task 11. This task will develop preliminary remedial action objectives (PRAOs), identify and screen applicable remedial technologies; develop remedial alternatives in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan, and screen remedial alternatives for effectiveness, implementability, and relative cost. The HHRA evaluation from Subtask 7.1 will determine the contaminated media to be addressed. Based on existing information, the RI, the HHRA evaluation, and the ecological risk assessment, CDM Smith will identify the site-specific PRAOs that should be developed to protect human health and the environment.

Task 11 – Remedial Alternatives Evaluation

Upon receipt of EPA comments on the development and screening of remedial alternative memorandum addressed in Task 10, CDM Smith will perform a detailed analysis of the remaining remedial alternatives and submit it to EPA for review and approval. This analysis will inform EPA's comparison of the alternatives, selection of remedial actions for the WSSOU, and will satisfy the

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) statutory remedy selection requirements.

Task 12 – Feasibility Study Report

CDM Smith will prepare an FS report for all impacted media that summarizes the development and screening of remedial alternatives and the detailed and comparative analysis of the alternatives, including a discussion of site background and characterization that will rely on reviews of existing reports and documents. The comments received from EPA on the detailed analysis of alternatives technical memorandum and comparative analysis of alternatives technical memorandum, addressed in Task 11, will be incorporated into the FS report.

Task 13 – Post-Remedial Investigation/Feasibility Study Support

Subtask 13.1 Proposed Plan

CDM Smith will provide technical support to EPA in the preparation of the proposed plan, which may include review of existing data.

Subtask 13.3 Record of Decision

CDM Smith will provide technical assistance to EPA in the preparation of the ROD, which is a decision document that presents to the public and interested parties the final RA plan for the WSSOU. The ROD summarizes the problems, the alternatives that were considered for addressing those problems, and the comparative analysis of the alternatives against EPA's evaluation criteria. The ROD will also present the selected remedy and provide the rationale for that selection, and how the remedy satisfies the requirements of CERCLA and how the remedy contributes to the overall Silver Bow Creek/Butte Area cleanup solution. The development of the ROD will include review and incorporation of historical documents and existing data.

A7 Quality Objectives and Criteria

The tasks presented in this QAPP do not include primary data collection efforts or site investigations performed by CDM Smith. CDM Smith will use existing data generated from sampling efforts conducted by Atlantic Richfield and data sets collected by other entities such as MBMG. Additionally, historic data; data generated by other EPA contractors; and data from DEQ, USGS, and other miscellaneous sources, have been or potentially will be used by CDM Smith in support of EPA on Clark Fork Basin sites.

Data applicable to the Clark Fork River Site exists from a variety of sources, some originating as far back as the 1980s. All data considered for use will be evaluated using the five general assessment factors as found in *A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information* (EPA 2003). The general assessment factors include:

- **Soundness** – The extent to which the scientific and technical procedures employed to generate the information are reasonable for, and consistent with, the intended application
- **Applicability and Utility** – The extent to which the information is relevant for the intended use
- **Clarity and Completeness** – The extent to which the clarity and completeness with which the data, assumptions, methods, quality assurance, sponsoring organizations and analyses employed to generate the information are documented

- **Uncertainty and Variability** – The extent to which the variability and uncertainty (quantitative and qualitative) in the information or in the procedures, measures, methods or models are evaluated and characterized

- **Evaluation and Review** – The extent of independent verification, validation and peer review of the information or of the procedures, measures methods or models

The appropriate level of review for any particular information product is necessarily related to how and in what context the information product is to be used. Therefore, the specific use of the data and these assessments factors will be addressed in all deliverables to EPA that use or reference existing data. Data generated under the CFRSSI documents are assessed against the adherence to those documents for the collection, documentation, and validation procedures. Figures A-3 and A-4 depict the data evaluation process used by CDM Smith to evaluate data generated by Atlantic Richfield and other entities involved with Clark Fork Basin sites, respectively.

The following sections discuss the evaluation process CDM Smith will employ to assess data to be used in support of Clark Fork Basin sites. It is the responsibility of the CDM Smith PMs to ensure the appropriate evaluation process is followed and documented in CDM Smith deliverables to EPA.

A7.1 Atlantic Richfield-Generated Data

As noted in Section A5, in the early 1990s, Atlantic Richfield and EPA agreed to use a set of protocols referred to as the CFRSSI documents. These documents govern data collection activities by Atlantic Richfield at all Clark Fork Basin Superfund Sites. Other data generators may also utilize CFRSSI documents in their sampling efforts.

The 1993 *Pilot Data Report for Organic and Inorganic Data* (Atlantic Richfield 1993) was to be used as a model report to guide in the preparation of DSRs at the Clark Fork Basin sites. Updates to the DM/DV Plan and Pilot Data Report were made in 2000. The DM/DV Plan (Atlantic Richfield 2000a) and the original (Atlantic Richfield 1993) and amended (Atlantic Richfield 2000b) Pilot Data Reports are included in Attachment 2. Although dated, the CFRSSI documents and updates still govern sampling activities at Clark Fork Basin sites.

Per EPA QAPP guidance, the goal of a QAPP for existing data is to establish performance or acceptance criteria that can be used to evaluate potential data sets. CDM Smith's technical support role to EPA commonly requires evaluating and using data generated by Atlantic Richfield. Based on an agreement for data usage between Atlantic Richfield and EPA, data acceptance criteria for Clark Fork Basin sites were defined in a February 15, 2000 EPA letter to Atlantic Richfield *Data Quality Issues for Clark Fork River Superfund Sites* (EPA 2000). Subsequently, EPA recommendations were incorporated into the DM/DV Plan Addendum and Pilot Data Report Addendum, as provided in Attachment 2. Figure A-3 depicts the data evaluation process used to evaluate Atlantic Richfield-generated data. To initiate the evaluation, the following questions must be answered:

1) Did the data involve useful environmental or other sampling or measurement activity?

2) Do the data provide useful site information?

3) Were the Pilot Data Report (April 1993 or July 2000, as appropriate) requirements met?

4) Were DQOs established?

5) Do the data meet project DQOs in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS)?

6) What were the governing documents for collection of the data (e.g., were CFRSSI governing documents cited and used in whole or in part to generate the data?)

After answering the questions above, and using the Figure A-3 flow chart, the CDM Smith data user/evaluator can then categorize the extent to which a given Atlantic Richfield data set can be utilized at Clark Fork Basin sites and document the details of this evaluation.

A7.1.1 Reporting Elements for EPA Deliverables Involving Atlantic Richfield Data

The following site-specific reporting elements will be included regarding data assessment documentation within a CDM Smith deliverable to EPA:

1) A statement identifying the category of use of the data set within Clark Fork Basin sites, including its enforcement or screening status.

2) A summary of how the conclusion in Step 1 was reached, including a statement regarding whether the Pilot Data Report (April 1993 or July 2000 version, as appropriate) requirements were met.

3) Identification of the form in which the data was reported (e.g., electronic deliverable, spreadsheet, portable document format [PDF] report) and the source of the data (e.g., Atlantic Richfield, EPA RPM, EPA Records Center), including a statement if the data was transcribed.

4) A summary of the data evaluation documentation, including whether data validation and qualification were performed.

5) A summary of whether the Clark Fork River usability codes (i.e., enforcement "E", screening "S", and rejected "R" codes) were used and correctly applied to the data.

These elements will be addressed in a separate data quality assessment section of a CDM Smith deliverable to EPA. Examples of CDM Smith deliverables requiring inclusion of a data quality assessment section include, but are not limited to, technical memoranda, reviews of DSRs, and data interpretation reports. Unless quality issues are identified, data sets from Atlantic Richfield meeting the Pilot Data Report requirements usually can be used without restriction. Further scrutiny is necessary for data sets that do not meet the Pilot Data Report requirements. Additionally, this section will include definitive statements regarding the soundness, completeness, and usability of the data (including limitations), and whether the data meets the objectives of the intended use in the CDM Smith deliverable. If the data were validated independently, references to this validation will be included. If the data quality checklists for Clark Fork Basin sites contained in the DM/DV Plan and Pilot Data Reports (Attachment 2) were generated, this will be referenced.

A7.2 USGS-Generated Data

Data from USGS typically includes water quality and surface water flow data that are frequently used at Clark Fork Basin sites. USGS data will be considered acceptable for use without restrictions in the completion of the tasks in the Clark Fork Basin. USGS data pass through many QA reviews, including rigorous peer review, prior to approval and release to ensure the reliability, objectivity, and integrity

of the information. One caveat is water quality data from USGS prior to 1996; this should be used with caution and considered screening level, as the analytical methods were changed by USGS at that time.

A7.2.1 Reporting Elements for EPA Deliverables Involving USGS Data

When data from USGS is included in a deliverable, the following reporting elements will be included:

1) The source of the data (e.g., website, report).

2) A statement regarding whether water quality data are pre- or post-1996.

A7.3 Other Data Generators

Data generators besides Atlantic Richfield include, but are not limited to, entities such as MBMG, other PRPs (e.g., railroads), and county governments. Other data generators include private entities or government agencies that produced historical mine maps used in the WSSOU RI. These data may or may not have been collected for purposes specific to the Clark Fork Basin sites; however, other data sources may not be available or the information may be historical in nature and not repeatable. It is important to evaluate these data against the current project objectives to ensure support of EPA's decision-making processes. The evaluation of the existing data will be based on review of the quality systems in place during collection, analysis, and reporting of the data. The purpose of these evaluations is to assess whether the QA activities associated with a data set meet the current project DQOs. A checklist to evaluate existing data for use at Clark Fork Basin sites was developed, with site specific modifications, similar to that prepared by the Great Lakes National Program Office and Office of Water Quality Management Training Modules. The checklist was used to help prepare Figure A-4, which depicts the data evaluation process for non-Atlantic Richfield-generated data. The site-specific checklist is as follows:

1) Identify the data and information from outside sources (other data generators) proposed for the project.

2) If CFRSSI governing documents were used to conduct the investigation, evaluate the data as stated in Section A7.1 for Atlantic Richfield-generated data.

3) Identify the decision to be made or the project objectives. Are the data useful in meeting project objectives?

4) Were the data generated under an approved quality plan or other sampling document?

5) Does this data have any constraints affecting their use (e.g., attorney/client privilege)?

6) Will the data be used in a site's decision-making process?

7) Do the reporting limits meet project action criteria? Was the data qualified? Are the data comparable to other accepted project data sets?

8) Document the analysis plan used for the acquisition of the data and evaluate the data for quality concerns and any limitations of the data relevant to the intended project use.

After answering the above questions, and following the Figure A-4 flow chart, CDM Smith will describe the extent to which an alternate source data set can be utilized at Clark Fork Basin sites and document the details and any limitations found as a result of this evaluation.

A7.3.1 Reporting Elements for EPA Deliverables Involving Data from Other Data Generators

The following site-specific reporting elements were developed that must be considered and addressed by the data user/evaluator within a CDM Smith deliverable to EPA:

1) A statement identifying the category of use of the data set within Clark Fork Basin sites.

2) A summary of how the conclusion in Step 1 was reached.

3) Identify the format the data was reported in (e.g., electronic deliverable, spreadsheet, PDF report) and the source of the data (e.g., directly from the data generator, EPA Records Center).

4) Cite the QAPP or other governing document used in the investigation.

5) Document that the analytical methods were sufficiently sensitive to support project objectives.

6) Summarize the comparison of the sampling and analytical methods or SOPs to those specified for Clark Fork Basin sites (e.g., the CFRSSI SOPs). All existing data sets used in Clark Fork Basin projects must be generated using the same or comparable sampling and analytical methods or SOPs.

7) Describe whether the data sets are complete and all necessary information is available (e.g., water quality parameters, date of sampling, composite or grab sampling).

8) State whether the data included laboratory qualifiers and qualifier definitions. Provide a summary of the data validation, if available.

The results of the evaluation must be addressed in a separate data quality assessment section of the CDM Smith deliverable. Examples of CDM Smith deliverables requiring inclusion of a data quality assessment section include, but are not limited to, technical memoranda, evaluations of historic data, and data interpretation reports. This section will include concrete statements regarding the usability of the existing data set (including limitations) and whether the data meets the objectives of the intended use in the CDM Smith deliverable. The evaluation of the existing data will be based on review of the quality systems in place during collection, analysis, and reporting of the data to determine if the data is usable in terms of the current project DQOs.

A8 Special Training/Certifications

There is no specialized training or certifications needed by CDM Smith personnel to support these WAs. However, evaluating existing data requires a certain amount of experience. Therefore, in general, evaluators of existing data should meet requirements for technical reviewers as specified in QP 3.2 of the QMP (CDM Smith 2017):

- Minimum 10 years of experience (grade 5 or 6) with subject area
- Degree in related technical subject area

A9 Documentation and Records

CDM Smith has not been tasked by EPA to maintain project databases. However, all documents and review communications prepared under these WAs will be prepared by CDM Smith technical staff using commercially available software (e.g., Microsoft Office). Project files will be managed and maintained on ProjectWise to ensure file integrity and security. Files will be maintained on ProjectWise until EPA directs that files can be archived or deleted. All formal CDM Smith deliverables are maintained at the EPA Records Center in Helena, Montana. ProjectWise is an enterprise-level electronic document management system for the purpose of creating a repository for all project-related documents and records.

All deliverables to EPA will be provided in an electronic format, such as a PDF (.pdf) and Microsoft Word document (.doc).

It is the responsibility of the CDM Smith PM (or designee) to ensure that appropriate project personnel have the most current approved QAPP, including any revisions or amendments. The approved WAs QAPP will be distributed in a .pdf format via email to the Distribution List (see Section A3) by the CDM Smith PM (or designee).

Figure A-1
Location Map
Clark Fork Basin Sites

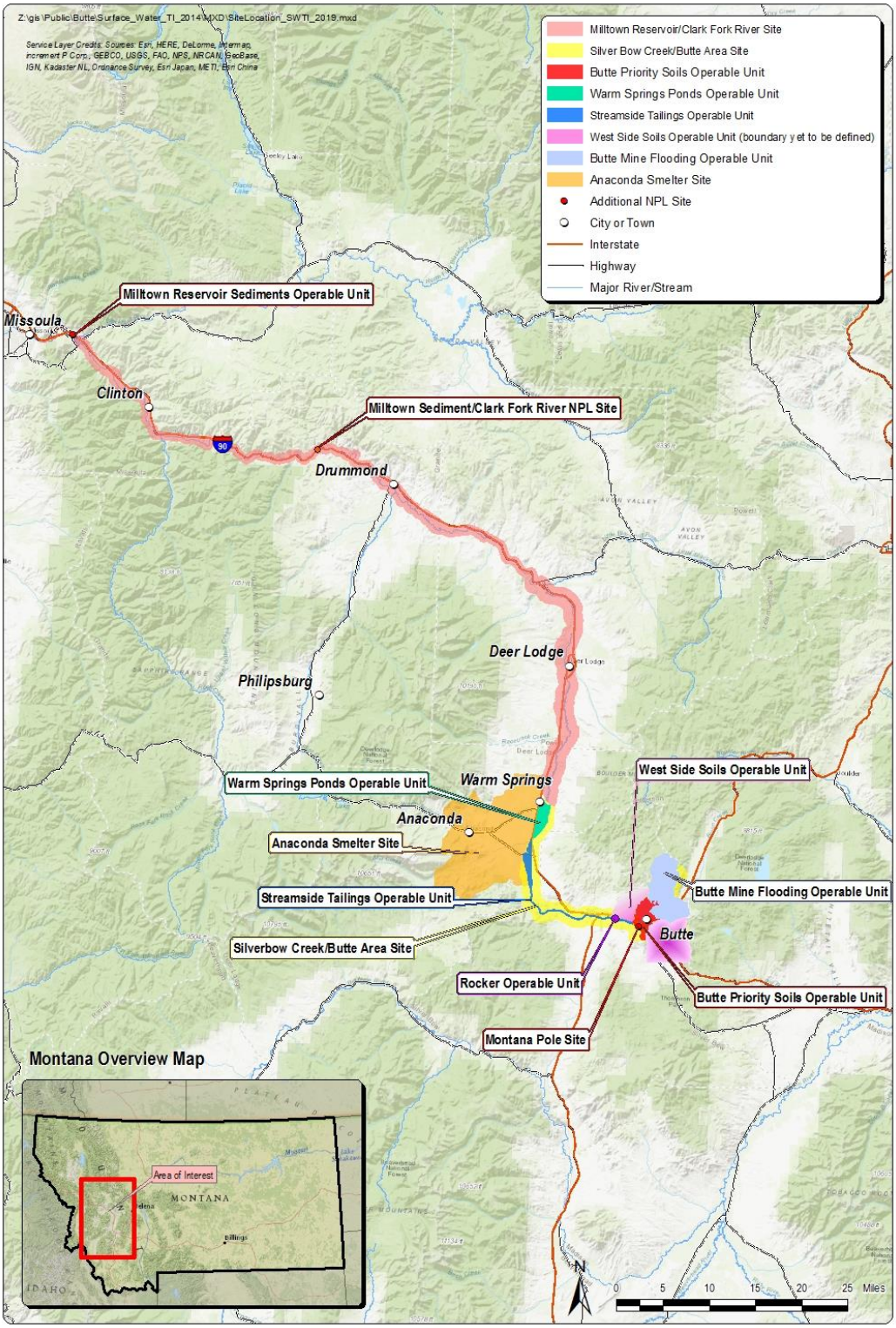


Figure A-2
Project Organization
Clark Fork Basin Sites

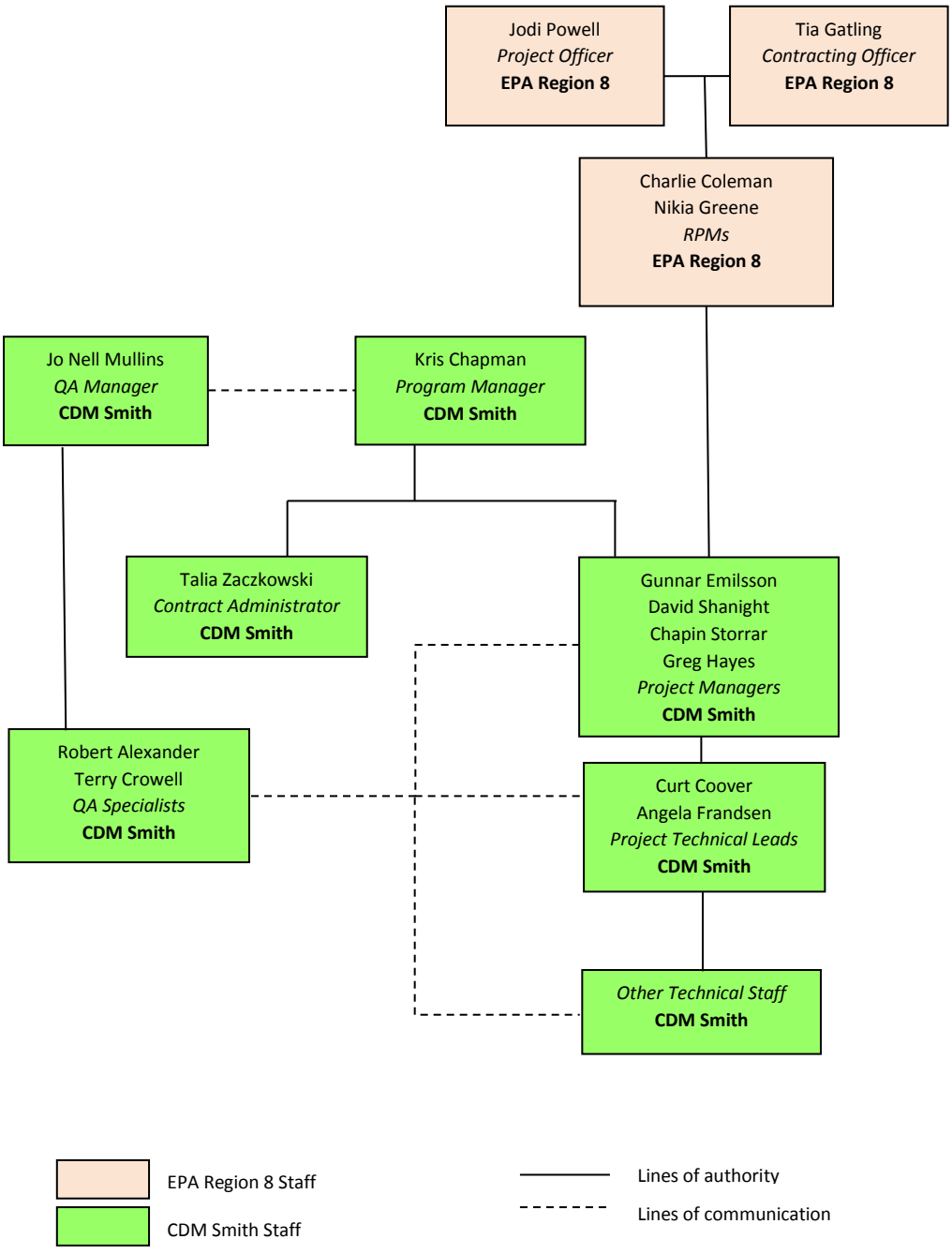


Figure A-3
Evaluation of Existing Data from Atlantic Richfield
Clark Fork Basin Sites

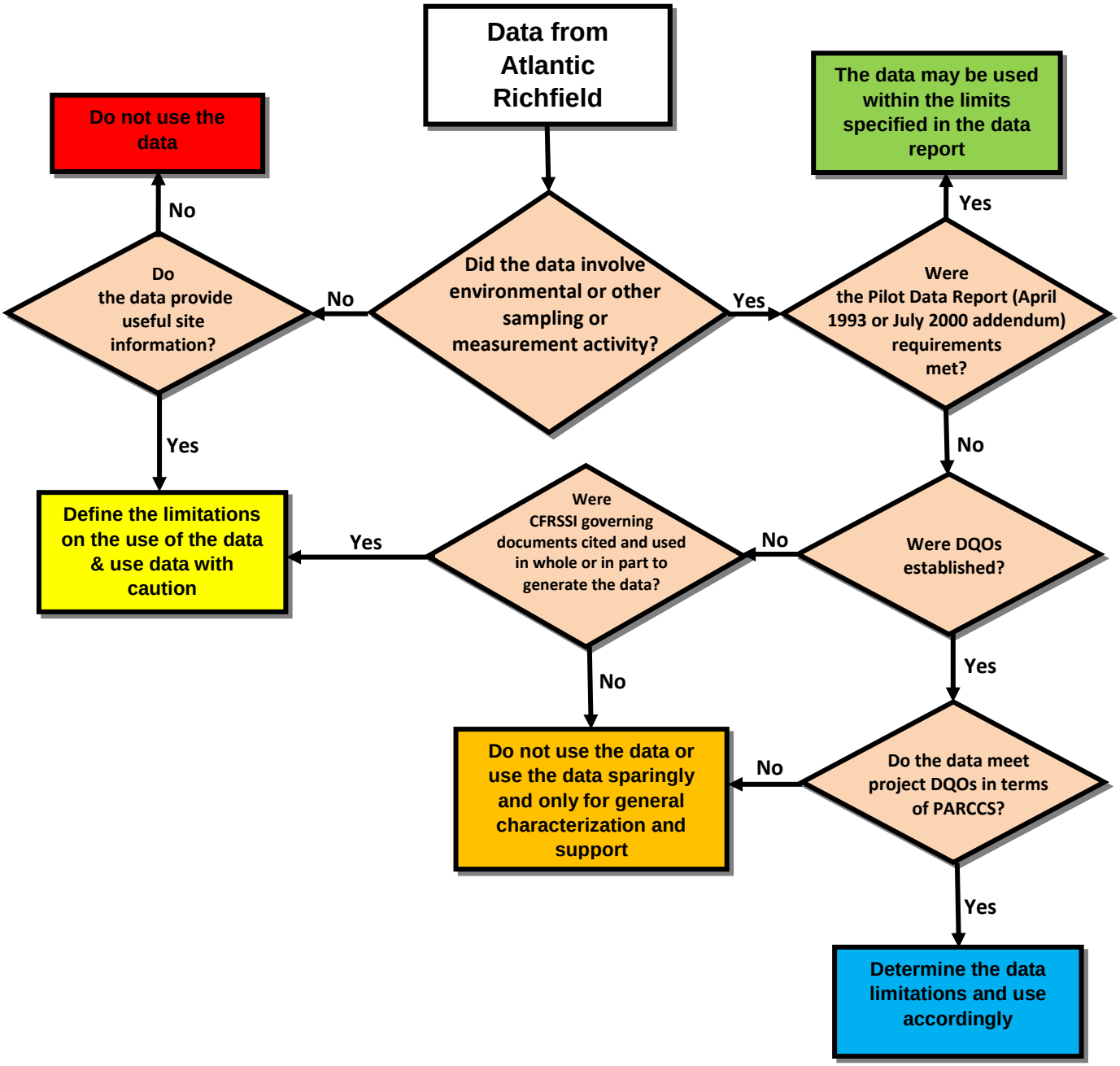
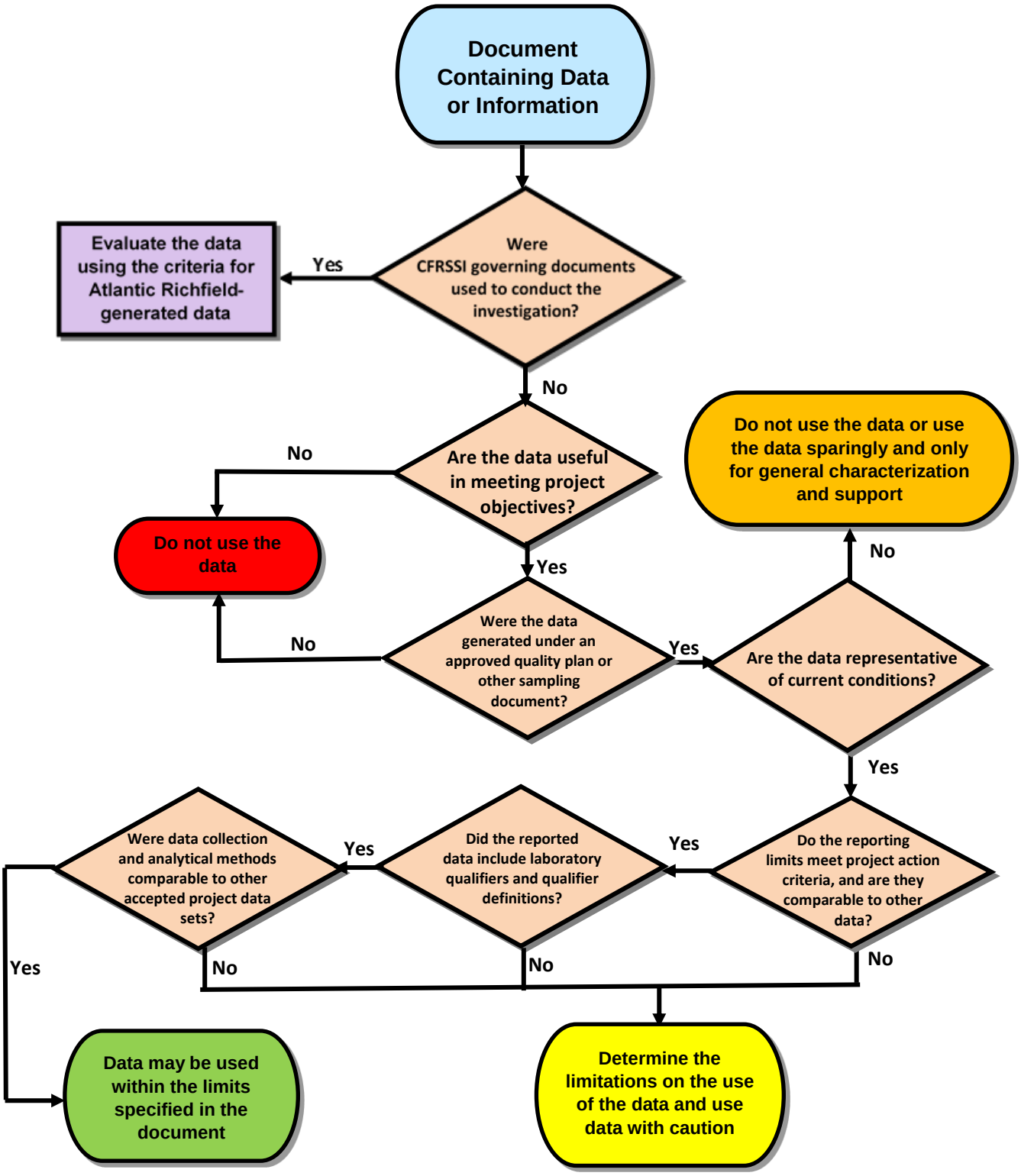


Figure A-4
Evaluation of Existing Data from Other Data Generators
Clark Fork Basin Sites



B – Data Generation/Acquisition

B1 – B8

The following elements, as specified in EPA QA/R-5 (EPA 2001), were determined to be not applicable to this QAPP, as no specific data collection efforts are to be performed by CDM Smith under the WA tasks presented in this QAPP.

- B1. Sampling Process Design
- B2. Sampling Methods
- B3. Sample Handling and Custody
- B4. Analytical Methods
- B5. Quality Control
- B6. Instrument/Equipment Testing, Inspection and Maintenance
- B7. Instrument/Equipment Calibration and Frequency
- B8. Inspection/Acceptance of Supplies and Consumables

B9 Use of Exisiting Data (Non-Direct Measurements)

Existing data will be evaluated against the project's needs. Acceptance criteria for the project are documented in the *Quality Assurance Project Plan* (Atlantic Richfield 1992b) and CFRSSI documents. Existing data that was not generated under the control of these documents will be evaluated in accordance with the process outlined in Section A7.3. In accordance with EPA QA/G-5, the following steps will be documented for all data cited:

- Determine the data needs for the current task
- Identify data sources that might meet these project needs
- Evaluate the existing data relative to the projects data quality specifications
- Document quality issues identified in measurement reports

As shown in Figures A-3 and A-4, when quality issues are identified, the data limitations will be defined. When quality information is not available, or the data quality does not meet current project DQOs, the data will not be used.

Data used at the Clark Fork Basin sites typically involve planning, sampling and analysis, and data assessment and validation; however, data from non-direct measurement sources, such as site reconnaissance, literature searches, interviews, and historical databases, may be used occasionally for project implementation and decision making. Examples of sources of non-direct measurement data include:

- Background information from corporate records
- Data obtained from computer databases (e.g., the former Clark Fork Data Management System, Montana Ground Water Information Center)
- Literature files/searches (e.g., EPA Montana Office Records Center)
- Meteorological data
- Publications
- Photographs
- Topographical maps

Non-direct measurement data will be similarly assessed as existing data for usability, suitability, and quality. Before using non-direct measurement data, the data must be evaluated to identify any limitations on their use. Also, to ensure transparency in the decision-making process, criteria and reasons for including and excluding certain data from use must be clearly documented.

B9.1 Data Source Originator Information

Data sources will be documented in all EPA deliverables and the use of and decisions based on the data will be documented. The data collected by Atlantic Richfield will be governed by the data protocol documents (discussed in Section A5) that guide the design of sample collection, analytical procedures, validation methods. and reporting requirements for data collection for the CFRSSI. Data will also be collected from USGS, MBMG, and other sources. These data will be assessed on its relevance to the site as it currently exists.

B9.2 Data Format and Accessibility

Data summary reports from Atlantic Richfield are typically distributed to EPA, DEQ, and other interested parties via email in PDF files. If requested, Atlantic Richfield will provide data in a Microsoft Excel spreadsheet format. USGS data are usually downloaded from their website and converted into an Excel spreadsheet. Data from MBMG and other data generators can be in various formats. Small or historical data sets are usually hand transcribed.

B9.3 Establishment of Acceptance Criteria

The CFRSSI DQOs that apply to the project as a whole are presented in the data protocol documents discussed in Section A5 and included in Attachment 2. Measurement performance criteria will be assessed in terms of PARCCS parameters. These parameters may be assessed by the PRP in accordance with the CFRSSI documents and used to determine the usability of the data. Precision and accuracy will meet the method requirements or the requirements of the governing data collection QAPP. Reporting limits must be evaluated to determine if the action criteria have been met before the data can be used for action criteria purposes. The time frame for data collection will be assessed in terms of the representativeness of current conditions, and data collection methods and analytical methods will be noted to assess comparability across data sets.

B9.4 Sample Data Collection Methodology

For data generated by Atlantic Richfield, the CFRSSI protocol documents listed in Section A5 usually guide the design of sample collection. Should data collection deviate from these documents, or data is considered for use that was not collected under these protocols, an evaluation will be performed as to the comparability of the sampling design. With the exception of USGS data, collection methodologies that did not use the CFRSSI protocols will be evaluated on a case-by-case basis to determine if the alternate methodology can be expected to produce data of similar quality and usability as that under CFRSSI methodologies.

B9.5 Quality Program and Quality Assurance Procedures used by Data Originator

The CFRSSI data protocol documents discussed in section A5, were written to guide the design of sample collection, analytical procedures validation methods and reporting requirements for all data collection at all Clark Fork Basin Superfund Sites.

For other data generators, their existing data may not have the necessary QC information readily available. The CDM Smith project team will carefully consider the importance of each type of information and determine how its absence will impact the project if this information is not available. Effort will be undertaken to ascertain the status of a data generator's quality procedures as part of CDM Smith's data evaluation.

B9.6 Sample Quality Assurance Procedures

In DSRs from Atlantic Richfield, the laboratory reports are typically provided in the report. CDM Smith spot checks the laboratory reports against the data tables provided in the DSR. USGS has internal checking procedures that cannot be independently verified; however, water quality data from USGS prior to 1996 will be used with caution and considered screening level, as their analytical methods were changed at that time. Existing data sets generated by others must be examined carefully to ensure, for example, correct units are specified and unusual data points and data outliers are scrutinized.

B10 Data Management

Atlantic Richfield and many of the PRPs working on the Clark Fork Site generate and assess laboratory data according to the CFRSSI QAPP and Pilot Data Report documents included in Attachment 2. These data are managed and made available to the public through internet sites as follows:

Recent Butte data:

http://etl.treccorp.com/Trec

Contact the CDM Smith PMs for the current usernames and passwords for this site.

Older Butte data on Geocortex®:

http://tempest.treccorp.com/SilverlightViewer_1_9/Viewer.html?ViewerConfig=http://tempest.treccorp.com/Geocortex/Essentials/Essentials%203.14.0/REST/sites/BPSOU/viewers/BPSOU/virtualdirectory/Config/Viewer.xml

Contact the CDM Smith PMs for the current usernames and passwords for this site.

Anaconda soil data:

http://tempest.treccorp.com/SilverlightViewer_1_10/Viewer.html?ViewerConfig=http://tempest.treccorp.com/Geocortex/Essentials/Essentials%203.14.0/REST/sites/Anaconda_NPL_Superfund_Site/viewers/Anaconda/virtualdirectory/Config/Viewer.xml

Anaconda ground water data:

http://mbmggwic.mtech.edu/sqlserver/v11/data/dataProject.asp?project=ARWWS&datatype=wq&

The Geocortex® internet site has been created and maintained for the Butte data under a Unilateral Agreement Order by EPA. Data and mapping viewers can be accessed for the Butte and Anaconda sites. Contact the CDM Smith PMs for the current usernames and passwords. The Geocortex® site was developed to provide shared access to data and geographic information and provides tools for exporting data in a variety of standard formats, including Excel file outputs, customized PDF maps, and GIS shapefiles. CDM Smith is not responsible for the site data management.

Data from USGS is usually obtained from their National Water Information System web interface:

http://nwis.waterdata.usgs.gov/mt/nwis/qwdata

Water data are collected at millions of sites around the country that are maintained by different USGS Water Science Centers. The USGS can provide its water data in a variety of formats, such as Excel spreadsheets and Keyhole Markup Language (KML) to support integration with products such as Google Maps and Google Earth, and GIS formats.

Data provided by EPA to CDM Smith for the purpose of evaluation and possible site use will be controlled by CDM Smith on the Helena network and on ProjectWise.

C – Assessment and Oversight

C1 Assessments and Response Actions

System assessments are qualitative reviews of different aspects of project work used to check on the use of appropriate QC measures and the functioning of the QA system.

The work plans for WAs 302, 320, 341, 349, 350, 353, 358, 362, and 363 all incorporate a QA section that specifies each project's auditing requirements. Based on the level of effort and the duration of the activities discussed in a project work plan, CDM Smith conducts internal office audits or self-assessments, as approved by the QA manager. In an office audit, an auditor will examine project activities and documentation to determine if activities are in conformance with the appropriate QAPP, work plan, and other governing documents. The auditor will document all audit findings and will maintain a list of personnel contacted during the audit. At the completion of the audit, a debriefing meeting will be held to present the findings and to encourage rapid correction of any deficiencies. The audit report will detail both proficiencies and deficiencies and will include any corrective action (and supporting documentation) that was taken to correct the problem. Self-assessments are evaluations of work activities conducted by project personnel who are knowledgeable in the project requirements to determine if technical and QA requirements are being met. They are intended to provide rapid feedback to the project staff to facilitate timely corrective action.

All aspects of project support for these WAs will be conducted in accordance with CDM Smith's formal QA program, as documented in the contract QMP (CDM Smith 2017). This QA program complies with American Society for Quality/American National Standards Institute E4-2004, *Quality Management Systems for Environmental Information and Technology Programs – Requirements with Guidance for Use*. The QMP provides the detailed instructions, responsibilities, and documentation requirements necessary to ensure the effective implementation of the CDM Smith QA program.

C2 Reports to Management

CDM Smith PMs will review this QAPP annually and make updates and changes as necessary. Additionally, CDM Smith will provide technical progress and project cost reports to the EPA RPM monthly. The technical progress report will be prepared by the CDM Smith PM with input from the technical support staff. The project cost report will be prepared by the CDM Smith Contract Administrator. The monthly progress reports will include a summary of tasks completed during the reporting period, costs incurred, any deliverables submitted, any issues identified and their resolution, as well as anticipated activities in the following reporting period.

QA reports will be provided to management whenever major quality problems are encountered.

D – Data Validation and Usability

D1 Data Review, Verification, and Validation

Determination of existing data quality will be based on the criteria outlined in Section A7. Professional judgment and site knowledge will also be used in determining the usability of existing data for site purposes. CDM Smith will consider possible end uses of the data when determining usability; however, CDM Smith is not formally validating site data.

D2 Verification and Validation Methods

For data generated under the CFRSSI governing documents, the laboratory and PRP will assess the data in accordance with EPA and Atlantic Richfield agreement protocols, as written in the DM/DV Plan Addendum (Atlantic Richfield 2000a) and the Pilot Data Report Addendum (Atlantic Richfield 2000b). CDM Smith will evaluate all data for adherence to the agreement protocols and provide an evaluation summary in all measurement reports where data is referenced. All data will be examined for unexpected results, data outliers, and data completeness. This review will be performed by appropriate CDM Smith technical staff that are familiar with project-specific data reporting, analytical methods, and investigation requirements.

An evaluation of existing data quality will be included in all WA deliverables to EPA. Data sources will be selected for use based on relevance, completeness, accuracy, quality, and the age of the data.

D3 Reconciliation with User Requirements

A tremendous amount of data is generated for the Clark Fork Basin. All data will be assessed before use. Data that are not supported by adequate QC documentation, as defined in the CFRSSI QAPP (Atlantic Richfield 1992b) may have a higher level of uncertainty than data collected with defined data quality objectives and performance criteria. Specific factors that may cause data to be considered unusable or of limited use include but are not limited to: data lacking appropriate or complete guidance documents governing data collection, data that are deemed too out-of-date to accurately reflect present site conditions, data that appear incomplete or significantly conflict with data of known quality, and data that are not characterized in a suitable data summary format. In certain instances, data that have been deemed of lesser-than-desired quality may be utilized for screening purposes. In those cases, all limitations on how such data should be used and interpreted will be documented. Some data may not be used for decision making but rather only for general characterization or support. Data will be reviewed for transcription errors, and where possible, data entry errors will be corrected or removed, as necessary.

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References

Atlantic Richfield. 1992a. *Clark Fork River Superfund Site Investigations, Laboratory Analytical Protocol.* Prepared for Atlantic Richfield by PTI Environmental Services, Bellevue, Washington.

Atlantic Richfield. 1992b. *Clark Fork River Superfund Site Investigations, Quality Assurance Project Plan.* Prepared for Atlantic Richfield by PTI Environmental Services, Bellevue, Washington.

Atlantic Richfield. 1992c. *Clark Fork River Superfund Site Investigations, Standard Operating Procedures.* Atlantic Richfield Co., Anaconda, MT.

Atlantic Richfield. 1992d. *Clark Fork River Superfund Site Investigations, Data Management/Data Validation Plan.* Prepared by Atlantic Richfield, Anaconda, Montana.

Atlantic Richfield. 1993. *Clark Fork River Superfund Site Investigations, Pilot Data Report for Organic and Inorganic Data.* Prepared by Atlantic Richfield, Anaconda, Montana.

Atlantic Richfield. 1995. *Clark Fork River Superfund Site Investigations, Laboratory Analytical Procedure for X-Ray Fluorescence Analysis of Solid Media.* Prepared for Atlantic Richfield by Ashe Analytics, Butte, Montana.

Atlantic Richfield 2000a. *Clark Fork River Superfund Site Investigations, Data Management/Data Validation Plan Addendum.* Prepared for Atlantic Richfield by Exponent, Lake Oswego, Oregon.

Atlantic Richfield 2000b. *Clark Fork River Superfund Site Investigations, Pilot Data Report Addendum.* Prepared for Atlantic Richfield by Exponent, Lake Oswego, Oregon.

CDM Smith. 2017. *Quality Management Plan*, Revision 5, for Contract EP-W-05-049, EPA Region 8, Revision 5.

EPA. 2000. *Data Quality Issues for Clark Fork River Superfund Sites.* Letter from Robert L. Fox (EPA-Montana Office Superfund Branch Chief), to Robin Bullock (Atlantic Richfield), dated February 15.

EPA. 2001. *Requirements for Quality Assurance Project Plans, QA/R-5.* Office of Environmental Information, U.S. Environmental Protection Agency, Washington, DC. EPA/240/B-01/003.

EPA. 2002. *Guidance for Quality Assurance Project Plans, QA/G-5.* Office of Environmental Information, U.S. Environmental Protection Agency, Washington, DC. EPA/240/R-02/009.

EPA. 2003. *A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information, Science Policy Council.* EPA 100/B-03/001.

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ATTACHMENT 1

EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

EPA REGION 8 QA DOCUMENT REVIEW CROSSWALK

QAPP/FSP/SAP for: *(check appropriate box)* ☐ **GRANTEE** ☐ **CONTRACTOR** ☐ **EPA** ☐ **Other**	**Entity** *(grantee, contract, EPA AO, EPA Program, Other)* EPA Contractor (CDM Smith)	**Regulatory Authority** **and/or** **Funding Mechanism**	___ **2 CFR 1500 for Grantee/Cooperative Agreements** ___ **48 CFR 46 for Contracts** ___ **Interagency Agreement** ___ **EPA/Court Order** ___ **EPA Program Funding** ___ **EPA Program Regulation** ___ **EPA CIO 2105**
Document Title ***[Note: Title will be repeated in Header]***	Quality Assurance Project Plan for the Use of Existing Data, Contract EP-W-05-49, Clark Fork River Work Assignments 302, 320, 341, 349, 350, 353, 358, 362, and 363 August 2019		
QAPP/FSP/SAP Preparer	CDM Smith		
Period of Performance *(of QAPP/FSP/SAP)*	September 27, 2019	**Date Submitted for Review**	4/1/19
EPA Project Officer **EPA Project Manager**	Jodi Powell 302, 320, 341, & 358 – Charlie Coleman 349, 350, 353, 362, 363 - Nikia Greene	**PO Phone #** **PM Phone #**	202-564-5659 406-457-5038 406-457-5019
QA Program Reviewer or Approving Official		**Date of Review**	

Documents Submitted for QAPP Review **(QA Reviewer must complete)*:***

1. QA Document(s) submitted for review:

QA Document	Document Date	Document Stand-alone	Document with QAPP
QAPP		**Yes** / No	
FSP		Yes / **No**	Yes / **No**
SAP		Yes / **No**	Yes / **No**
SOP(s)			Yes / **No**

2. WP/SOW/TO/PP/RP Date _____
WP/SOW/TO/RP Performance Period _____

3. QA document consistent with the:
WP/SOW/PP for grants? Yes / No
SOW/TO for contracts? Yes / No

4. QARF signed by R8 QAM Yes / No / NA
Funding Mechanism IA / contract / grant / NA
Amount _____

Notes for Document Submittals:

1. A QAPP written by a Grantee, EPA, or Federal Partner must include for review: Work Plan(WP) / Statement of Work (SOW) / Program Plan (PP) / Research Proposal (RP) and funding mechanism

2. A QAPP written by Contractor must include for review:
- **a)** Copy of Task Order Work Assignment/SOW
- **b)** Reference to a hard or electronic copy of the contractor's approved QMP
- **c)** Copy of Contract SOW if no QMP has been approved
- **d)** Copy of EPA/Court Order, if applicable
- **e)** The QA Review must determine (with the EPA CO or PO) if a QARF was completed for the environmental data activity described in the QAPP.

3. a. Field Sampling Plan (FSP) and/or Sampling & Analyses Plan (SAP) must include the Project QAPP ***or*** must be a stand-alone QA document that contain all QAPP required elements (Project Management, Data Generation/Acquisition, Assessment and Oversight, and Data Validation and Usability).

c. SOPs must be submitted with a QA document that contains all QAPP required elements.

Summary of Comments *(highlight significant concerns/issues)***:**

1. Comment #1
2. Comment #2
3. Comment #3
4. **The** Click here and type Entity **must address the comments in the Summary of Comments, as well as those identified in the Comment section(s) that includes a "Response (date)" and Resolved (date)".**

Element	Acceptable *Yes/No/NA*	Page/ Section	Comments
A. Project Management			
A1. Title and Approval Sheet			
a. Contains project title		A1, pg. 1	
b. Date and revision number line (for when needed)		A1, pg. 1	
c. Indicates organization's name		A1, pg. 1	
d. Date and signature line for organization's project manager		A1, pg. 1	
e. Date and signature line for organization's QA manager		A1, pg. 1	
f. Other date and signatures lines, as needed		A1, pg. 1	
A2. Table of Contents			
a. Lists QA Project Plan information sections		A2, pg. 5	
b. Document control information indicated		Page footer	
A3. Distribution List			
Includes all individuals who are to receive a copy of the QA Project Plan and identifies their organization		A3, pg. 10	
A4. Project/Task Organization			
a. Identifies key individuals involved in all major aspects of the project, including contractors		A4, pg. 10-12	
b. Discusses their responsibilities		A4, pg. 10-12	
c. Project QA Manager position indicates independence from unit generating data		A4, pg. 10-12	
d. Identifies individual responsible for maintaining the official, approved QA Project Plan		A4, pg. 10-12	
e. Organizational chart shows lines of authority and reporting responsibilities		Fig A-2, pg. 26	
A5. Problem Definition/Background			
a. States decision(s) to be made, actions to be taken, or outcomes expected from the information to be obtained		A5, pg. 12-13	

b. Clearly explains the reason (site background or historical context) for initiating this project		A5, pg. 12-13	
c. Identifies regulatory information, applicable criteria, action limits, etc. necessary to the project		A5, pg. 12-13	
A6. Project/Task Description			
a. Summarizes work to be performed, for example, measurements to be made, data files to be obtained, etc., that support the project=s goals		A6, pg. 13-19	
b. Provides work schedule indicating critical project points, e.g., start and completion dates for activities such as sampling, analysis, data or file reviews, and assessments		A6, pg. 13	
c. Details geographical locations to be studied, including maps where possible		A5, pg. 12-13 Figure A-1	
d. Discusses resource and time constraints, if applicable		A6, pg. 13	Detailed information on costs and period of performance is provided in the individual work plan and cost estimate for each WA.
A7. Quality Objectives and Criteria			
a. Identifies - performance/measurement criteria for all information to be collected and acceptance criteria for information obtained from previous studies, - including project action limits and laboratory detection limits and - range of anticipated concentrations of each parameter of interest		A5, pg. 10 Attachment 2 B9.3, pg 24	Contained in the Clark Fork River Superfund Site Investigation documents
b. Discusses precision		B9.3, pg 24 Attachment 2	Pilot Data Report, Attachment 2
c. Addresses bias		B9.3, pg 24 Attachment 2	Pilot Data Report, Attachment 2
d. Discusses representativeness		B9.3, pg 24 Attachment 2	Pilot Data Report, Attachment 2
e. Identifies the need for completeness		B9.3, pg 24 Attachment 2	Pilot Data Report, Attachment 2
f. Describes the need for comparability		B9.3, pg 24 Attachment 2	Pilot Data Report, Attachment 2
g. Discusses desired method sensitivity		B9.3, pg 24 Attachment 2	Pilot Data Report, Attachment 2
A8. Special Training/Certifications			

a. Identifies any project personnel specialized training or certifications		A8, page 23	
b. Discusses how this training will be provided		NA	No special training is necessary
c. Indicates personnel responsible for assuring training/certifications are satisfied		NA	No special training is necessary
d. identifies where this information is documented		NA	No special training is necessary
A9. Documentation and Records			
a. Identifies report format and summarizes all data report package information		A9, pg. 24-28	
b. Lists all other project documents, records, and electronic files that will be produced		A9, pg. 24-28	
c. Identifies where project information should be kept and for how long		A9, pg. 24-28	All formal CDM Smith deliverables are maintained at the EPA Records Center in Helena, Montana.
d. Discusses back up plans for records stored electronically		A9, pg. 24-28	
e. States how individuals identified in A3 will receive the most current copy of the approved QA Project Plan, identifying the individual responsible for this		A9, pg. 27	
B. Data Generation/Acquisition			
B1. Sampling Process Design (Experimental Design)			
a. Describes and justifies design strategy, indicating size of the area, volume, or time period to be represented by a sample		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Details the type and total number of sample types/matrix or test runs/trials expected and needed		NA	
c. Indicates where samples should be taken, how sites will be identified/located		NA	
d. Discusses what to do if sampling sites become inaccessible		NA	
e. Identifies project activity schedules such as each sampling event, times samples should be sent to the laboratory, etc.		NA	
f. Specifies what information is critical and what is for informational purposes only		NA	
g. Identifies sources of variability and how this variability should be reconciled with project information		NA	

B2. Sampling Methods			
a. Identifies all sampling SOPs by number, date, and regulatory citation, indicating sampling options or modifications to be taken		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Indicates how each sample/matrix type should be collected		NA	
c. If in situ monitoring, indicates how instruments should be deployed and operated to avoid contamination and ensure maintenance of proper data		NA	
d. If continuous monitoring, indicates averaging time and how instruments should store and maintain raw data, or data averages		NA	
e. Indicates how samples are to be homogenized, composited, split, or filtered, if needed		NA	
f. Indicates what sample containers and sample volumes should be used		NA	
g. Identifies whether samples should be preserved and indicates methods that should be followed		NA	
h. Indicates whether sampling equipment and samplers should be cleaned and/or decontaminated, identifying how this should be done and by-products disposed of		NA	
i. Identifies any equipment and support facilities needed		NA	
j. Addresses actions to be taken when problems occur, identifying individual(s) responsible for corrective action and how this should be documented		NA	
B3. Sample Handling and Custody			
a. States maximum holding times allowed from sample collection to extraction and/or analysis for each sample type and, for in-situ or continuous monitoring, the maximum time before retrieval of information		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Identifies how samples or information should be physically handled, transported, and then received and held in the laboratory or office (including temperature upon receipt)		NA	
c. Indicates how sample or information handling and custody information should be documented, such as in field notebooks and forms, identifying individual responsible		NA	

d. Discusses system for identifying samples, for example, numbering system, sample tags and labels, and attaches forms to the plan		NA	
e. Identifies chain-of-custody procedures and includes form to track custody		NA	
B4. Analytical Methods			
a. Identifies all analytical SOPs (field, laboratory and/or office) that should be followed by number, date, and regulatory citation, indicating options or modifications to be taken, such as sub-sampling and extraction procedures		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Identifies equipment or instrumentation needed		NA	
c. Specifies any specific method performance criteria		NA	
d. Identifies procedures to follow when failures occur, identifying individual responsible for corrective action and appropriate documentation		NA	
e. Identifies sample disposal procedures		NA	
f. Specifies laboratory turnaround times needed		NA	
g. Provides method validation information and SOPs for nonstandard methods		NA	
B5. Quality Control			
a. For each type of sampling, analysis, or measurement technique, identifies QC activities which should be used, for example, blanks, spikes, duplicates, etc., and at what frequency		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Details what should be done when control limits are exceeded, and how effectiveness of control actions will be determined and documented		NA	
c. Identifies procedures and formulas for calculating applicable QC statistics, for example, for precision, bias, outliers and missing data		NA	
B6. Instrument/Equipment Testing, Inspection, and Maintenance			
a. Identifies field and laboratory equipment needing periodic maintenance, and the schedule for this		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Identifies testing criteria		NA	
c. Notes availability and location of spare parts		NA	

d. Indicates procedures in place for inspecting equipment before usage		NA	
e. Identifies individual(s) responsible for testing, inspection and maintenance		NA	
f. Indicates how deficiencies found should be resolved, re-inspections performed, and effectiveness of corrective action determined and documented		NA	
B7. Instrument/Equipment Calibration and Frequency			
a. Identifies equipment, tools, and instruments that should be calibrated and the frequency for this calibration		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Describes how calibrations should be performed and documented, indicating test criteria and standards or certified equipment		NA	
c. Identifies how deficiencies should be resolved and documented		NA	
B8. Inspection/Acceptance for Supplies and Consumables			
a. Identifies critical supplies and consumables for field and laboratory, noting supply source, acceptance criteria, and procedures for tracking, storing and retrieving these materials		NA - B1, pg. 29	There are no data collection efforts or site investigations planned by CDM Smith under this QAPP.
b. Identifies the individual(s) responsible for this		NA	
B9. Use of Existing Data (Non-direct Measurements)			
a. Identifies data sources, for example, computer databases or literature files, or models that should be accessed and used		B9, B9.1 pg. 29	
b. Describes the intended use of this information and the rationale for their selection, i.e., its relevance to project		A6, pg. 13-19 Figure A-3, A-4	
c. Indicates the acceptance criteria for these data sources and/or models		B9.3, pg. 30 Figure A-3, A-4	
d. Identifies key resources/support facilities needed		NA	Not applicable
e. Describes how limits to validity and operating conditions should be determined, for example, internal checks of the program and Beta testing		Figure A-3, A-4	
B10. Data Management			

a. Describes data management scheme from field to final use and storage		B10, pg. 31-32	CDM Smith does not manage the data. The data management by the PRPs is described in B10
b. Discusses standard record-keeping and tracking practices, and the document control system or cites other written documentation such as SOPs		A9, pg. 24 B10, pg. 26	
c. Identifies data handling equipment/procedures that should be used to process, compile, analyze, and transmit data reliably and accurately		NA	
d. Identifies individual(s) responsible for this		NA	The PRP is responsible for the data management. CDM Smith requests data from this site through the EPA.
e. Describes the process for data archival and retrieval		NA	CDM Smith requests data from this site through the EPA.
f. Describes procedures to demonstrate acceptability of hardware and software configurations		NA	Not applicable
g. Attaches checklists and forms that should be used		NA	Not applicable
C. Assessment and Oversight			
C1. Assessments and Response Actions			
a. Lists the number, frequency, and type of assessment activities that should be conducted, with the approximate dates		C1, pg. 33	
b. Identifies individual(s) responsible for conducting assessments, indicating their authority to issue stop work orders, and any other possible participants in the assessment process		C1, pg. 33	
c. Describes how and to whom assessment information should be reported		C1, pg. 33	
d. Identifies how corrective actions should be addressed and by whom, and how they should be verified and documented		C1, pg. 33	
C2. Reports to Management			
a. Identifies what project QA status reports are needed and how frequently		C2, pg. 33	
b. Identifies who should write these reports and who should receive this information		C2, pg. 33	
D. Data Validation and Usability			
D1. Data Review, Verification, and Validation			

Describes criteria that should be used for accepting, rejecting, or qualifying project data		D1, pg. 34	
D2. Verification and Validation Methods			
a. Describes process for data verification and validation, providing SOPs and indicating what data validation software should be used, if any		D2, pg. 34	
b. Identifies who is responsible for verifying and validating different components of the project data/information, for example, chain-of-custody forms, receipt logs, calibration information, etc.		D2, pg. 34	
c. Identifies issue resolution process, and method and individual responsible for conveying these results to data users		D2, pg. 34	
d. Attaches checklists, forms, and calculations		NA	
D3. Reconciliation with User Requirements			
a. Describes procedures to evaluate the uncertainty of the validated data		D3, pg. 34	
b. Describes how limitations on data use should be reported to the data users		D3, pg. 34	

ATTACHMENT 2

Clark Fork River Superfund Site Investigations: Data Management/Data Validation Plan Addendum (June 2000), Pilot Data Report for Organic and Inorganic Data (April 1993), and Pilot Data Report Addendum (July 2000), EPA letter to ARCO regarding Data Quality Issues for Clark Fork River Superfund Sites (February 2000)

Clark Fork River Superfund Site Investigations

Data Management/Data Validation Plan Addendum

ARCO
Anaconda, Montana

June 2000

Clark Fork River Superfund
Site Investigations
Data Management/Data Validation
Plan Addendum

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June 2000

Doc. No.: 8601367.009 0101 0600 LJ02

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Acronyms and Abbreviations

CFRSSI	Clark Fork River Superfund Site Investigation
DM/DV	data management/data validation
DQA	data quality assessment
DQO	data quality objective
DSR	data summary report
EPA	U.S. Environmental Protection Agency
GFAA	graphite furnace atomic absorption spectrometry
ICP	inductively coupled plasma-atomic emission spectrometry
QA/QC	quality assurance and quality control
RI/FS	remedial investigation and feasibility study
ROD	record of decision
SAP	sampling and analysis plan
XRF	x-ray fluorescence

Introduction

This addendum was generated to supplement the original *Clark Fork River Superfund Site Investigations* (CFRSSI) *Data Management/Data Validation Plan* (DM/DV Plan; ARCO 1992) and document changes to the data validation and assessment process since publication of the original document. This addendum is intended to supplement the original document specifically addressing the data validation and assessment discussions in Part III.

The DM/DV Plan was developed in the early 1990s, along with the other CFRSSI documents, to provide consistent site-wide procedures for environmental measurements and monitoring and associated documentation. During the early 1990s, most of the operable units were in the early to mid-stages of site characterization and the CFRSSI procedures were developed with site characterization activities in mind. The remedial investigation and feasibility study (RI/FS) data collection, validation, and assessment procedures required scrutiny of each individual data point. In recent years, the scope of data collection activities has changed as projects moved into the post-RI phases. The data quality needs and associated data validation and assessment process have been modified based on the quality needs for post-RI data collection activities.

The following sections discuss the development of data quality objectives for sampling and analysis plans (SAPs) and the revisions to the data validation and assessment process.

Data Quality Objectives and Assessment

Project-specific data quality objectives (DQOs) will be established in the SAPs. Consistent with U.S. Environmental Protection Agency (EPA) DQO guidance (U.S. EPA 1993, 2000) the DQOs discussion in the SAP will include:

- Identification of project and regulatory personnel
- Description of the project goals and objectives
- Identification of project schedules, resources, and regulatory requirements
- Identification of the type of data needed
- Determination of the quantity of data needed
- Description of how data will be collected.

As the projects continue through post-RI phases of activity, it is anticipated that project-specific DQOs may include objectives regarding validation and assessment of project data. For example, construction and treatability bench-scale data will typically not be subjected to data validation. For relevant projects, such project-specific DQOs will be stated in the DQO section of the project-specific SAP. The relevant data summary reports (DSRs) will include a data quality assessment (DQA) of the investigation results as they apply to the project-specific DQOs.

DQA is performed to determine whether the project-specific DQOs have been satisfied. DQA consists of five steps that relate the quality of the results to the intended use of the data:

Step 1: Review DQOs and sampling design

Step 2: Conduct preliminary data review

Step 3: Select statistical test(s), as appropriate, to evaluate data quality

Step 4: Verify assumptions

Step 5: Draw conclusions about the quality of the data (data report will not include interpretation of results, but will state conclusions regarding the quality of the results).

If, as a result of the DQA process, it is determined that data do not satisfy all DQOs, then corrective action(s) should be recommended. Corrective actions include, but are not limited to, revision of the DQOs, based on the results of the investigation, or collection of more information or data. It may be determined that corrective actions are not required, or the decision process may continue with the existing data, with recognition of the limitations of the data.

Data Validation, Assessment, and Reporting

The data validation process originally presented in the 1992 DM/DV Plan has been revised to streamline the actual validation process, support the post-record of decision (ROD) decision-making process, and to incorporate recent EPA quality assurance guidance. The following changes will be implemented for data validation and assessment activities:

- The analytical laboratory that generates the data is responsible for the validation of the results. Laboratory validation checklists have been developed for implementation by the analytical laboratories.
- The analytical laboratory will be responsible for assigning laboratory flags (U.S. EPA 1988) and data validation qualifiers (*U, J, R*) (Table 1). CFRSSI descriptors and descriptor values, defined in the 1992 DM/DV Plan, will no longer be added to the data validation qualifiers.
- The Level A/B criteria have been revised to include only the criteria that apply to sample collection and documentation records. The criteria that apply to laboratory analysis records have been deleted from the Level A/B checklist.
- ARCO requires all laboratories that generate data for the CFRSSI sites to maintain analytical records from the analyses for future laboratory audits by ARCO or EPA.
- The DQA process has been revised to accommodate recent EPA guidance.

- The format for DSRs and laboratory quality assurance and quality control (QA/QC) reports has been revised to reflect the changes in the data validation and assessment process.

The revised data validation and assessment process is discussed below.

Data Validation and Assessment

Project data will be validated, as required, to meet the project-specific DQOs. As discussed in the previous section, project-specific DQOs may include objectives regarding the data validation and assessment process. If the project-specific objectives include validation of inorganic data, the revised data validation and assessment process described below will be implemented.

The analytical laboratory that generates the data is responsible for the validation of the results. Laboratory validation checklists for inorganic analyses have been developed for implementation by the analytical laboratories. CFRSSI data validation checklists for analysis of metals by inductively coupled plasma-atomic emission spectroscopy (ICP) or graphite furnace atomic absorption spectrometry (GFAA), and Spectrace® x-ray fluorescence spectrometry (XRF), are presented in Attachments A and B. Personnel from the laboratory that generates the results will complete these data validation checklists. As indicated on the checklists, the laboratory will assign laboratory flags (Table 1) to the data during the data validation review. The laboratories will report the data with laboratory-assigned flags and a completed data validation checklist.

ARCO or ARCO's contractors will be responsible for tabulating the data and reviewing the field quality control sample results. A checklist for summarizing the field quality control results will be completed (Attachment C). The Level A/B criteria have been revised to include only the criteria that apply to sample collection and documentation records. The criteria that apply to laboratory analysis records have been deleted from the

Level A/B checklist. A revised Level A/B checklist (Attachment D) will be completed for the investigation. Qualifiers (Table 1) will be assigned by ARCO or ARCO's contractor based on the completed data validation checklists, the field quality control checklist, and the Level A/B checklist. The data will be designated as enforcement quality data or screening quality data based on the DQOs for the investigation and the results of the data validation and data assessment checklist activities.

The enforcement quality/screening quality designations are consistent with the original definitions in the 1992 DM/DV Plan. Enforcement quality data are supported by rigorous sampling and analysis procedures, QA/QC protocols, and documentation requirements. In addition to the Level A/B assessment, the data are reviewed for qualifiers. Data that meet the Level A and B criteria and are not qualified as estimated or rejected are assessed as enforcement quality.

Data Reporting

Based on the changes in the data validation and assessment process, a revised reporting format for preparation of DSRs and associated quality assurance reports was developed. The *Clark Fork River Superfund Site Investigations Pilot Data Report Addendum* (ARCO 2000) outlines the format for presentation of sampling activities and analytical results.

References

ARCO. 1992. Clark Fork River Superfund site investigations data management/data validation plan. Prepared by PTI Environmental Services, Bellevue, WA. ARCO, Anaconda, MT.

ARCO. 2000. Clark Fork River Superfund site investigations pilot data report addendum. Prepared by Exponent, Lake Oswego, Oregon. ARCO, Anaconda, MT.

U.S. EPA. 1988. U.S. EPA Contract Laboratory Program, statement of work for inorganics analysis, multi-media, multi-concentration, SOW No. 788. U.S. Environmental Protection Agency, Washington, DC.

U.S. EPA. 1993. Data quality objectives process for Superfund, Interim Final Guidance. EPA PB94-963203. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 2000. Data quality objective process for hazardous waste site investigations. EPA/600/R-00/007. United States Environmental Protection Agency, Office of Environmental Information, Washington, DC.

Table 1. Definitions of data flags and qualifiers for inorganic data

Type	Description	Value
Laboratory Flag[a]		
N	Laboratory spike sample results outside control limits	--
*	Laboratory duplicate results outside control limits	--
E	Sample results qualified because of interference (graphite furnace atomic absorption [GFAA] analytical spike or inductively coupled plasma [ICP] serial dilution	--
M	Duplicate injection precision for GFAA analysis outside control limits	--
W	Post-digestion spike for GFAA outside control limits	--
+	Correlation coefficient for Method of Standard Additions (MSA) for GFAA less than 0.995	--
S	The reported value was determined by MSA	--
Qualifier		
R[b]	Rejected	--
U[b]	Undetected	--
J[b]	Estimated	--

[a] Defined in U.S. EPA 1988. *Contract Laboratory Program statement of work. Inorganic analysis, multi-media, multi-concentration*. ILM04.0. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laborator, Las Vegas, NV. (Flags are assigned by the laboratory).

[b] Defined in U.S. EPA 1994. *Laboratory data validation: functional guidelines for evaluating inorganic analyses*. U.S. Environmental Protection Agency, Washington, DC.

Attachment A

Laboratory Data Validation Checklist for Metals Analysis by ICP or GFAA

Attachment A
Laboratory Data Validation
Checklist for Metals Analysis by ICP or GFAA

Site:
Project:
Sample Dates:
Data Validator:

Case No.:
Sample Matrix:
Analysis Dates:
Validation Dates:

Laboratory:
Analyses:

1. Holding Times

Analyte	Matrix	Method	Holding Time*	Collection date	Analysis date	Holding time met? (Y/N)	Affected data flagged? (Y/N)

* cite reference for holding time

Were any data flagged because of holding time problems? Y___ N___

2. Instrument Calibration

Was instrument successfully calibrated at the correct frequency and with appropriate standards and blanks? Y___ N___
Was Initial Calibration Verification (ICV) performed? Y___ N___
Was ICV within control window of ___ to ___? Y___ N___
Were Continuing Calibration Verifications (CCVs) performed at the frequency of _____? Y___ N___
Were CCVs within control window of ___ to ___? Y___ N___
Describe corrective actions taken because of calibration problems ______________
Were any data flagged because of calibration problems? Y___ N___

3. Blanks

Was Initial Calibration Blank (ICB) analyzed? Y___ N___
Was ICB within control window of ________? Y___ N___
Were Continuing Calibration Blanks (CCBs) analyzed at the frequency of ______? Y___ N___
Were CCBs within control window of ______? Y___ N___
Were Preparation Blanks (PB) analyzed at the frequency of ________? Y___ N___
Were PBs within control window of ______? Y___ N___
Describe corrective action taken because of blank problems ______________
Were any data flagged because of blank problems? Y___ N___

4. ICP Interference Check Sample

Was ICP Interference Check Sample (ICS) analyzed at the frequency of ______? Y___ N___
Were ICS results within the control window of ______? Y___ N___
Describe corrective actions taken because of ICS results ______________
Were any data flagged because of ICS problems? Y___ N___

5. Laboratory Control Sample

Was Laboratory Control Sample (LCS) analyzed at the frequency of ______? Y___ N___
What was the source of the LCS? ______________
Were LCS results within the control window of _____ to ________? Y___ N___
Describe corrective actions taken because of LCS results ______________
Were any data flagged because of LCS problems? Y___ N___

6. Duplicate Sample Results

Was Laboratory Duplicate Sample (LDS) analyzed at the frequency of ______? Y___ N___
Were results of LDS within the control window of ______? Y___ N___
Describe corrective actions taken because of LDS results ______________
Were any data flagged because of LDS problems? Y___ N___

7. Matrix Spike Sample Results

Was Laboratory Matrix Spike Sample (LMS) analyzed at the frequency of ______? Y___ N___
Were results of LMS within the control window of _____ to _____? Y___ N___
Describe corrective actions taken because of LMS results ______________
Were data flagged because of LMS problems? Y___ N___

8. **ICP Serial Dilution**

Was ICP Serial Dilution (SD) analyzed at the frequency of _____? Y___ N___

Were results of SD within the control window of _____? Y___ N___

Describe corrective actions taken because of SD results _____

Were any data flagged because of SD problems? Y___ N___

9. **Graphite Furnace Atomic Absorption Quality Control**

Was graphite furnace AA scheme followed? Y___ N___

Did duplicate injections agree within the control window of _____? Y___ N___

Were spike recoveries for PB and LCS within control windows of _____? Y___ N___

Were Method of Standard Additions (MSA) results correctly calculated, at the appropriate levels and were correlation coefficients < 0.995? Y___ N___

Were any data flagged because of GFAA problems? Y___ N___

10. **Overall Assessment**

Are there analytical limitations of the data that users should be aware of? Y___ N___

If so, explain: _____

11. **Authorization of Data Release from the Laboratory**

Laboratory Data Validator

Name: _____

Signature: _____

Date: _____

Laboratory QA Officer/Manager

Name: _____

Signature: _____

Date: _____

Attachment B

Laboratory Data Validation Checklist for Metals Analysis by Spectrace XRF

Attachment B
Laboratory Data Validation
Checklist for Metals Analysis by Spectrace XRF

Site: Case No.: Laboratory:
Project: Sample Matrix: Analyses:
Sample Dates: Analysis Dates:
Data Validator: Validation Dates:

1. **Holding Times**

Analyte	Matrix	Method	Holding Time*	Collection Date	Analysis date	Holding time met? (Y/N)	Affected data flagged? (Y/N)

* cite reference for holding time
Were any data flagged because of holding time problems? Y____ N____

2. **XRF Quality Control**

What sample preparation steps were performed (i.e., drying and sieving, grinding)? _____
Were the samples prepared according to the SAP? Y____ N____
Was energy calibration performed at the frequency of once per day? Y____ N____
Were initial and continuing calibrations performed at the frequency in Table 8-1 of the XRF LAP? Y____ N____
Were initial and continuing calibration results within control windows? Y____ N____
Was laboratory duplicate analysis performed at the frequency of 1 per 20? Y____ N____
Were laboratory duplicate results within control window of _____? Y____ N____
Was laboratory replicate analysis performed at the frequency of 1 per 20? Y____ N____
Were laboratory replicate results within control window of _____? Y____ N____
Was cross-contamination check sample analyzed at the frequency of 1 per 50? Y____ N____
Was cross-contamination check sample results within control window of _____? Y____ N____
Was sand blank analysis performed at the frequency of 1 per 50? Y____ N____
Was sand blank result within control window of_____? Y____ N____
Were any data flagged because of XRF analysis? Y____ N____

3. **Overall Assessment**
Are there analytical limitations of the data that users should be aware of? Y____ N____
If so, explain: _____

4. **Authorization of Data Release from the Laboratory**

Laboratory QA Officer/Manager

Name: _____

Signature: _____ Date: _____

Attachment C

Data Validation Checklist for Field Quality Control

Attachment C
Data Validation
Checklist for Field Quality Control

Site:
Project:
Sample Dates:
Data Validator:

Case No.:
Sample Matrix:
Analysis Dates:
Validation Dates:

Laboratory:
Analyses:

---

1. Holding Times

Analyte	Matrix	Method	Collection date	Analysis date	Affected data flagged? (Y/N)

2. Field QC Samples

Field Blanks

Were field blanks submitted as specified in the Sampling & Analysis Plan? Y____ N____

Were any data qualified because of field blank problems? Y____ N____

Field Duplicates

Were field duplicates submitted as specified in the Sampling & Analysis Plan? Y____ N____

Were any data qualified because of field duplicate results? Y____ N____

Were results for field blanks within the target control limits in the CFRSSI QAPP? Y____ N____

Field Reference Materials

Were field Reference Materials or Performance Evaluation Samples submitted as specified in the Sampling & Analysis Plan? Y____ N____

Were the results within the manufacturer's control limits? Y____ N____

Attachment D

Level A/B Screening Checklist

Attachment D
Level A/B Screening Checklist

I. General Information

Site:
Project:
Client:
Sample Matrix:

II. Screening Results

Data are:
1) Unusable ____________
2) Level A ____________
3) Level B ____________

II. Level A Screening

Criteria	Yes/No
1. Sampling date	
2. Sample team/or leader	
3. Physical description of sample location	
4. Sample depth (soils)	
5. Sample collection technique	
6. Field preparation technique	
7. Sample preservation technique	
8. Sample shipping records	

II. Level B Screening

Criteria	Yes/No
1. Field instrumentation methods and standardization complete	
2. Sample container preparation	
3. Collection of field replicates (1/20 minimum)	
4. Proper and decontaminated sampling equipment	
5. Field custody documentation	
6. Shipping custody documentation	
7. Traceable sample designation number	
8. Field notebook(s), custody records in secure repository	
9. Completed field forms	

Clark Fork River Superfund Site Investigations

Pilot Data Report for Organic and Inorganic Data

ARCO
Anaconda, Montana

April 1993

Clark Fork River
Superfund Site Investigations

Pilot Data Report for
Organic and Inorganic Data

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ABBREVIATIONS AND ACRONYMS

CLP	Contract Laboratory Program
DM/DV	data management/data validation
DS/DU/DV	data summary/data validation/data usability report
EE/CA	engineering evaluation and cost analysis
EPA	U.S. Environmental Protection Agency
LAP	laboratory analytical protocol
MDHES	Montana Department of Health and Environmental Sciences MDEQ
NPL	National Priorities List
QA/QC	quality assurance and quality control
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SOP	standard operating procedure

ABSTRACT

To assist in document management and retrieval, all deliverables should include an abstract. The abstract should include, at a minimum, document title, author or project manager, company name and address, date, project site, and a description of the document in 500 words or less. This abstract should be less than one page in length.

STATEMENT OF AUTHENTICITY

Consistent with the provisions of Administrative Orders on Consent Docket Nos. CERCLA-VIII-##-## and CERCLA-VIII-##-## the following data sets are considered to be final data generated or evaluated. Data have been designated as enforcement quality and screening quality as described in the Clark Fork River Superfund site investigations quality assurance project plan (QAPP) and data validation/data management (DM/DV) plan. Consistent with the aforementioned orders, the signatories below hereby stipulate to the authenticity and accuracy of the data and hereby waive any evidentiary or other objection as to the authenticity and accuracy of reference in endangerment assessments, public health evaluations, and feasibility studies.

Approved by: _____ _____

ARCO Representative (Name) Date
Montana Superfund Manager
ARCO

Approved by: _____ _____

EPA Remedial Project Manager (Name) Date
U.S. Environmental Protection Agency
Region VIII

EXECUTIVE SUMMARY

This pilot data report is a model report to be used as a guide in the preparation and production of the data summary/data validation/data usability (DS/DV/DU) report that would typically be generated for Clark Fork River Superfund site investigations. The information included in each section of a DS/DV/DU report is summarized in this model report.

The following documents have been developed for all Clark Fork River Superfund site investigations: a laboratory analytical protocol (LAP) (ARCO 1992c), quality assurance project plan (ARCO 1992d), data management/data validation plan (ARCO 1992b), and standard operating procedures (SOPs) (ARCO 1992a). The procedures and requirements contained within these documents should be followed and referenced in all DS/DV/DU reports.

All DS/DV/DU reports will include quality assurance/quality control (QA/QC) reports as appendices to the data reports. The purpose of a data report is to be the primary reference to be consulted by all data users for the presentation of data, data usability, and data validation information associated with an investigation. This first section, the executive summary, will contain a concise statement on the content of the specific data report. Three tables will be included in this section:

- Table 1 will contain all analytical data with an enforcement and screening assessment;
- Table 2 will contain the results of all samples collected (including field quality control results) with qualifiers, descriptors, and descriptor values; and
- Table 3 will include all sample identifier information.

TABLE 1. DATA SUMMARY WITH ENFORCEMENT AND SCREENING ASSESSMENT[a]

Sample[b] Number	Arsenic (mg/kg)	Status[c]	Cadmium (mg/kg)	Status	Copper (mg/kg)	Status	Lead (mg/kg)	Status	Zinc (mg/kg)	Status

[a] This table should include results for natural field samples only. This table should **not** include results for field replicates, field blanks, referee laboratory samples, or reference materials.

[b] Order the samples in this table by sample number.

[c] The following codes for data assessment should be used in this table and footnoted:

E - enforcement quality
S - screening quality
R - rejected
U qualifiers should also be included in this table.

TABLE 2. DATA SUMMARY WITH QUALIFIER AND DESCRIPTOR CODES[a]

Sample[b] Number	Level A/B Assessment	Arsenic (mg/kg)	Qualifier[c]	Cadmium (mg/kg)	Qualifier	Copper (mg/kg)	Qualifier	Lead (mg/kg)	Qualifier	Zinc (mg/kg)	Qualifier

[a] This table should include results for all natural samples, field replicates, referee laboratory splits, field blanks, and reference materials. Results for conventional and field analyses should be included in this table.

[b] Order the samples in this table by sample number.

[c] All qualifiers, descriptors, and descriptor values should be included in this column.

TABLE 3. SAMPLE IDENTIFICATION[a]

Sample[b] Number	Sampling Event	Station	Sample ID	Field Replicate	Subsample	Sample Type[c]	Date	Time	Interval Upper Depth	Interval Lower Depth	Matrix[d]	Tag Number	Analysis[e] Type

[a] This table should include all natural samples, field replicates, referee laboratory splits, field blanks, and reference material.

[b] Order the samples in this table by sample number.

[c] Appropriate sample types may include natural samples, field duplicates, field blank, reference material, etc.

[d] Appropriate matrices may include sediment, tailings, slag, soil, surface water, groundwater, etc.

[e] List analyses performed (e.g., CLP metals, XRF metals, cations, anions)

INTRODUCTION

This report presents the results of _____ sampling and analysis for the _____ Investigation of the Clark Fork River Superfund site. The site is located within the National Priorities List (NPL) site and is the subject of the _____. The information contained in this report was gathered following objectives and procedures documented in the _____ *Sampling and Analysis Plan* (**Document reference**). Overall _____ objectives and requirements are outlined in the _____.

The following information (**as an example**) will be included in this data report:

- Results of field and laboratory analyses;
- Description of field sampling methods; and
- Locations of all sampling stations plotted on 1 in. = 200 ft scale maps.

The field notebook and field data sheets for this investigation are located at ARCO contractor offices in **City, State.**

A listing of specific areas that were investigated is included in this section. This data report summarizes data collected from these sampling stations during this investigation and data collected during previous investigations and contained within the historical database (**Document reference**). A quality assurance and quality control (QA/QC) review of inorganic data collected for this investigation will be included in Appendix A, and a QA/QC review of organic data will be included in Appendix B. Interpretation and discussion of all data contained herein will be included in the _____ report.

OBJECTIVES

The objectives of the _____ Investigation, as outlined in the _____, were as follows:

- Specific objectives as detailed in the work plan will be listed here.

The results of this investigation supplement existing data contained within the historical database (**Document reference**) and will be used to analyze human health and environmental risks associated with the presence of hazardous substances, pollutants, and contaminants at the _____ site. This analysis will be contained in the preliminary endangerment assessment cited above to be completed by the U.S. Environmental Protection Agency (EPA). The data will also be used in evaluating the potential fate and transport of contaminants, in determining the volume of materials to be the

subject of remedial or removal response, and upon which the feasibility study will be based. These analyses will be contained within the _____.

BACKGROUND

The background section provides pertinent site-specific details or historical information and data about the subject site.

The following is a typical section that was contained in various Old Works data reports and is provided as an example.

The Old Works engineering evaluation and cost analysis (EE/CA) study area is located in southwestern Montana, adjacent to the town of Anaconda (Figure __). The site is bounded by Highway 1 to the south, Highway 273 to the east, Stucky Ridge (Lost Creek-Warm Springs Creek divide) to the north, and Cedar Street in Anaconda to the west. Warm Springs Creek flows in an easterly direction through the site for approximately 3 miles. Included within the site boundaries are two residential areas (Cedar Park and Teressa Ann Terrace), a municipal landfill, a drag strip, a railroad right-of-way, and a few roads with restricted access to the site. Benny Goodman Park, located south of Highway 1, is also included within the site boundaries. The Anaconda municipal sewage treatment plant is excluded.

The Old Works EE/CA study area is divided into two general physical areas: the Upper Works and the Lower Works. Figure __ shows the locations of the original Old Works buildings, flues, and other structures. The figure was produced using historical maps and archeological data for the Old Works (GCM 1989). The Old Works facilities were the first smelting facilities to be located in Anaconda. Ore mined at Butte was processed at Anaconda due to the availability of water from Warm Springs Creek and room for expansion. The first shipment of ore to the Upper Works smelter from the Butte mine was on September 8, 1884 (Smith 1953). Described in local newspapers as the largest smelter in the United States at that time, the Upper Works received and processed the ore from four railroad cars daily. The original Lower Works smelting plant was constructed of wood and opened in December 1888. The plant burned down in 1889 and was rebuilt of steel shortly thereafter. The Lower and Upper Works were both expanded between 1889 and 1901. Both plants were closed in 1901, at which time the combined output of copper from the plants was 10,000,000 pounds per month. The Anaconda Copper Mining Company decided it would be more economical and more conducive to future expansion if a new plant was built at a new location. This plant, called the Washoe Smelter, was located south of Warm Springs Creek on Smelter Hill and commenced operations in 1902.

During its period of operation, the Old Works produced waste in the form of heap roast slag, furnace slag, jig tailings, and other materials. Several million cubic yards of tailings and slag have been estimated to exist on the Old Works site, covering over 300 acres (Tetra Tech 1987). In addition, the remains of building foundations, furnace flues, and railroad grades are present onsite. A portion of the Warms Springs Creek channel within the site was straightened and realigned during the early days of smelting activities.

Additional historical information is contained in the *Smelter Hill Operational History Cultural Resource Inventory and Assessment of the Old Works EE/CA Site* (GCM 1989), *Old Works Operable Unit Engineering Evaluation and Cost Analysis Work Plan* (USBR 1988), *Anaconda Smelter Remedial Investigation and Feasibility Study Master Investigation Draft Remedial Investigation Report* (Tetra Tech 1987), and other references in these documents.

The following is a typical section that was contained in various Smelter Hill data reports and is provided as an example.

The Smelter Hill operable unit of the Anaconda Smelter NPL site was the location of the first copper smelting facilities erected in Anaconda, Montana by the Anaconda Copper Mining Company. The facilities were built to process copper ore mined in nearby Butte. Although the source of the copper ore was over 30 miles away, the smelters were built in Anaconda because of the availability of a dependable water supply from Warm Springs Creek. Figure ___ shows the location of the copper smelting facilities, known as the Upper and Lower Works. The Upper Works went on-line in 1884 with a capacity of 500 tons of copper ore per day. The Lower Works was built on the same hillside approximately 1 mile east of the Upper Works in 1888, bringing the total capacity to 4,000 tons of copper ore per day. The Washoe Works (later known as the Anaconda Reduction Works) went on-line at Smelter Hill in 1902 and ceased operation in September 1980. The facility was demolished between September 1982 and June 1986. The only structures remaining onsite are the smelter stack, garage, two east Anaconda yard office buildings, and remnants of six brick flues on the hillside to the north of Warm Springs Creek. Additional historical information is contained in the *Anaconda Smelter Remedial Investigation/Feasibility Study Master Investigation Draft Remedial Investigation Report* (Tetra Tech 1987).

The Smelter Hill site is located in the west-central portion of the Anaconda quadrangle to the southeast of the town of Anaconda at the southwestern end of Deer Lodge Valley (Figure __). The area is bounded to the west by the Flint Creek Range, to the south by the steeply rising Anaconda Range, and to the east and north by Deer Lodge Valley. The foothills of the Flint Creek Range are rounded and grass-covered, rising abruptly from the valley floor (Wanek and Barclay 1966).

Anaconda has a semi-arid climate characterized by cold winters; cool, short summers; low precipitation; and moderate winds (Tetra Tech 1987). Surface runoff from the study area drains into Mill Creek and into various ditches that route water around the Opportunity tailings ponds.

The average annual temperature at east Anaconda is 42.4°F. Average annual precipitation in the area is 13.7 inches, and average annual evaporation is 48.86 inches. Approximately 33 percent of the average annual precipitation occurs during May and June, and 66 percent occurs from April through September (Tetra Tech 1987).

INVESTIGATION SITE DESCRIPTION

This section will list and discuss specific areas that were targeted for detailed sampling and analysis during the investigation. This section will also identify specific geographical features of the study areas. If maps were produced during the investigation, these maps would be discussed in this section.

SAMPLING AND ANALYSIS SUMMARY

A summary of sample station locations, sample numbers, and analytical parameters will be presented in this section. Table 4 will include the coordinates of each sampling station. Sample station locations as shown on small-scale and oversize maps will be discussed. Actual analytical results will be contained in the following area-specific sections. The total number of sample stations and number of samples collected will be included in this section. A statement of where samples were analyzed (e.g., field laboratory, primary and referee Contract-Laboratory-Program- [CLP-] participating laboratory, testing laboratory) and the specific analytes will be included in this section. Specific information relating to the completeness of the data set will be included in the appendices to this report.

All sample stations are generally located in cooperation and agreement with the attending EPA oversight observer. Samples are collected following procedures detailed in the sampling and analysis plan (SAP), except where modifications of the sampling design or procedures were required. In this case, provide a *Deviations from the Sampling and Analysis Plan* section. A general statement describing the sampling approach (e.g., backhoe pits, hand-dug pits) will be included in this section. Specific details on sample collection methods for each sample type will be provided in following sections.

TABLE 4. SAMPLING COORDINATES

Station Identification	Locational Coordinates (State Plane[a] northing/easting)	Error Associated with Horizontal Information	Error Associated with Elevation Information	Elevation	Elevation Reference	Height of Reference Above Ground	County	Township	Range	Section	Latitude	Longitude	EPA Stream Reach

[a] All coordinates identified in state plane south zone.

PREVIOUS INVESTIGATIONS

A discussion of background and analytical results from previous studies will be included in this section. Analytical results will be reproduced in tables for comparison with data collected during the present investigation.

DATA QUALITY OBJECTIVES

The data quality objectives as defined in the SAP will be identified in this section. The degree to which the data quality objectives were satisfied by the investigation will also be discussed in this section, as will requirements for further study or additional information.

SPECIFIC AREA NAME

SAMPLING METHODS

Sampling methods that were used will be discussed in this section, generally citing the respective SAPs for details.

ANALYTICAL RESULTS

Analytical results for specific areas will be presented in this section. Tables containing data for each area sampled will be included. Data summary tables for the entire investigation with the screening/enforcement assessment and qualifiers and descriptors are presented in the executive summary and should not be duplicated in this section.

VOLUME CALCULATIONS

The procedures used for calculation of volume **(if any)** will be discussed in this section. A table listing calculated volumes will be presented. Actual calculations will be reproduced in an appendix.

DEVIATIONS FROM THE SAMPLING AND ANALYSIS PLAN

Standard operating procedures (SOPs) for Clark Fork River Superfund site investigations have been compiled by ARCO (ARCO 1992a) and are to be followed for all field tasks. The objectives of this investigation as described in the SAP were _____. These objectives have/have not been met during this investigation. The following deviations from the _____ Investigation SAP were noted during the field sampling event and subsequent data processing:

- List deviations.

Approval for deviations provided by EPA field oversight personnel or other EPA/Montana Department of Health and Environmental Sciences (MDHES) personnel should be referenced and included in this section.

COMPLETENESS

Completeness of field collection will be included here. The narrative will include a discussion of the total number of stations occupied and samples collected, as compared to the objectives in the SAP. An explanation of stations that were not occupied and samples that were not collected will be presented. A table summarizing sample site locations and number of samples collected will be provided. Completeness will be presented in sufficient detail (e.g., by sample matrix, analyte, sample location, depth interval) to demonstrate that the objectives in the SAP are met.

REFERENCES

A list of all references used in the data report will be included in this section.

The following documents are referenced in this pilot data report (not including appendices):

ARCO. 1992a. Clark Fork River Superfund site investigations standard operating field procedures. Draft Report. ARCO, Anaconda, MT.

ARCO. 1992b. Clark Fork River Superfund site investigations data management/data validation plan. Prepared by PTI Environmental Services, Bellevue, WA. ARCO, Anaconda, MT.

ARCO. 1992c. Clark Fork River Superfund site investigations laboratory analytical protocol. Prepared by PTI Environmental Services, Bellevue, WA. ARCO, Anaconda, MT.

ARCO. 1992d. Clark Fork River Superfund site investigations quality assurance/quality control project plan. Prepared by PTI Environmental Services, Bellevue, WA. ARCO, Anaconda, MT.

GCM. 1989. Smelter Hill operational history cultural resources inventory and assessment of the Old Works EE/CA site. Prepared for ARCO Coal Company. GCM Services, Inc., Butte, MT.

Smith, R. 1953. History of the early reduction plants of Butte, Montana. Reprint from De Re Metallica, Volume 18, Numbers 2 and 3. Montana School of Mines, Butte, MT.

Tetra Tech. 1987. Anaconda Smelter remedial investigation/feasibility study. Master Investigation draft, remedial investigation report. TTB 173 DO. Tetra Tech, Inc., Bellevue, WA.

USBR. 1988. Old Works operable unit engineering evaluation and cost analysis. Work plan. Prepared for U.S. Environmental Protection Agency. U.S. Bureau of Reclamation, Missouri Basin Regional Office, Billings, MT.

Wanek, A.A., and C.S.V. Barclay. 1966. Geology of the northwest quarter of the Anaconda quadrangle, Deer Lodge County, Montana. U.S. Geological Survey Bulletin 1222-B. U.S. Geological Survey, Reston, VA.

APPENDIX A

Inorganic Data Quality Assurance and Quality Control Review

CONTENTS

CONTENTS (Continued)

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

Ashe	Ashe Analytics, Inc.
CLP	Contract Laboratory Program
EPA	U.S. Environmental Protection Agency
GFAA	graphite furnace atomic absorption spectrometry
ICP	inductively coupled plasma-atomic emission spectrometry
ICS	interference check sample
LAP	laboratory analytical protocol
LCS	laboratory control sample
LOQ	limit of quantification
MDHES	Montana Department of Health and Environmental Sciences
MDL	method detection limit
NBS	National Bureau of Standards
NPL	National Priorities List
QAPP	quality assurance project plan
QA/QC	quality assurance and quality control
ROI	region of interest
RPD	relative percent difference
SAP	sampling and analysis plan
SDG	sample digestion group
SOW	statement of work
SRM	standard reference material
XRF	X-Ray fluorescence

QUALITY ASSURANCE AND QUALITY CONTROL REVIEW OF INORGANIC DATA FOR _____ INVESTIGATION

Multiple analytical protocols were used to obtain the inorganic metals data during the _____Investigation, including XRF (Spectrace®) and contract laboratory program (CLP) methods. To prevent confusion during discussion of inorganic metals data obtained by different methods, this inorganic appendix is divided into two sections: one pertaining to the CLP-produced data only, the other discussing only the Spectrace® data. However, all the inorganic data are summarized together in the paragraph below.

EXECUTIVE SUMMARY

Enforcement quality data are supported by rigorous sampling and analysis procedures, quality assurance and quality control (QA/QC) protocols, and documentation requirements. Enforcement quality data include data that meet the Level B criteria outlined in U.S EPA (1985b) and are not qualified as estimated during the validation process. Enforcement quality data also include data that are qualified, or do not meet Level A/B criteria but for which justification as enforcement quality data is provided. All of the Level A and Level B criteria are satisfied for this investigation, and the metals data are assessed as Level B. In addition to the Level A/B assessment, the data are reviewed for qualifiers. Data that meet Level B criteria and are free of qualifiers are assessed as enforcement quality data. Of the _____ total data points for metals, _____ percent are qualified because of duplicate results, and _____ percent are qualified because of matrix spike results. None of the data for this investigation are rejected. The analytical data and the enforcement and screening assessment will be presented in Table 1 in the main text of the report. Sample number codes and sampling coordinates at each station will also be identified in Tables 2–4 in the main body of the report.

QUALITY ASSURANCE AND QUALITY CONTROL REVIEW OF CONTRACT LABORATORY PROGRAM INORGANIC DATA

As outlined in the _____ Investigation Sampling and Analysis Plan (SAP) **(Document reference)** _____ samples were collected and analyzed for the Investigation. The samples were collected from _____ through _____. The sampling was conducted in specific study areas as defined in the SAP. The specific study areas and the analyte list will be outlined in Table A-1. The soil samples were analyzed for _____ by procedures in the *U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work 788* (U.S. EPA 1988). The data were subjected to 100-percent data validation and assessment per *Laboratory Data Validation: Functional Guidelines for Evaluating Inorganic Analyses* (U.S. EPA 1985a; Viar & Co. 1988); *Evaluation Criteria for Existing Data from CERCLA Study Areas* (U.S. EPA 1985b); and the _____ Investigation SAP **(Document reference)**.

SUMMARY OF CLP DATA

The CLP data will be summarized in this section. A table of all data with qualifiers, descriptors, and descriptor values will be included in Table 2 of the main body of this report. Table A-2 will summarize definitions of data flags, qualifiers, and descriptors.

Level A/B Criteria

Enforcement quality data are supported by rigorous sampling and analysis procedures, QA/QC protocols, and documentation requirements. Enforcement quality data include data that meet the Level B criteria outlined in U.S. EPA (1985b) and are not qualified as estimated during the validation process. Enforcement quality data also include data that are qualified, or do not meet the Level A/B criteria but for which justification as enforcement quality is provided. U.S. EPA (1985b) establishes three categories for the data: unusable, Level A, and Level B. It is necessary to examine the data packages in terms of Level A criteria first, because only those data that meet Level A criteria can be considered for Level B categorization.

To ascertain the Level A/B status of the data, the data packages and all associated field documentation are reviewed.

All of the data meet Level A criteria, which include documentation of sampling, field, and laboratory records. For the data to meet Level B criteria, there must be full

TABLE A-1. SUMMARY OF _____ INVESTIGATION NATURAL SAMPLES

Area	Total Samples	Analytical Parameters
Lower Works structural area		Total arsenic, copper, lead, zinc; soil slurry pH and conductivity
Upper Works structural area		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity; Radium-226
Hillside Flue		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity; Radium-226
Waste Piles		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity; Radium-226
Heap roast slag piles		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity; Radium-226
Red Sands area		Total arsenic, cadmium, copper, lead, zinc
Heap roast slag piles		Total arsenic, cadmium, copper, lead, zinc
Tailing ponds		Total arsenic, cadmium, copper, lead, zinc; EP Tox extraction for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, nitrate-nitrogen; soil slurry pH and conductivity
Total		

TABLE A-2. DEFINITIONS OF DATA FLAGS QUALIFIERS, AND DESCRIPTORS FOR INORGANIC DATA

Type	Description	Value
Flag[a]		--
N	Laboratory spike sample results outside control limits	--
*	Laboratory duplicate results outside control limits	--
E	Sample results qualified because of interference (graphite furnace atomic absorption [GFAA] analytical spike or inductively coupled plasma [ICP] serial dilution)	--
M	Duplicate injection precision for GFAA analysis outside control limits	--
W	Post-digestion spike for GFAA outside control limits	--
+	Correlation coefficient for Method of Standard Additions (MSA) for GFAA less than 0.995	--
S	The reported value was determined by MSA	
Qualifier		
R[b]	Rejected	--
U[b]	Undetected	--
J[b]	Estimated	--
A[c]	Justified as enforcement quality data	
Descriptor[d]		
S%	Qualified because matrix spike control limits are exceeded	Percent recovery of matrix spike
SX	Qualified because frequency of matrix spike sample analysis is not satisfied	No descriptor value
D%	Qualified because duplicate relative percent difference (RPD) control limits are exceeded	RPD of duplicate analysis
DX	Qualified because frequency of duplicate sample analysis is not satisfied	No descriptor value
E%	Qualified because ICP serial dilution control limits are exceeded	Percent difference of ICP serial dilution
EX	Qualified because frequency of ICP serial dilution is not satisfied	No descriptor value
HT	Qualified because holding time is exceeded	Holding time in days
MC	Qualified because correlation coefficient of MSA results is less than 0.995	Correlation coefficient of MSA
L%	Qualified because laboratory control sample (LCS) control limits are exceeded	Percent recovery of LCS
LX	Qualified because frequency of LCS analysis is not satisfied	No descriptor value

TABLE A-2. (Continued)

Type	Description	Value
I%	Qualified because of ICP interference check sample (ICS) results	Percent recovery of ICS
IX	Qualified because frequency of analysis of ICP ICS is not satisfied	No descriptor value
GS	Qualified because GFAA analytical spike result control limits are exceeded	Analytical spike percent recovery
BP	Qualified because of laboratory blank results	Laboratory blank value
BX	Qualified because frequency of preparation blank analysis is not satisfied	No descriptor value
B	Qualified because of field or laboratory blank results	No descriptor value
K	Qualified because of negative blank results	Absolute value of the negative blank result
C%	Qualified because of instrument calibration (i.e., initial calibration verification, continuing calibration verification, frequency of calibration)	Percent recovery of continuing calibration verification or initial calibration verification
CX	Qualified because frequency of analysis of calibration samples is not satisfied	No descriptor value
CC	Qualified because correlation coefficient of instrument calibration is exceeded	Correlation coefficient
CL	Qualified because linear range of calibration is exceeded	No descriptor value
EU	Qualified because of an unexplained interference	No descriptor value
Q	Qualified because of other QC violations	No descriptor value

[a] Defined in U.S. EPA. 1988. *Contract Laboratory Program statement of work. Inorganic analysis, multi-media, multi-concentration*. July 1988. SOW No. 788. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, NV. (Flags are assigned by the laboratory.)

[b] Defined in U.S. EPA. (1985). *Laboratory data validation: functional guidelines for evaluating inorganic analyses*. U.S. Environmental Protection Agency, Washington, DC. Also defined in Viar & Co. (eds.). 1988 (revision). *Laboratory data validation: functional guidelines for evaluating inorganics analyses*. Prepared by U.S. Environmental Protection Agency Work Group. Prepared for the U.S. Environmental Protection Agency, Hazardous Site Evaluation Division, Washington, DC.

[c] Justified as enforcement quality data as defined in Administrative Order on Consent.

[d] Defined in MDHES. 1990. *Clark Fork Data System reference*. Montana Department of Health and Environmental Sciences, Solid and Hazardous Waste Bureau. Montana State Library Natural Resource Information System, Helena, MT. (The descriptors provide the data user with information concerning the qualification of data.)

documentation of compliance with the requirements for quantitative statistical significance, which includes meeting quality control frequencies and laboratory certification. All analyses, sampling procedures, and documentation meet the Level B criteria. The analytical data, Level A/B status, and the enforcement and screening assessment are presented in Table 1 in the main body of the text.

JUSTIFICATION

Justification for upgrading screening quality data to enforcement quality will be presented in this section. If applicable, documentation of ARCO/U.S. Environmental Protection Agency (EPA) correspondence relating to the assessment will be referenced here.

SAMPLE SET

A summary of field and quality control samples will be presented in this section. The frequencies of collection and analysis will also be discussed in this section. In addition, the sample set as delivered to the laboratory will be discussed in this section.

COMPLETENESS

The completeness of the analytical data set was assessed by comparing the total number of data points generated to the number of data points rejected and calculating a percent completeness. _____ of the data points generated at the laboratories were rejected; therefore, the analytical data are considered _____-percent complete.

ANALYTICAL METHODS

The analytical laboratory followed the sample digestion and analysis procedures of the CLP statement of work (SOW) 788 (U.S. EPA 1988). The analyte list for each study area will be presented and discussed in this section.

SAMPLE DIGESTION GROUPS

The samples were divided into _____ sample digestion groups (SDGs) at the analytical laboratory. The composition of the SDGs and the preparation of the digestion-specific quality control checks will be discussed in this section. The number of samples in each SDG for each method and analyte will be summarized in Table A-3. A list of samples in each SDG is presented in Table A-4.

TABLE A-3. NUMBER OF SAMPLES IN EACH SDG[a] FOR EACH METHOD

Analyte	Method	Number of Samples										
		SDG S-9170	SDG S-9194	SDG S-9196	SDG S-9197	SDG S-9230	SDG S-9255	SDG S-9260	SDG S-9285	SDG S-9315	SDG S-9342	SDG S-9375
Arsenic	ICP[b]											
Arsenic	GFAA[c]											
Cadmium	ICP											
Copper	ICP											
Lead	ICP											
Lead	GFAA											
Zinc	ICP											

[a] SDG - sample digestion group.

[b] ICP - inductively coupled plasma-atomic emission spectrometry.

[c] GFAA - graphite furnace atomic absorption spectrometry.

TABLE A-4. LIST OF SAMPLES IN EACH SDG[a]

SDG S-9170	SDG S-9194	SDG S-9196	SDG S-9197
S00001			
S00002			
S00003			
S00004			
S00005			
S00006			
S00007			
S00008			
S00009			
S00010			
S00011			
S00012			
S00013			
S00014			
S00015			
S00016			
S00017			
S00018			
S00019			
S00020			

[a] SDG - sample digestion group.

DATA VALIDATION

The data validation process is divided into four main components: examining the data package as a whole to ensure that all required deliverables are present and in clear and readable form; performing manual validation of all transcriptions and calculations, including checking frequency and recovery control limit compliance for instrument quality control checks and calibrations; verifying data-flagging assignments and documenting corrective action taken on all missing or incorrect elements; and assigning qualifiers, descriptors, and descriptor values to the data.

Any problems discovered during data validation will be discussed in this section.

CLP QUALITY ASSURANCE/QUALITY CONTROL

The laboratory data are evaluated according to the criteria in U.S. EPA (1985b) and Viar & Co. (1988). Qualifiers are applied per U.S. EPA (1985b) and Viar & Co. (1988) and descriptors and descriptor values per MDHES (1990). Summaries of the data assessment are presented in the following sections.

Holding Times

The holding time requirements and satisfaction or violation of holding time requirements will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on holding time results will also be discussed in this section.

Calibration

Compliance of the analytical laboratory with the requirements for instrument calibration will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on calibration results will also be discussed in this section.

Blanks

Blank results are assessed to determine the existence and magnitude of contamination. The application of qualifiers, descriptors, and descriptor values based on blank results will be discussed in this section.

Preparation blank results will be discussed in this section. Preparation blank results will be presented in Table A-5.

TABLE A-5. PREPARATION BLANK RESULTS — CLP

Analyte	Method	SDG[a] S-9170 Sample Detection Limit (mg/kg)	SDG S-9170 Result (mg/kg)	SDG S-9194 Sample Detection Limit (mg/kg)	SDG S-9194 Result (mg/kg)	SDG S-9196 Sample Detection Limit (mg/kg)	SDG S-9196 Result (mg/kg)
Arsenic	ICP[b]						
Arsenic	GFAA[c]						
Cadmium	ICP						
Copper	ICP						
Lead	ICP						
Lead	GFAA						
Zinc	ICP						

Analyte	Method	SDG S-9197 Sample Detection Limit (mg/kg)	SDG S-9197 Result (mg/kg)	SDG S-9230 Sample Detection Limit (mg/kg)	SDG S-9230 Result (mg/kg)	SDG S-9255 Sample Detection Limit (mg/kg)	SDG S-9255 Result (mg/kg)
Arsenic	ICP						
Arsenic	GFAA						
Cadmium	ICP						
Copper	ICP						
Lead	ICP						
Lead	GFAA						
Zinc	ICP						

Analyte	Method	SDG S-9260 Sample Detection Limit (mg/kg)	SDG S-9260 Result (mg/kg)	SDG S-9285 Sample Detection Limit (mg/kg)	SDG S-9285 Result (mg/kg)	SDG S-9315 Sample Detection Limit (mg/kg)	SDG S-9315 Result (mg/kg)
Arsenic	ICP						
Arsenic	GFAA						
Cadmium	ICP						
Copper	ICP						
Lead	ICP						
Lead	GFAA						
Zinc	ICP						

Analyte	Method	SDG S-9342 Sample Detection Limit (mg/kg)	SDG S-9342 Result (mg/kg)	SDG S-9375 Sample Detection Limit (mg/kg)	SDG S-9375 Result (mg/kg)
Arsenic	ICP				
Arsenic	GFAA				
Cadmium	ICP				
Copper	ICP				
Lead	ICP				
Lead	GFAA				
Zinc	ICP				

[a] SDG - sample digestion group.

[b] ICP - inductively coupled plasma-atomic emission spectrometry.

[c] GFAA - graphite furnace atomic absorption spectrometry.

Inductively Coupled Plasma Interference Check Sample

The inductively coupled plasma (ICP) interference check sample (ICS) results and any exceedance of control limits will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on ICP ICS results will also be discussed in this section.

Laboratory Control Sample

The laboratory control sample (LCS) monitors the overall performance of the analysis, including sample preparation. The LCS results will be summarized in Table A-6. The application of qualifiers, descriptors, and descriptor values based on LCS results will be discussed in this section.

Duplicate Sample Results

The duplicate sample results are a measure of laboratory precision and sample homogeneity. The frequency of laboratory duplicate analysis will be discussed in this section. The relative percent difference (RPD) of duplicate results for the ICP and graphite furnace atomic absorption (GFAA) analyses will be presented in Table A-7. The application of qualifiers and descriptors based on duplicate analysis results will be discussed in this section.

Matrix Spike Sample Results

The matrix spike sample results are used to assess the analytical accuracy of the reported data and the effect of the matrix on the analysis results. The matrix spike sample results for ICP and GFAA results will be summarized in Table A-8. The application of qualifiers and descriptors based on matrix spike sample results will be discussed in this section.

ICP Serial Dilution

The ICP serial dilution monitors physical or chemical interferences due to the sample matrix. The CLP SOW 788 requires an ICP serial dilution for each analyte in each SDG. If the analyte concentration is at least a factor of 50 above the instrument detection level, then the analysis of the 5-fold serial dilution must agree within 10 percent difference of the original sample result. The ICP serial dilution results will be summarized in Table A-9. The application of qualifiers, descriptors, and descriptor values based on ICP serial dilution results will be discussed in this section.

TABLE A-6. LABORATORY CONTROL SAMPLE RESULTS — CLP

Analyte	Method	Control Limit Range[a] (mg/kg)	LCS Results (mg/kg) SDG[b] S-9170	SDG S-9194	SDG S-9196	SDG S-9197	SDG S-9230	SDG S-9255	SDG S-9260	SDG S-9285	SDG S-9315	SDG S-9342	SDG S-9375
Arsenic	ICP[c]	635-1199											
Arsenic	GFAA[d]	635-1199											
Cadmium	ICP	35.7-55.1											
Copper	ICP	6006-7820											
Lead	ICP	188-285											
Lead	GFAA	188-285											
Zinc	ICP	138-236											

[a] Source - EMSL-LV.

[b] SDG - sample digestion group.

[c] ICP - inductively coupled plasma-atomic emission spectrometry.

[d] GFAA - graphite furnace atomic absorption spectrometry.

TABLE A-7. DUPLICATE SAMPLE RESULTS — CLP

Analyte	Method	Duplicate RPD[a]										
		SDG[b] S-9170	SDG S-9194	SDG S-9196	SDG S-9197	SDG S-9230	SDG S-9255	SDG S-9260	SDG S-9285	SDG S-9315	SDG S-9342	SDG S-9375
Arsenic	ICP[c]											
Arsenic	GFAA[d]											
Cadmium	ICP											
Copper	ICP											
Lead	ICP											
Lead	GFAA											
Zinc	ICP											

[a] RPD - relative percent difference = $\frac{\text{sample - duplicate}}{\text{mean}} \times 100$.

[b] SDG - sample digestion group.

[c] ICP - inductively coupled plasma-atomic emission spectrometry.

[d] GFAA - graphite furnace atomic absorption spectrometry.

TABLE A-8. MATRIX SPIKE SAMPLE RESULTS — CLP

Analyte	Method	Percent Recovery[a]										
		SDG[b] S-9170	SDG S-9194	SDG S-9196	SDG S-9197	SDG S-9230	SDG S-9255	SDG S-9620	SDG S-9285	SDG S-9315	SDG S-9342	SDG S-9375
Arsenic	ICP[c]											
Arsenic	GFAA[d]											
Cadmium	ICP											
Copper	ICP											
Lead	ICP											
Lead	GFAA											
Zinc	ICP											

[a] Percent recovery = $\frac{\text{(spike sample result - sample result)}}{\text{spike added}} \times 100.$

[b] SDG - sample digestion group.

[c] ICP - inductively coupled plasma-atomic emission spectrometry.

[d] GFAA - graphite furnace atomic absorption spectrometry.

TABLE A-9. SERIAL DILUTION RESULTS[a] — CLP

Analyte	SDG[b] S-9170	SDG S-9194	SDG S-9196	SDG S-9197	SDG S-9230	SDG S-9255
Arsenic						
Cadmium						
Copper						
Lead						
Zinc						

[a] Percent difference = $\frac{\text{initial sample result - serial dilution result}}{\text{initial sample result}} \times 100.$

[b] SDG - sample digestion group.

Graphite Furnace Atomic Absorption Quality Control

Duplicate injections and furnace post digestion spikes are used to assess the precision and accuracy of individual analytical results. The GFAA quality control samples will be discussed in this section.

FIELD QUALITY CONTROL

The frequency of field quality control as outlined in the quality assurance project plan (QAPP) (ARCO 1992c) and _____ Investigation SAP will be discussed in this section. If sample results are qualified because of field quality control results, a list or table of affected samples will be included in the appropriate field quality control section.

Field Blank Results

Results of bottle blanks, external contamination blanks, and cross-contamination blanks will be discussed in this section. The results will be summarized in Table A-10.

Field Replicate Results

Field replicates are used to assess field and laboratory precision. The field replicate results will be discussed in this section and presented in Table A-11.

Reference Material Results

The source of the standard reference material (SRM) will be identified and the frequency of analyses will be discussed in this section. Results of the SRM will be discussed in this section and also summarized in Table A-12.

Interlaboratory Comparison

The interlaboratory comparison results may identify consistent bias in the results. The interlaboratory comparison results will be discussed in this section and also presented in Table A-13.

TABLE A-10. FIELD BLANK RESULTS — CLP

Sample Number	Total μg				
	Arsenic	Cadmium	Copper	Lead	Zinc

TABLE A-11. FIELD REPLICATE RESULTS — CLP

Analyte	Sample Concentration (mg/kg) Sample	Replicate A	Replicate B	Mean	Standard Deviation	RSD[a]
Sample Number						
Arsenic						
Cadmium						
Copper						
Lead						
Zinc						
Sample Number						
Arsenic						
Cadmium						
Copper						
Lead						
Zinc						
Sample Number						
Arsenic						
Cadmium						
Copper						
Lead						
Zinc						
Sample Number						
Arsenic						
Cadmium						
Copper						
Lead						
Zinc						
Sample Number						
Arsenic						
Cadmium						
Copper						
Lead						
Zinc						

[a] Relative standard deviation.

TABLE A-12. REFERENCE MATERIALS — CLP

Analyte	True Value[a] (mg/kg)	Sample Number	%R[b]	Sample Number	%R	Sample Number	%R	Sample Number	%R	Sample Number	%R
Arsenic											
Cadmium											
Copper											
Lead											
Zinc											

Analyte	True Value (mg/kg)	Sample Number	%R[a]	Sample Number	%R	Sample Number	%R	Sample Number	%R
Arsenic									
Cadmium									
Copper									
Lead									
Zinc									

[a] Source is _____.

[b] %R - percent recovery = $\frac{\text{found}}{\text{true}} \times 100$.

TABLE A-13. INTERLABORATORY COMPARISON RESULTS — CLP

Laboratory	Sample Number	mg/kg Arsenic	Cadmium	Copper	Lead	Zinc
Laboratory A						
Laboratory B						
	Mean					
	RPD[a]					
Laboratory A						
Laboratory B						
	Mean					
	RPD					
Laboratory A						
Laboratory B						
	Mean					
	RPD					
Laboratory A						
Laboratory B						
	Mean					
	RPD					

[a] RPD - relative percent difference.

QUALITY ASSURANCE AND QUALITY CONTROL REVIEW OF XRF (SPECTRACE) INORGANIC DATA

The soil samples were analyzed for _____by X-Ray fluorescence (XRF [Spectrace®]) as specified in (**Document reference**) and Ashe (1992). Additional analyses will also be discussed in this section. The additional ____ samples included field blanks; these field blanks were archived because they are not amenable to analysis by XRF (Spectrace®). Interlaboratory splits collected in the field at a frequency of _____ and sent for analysis to a laboratory participating in the CLP will be discussed in this section. CLP samples were analyzed by the procedures in U.S. EPA (1988) for _____. Interlaboratory splits and field quality control sampling parameters will be discussed in this section. The data were subjected to 100-percent data validation and assessment as indicated in U.S. EPA (1985a,b) and Viar & Co. (1988).

SUMMARY OF XRF (SPECTRACE®) DATA

The XRF (Spectrace®) will be summarized in this section. A table of all data with qualifiers, descriptors, and descriptor values will be included in Table 2 of the main body of this report. Table A-2 will summarize definitions of data flags, qualifiers, and descriptors.

Level A/B Criteria

To ascertain the Level A/B status of the data, the data packages and all associated field documentation are reviewed. U.S. EPA establishes three categories for the data: unusable, Level A, and Level B. It is necessary to examine the data packages in terms of Level A criteria first, because only those data that meet Level A criteria can be considered for Level B categorization. Level A criteria include documentation of sampling, field, and laboratory records. For the data to meet Level B criteria, there must be full documentation of compliance with the requirements for quantitative statistical significance, which include meeting quality control frequencies and laboratory certification.

Level A/B criteria not applicable to the XRF (Spectrace®) results include:

- Verification of standards using EPA or National Bureau of Standards (NBS) reference materials not less than once each 3 months

- Analysis of laboratory reagent blanks (no reagents are used to prepare the samples for analysis)
- Analysis of laboratory spikes (XRF samples are not amenable to spiking)
- Quality control limits consistent with limits established for EPA's CLP
- QA/QC certification of the laboratory by EPA-accredited agencies.

The data and associated documentation were not reviewed for these criteria.

JUSTIFICATION

Justification for upgrading screening quality data to enforcement quality will be presented in this section. If applicable, documentation of ARCO/EPA correspondence relating to the assessment will be referenced here.

SAMPLE SET

The sample set consisted of _____ samples. Analyses were performed using XRF (Spectrace®) by Ashe Analytics, Inc. (Ashe), Butte, MT. The XRF (Spectrace®) results were verified by the analysis of field split samples collected at a frequency of _____. Laboratory split samples were prepared at a frequency of _____. They were sent to _____ for CLP analyses. XRF (Spectrace®) was used to analyze _____ samples, while _____ samples were analyzed by the referee CLP laboratory. Percent solids analyses were performed by _____. This section of the QA/QC review will discuss the XRF (Spectrace®) data review and the comparison of XRF (Spectrace®) and CLP replicates.

COMPLETENESS

The completeness of the analytical data set was assessed by comparing the total number of data points generated to the number of data points rejected, and calculating a percent completeness. _____ of the data points generated at the laboratories were rejected; therefore, the analytical data are considered ___-percent complete.

ANALYTICAL METHODS

Using XRF (Spectrace®), _____ samples were analyzed for _____. In describing XRF (Spectrace®) analysis and quality control procedures, frequent comparisons to CLP procedures will be made. These comparisons provide a framework

for discussing some of the fundamental differences between the XRF (Spectrace®) and CLP analytical methods and applicable quality control checks.

CALIBRATION

Calibration of the Spectrace® 5000 is a two-step process. First, a list of elements to be considered in the spectrum deconvolution is established. The list should contain major constituent elements above potassium on the periodic chart of the elements and elements adjacent to the analytes of interest if it is likely that they will be in the sample. For the _____ investigation, the list of processing elements was _____ _____.

Spectra of these pure elements are acquired and regions of interest (ROIs) are set about the prominent X-Ray lines. These defined lines (the ROIs) are used in a least-squares program to deconvolve the unknown spectra into a table of "intensities." Each unknown spectrum is decomposed into a set of relative intensities (counts per second) for each of the elements on the list of processing elements.

To determine the fundamental parameters concentration calculations, a suite of samples covering the analytes and major constituent elements is chosen. Concentrations should be well above the limit of quantification (LOQ) so that good statistical accuracy can be achieved. In principle, pure elements could be used in this step, but count rate considerations preclude pure element standards. The program uses the measured relative intensities to calculate pure element count rates for the specified analytes. It is preferable to have several (three to five) samples for each analyte so that an average value of the pure element count rate will be calculated. This reduces the dependence on any single chemical determination. The program estimates pure element count rates for any analytes not included in the standards. The final step in calibration is the calculation of interelement correction factors (alpha coefficients) for all analytes.

The standards included in the calibration were _____. The other analytes were determined without chemical standards.

Sample Preparation

Soil sample preparation techniques will be discussed in this section. The size of the final analytical sample will also be identified in this section. Sample preparation and handling is discussed in _____ **(Document reference)**.

Detection Limits

XRF (Spectrace®) method detection limits (MDLs) are determined by measuring a sample with concentrations near the estimated detection limit. The sample is run on multiple

days, and the standard deviation of the analyses is calculated. More than one sample may be used to cover all analytes, but each standard deviation is computed from measurements of a single sample. The method detection limit is defined as three times the standard deviation. The method detection limits for the investigation will be identified in this section.

The LOQ is defined as 10 times the standard deviation of the low-level sample. The LOQ is directly computable from the MDL. Concentrations between the MDL and LOQ were assigned a *B* concentration qualifier. The LOQs will be identified in this section.

QUALITY ASSURANCE/QUALITY CONTROL

Because XRF (Spectrace®) analysis is a nondestructive technique that does not employ digestion of the sample and thus has no reagents or solvents, many of the quality control checks used in the CLP either are not relevant or cannot be implemented in the same way. A comparison of the CLP quality control checks to XRF (Spectrace®) analysis will be provided in Table A-14. The three general classes of checks are calibration quality control, interference/matrix quality control, and field quality control. The calibration quality control checks are designed to ensure that instruments are calibrated correctly and remain in calibration throughout the course of the analytical run. The interference/matrix quality control checks are designed to monitor for the presence of spectral interferences inherent in the optical spectroscopic techniques of the CLP and to detect influences on analytical results caused by reagents, sample matrices, and the sample preparation process itself. Field quality control checks are designed to monitor overall sampling and analysis precision and accuracy by providing blind quality control samples to the laboratory. There are no CLP control limits for field quality control statistics.

The CLP QA/QC program is the basis of the XRF (Spectrace®) QA/QC program. The portions of the CLP QA/QC program that are directly applicable to XRF (Spectrace®) include laboratory duplicates, field replicates, and laboratory splits. These quality control checks were implemented, and the results are discussed in the following sections of this report.

Laboratory Control Samples

The LCSs were prepared in the same manner as the natural samples. The low-concentration LCS was taken from the _____. The medium-concentration LCS was taken from the _____. The percent recoveries will be discussed in this section.

TABLE A-14. COMPARISON OF CLP AND XRF (SPECTRACE) QUALITY CONTROL CHECKS[a]

Quality Control Category	Quality Control Element[b]	Applicable to XRF	Comments on Applicability
Matrix/ Interference	ICP interference check sample	No	XRF is not an ICP technique
	ICP serial dilution sample	No	XRF is not an ICP technique
	Laboratory control sample	Yes	
	Preparation blank	No	No "reagents" or digestions
	Laboratory duplicate	Yes	XRF duplicate analogous
	Matrix spike sample	No	No digestion
	Analytical spike	No	No digestion
Calibration	Calibration blank	Yes	Uncontaminated sand can be used as blank
	Calibration standards	Yes	
	Initial calibration verification	Yes	
	Initial calibration blank	No	No carryover in XRF
	Continuing calibration verification	Yes	
	Continuing calibration blank	No	No carryover in XRF
Field	Field blanks	No	Field blanks not amenable to XRF preparation and analysis
	Field triplicate	Yes	XRF analogous to CLP
	SRM	Yes	
	Referee laboratory split	Yes	CLP split

[a] CLP - Contract Laboratory Program.
XRF - X-Ray fluorescence.

[b] ICP - inductively coupled plasma-atomic emission spectrometry.
SRM - standard reference material.

Laboratory Duplicates

Splits were prepared in the laboratory at a frequency of _____. In the CLP, duplicates are associated with the digestion batch, which has a maximum of 20 samples, and the corrective action for exceeding the control limit is to flag affected results for all samples within the digestion batch. However, there is no digestion with XRF (Spectrace®) analyses; therefore, there are no digestion batches. Thus, associating any batch of results with a duplicate is artificial. For the XRF (Spectrace®) quality control program, a control limit of 35 RPD was established as the target control limit for precision for results greater than the LOQ, and 50 RPD for results between the MDL and LOQ. Results that exceed the respective control limits are qualified as estimated, *J*, and descriptors (D%) and descriptor values equal to the RPD are appended to the qualifier.

Laboratory duplicates for the XRF (Spectrace®) quality control program were analyzed at a frequency of _____. Any exceptions to this frequency will be identified in this section. The duplicate RPDs will be summarized in Table A-15. Of the ____ total data points for metals, ____ percent were qualified as estimated because of duplicate results. Any deviations from the duplicate control limits will be discussed in this section.

FIELD QUALITY CONTROL

There are no EPA control limits or corrective actions for field quality control statistics. U.S. EPA (1985a) and Viar & Co. (1988) consider field quality control as useful in assessing a laboratory's performance independent of sample or method problems, and primarily useful as supporting evidence in the overall assessment of a data set or sampling event. The functional guidelines continue by stating that field quality control is not the basis for accepting or rejecting data, but rather additional evidence in support of these conclusions arrived at by a review of the total package. Therefore, except in the case of gross errors, poor performance on field quality control samples does not result in the invalidation of data.

Field Replicate Results

Field replicates are amenable to analysis by XRF (Spectrace®). Field triplicates were collected in the field at a frequency of __ in __ samples. The field replicate results will be summarized in Table A-16. The mean, standard deviation, and RSD will be calculated for samples when all of the replicates are reported above the MDL. For each triplicate, the RSD will be used as an indication of the overall precision of sampling and analysis. The RSD will be taken as analogous to the laboratory duplicate RPD. A target control limit of 35 RSD will be used for the examination of the data. All deviations from the target control limit will be identified in this section.

TABLE A-15. DUPLICATE SAMPLE RESULTS — XRF (SPECTRACE®)

	Duplicate RPD[a]					
Analyte	SPG[b] S00001	SPG S00013	SPG S00101	SPG S00153	SPG S00214	SPG S00252
Arsenic						
Copper						
Lead						
Zinc						

	Duplicate RPD					
Analyte	SPG S00411	SPG S00549	SPG S00653	SPG S00762	SPG S00809	SPG S00864
Arsenic						
Copper						
Lead						
Zinc						

	Duplicate RPD					
Analyte	SPG S01051	SPG S01203	SPG S01411	SPG S01460	SPG S01611	SPG S01645
Arsenic						
Copper						
Lead						
Zinc						

	Duplicate RPD		
Analyte	SPG S01685	SPG S01763	SPG S01925
Arsenic			
Copper			
Lead			
Zinc			

[a] $RPD = \left| \frac{sample - duplicate}{mean} \right| \times 100.$

[b] SPG - sample preparation group.

TABLE A-16. FIELD REPLICATE RESULTS — XRF (SPECTRACE®)

Original Sample Number	Replicate A Sample Number	Replicate B Sample Number	Analyte	Concentration (mg/kg)					
				Original	Replicate A	Replicate B	Mean	STD[a]	RSD[b]
S00001	S00002	S00003	Arsenic						
			Lead						
S00057	S00058	S00059	Arsenic						
			Lead						
S00109	S00110	S00111	Arsenic						
			Lead						
S00153	S00154	S00155	Arsenic						
			Lead						
S00200	S00201	S00202	Arsenic						
			Lead						
S00258	S00259	S00260	Arsenic						
			Lead						
S00312	S00313	S00314	Arsenic						
			Lead						
S00368	S00369	S00370	Arsenic						
			Lead						

TABLE A-16. (Continued)

Original Sample Number	Replicate A Sample Number	Replicate B Sample Number	Analyte	Concentration (mg/kg) Original	Replicate A	Replicate B	Mean	STD[a]	RSD[b]
S01723	S01724	S01725	Arsenic						
			Copper						
			Lead						
			Zinc						
S01769	S01770	S01771	Arsenic						
			Copper						
			Lead						
			Zinc						
S01809	S01810	S01811	Arsenic						
			Copper						
			Lead						
			Zinc						

[a] STD - standard deviation.

[b] RSD - relative standard deviation.

Interlaboratory Comparison

The interlaboratory splits were collected at a frequency of _ in __ samples. The splits were sent to the CLP referee laboratory for analysis. The RPDs between CLP and XRF (Spectrace®) data will be presented in Table A-17. The XRF (Spectrace®) laboratory also generates quarterly reports summarizing results of XRF laboratory-prepared (dried, sieved, ground) samples analyzed by CLP procedures. A reference to the quarterly report covering the time of analysis should be included here.

The LAP (Ashe 1992) requires that samples be analyzed by CLP methods at a frequency of 1 in 20 samples for comparison with the XRF results. Ashe (1992) establishes a control limit for percent recovery of 100±35 percent if the result is less than two times the LOQ and 100±20 percent if the sample is greater than two times the LOQ. Ashe used the CLP result as the reference value to calculate the percent recovery of the XRF (Spectrace®) result. If a result exceeds its respective control limit, Ashe (1992) requires that the sample by reanalyzed by XRF (Spectrace®). If the reanalysis result still exceeds the control limits, Ashe (1992) requires that a second subsample be prepared and XRF and CLP analyses be performed on the second subsample. All samples that exceed the control limits defined by Ashe (1992) will be discussed in this section.

Field Blank Results

Field blanks were collected and archived to satisfy the Level A/B frequency requirements for field quality control. However, the field blanks are not amenable to analysis by XRF (Spectrace®).

Reference Material Results

____ reference material samples were collected for every __ samples, as required by the QAPP (**Document reference**). The reference materials were purchased from _____ _____. Results of the reference materials analyses, generated by XRF (Spectrace®), will be presented in Table A-18. Results will be reviewed against a target control limit of 100 ±25 percent. All control limit exceedances will be discussed in this section.

TABLE A-17. INTERLABORATORY COMPARISON RESULTS — XRF (SPECTRACE®) AND CLP ANALYSES (CAS)

XRF Sample Number	CLP Sample Number	Analyte	Concentration (mg/kg) XRF Result	CLP Result	RPD[a]
S00200	S00203	Arsenic			
		Copper			
		Lead			
		Zinc			
S00258	S00261	Arsenic			
		Copper			
		Lead			
		Zinc			
S00312	S00315	Arsenic			
		Copper			
		Lead			
		Zinc			
S00368	S00371	Arsenic			
		Copper			
		Lead			
		Zinc			
S00001	S00004	Arsenic			
		Copper			
		Lead			
		Zinc			
S000057	S00060	Arsenic			
		Copper			
		Lead			
		Zinc			
S00109	S00112	Arsenic			
		Copper			
		Lead			
		Zinc			

TABLE A-17. (Continued)

XRF Sample Number	CLP Sample Number	Analyte	Concentration (mg/kg)		RPD[a]
			XRF Result	CLP Result	
S01723	S01726	Arsenic			
		Copper			
		Lead			
		Zinc			
S01769	S01772	Arsenic			
		Copper			
		Lead			
		Zinc			
S01809	S01812	Arsenic			
		Copper			
		Lead			
		Zinc			
S01631	S01634	Arsenic			
		Copper			
		Lead			
		Zinc			

[a] $RPD = \frac{\text{XRF result} - \text{CLP result}}{\text{mean}} \times 100.$

TABLE A-18. REFERENCE MATERIALS — XRF (SPECTRACE®)

Sample Number	Analyte	Reference Value[a] (mg/kg)	Measured Value (mg/kg)	Percent Recovery[b]
S00013	Arsenic			
	Lead			
S00014	Arsenic			
	Lead			
S00073	Arsenic			
	Lead			
S00125	Arsenic			
	Lead			
S00169	Arsenic			
	Lead			
S00212	Arsenic			
	Lead			
S00214	Arsenic			
	Lead			
S00270	Arsenic			
	Lead			
S01701	Arsenic			
	Copper			
	Lead			
	Zinc			
S01783	Arsenic			
	Copper			
	Lead			
	Zinc			

TABLE A-18. (Continued)

Sample Number	Analyte	Reference Value[a] (mg/kg)	Measured Value (mg/kg)	Percent Recovery[b]
S01823	Arsenic			
	Copper			
	Lead			
	Zinc			

[a] Reference value - Source.

[b] Percent recovery = $\frac{\text{measured value}}{\text{reference value}} \times 100.$

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U.S. EPA. 1988. Contract Laboratory Program statement of work. Inorganic analysis, multi-media, multi-concentration, July 1988. SOW No. 788. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, NV.

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APPENDIX B

Organic Data Quality Assurance and Quality Control Review

CONTENTS

CONTENTS (Continued)

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

CLP	Contract Laboratory Program
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatography/mass spectrometry
LAP	laboratory analytical protocol
MDHES	Montana Department of Health and Environmental Sciences
QAPP	quality assurance project plan
QA/QC	quality assurance and quality control
RPD	relative percent difference
SAP	sampling and analysis plan
SOW	statement of work
SPG	sample preparation group

QUALITY ASSURANCE AND QUALITY CONTROL REVIEW OF ORGANIC DATA FOR _____ INVESTIGATION

As outlined in the _____ Investigation sampling and analysis plan (SAP) **(Document reference)** _____ samples were collected and analyzed for the Investigation. The samples were collected from _____ through _____. The sampling was conducted in specific study areas as defined in the SAP. The specific study areas and the analyte list will be outlined in Table B-1. The soil samples were analyzed for _____ by procedures in the *U.S. Environmental Protection Agency Contract Laboratory Program Statement of Work 288* (U.S. EPA 1988). The data were subjected to 100-percent data validation and assessment per *Laboratory Data Validation: Functional Guidelines for Evaluating Organics Analyses* (Viar & Co. 1988), *Evaluation Criteria for Existing Data from CERCLA Study Areas* (U.S. EPA 1985), and the *Clark Fork River Superfund Site Investigations Quality Assurance Project Plan* (QAPP) (ARCO 1992a).

EXECUTIVE SUMMARY

Enforcement quality data are supported by rigorous sampling and analysis procedures, quality assurance and quality control (QA/QC) protocols, and documentation requirements. Enforcement quality data include data that meet the Level B criteria outlined in U.S. EPA (1985b) and are not qualified as estimated during the validation process. Enforcement quality data also include data that are qualified, or do not meet Level A/B criteria, but for which justification as enforcement quality data is provided. All of the Level A and Level B criteria are satisfied for this investigation, and the metals data are assessed as Level B. In addition to the Level A/B assessment, the data are reviewed for qualifiers. Data that meet Level B criteria and are free of qualifiers are assessed as enforcement quality data. Of the _____ total data points for metals, _____ percent are qualified because of duplicate results, and _____ percent are qualified because of matrix spike results. None of the data for this investigation are rejected. The analytical data and the enforcement and screening assessment will be presented in Table 1 in the main text of the report. Sample number codes and sampling coordinates at each station will also be identified in Tables 2–4 in the main body of the report.

JUSTIFICATION

Justification for upgrading screening quality data to enforcement quality will be presented in this section. If applicable, documentation of ARCO/EPA correspondence relating to the assessment will be referenced here.

TABLE B-1. SUMMARY OF _____ INVESTIGATION NATURAL SAMPLES

Area	Total Samples	Analytical Parameters
Treating Area A		Volatiles, semivolatiles, pesticides, polychlorinated biphenyls, pentachlorophenol
Treating Area B		Pentachlorophenol, semivolatiles, polycyclic aromatic hydrocarbons
Runoff Area A		Polycyclic aromatic hydrocarbons
Total		

SAMPLE SET

A summary of field and quality control samples will be presented in this section. The frequencies of collection and analysis will also be discussed in this section. In addition, the sample set as delivered to the laboratory will be discussed in this section.

ANALYTICAL METHODS

The analytical laboratory followed the sample extraction and analysis procedures of the Contract Laboratory Program (CLP) statement of work (SOW) 288 (U.S. EPA 1988). The analyte list for each study area will be presented and discussed in this section.

QUALITY ASSURANCE AND QUALITY CONTROL REVIEW OF CONTRACT LABORATORY PROGRAM ORGANIC DATA

SAMPLE PREPARATION GROUPS

The samples were divided into _____ sample preparation groups (SPGs) at the analytical laboratory. The composition of the SPGs and the preparation of the specific quality control checks will be discussed in this section. The number of samples in each SPG for each method and analyte will be summarized in Table B-2. A list of samples in each SPG is presented in Table B-3.

DATA VALIDATION

The data validation process is divided into four main components: examining the data package as a whole to ensure that all required deliverables were present and in clear and readable form; performing manual validation of all transcriptions and calculations, including checking frequency and recovery control limit compliance for instrument quality control checks and calibrations; verifying data-flagging assignments and documenting corrective action taken on all missing or incorrect elements; and assigning qualifiers, descriptors, and descriptor values to the data.

Any problems discovered during data validation will be discussed in this section.

DATA ASSESSMENT

The laboratory data are evaluated according to the criteria in Viar & Co. (1988). Qualifiers are applied per Viar & Co. (1988) and descriptors and descriptor values per Montana Department of Health and Environmental Sciences (MDHES) (1990). Summaries of the data assessment are presented in the following sections.

Holding Times

The holding time requirements and satisfaction or violation of holding time requirements will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on holding time results will also be discussed in this section.

TABLE B-2. NUMBER OF SAMPLES IN EACH SPG FOR EACH METHOD

Analyte	Method	Number of Samples									
		SPG[a] S-9170	SPG S-9194	SPG S-9196	SPG S-9197	SPG S-9230	SPG S-9255	SPG S-9260	SPG S-9285	SPG S-9315	SPG S-9342
Semivolatile organic compounds	EPA CLP SOW 2/88[b]										
Polycyclic aromatic hydrocarbons	EPA Method 8310[c]										
Pentachlorophenol	Key 589[d]										
Phenols	EPA Method 8040[c]										
Volatile organic compounds	EPA CLP SOW 2/88										
Halogenated volatile organic compounds	EPA Method 8010[c]										
Volatile aromatic compounds	EPA Method 8020[c]										
Pesticides	EPA CLP SOW 2/88										
Dioxins/Furans	EPA Method 8290[e]										

[a] SPG - sample preparation group.

[b] Defined in U.S. EPA. 1988. *Contract Laboratory Program statement of work. Organic analysis, multimedia, multiconcentration.* February 1988. SOW No. 288. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Washington, DC.

[c] Defined in U.S. EPA. 1986. *Test methods for evaluating solid waste. Volume 1B: Laboratory manual physical/chemical methods. SW-846.* Third Edition. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

[d] Defined in Keystone. 1990. *Analysis of pentachlorophenol by gas chromatography method Key 589.* November 1990. SOP 893. Revision 0. Keystone Environmental Resources, Inc., Monroeville, PA.

[e] Defined in U.S. EPA. 1989. *Test methods for evaluating solid waste. Determination of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans by high resolution gas chromatography/high resolution mass spectrometry* (HRGC/HRMS). *SW-846 Method 8290.* Revision 0. U.S. Environmental Protection Agency, Washington, DC.

TABLE B-3. LIST OF SAMPLES IN EACH SPG[a]

SPG S-9170	SPG S-9194	SPG S-9196	SPG S-9197
S00001			
S00002			
S00003			
S00004			
S00005			
S00006			
S00007			
S00008			
S00009			
S00010			
S00011			
S00012			
S00013			
S00014			
S00015			
S00016			
S00017			
S00018			
S00019			
S00020			

[a] SPG - sample preparation group.

Gas Chromatographer/Mass Spectrometer Tuning

Tuning is performed to ensure that mass resolution, identification, and, to some degree, sensitivity of the gas chromatography/mass spectrometry (GC/MS) instrument have been established. Whether analyzing for volatile or extractable organic compounds, the instrument tuning must be performed prior to the analysis of either the standard or samples and must meet the criteria established by U.S. Environmental Protection Agency (EPA) guidelines.

The instrument tuning requirements and satisfaction or violation of the requirements will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on tuning results will also be discussed in this section.

Calibration

Instrument calibration is performed to establish that the instrument is capable of producing consistent and reliable analytical data. Initial and continuing calibrations are to be performed using EPA guidelines. An initial multipoint calibration is performed prior to sample analysis to establish the linear range of the instrument. Continuing calibration checks are performed to verify that instrument performance is stable and reproducible on a day-to-day basis.

A detailed description of the compliance of the analytical laboratory with the requirements for both initial and continuing instrument calibration will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on calibration results will also be discussed in this section.

Method Blanks

Method blank results are assessed to determine the existence and magnitude of laboratory contamination. These results, along with the application of qualifiers, descriptors, and descriptor values based on blank results, will be discussed in this section.

ACCURACY

Accuracy of the analytical results is expressed in terms of the bias and precision of the measurements. Bias is assessed by evaluating the recoveries of stable isotopically-labeled surrogate compounds in samples and additional matrix spike analyses. Precision is assessed by evaluating the differences between duplicate matrix spike analyses. Criteria for the performance of surrogate compound, matrix spike, and matrix spike duplicate analyses are established by U.S. EPA (1986) and other EPA guidance documents listed in the *Clark Fork River Superfund Site Investigation Laboratory Analytical Protocol*

(LAP) and QAPP (ARCO 1992a,b). The results for bias and precision will be presented below.

Surrogate Compound Recoveries

The surrogate compound recovery requirements and satisfaction or violation of the requirements will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on surrogate recovery results will also be discussed here.

Matrix Spike Recoveries

The matrix spike compound recovery requirements and satisfaction or violation of the requirements will be discussed in this section. The application of qualifiers, descriptors, and descriptor values based on matrix spike recovery results will also be discussed in this section. The matrix spike results will be summarized in Table B-4.

PRECISION

Precision is expressed as the relative percent difference (RPD) between the recoveries of the matrix spike and matrix spike duplicate analyses. The RPD is a measure of laboratory precision, and will be discussed in this section. The RPD results will be presented in Table B-5. The application of qualifiers and descriptors based on duplicate analysis results will also be discussed in this section.

SURROGATE RECOVERIES

Surrogate recoveries are used to assess the accuracy of reported results. Surrogate recoveries will be discussed in this section and summarized in Table B-6. The application of qualifiers, descriptors, and descriptor values based on surrogate recovery will also be discussed in this section.

INTERNAL STANDARD PERFORMANCE

Internal standard performance is assessed to determine whether abrupt changes in instrument response and sensitivity occurred that may have affected the reliability of the analytical data. The response (area or height) of the internal standards must not vary by more than +100 percent or −50 percent from the response of the standard that was used to calculate the upper and lower bounds. The upper and lower bounds define the range for acceptable internal standard response (area or height) for the sample analyses.

TABLE B-4. MATRIX SPIKE RESULTS

Matrix Spike Compound	Method	Percent Recovery[a]							
		SPG[b] S-9170	SPG S-9194	SPG S-9196	SPG S-9230	SPG S-9255	SPG S-9260	SPG S-9285	SPG S-9315
Benzene	EPA CLP SOW 2/88[c]								
Chlorobenzene	EPA CLP SOW 2/88								
1,1-Dichlorobenzene	EPA CLP SOW 2/88								
Toluene	EPA CLP SOW 2/88								
Trichloroethene	EPA CLP SOW 2/88								

[a] Percent recovery = $\frac{\text{(spike sample result - sample result)}}{\text{Spike added}} \times 100$.

[b] Sample preparation group.

[c] Defined in U.S. EPA. 1988. *Contract Laboratory Program statement of work. Organic analysis, multi-media, multi-concentration.* February 1988. SOW No. 288. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Washington, DC.

TABLE B-5. MATRIX SPIKE DUPLICATE RESULTS

Matrix Spike Compound	Method	Duplicate RPD[a]							
		SPG[b] S-9170	SPG S-9194	SPG S-9196	SPG S-9230	SPG S-9255	SPG S-9260	SPG S-9285	SPG S-9315
Benzene	EPA CLP SOW 2/88[c]								
Chlorobenzene	EPA CLP SOW 2/88								
1,1-Dichlorobenzene	EPA CLP SOW 2/88								
Toluene	EPA CLP SOW 2/88								
Trichloroethene	EPA CLP SOW 2/88								

[a] Relative percent difference = $\frac{(\text{sample} - \text{duplicate})}{\text{Mean}} \times 100.$

[b] Sample preparation group.

[c] Defined in U.S. EPA. 1988. *Contract Laboratory Program statement of work. Organic analysis, multi-media, multi-concentration.* February 1988. SOW No. 288. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Washington, DC.

TABLE B-6. SURROGATE SPIKE RECOVERY RESULTS

Compound	Method	Surrogate Spike Percent Recovery[a]			
		SPG[b] S-9170	SPG S-9194	SPG S-9196	SPG S-9230

[a] Percent recovery = $\frac{\text{concentration measured}}{\text{concentration spiked}} \times 100.$

[b] SPG - sample preparation group.

The internal standard requirements and satisfaction or violation of the requirements will be discussed in this section and the recovery of internal standards will be tabulated in Table B-7. The application of qualifiers, descriptors, and descriptor values based on internal standard recovery results will also be discussed in this section.

IDENTIFICATION OF COMPOUNDS

Information concerning the positive identification of compounds and tentatively identified compounds will be addressed in this section.

COMPOUND QUANTIFICATIONS AND REPORTED DETECTION LIMITS

Compound quantifications and reported detection limits are recalculated and verified during the quality assurance review to ensure that they are accurate and consistent with EPA guidelines. Any discrepancies, errors, or general information concerning compound quantifications or detection limits will be discussed in this section.

FIELD QUALITY CONTROL

The frequency of field quality control as outlined in the QAPP and _____ Investigation SAP will be discussed in this section. If sample results are qualified because of field quality control results, a list or table of affected samples will be included in the appropriate field quality control section.

Field Blank Results

The results of bottle blanks, external contamination blanks, and cross-contamination blanks will be discussed in this section.

Field Replicate Results

Field replicates are used to assess field and laboratory precision. The field replicate results will be discussed in this section and presented in Table B-8.

Interlaboratory Comparison Results

The interlaboratory comparison results may identify a consistent bias in the results. The interlaboratory comparison results will be discussed in this section and presented in Table B-9.

TABLE B-7. INTERNAL STANDARD RESULTS[a]

	Internal Standard 1[b] Area	Retention Time	Internal Standard 2[b] Area	Retention Time	Internal Standard 3[b] Area	Retention Time
12-hour standard[b]						
Upper limit[c]						
Lower limit[c]						
Sample Identity						

[a] The number of internal standards depends on the method. Adjust table, as necessary, to include all internal standards.

[b] Identify compound used as internal standard.

[c] Area upper limit = +100 percent of internal standard area
Area lower limit = −50 percent of internal standard area
Retention time upper limit = +0.50 minutes of internal standard retention time
Retention time lower limit = −0.50 minutes of internal standard retention time.

TABLE B-8. FIELD REPLICATE RESULTS

	Sample Concentration (mg/kg)					
Analyte	Sample	Replicate A	Replicate B	Mean	Standard Deviation	RSD[a]
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						

[a] Relative standard deviation.

TABLE B-9. INTERLABORATORY COMPARISON RESULTS

	Sample Concentration (mg/kg)					
Analyte	Sample	ATI[a]	KEY[b]	Mean	Standard Deviation	RSD[c]
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						
Sample Number						
Benzene						
Toluene						
Chlorobenzene						
Ethylbenzene						
Styrene						
Xylene						

[a] Analytical Technologies, Inc., Fort Collins, CO.

[b] Keystone Environmental Resources, Inc., Monroeville, PA.

[c] Relative standard deviation.

SUMMARY OF DATA

The data will be summarized in this section. All data with qualifiers, descriptors, and descriptor values will be included in Table 2 of the main body of the report. Table B-10 summarizes definitions of data flags, qualifiers, and descriptors.

Level A/B Criteria

Enforcement quality data are supported by rigorous sampling and analysis procedures, QA/QC protocols, and documentation requirements. Enforcement quality data include data not qualified as estimated during the validation process. Enforcement quality data also include data that are qualified or do not meet the Level A/B criteria, but for which justification as enforcement quality is provided. U.S. EPA (1985b) establishes three categories for the data: unusable, Level A, and Level B. It is necessary to examine the data packages in terms of Level A criteria first, because only those data that meet Level A criteria can be considered for Level B categorization.

To ascertain the Level A/B status of the data, the data packages and all associated field documentation are reviewed.

All of the data meet Level A criteria, which include documentation of sampling, field, and laboratory records. For the data to meet Level B criteria, there must be full documentation of compliance with the requirements for quantitative statistical significance, which includes meeting quality control frequencies and laboratory certification. All analyses, sampling procedures, and documentation meet the Level B criteria. The analytical data, Level A/B status, and the enforcement and screening assessment are presented in Table 1 in the main body of the text.

TABLE B-10. DEFINITIONS OF DATA FLAGS, QUALIFIERS, AND DESCRIPTORS FOR ORGANIC DATA

Type	Description	Value
Flag[a]		
U	Indicates compound was analyzed for but not detected	--
J	Indicates an estimated value	--
C	Applies to pesticide results where the identification has been confirmed by gas chromatography/mass spectrometry (GC/MS)	--
B	Indicates analyte was found in the associated blank as well as in the sample	--
E	Indicates compounds with concentrations that exceed the calibration range of the GC/MS instrument for that specific analysis	--
D	Indicates compounds identified in an analysis at a secondary dilution factor	--
A	Indicates that a tentatively identified compound (TIC) is a suspected aldol-condensation product	--
X	Indicates other specific flags required to properly define the results	--
Qualifier		
C	EMPC - concentration qualifier applicable to dioxin data	--
R[b]	Rejected	--
U[b]	Undetected	--
J[b]	Estimated	--
A[c]	Justified as enforcement quality data	--
Descriptor		
HT	Qualified because sample holding times are exceeded	Time in days[d]
G	Qualified because GC/MS tuning mass calibration and ion abundance criteria are not met[e]	No value
CI	Qualified because initial calibration percent relative standard deviation criteria are not met[f]	% RSD
CD	Qualified because continuing calibration percent difference criteria are not met[f]	% D
CC	Qualified because continuing calibration correlation coefficient criteria are not met (does not include organics by GC or high performance liquid chromatography [HPLC])	CC
C%	Qualified because continuing calibration percent recovery criteria are not met (does not include organics by GC or HPLC)	% R
F	Qualified because relative response factor criteria are not met[g]	RRF
BF	Qualified because field blank contaminant criteria are not met[h,i]	Blank amount
BL	Qualified because lab blank contaminant criteria are not met[h,i]	Blank amount
BX	Qualified because blank frequency criteria are not met[h,i]	No value
S%	Qualified because surrogate percent recovery criteria are not met	% R
M%	Qualified because matrix spike/matrix spike duplicate percent recovery and relative percent difference criteria are not met	% R
DF	Qualified because field duplicate criteria are not met[j,k]	% RPD

TABLE B-10. (cont.)

Type	Description	Value
DL	Qualified because lab duplicate criteria are not met[j,k]	% RPD
K%	Qualified because internal standards percent recovery criteria are not met[l]	% R
KT	Qualified because internal standards retention time criteria are not met[l]	No value
O	Qualified because compound mass spectral match and/or relative retention time criteria are not met[e]	No value
OT	Qualified because compound retention time criteria are not met[m]	No value
OP	Qualified because second column confirmation criteria are not met[n]	No value
P	Qualified because system performance indicators criteria are not met[o]	No value
YI	Qualified because initial calibration GC and HPLC percent relative standard deviation criteria are not met[m]	% RSD
YC	Qualified because initial calibration[j] (GC, HPLC) correlation coefficient criteria are not met[m]	CC
YD	Qualified because continuing calibration (GC, HPLC) percent difference criteria are not met[m]	% D
Y%	Qualified because continuing calibration (GC, HPLC) percent recovery criteria are not met[m]	% R
YX	Qualified because continuing calibration (GC, HPLC) standard sequence or frequency criteria are not met[m]	No value
EW	Qualified because instrument performance (GC, HPLC) retention time windows criteria are not met[m]	No value
ES	Qualified because instrument performance (GC, HPLC) surrogate retention time check criteria are not met[m]	% D
ET	Qualified because instrument performance (GC) DDT retention time criteria are not met[q]	No value
E%	Qualified because instrument performance (GC) percent breakdown criteria are not met[q]	% B
L%	Qualified because LCS/reference check sample percent recovery criteria are not met[r]	% R
VS	Qualified because dioxin system performance signal/noise ratio criteria are not met	No value
VG	Qualified because dioxin system performance ion abundance ratio criteria are not met	No value
VX	Qualified because dioxin system performance correct analytical sequence criteria are not met	No value
V%	Qualified because dioxin system performance chromatographic resolution check criteria are not met	No value
WT	Qualified because dioxin retention time criteria are not met	No value
W	Qualified because dioxin interferences/coelution criteria are not met	No value
WG	Qualified because dioxin monitored ions max criteria are not met	No value
Z	Qualified because value below contract-required detection limit, but is a positive estimated result	No value
Q	Qualified because of other quality control violations, including nonspecific criteria such as overall data assessment[s]	Value (as appropriate)

Footnotes appear on following page

TABLE B-10. (cont.)

The following secondary character descriptor codes can typically be described as follows:

T - Time (either days or analytical, as in retention time)

X - Frequency, sequence, or performance of criteria

% - Value is reported as a percentage of difference, relative difference, recovery, breakdown, or otherwise

D - Percent difference for continuing calibration checks as the "%" character refers to recovery in this situation

I - Percent RSD for initial calibration

C - Correlation coefficient for initial calibration

F - Quality control sample generated in the field

L - Quality control sample generated in the laboratory.

Footnote definitions:

[a] Defined in U.S. EPA. 1988. *Contract Laboratory Program statement of work. Organic analysis, multi-media, multi-concentration.* February 1988. SOW No. 288. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Washington, DC. (Flags are assigned by the laboratory.)

[b] Defined in U.S. EPA. 1985. *Laboratory data validation: functional guidelines for evaluating organic analyses.* U.S. Environmental Protection Agency, Washington, DC. Also defined in Viar & Co. (eds.). 1988 (revision). *Laboratory data validation: functional guidelines for evaluating inorganics analyses.* Prepared by U.S. Environmental Protection Agency Work Group. Prepared for the U.S. Environmental Protection Agency, Hazardous Site Evaluation Division, Washington, DC.

[c] Justified as enforcement quality data as defined in Administrative Order on Consent.

[d] The time in days is the number of days the holding time was exceeded.

[e] Volative and semivolatile fractions only.

[f] Volatile, semivolatile, and dioxin analyses only.

[g] May be applicable for GC/MS, GC, or HPLC methods when internal standards are used.

[h] Most highly contaminated associated blank is applied.

[i] Field blanks can be trip, rinsate, bottle, etc.

[j] May be qualified on a case-by-case basis using validator's professional judgment.

[k] MS/MSD analyses rather than lab duplicate analyses are performed for CLP organics as well as most other types of organics methods.

[l] Not applicable for pesticide/PCB and some other GC or HPLC methodologies.

[m] Applies to pesticide/PCB and other GC and HPLC analyses.

[n] Required for pesticide/PCB and other GC methods specifying second column analyses to confirm identification.

[o] May be applicable when performance of the analytical system indicates that the detection limit was not attainable.

[p] For pesticide/PCB analyses, the % RSD and % D will always apply for initial and continuing calibration. However, other GC methods and HPLC allow an option for use of linear regression, which results in a correlation coefficient value. Either % D or % R may be reported in the latter situation.

[q] Applies only to pesticide/PCB analyses.

[r] An LCS is not required for CLP organics analyses. For dioxin, this is a fortified blank.

[s] If a field quality control sample (e.g., a blind SRM) causes data qualification, the second descriptor code character should be "F."

REFERENCES

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Viar & Co. (eds.) 1988 (revision). Laboratory data validation: functional guidelines for evaluating organics analyses. Prepared by U.S. Environmental Protection Agency Work Group. Prepared for the U.S. Environmental Protection Agency, Hazardous Site Evaluation Division, Washington, DC.

APPENDIX C

Clark Fork Data Management System Data

Clark Fork Data Management System Data

Data should be prepared for submittal to the Clark Fork Data Management System (CFDMS) following the most recent CFDMS Coding Specifications. In most cases, data should be submitted as electronic files, in dBase-III format. With the concurrence of the Montana Department of Health and Environmental Sciences (MDHES), data may also be submitted as quote- and comma-delimited ASCII files. If a very small amount of data is to be submitted, then, by prior arrangement with MDHES, completed paper copies of CFDMS coding forms may be submitted instead of electronic files.

The transmittal letter accompanying each data submittal should document:

- The name of the associated Data Summary Report (DSR);
- A list of DSR sections containing raw data summaries;
- The survey ID associated with each section of the DSR containing a summary of data transferred to the CFDMS;
- The source and storage format of all data appearing in the DSR that are not transferred to the CFDMS;
- The names of the individuals responsible for project management, data validation, and data management, as well as of any other individuals responsible for production of the data;
- If document information is not provided in the form of CFDMS RDM and RDE tables, a list of all documents related to the data;
- The type of file (e.g., ASCII, dBase, KMan);
- The status of each file (copied, archived, or backed up) and, if archived or backed up, the name of the software used and instructions for restoring the file;
- The target CFDMS table name for each file;
- The number of records in each file; and
- If files are ASCII, a list of the target CFDMS field names in order.

200.062
(duplicate)

Clark Fork River Superfund Site Investigations

Pilot Data Report Addendum

ARCO
Anaconda, Montana

July 2000

Clark Fork River Superfund Site Investigations Pilot Data Report Addendum

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July 2000

Doc. No.: 8601367.009 0101 0500 LJ05

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Acronyms and Abbreviations

DQA	data quality assessment
DQO	data quality objective
DSR	data summary report
EPA	U.S. Environmental Protection Agency
MDEQ	Montana Department of Environmental Quality
NPL	National Priorities List
QA/QC	quality assurance and quality control
SAP	sampling and analysis plan
SOP	standard operating procedure

Statement of Authenticity

Consistent with the provisions of [reference appropriate agreement for performance of RI/FS or RD/RA], the following data sets are considered to be final data generated or evaluated. Data have been designated as enforcement quality and screening quality as described in the Clark Fork River Superfund site investigations quality assurance project plan (QAPP) and data management/data validation (DM/DV) plan as supplemented by addendum. Consistent with the aforementioned orders, the signatories below hereby stipulate to the authenticity and accuracy of the data and hereby waive any evidentiary or other objection as to the authenticity and accuracy of reference in endangerment assessments, public health evaluations, feasibility studies, and RD/RA documents.

Approved by: _____ _____

ARCO Representative (Name)
Montana Project Manager
AERL

Date

Approved by: _____ _____

EPA Remedial Project Manager (Name)
U.S. Environmental Protection Agency
Region VIII

Date

Approved by: _____ _____

MDEQ Project Manager (Name)
Montana Department of
Environmental Quality

Date

Executive Summary

This pilot data report addendum is a model report to be used as a guide in the preparation and production of a data summary report (DSR) that would typically be generated for Clark Fork River Superfund site investigations. The information included in each section of a DSR is summarized in this model report.

The following documents have been developed for all Clark Fork River Superfund site investigations: a laboratory analytical protocol (LAP) (ARCO 1992c), quality assurance project plan (ARCO 1992d), data management/data validation plan (ARCO 1992b) and Addendum (ARCO 2000), and standard operating procedures (SOPs) (ARCO 1992a). The procedures and requirements contained within these documents should be followed and referenced in all DSRs.

All DSRs will typically include quality assurance and quality control (QA/QC) reports as appendices. Project-specific data quality objectives (DQOs) established in the sampling and analysis plan (SAP) may include objectives regarding data validation and assessment (i.e., construction data will not be subjected to data validation). In such cases, the DSR will not include QA/QC report appendices summarizing the results of data validation and assessment.

The purpose of a data report is to be the primary reference to be consulted by all data users for the data presentation, usability, and validation information associated with an investigation. This first section, the executive summary, will contain a concise statement on the content of the specific data report. Three tables will be included in this section:

- Table 1 will contain all analytical data with an enforcement and screening assessment;
- Table 2 will contain the results of all samples collected (including field quality control results) with Level A/B assessment and laboratory-assigned flags and qualifiers; and
- Table 3 will include all sample identifier information.

Introduction

This report presents the results of _____ sampling and analysis for the _____ Investigation of the Clark Fork River Superfund site. The site is located within the National Priorities List (NPL) site and is the subject of the _____. Results from previous investigations are summarized in _____ **(insert references here)**. The information contained in this report was gathered following objectives and procedures documented in the _____ *Sampling and Analysis Plan* (SAP) (**Document reference**). Overall _____ objectives and requirements are outlined in the _____.

The following information (**as an example**) will be included in this data report:

- Results of field and laboratory analyses;

Description of field sampling methods; and

- Locations of all sampling stations.

The field notebook and field data sheets for this investigation are located at ARCO contractor offices in **City, State**.

A listing of specific areas that were investigated is included in this section. This data report summarizes data collected from these sampling stations during this investigation as well as data collected during previous investigations and contained within the historical database (**Document reference**). When applicable, a quality assurance and quality control (QA/QC) review of inorganic data collected for this investigation will be included in Appendix A.

Investigation Objectives

The objectives of the _____ Investigation, as outlined in the _____, were as follows:

- Specific objectives as detailed in the work plan or SAP will be listed here.

The results of this investigation supplement existing data contained within the historical database (**Document reference**). These data will be used in (e.g., evaluate the potential volume of materials to be removed, fill in data gaps . . .).

Data Quality Objectives and Assessment

The data quality objectives (DQOs) of the _____ Investigation, as outlined in the SAP (**reference**), were as follows:

- Specific objectives of the SAP will be restated here.

Results of the data quality assessment (DQA) are:

- Specific results of the DQA will be restated here.

DQA Process (U.S. EPA 2000)

Step 1: Review DQOs and sampling design
Step 2: Conduct preliminary data review
Step 3: Select statistical test(s), as appropriate, to evaluate data quality
Step 4: Verify assumptions
Step 5: Draw conclusions about the quality of data (data report will not include interpretation of results, but will state conclusions regarding the quality of the results).

Completeness of field collection will be included here. The narrative will include a discussion of the total number of stations occupied and samples collected, as compared to the objectives in the SAP. An explanation of stations that were not occupied and samples that were not collected will be presented. A table summarizing sample site locations and number of samples collected will be provided.

If, as a result of the DQA process, it is determined that data do not satisfy all DQOs, then corrective action(s) should be recommended. Corrective actions include, but are not limited to, revision of the DQOs or collection of more information or data. It may be determined that corrective actions are not required, or the decision process may continue with the existing data, with recognition of the limitations of the data.

Investigation Site Description

This section will list and discuss specific areas that were targeted for detailed sampling and analysis during the investigation. This section will also identify specific geographical features of the study areas. If maps were produced during the investigation, these maps would be discussed in this section.

Sampling and Analysis Summary

A summary of sample station locations, sample numbers, and analytical parameters will be presented in this section. Table 4 will include the coordinates of each sampling station. Sample station locations as shown on small-scale and oversize maps will be discussed. Actual analytical results will be contained in the area-specific sections that follow. The total number of sample stations and number of samples collected will be included in this section. A statement of where samples were analyzed (i.e., individual laboratory names) and the specific analytes will be included in this section. Specific information relating to the completeness of the data set will be included in the appendices to this report.

Samples are collected following procedures detailed in the SAP, except where modifications of the sampling design or procedures were required. Sample stations may be located in cooperation and agreement with the attending U.S. Environmental Protection Agency (EPA) oversight observer. In this case, provide a *Deviations from the Sampling and Analysis Plan* section. A general statement describing the sampling approach (e.g., backhoe pits, hand-dug pits) will be included in this section. Specific details on sample collection methods for each sample type will be provided in the following sections.

Specific Area Name

If specific areas (e.g., Anaconda community, regional community) are identified for investigation in the SAP, the sampling methods and analytical results, by area, will be discussed in this section. If specific areas of investigation were not identified in the SAP, this section will be deleted from the data summary report (DSR).

Sampling Methods

Sampling methods that were used will be discussed in this section, generally citing the respective SAPs for details.

Analytical Results

Analytical results for specific areas will be presented in this section. Tables containing data for each area sampled will be included. Data summary tables for the entire investigation with the screening/enforcement assessment and qualifiers are presented in the executive summary and should not be duplicated in this section.

Calculations

The procedures used for calculations (if any) will be discussed in this section. A table listing results of the calculations will be presented. Actual calculations will be reproduced in an appendix.

Deviations from the Sampling and Analysis Plan

Standard operating procedures (SOPs) for Clark Fork River Superfund site investigations have been compiled by ARCO (ARCO 1992a) and are to be followed for all field tasks. The following deviations from the _____ Investigation SAP were noted during the field sampling event and subsequent data processing:

- List deviations.

Approval for deviations provided by EPA field oversight personnel or other EPA/Montana Department of Environmental Quality (MDEQ) personnel should be referenced and included in this section.

References

A list of all references used in the data report will be included in this section.

The following documents are referenced in this pilot data report addendum (not including appendices)

ARCO. 1992a. Clark Fork River Superfund site investigations standard operating field procedures. Draft report. ARCO, Anaconda, MT.

ARCO. 1992b. Clark Fork River Superfund site investigations data management/data validation plan. Prepared by PTI Environmental Services. Bellevue, WA. ARCO, Anaconda, MT.

ARCO. 1992c. Clark Fork River Superfund site investigations laboratory analytical protocol. Prepared by PTI Environmental Services, Bellevue, WA. ARCO, Anaconda, MT.

ARCO. 1992d. Clark Fork River Superfund site investigations quality assurance/quality control project plan. Prepared by PTI Environmental Services, Bellevue, WA. ARCO, Anaconda, MT.

ARCO. 2000. Clark Fork River Superfund site investigations data management/data validation plan addendum. Prepared by Exponent, Lake Oswego, OR. ARCO, Anaconda, MT.

U.S. EPA. 2000. Data quality objectives process for hazardous waste site investigations. EPA QA/G-4HW Final. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC.

Table 1. Data summary with enforcement and screening assessment[a]

Sample Number	Arsenic (mg/kg)	Status[b]	Cadmium (mg/kg)	Status	Copper (mg/kg)	Status	Lead (mg/kg)	Status	Zinc (mg/kg)	Status

[a] This table should include results for natural field samples only. This table should **not** include results for field replicates, field blanks, or reference materials.

The following codes for data assessment should be used in this table and footnoted:
E - enforcement
R - rejected
S - screening

Table 2. Data summary with laboratory flag and qualifier codes

Sample Number	Level A/B Assessment	Arsenic (mg/kg)	Lab Flag[a]	Qual[b]	Cadmium (mg/kg)	Lab Flag	Qual	Copper (mg/kg)	Lab Flag	Qual	Lead (mg/kg)	Lab Flag	Qual	Zinc (mg/kg)	Lab Flag	Qual

Note: This table should include results for natural samples, field replicates, and field blanks.
Footnotes for each laboratory flag and qualifier used in the table should be presented.

[a] Laboratory flag (assigned by the laboratory). Defined in U.S. EPA 1988. Contract Laboratory Program statement of work. Inorganic analysis, multi-media, multi-concentration. ILM04.0. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, NV:

- * - Laboratory duplicate results outside control limits
- + - Correlation coefficient for Method of Standard Additions (MSA) for GFAA less than 0.995
- E - Sample results qualified because of interference (graphite furnace atomic absorption [GFAA] analytical spike or inductively coupled plasma [ICP] serial dilution)
- M - Duplicate injection precision for GFAA analysis outside control limits
- N - Laboratory spike sample results outside control limits
- S - The reported value was determined by MSA
- W - Post-digestion spike for GFAA outside control limits

[b] Qualifier (Defined in U.S. EPA 1994. *Laboratory data validation: functional guidelines for evaluating inorganic analyses*. U.S. Environmental Protection Agency, Washington, DC):

- *J* - Estimated
- *R* - Rejected
- *U* - Undetected

Table 3. Sample identification

Sample Number	Sample Type[a]	Station	Sample ID	Subsample	Date	Time	Matrix	Tag Number	Analysis Type

[a] This table should include results for natural samples, field replicates, and field blanks. The type of sample (i.e., field replicate, field blank) should be included in the *sample type* column.

Table 4. Sampling coordinates

Locational Coordinates (State Plane northing/easting)	Error Associated with Horizontal Information	Error Associated with Elevation Information	Elevation	Elevation Reference	Height of Reference Above Ground	EPA Stream Reach

Attachment A

Laboratory Data Validation Checklist for Metals Analysis by ICP or GFAA

Attachment A
Laboratory Data Validation
Checklist for Metals Analysis by ICP or GFAA

Site:	Case No.:	Laboratory:
Project:	Sample Matrix:	Analyses:
Sample Dates:	Analysis Dates:	
Data Validator:	Validation Dates:	

1. Holding Times

Analyte	Matrix	Method	Holding Time*	Collection date	Analysis date	Holding time met? (Y/N)	Affected data flagged? (Y/N)

* cite reference for holding time

Were any data flagged because of holding time problems? Y____ N____

2. Instrument Calibration

Was instrument successfully calibrated at the correct frequency and with appropriate standards and blanks? Y____ N____
Was Initial Calibration Verification (ICV) performed? Y____ N____
Was ICV within control window of ___ to ___? Y____ N____
Were Continuing Calibration Verifications (CCVs) performed at the frequency of _____? Y____ N____
Were CCVs within control window of ___ to ___? Y____ N____
Describe corrective actions taken because of calibration problems _____
Were any data flagged because of calibration problems? Y____ N____

3. Blanks

Was Initial Calibration Blank (ICB) analyzed? Y____ N____
Was ICB within control window of _____? Y____ N____
Were Continuing Calibration Blanks (CCBs) analyzed at the frequency of _____? Y____ N____
Were CCBs within control window of _____? Y____ N____
Were Preparation Blanks (PB) analyzed at the frequency of _____? Y____ N____
Were PBs within control window of _____? Y____ N____
Describe corrective action taken because of blank problems _____
Were any data flagged because of blank problems? Y____ N____

4. ICP Interference Check Sample

Was ICP Interference Check Sample (ICS) analyzed at the frequency of _____? Y____ N____
Were ICS results within the control window of _____? Y____ N____
Describe corrective actions taken because of ICS results _____
Were any data flagged because of ICS problems? Y____ N____

5. Laboratory Control Sample

Was Laboratory Control Sample (LCS) analyzed at the frequency of _____? Y____ N____
What was the source of the LCS? _____
Were LCS results within the control window of _____ to _____? Y____ N____
Describe corrective actions taken because of LCS results _____
Were any data flagged because of LCS problems? Y____ N____

6. Duplicate Sample Results

Was Laboratory Duplicate Sample (LDS) analyzed at the frequency of _____? Y____ N____
Were results of LDS within the control window of _____? Y____ N____
Describe corrective actions taken because of LDS results _____
Were any data flagged because of LDS problems? Y____ N____

7. Matrix Spike Sample Results

Was Laboratory Matrix Spike Sample (LMS) analyzed at the frequency of _____? Y____ N____
Were results of LMS within the control window of _____ to ____? Y____ N____
Describe corrective actions taken because of LMS results _____
Were data flagged because of LMS problems? Y____ N____

8. ICP Serial Dilution

Was ICP Serial Dilution (SD) analyzed at the frequency of _____? Y____ N____

Were results of SD within the control window of _____? Y____ N____

Describe corrective actions taken because of SD results _____

Were any data flagged because of SD problems? Y____ N____

9. Graphite Furnace Atomic Absorption Quality Control

Was graphite furnace AA scheme followed? Y____ N____

Did duplicate injections agree within the control window of _____? Y____ N____

Were spike recoveries for PB and LCS within control windows of _____? Y____ N____

Were Method of Standard Additions (MSA) results correctly calculated, at the appropriate levels and were correlation coefficients > 0.995? Y____ N____

Were any data flagged because of GFAA problems? Y____ N____

10. Overall Assessment

Are there analytical limitations of the data that users should be aware of? Y____ N____

If so, explain: _____

11. Authorization of Data Release from the Laboratory

Laboratory Data Validator	Laboratory QA Officer/Manager
Name: _____	Name: _____
Signature:_____	Signature:_____
Date: _____	Date: _____

Attachment B

Laboratory Data Validation Checklist for Metals Analysis by Spectrace XRF

Attachment B
Laboratory Data Validation
Checklist for Metals Analysis by Spectrace XRF

Site:	Case No.:	Laboratory:
Project:	Sample Matrix:	Analyses:
Sample Dates:	Analysis Dates:	
Data Validator:	Validation Dates:	

---

1. Holding Times

Analyte	Matrix	Method	Holding Time*	Collection Date	Analysis date	Holding time met? (Y/N)	Affected data flagged? (Y/N)

* cite reference for holding time

Were any data flagged because of holding time problems? Y____ N____

2. XRF Quality Control

What sample preparation steps were performed (i.e., drying and sieving, grinding)? _____

Were the samples prepared according to the SAP? Y____ N____

Was energy calibration performed at the frequency of once per day? Y____ N____

Were initial and continuing calibrations performed at the frequency in Table 8-1 of the XRF LAP? Y____ N____

Were initial and continuing calibration results within control windows? Y____ N____

Was laboratory duplicate analysis performed at the frequency of 1 per 20? Y____ N____

Were laboratory duplicate results within control window of _____? Y____ N____

Was laboratory replicate analysis performed at the frequency of 1 per 20? Y____ N____

Were laboratory replicate results within control window of _____? Y____ N____

Was cross-contamination check sample analyzed at the frequency of 1 per 50? Y____ N____

Was cross-contamination check sample results within control window of _____? Y____ N____

Was sand blank analysis performed at the frequency of 1 per 50? Y____ N____

Was sand blank result within control window of_____? Y____ N____

Were any data flagged because of XRF analysis? Y____ N____

3. Overall Assessment

Are there analytical limitations of the data that users should be aware of? Y____ N____

If so, explain: _____

4. Authorization of Data Release from the Laboratory

Laboratory QA Officer/Manager

Name: _____

Signature: _____ Date: _____

Attachment C

Data Validation Checklist for Field Quality Control

Attachment C
Data Validation
Checklist for Field Quality Control

Site: Case No.: Laboratory:
Project: Sample Matrix: Analyses:
Sample Dates: Analysis Dates:
Data Validator: Validation Dates:

---

1. Holding Times

Analyte	Matrix	Method	Collection date	Analysis date	Affected data flagged? (Y/N)

2. Field QC Samples

Field Blanks

Were field blanks submitted as specified in the Sampling & Analysis Plan? Y____ N____
Were any data qualified because of field blank problems? Y____ N____

Field Replicates

Were field duplicates submitted as specified in the Sampling & Analysis Plan? Y____ N____
Were any data qualified because of field duplicate results? Y____ N____
Were results for field blanks within the target control limits in the CFRSSI QAPP? Y____ N____

Field Reference Materials

Were field Reference Materials or Performance Evaluation Samples submitted as specified in the Sampling & Analysis Plan? Y____ N____
Were the results within the manufacturer's control limits? Y____ N____

Attachment D

Level A/B Screening Checklist

Attachment D
Level A/B Screening Checklist

I. General Information

Site:
Project:
Client:
Sample Matrix:

II. Screening Results

Data are:
1) Unusable _____
2) Level A _____
3) Level B _____

II. Level A Screening

Criteria	Yes/No	Comments
1. Sampling date		
2. Sample team/or leader		
3. Physical description of sample location		
4. Sample depth (soils)		
5. Sample collection technique		
6. Field preparation technique		
7. Sample preservation technique		
8. Sample shipping records		

II. Level B Screening

Criteria	Yes/No	Comments
1. Field instrumentation methods and standardization complete		
2. Sample container preparation		
3. Collection of field replicates (1/20 minimum)		
4. Proper and decontaminated sampling equipment		
5. Field custody documentation		
6. Shipping custody documentation		
7. Traceable sample designation number		
8. Field notebook(s), custody records in secure repository		
9. Completed field forms		

Appendix A

Quality Assurance and Quality Control Review of Inorganic Data for _____ Investigation

Quality Assurance and Quality Control Review of Inorganic Data for _____ Investigation

A summary of the samples collected for this investigation is included in Table A-1. The analytical protocols used to obtain the inorganic metals data during the _____ Investigation included x-ray fluorescence (XRF) (Spectrace®), inductively coupled plasma atomic emission spectrometry (ICP), and graphite furnace atomic absorption spectrometry (GFAA) methods. The quality of the inorganic data is summarized in the paragraph below and discussed in this report and attachments.

Enforcement and Screening Quality Assessment

Enforcement quality data are supported by rigorous sampling and analysis procedures, quality assurance and quality control (QA/QC) protocols, and documentation requirements. Enforcement quality data include data that meet the Level A and B criteria (Attachment D) and are not qualified as estimated during the data validation process. In addition to the Level A/B assessment, the data are reviewed for qualifiers. Data that meet the Level A and B criteria and are free of qualifiers are assessed as enforcement quality. Of the _____ total data points for metals, _____ percent are qualified because of duplicate results, and _____ percent are qualified because of matrix spike results. _____results for this investigation are rejected. The analytical data and the enforcement and screening assessment will be presented in Table 1 in the main text of the report. Sample number codes and sampling coordinates at each station will also be identified in Tables 2–4 in the main body of the report.

Quality Assurance and Quality Control Review of Inorganic Data

Data validation checklists were completed by the laboratory(ies) for the _____ Investigation. The completed checklists are included in Attachment A. Laboratory flags and data validation qualifiers were assigned to selected results. Laboratory data flags and qualifiers are listed in Table A-2. This section should include a brief summary of the laboratory quality control results and results that were qualified during data validation.

Field Quality Control Samples

The frequency of field quality control as outlined in the quality assurance project plan (QAPP) (ARCO 1992c) and _____ Investigation sampling and analysis plan (SAP) will be discussed in this section. If sample results are qualified because of field quality

control results, a list or table of affected samples will be included in the appropriate field quality control section.

Field Blank Results

Results of bottle blanks, external contamination blanks, and cross-contamination blanks will be discussed in this section. The results will be summarized in Table A-3.

Field Replicate Results

Field replicates are used to assess field and laboratory precision. The field replicate results will be discussed in this section and presented in Table A-3.

Reference Material Results

The source of the standard reference material (SRM) will be identified and the frequency of analyses will be discussed in this section. Results of the SRM will be discussed in this section and also summarized in Table A-3.

Table A-1. Summary of _____ Investigation natural samples

Area	Total Samples	Analytical Parameters
Lower Works structural area		Total arsenic, copper, lead, zinc; soil slurry pH and conductivity
Upper Works structural area		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity
Hillside flue		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity
Waste piles		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity
Heap roast slag piles		Total arsenic, cadmium, copper, lead, zinc; soil slurry pH and conductivity
Red Sands area		Total arsenic, cadmium, copper, lead, zinc
Heap roast slag piles		Total arsenic, cadmium, copper, lead, zinc
Tailing ponds		Total arsenic, cadmium, copper, lead, zinc; EP Tox extraction for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, nitrate-nitrogen; soil slurry pH and conductivity
Total		

Table A-2. Definitions of data flags and qualifiers for inorganic data

Type	Description	Value
Laboratory Flag[a]		
N	Laboratory spike sample results outside control limits	--
*	Laboratory duplicate results outside control limits	--
E	Sample results qualified because of interference (graphite furnace atomic absorption [GFAA] analytical spike or inductively coupled plasma [ICP] serial dilution	--
M	Duplicate injection precision for GFAA analysis outside control limits	--
W	Post-digestion spike for GFAA outside control limits	--
+	Correlation coefficient for Method of Standard Additions (MSA) for GFAA less than 0.995	--
S	The reported value was determined by MSA	--
Qualifier		
R [b]	Rejected	--
U [b]	Undetected	--
J [b]	Estimated	--

[a] Defined in U.S. EPA 1988. *Contract Laboratory Program statement of work. Inorganic analysis, multi-media, multi-concentration*. ILM04.0. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laborator, Las Vegas, NV. (Flags are assigned by the laboratory).

[b] Defined in U.S. EPA 1994. *Laboratory data validation: functional guidelines for evaluating inorganic analyses.* U.S. Environmental Protection Agency, Washington, DC.

Table A-3. Field quality control sample results

	Reference Material[a]			Field Blank		Field Duplicate				
Analyte	True Value[a] (mg/kg)	Sample No.	%R[b]	Sample No.	Concentration (mg/kg)	Sample No.	Concentration (mg/kg)	Sample No.	Concentration (mg/kg)	RPD[c]
Arsenic										
Cadmium										
Copper										
Lead										
Zinc										

Note: RPD - relative percent difference

[a] Source is _____.

[b] %R - percent recovery $= \frac{\text{found}}{\text{true}} \times 100.$

[c] RPD $= \left| \frac{\text{sample-duplicate}}{\text{mean}} \right| \times 100.$

200.061

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 301 S. PARK, DRAWER 10096
HELENA, MONTANA 59626-0096

February 15, 2000

Ref: 8MO

Ms. Robin Bullock
ARCO
307 East Park Street, Suite 400
Anaconda, Montana 59711

Subject: Data Quality Issues for Clark Fork River Superfund Sites.

Dear Robin:

In my last correspondence to you on the matter of data quality (letter of January 14, 1999), I indicated EPA would prepare draft addenda to the Clark Fork Site Superfund Investigation (CFRSSI) documents addressing post-ROD data quality requirements. The Agency reaffirms our commitment of placing the same level of importance on many data collected after the ROD as we do "enforcement quality data" collected in support of remedial investigations, risk assessments, and feasibility studies. In your letter of July 23, 1998, ARCO suggested three approaches to post-RI data quality assessment, and the Agency in general accepted the first approach which is the continued use of the CFRSSI procedures. In attachments to this correspondence, the Agency will suggest changes to these procedures that will simplify the validation process, but still provide mechanisms to assure that remedial decision making in the post-ROD context is based on solid data of known and acceptable quality. An issue that was not addressed by this addenda that EPA and ARCO may also want to address is the language contained in the statement of authenticity previously agreed upon.

After ARCO's consideration of this proposal, I suggest a meeting between interested parties in order to implement these time saving changes. Please feel free to provide your reaction to this addenda to Mike Bishop (406) 441- 1150, X248, of my staff.

Sincerely,

Robert L. Fox
Superfund Branch Chief

cc: Mike Bishop,8MO
Charles Coleman, 8MO
Henry Elsen, 8MO
Tom Brooks, 8MO
Kevin Kirley, DEQ
Dennis Neuman, MSU

Addenda to Clark Fork River Superfund Site Investigations
1. Sampling and Analysis Plans
2. Data Management/Data Validation Plan
3. Data Pilot Report

February, 2000

National EPA QA/QC Guidance

Since the Clark Fork River Superfund Site Investigation Documents were written in the early 1990s, EPA has developed many policy and guidance documents (see Appendix 3 to this Attachment) that address QA/QC programs. Most recently, EPA Order 5360.1 CHG 1, *Policy and Program Requirements for the Mandatory Agency-wide Quality System* provides requirements for the conduct of quality management practices, including quality assurance (QA) and quality control(QC), for all environmental data collection and environmental technology programs performed by or for EPA. The primary goal of the Agency-wide Quality System is to ensure that environmental programs and decisions are supported by data of the type and quality needed and expected for their intended use, and that decisions involving the design, construction, and operation of environmental technology are supported by appropriate quality assured engineering standards and practices. The Agency is placing more emphasis on the Data Quality Object process. In 1993 EPA developed and implemented (see *Data Quality Objectives Process for Superfund: Interim Final Guidance*, EPA/540/G-93/071) a mandatory Agency-wide program of quality assurance for environmental data, including a process for developing Data Quality Objectives (DQOs), as an important tool for project managers and planners to determine the type, quantity, and quality of data needed to make defensible decisions. This tool has been refined and enhanced as presented in *Guidance for the Data Quality Objectives Process, EPA QA/G-4,* EPA/600/R-96/055.

Agency QA/QC Needs for Clark Fork River Basin Superfund Sites

The Quality System needs to fulfill the following Agency's mandate for data and information generated within the Basin's Superfund Sites in the following areas: 1]. The System needs to be compliant with National EPA QA/QC guidance. 2]. It needs to assure that Remedial Project Managers and other decision makers have the ability to make decisions based on empirical information of known quality. 3]. The Agency needs to be confident that data are authentic and accurate and that agency can formally attest to their authenticity and accuracy. 4]. The System must allow the agency to be able to construct a paper trail in the Administrative Record that demonstrates the rationale supporting decision making. 5]. The System must have the ability to track the quality of data wherever it is archived.

Clark Fork River Superfund Site Investigation Documents

In the early to mid 1990s the Environmental Protection Agency (EPA) and Atlantic Richfield Company (ARCO) agreed to use a set of protocols that would guide the design of sample collection, actual field procedures for sample collection, analytical procedures, validation methods, and reporting requirements for information being collected for Superfund sites within the Clark Fork River Basin. These protocols are still in effect and are embodied in the following documents:

- Clark Fork River Superfund Site Investigations, Laboratory Analytical Protocol, prepared for ARCO by PTI Environmental Services, Bellevue, WA, April 1992.

- Clark Fork River Superfund Site Investigations, Quality Assurance Project Plan, prepared for ARCO by PTI environmental Services, Bellevue, WA, May 1992.

- Clark Fork River Superfund Site Investigations, Laboratory Analytical Procedure for X-Ray Fluorescence Analysis of Solid Media; 1. Laboratory grade instrumentation method, prepared for ARCO by Ashe Analytics, Butte, MT, 1995.

- Clark Fork River Superfund Site Investigations, Standard Operating Procedures, compiled for ARCO by Canonie Environmental Services, Englewood, CO, September, 1992.

- Clark Fork River Superfund Site Investigations, Data Management/Data Validation Plan, prepared for ARCO by PTI Environmental Services, Lake Oswego, OR, (Revision 2), Mat 1992. [note: Level A/B criteria were revised per agreement between EPA and ARCO and added to Data Management/Data Validation Plan on August 23, 1993].

- Clark Fork River Superfund Site Investigations, Data Pilot Report for Organic and Inorganic Data, prepared for ARCO, 1993.

In 1996 ARCO proposed (letter from Bullock to Fox March 19, 1996) deletion of certain field quality control samples. The Agencies agreed and this change was an addendum to the Quality Assurance Project Plan.

Clark Fork River Data Development/Management Objectives

In the Clark Fork River Superfund Site Investigations *Data Management/Data Validation Plan* (ARCO 1992) the following steps are required to "develop a reliable data system that integrates data from several sources and supports data development/management objectives. . . ." The following statements are found on page 1-2 (*Data Management/Data Validation Plan* (ARCO 1992)).

- DQOs must be established.
- Data must be collected and analyzed according to a consistent set of criteria.
- Data must be reported in proper units, validated and properly qualified , and assessed.

- Data usability must be determined.
- Data must be properly identified, entered into a data system, and verified.
- Data values must belong to explicitly defined domains (data system integrity must be maintained).

These objectives are generally in alignment with Current National EPA Guidance. They also describe a Quality System that has been found to work for RI/FS activities conducted at the Superfund Sites in the Clark Fork River Basin. The usability of these documents in the post-ROD environment is of primary importance. The following enhancements to the Clark Fork Quality System are suggested to strengthen the System, to make it more compatible with National QA/QC guidance, and to make it more useful for Post-ROD decision making.

Suggested Changes to Clark Fork River Superfund Site Investigation Documents

Changes to Sampling and Analysis Plans

For every sampling and analysis activity, a set of Data Quality Objectives is to be written in the Sampling and Analysis Plan, and reviewed by Agency personnel. These DQOs are to be consistent with current EPA guidance as found in *Guidance for the Data Quality Objective Process. EPA QA/G-4.* EPA/600/R-96/055, September 1994, US EPA Office of Research and Development, Washington, DC. For any data to be generated the DQO process is to be followed:

Step 1. State the Problem
Step 2. Identify the Decision
Step 3. Identify Inputs to the Decision
Step 4. Define the Study Boundaries
Step 5. Develop a Decision Rule
Step 6. Specify Tolerable Limits on Decision Errors
Step 7. Optimize the Design

For each identified data set defined in the DQO process in the SAP, the level of quality required to support decision making is to be identified using CFRSSI definitions (see page 1-8 and 1-9 of *Data Management/Data Validation Plan* (ARCO 1992)). Critical data need to be of enforcement quality, while other lesser important data may be of screening quality. Rationale in the SAP is to be presented and reviewed by the agency that defines data quality needs as either Enforcement for critical data, or Screening for less important data. Agreement between the Agency and ARCO regarding which data are intended to support critical decisions, and which data are required to support lower level decisions is to be reached prior to sample collection and analysis. To help distinguish quality needs the following statements are to be used as guidelines:

"Enforcement Quality (Unrestricted Use) Data are required to support critical decisions being made as part of a Superfund project that may be disputed in a legal context." (*Data Management/Data Validation Plan* (ARCO 1992)).

"EPA places the same level of importance on many data collected after the ROD as we do to "enforcement quality data" data collected in support of remedial investigations, risk assessments, and feasibility studies." (*Fox to Bullock 1-14-99*).

" . . . . where a decision milestone must be well supported, enforcement quality data are appropriate regardless of what stage of the Superfund process you are in (pre or post ROD)." (*Fox to Bullock 1-14-99*).

Uses for Enforcement Quality Data as defined in *Data Management/Data Validation Plan* (ARCO 1992) are for site characterization, health & safety, engineering evaluation/cost analysis, Remedial Investigations/Feasibility Studies, evaluation of alternatives, confirmational purposes, Risk Assessments, and engineering designs.

Uses for Enforcement Quality Data as defined in *Fox to Bullock (1-14-99*) also include proof of concept, assessing remedy success, and enforcement actions.

The definition of Enforcement Quality Data is as follows:

> "Enforcement quality data include data following rigerous sampling and analysis procedures which either 1) are not qualified during the data validatrion process; or 2) are qualified or do not meet Level A/B criteria, but for which justification for cathgorization as enforcement quality is provided in the administrative record (A qualified data.)." (see page 1-8 of (*Data Management/Data Validation Plan* (ARCO 1992)).

The definition of Screening Quality (Restricted Use) Data is as follows:

> Screening Quality (Restricted Use) Data result ". . . from less rigorous sampling and analysis procedures that enforcement quality data, qualified data that have not been justified for use as enforcement quality, or data lacking Level B documentation." (*Data Management/Data Validation Plan* (ARCO 1992)).

It should be noted that the QA/QC elements described in the Pilot Data Report, the Appendix 1 assessment and the modified Level A/B are to be included in the planning, collection, analysis and evaluation of Screening Quality Data. The Screening Quality Data definition noted above, including,"qualified data", and "data lacking level B documentation" are not intended to mean that QA/QC requirements are to be ignored.

Uses of Screening Quality Data as defined in *Data Management/Data Validation Plan* (ARCO 1992) are for site characterization, presence or absence of contaminants, developing/refining sampling and analysis techniques, determining relative concentrations, scoping and planning for future studies, engineering studies and engineering designs, and monitoring during implementation.

Uses of Screening Quality Data as defined in *Fox to Bullock (1-14-99)* also include laboratory/bench-scale work (up to final proof of concept) and other data collections on a case by case basis as defined in the DQOs in the SAP document.

Examples of the need for enforcement quality data for final proof of concept could include:

- The final data set provided to the Agency at the conclusion of a sequence of bench-scale waste- chemical stabilization treatment batches to optimize long term efficacy of the reduction in mobility of the contaminants in order to meet project goals;
- During the course of remediation, real- time data may be collected using surrogate indicator parameters (e.g., pH, screening X-ray fluorescence procedures, etc.) in order to keep field work progressing. The final data set that would be used to demonstrate the remedy has been appropriately completed should be enforcement quality data.

The definition of Unusable Quality Data is as follows:

> "These are data resulting from inadequate or faulty sampling and analysis procedures or data which have been critically reduced in quality due to extreme lack of adherence to QA/QC procedures and/or lack of Level A requirements. These data are not usable for Superfund-related activities." (*Data Management/Data Validation Plan* (ARCO 1992)).

Addenda to CFRSSI Data Management/Data Validation Plan

The basic approach to data validation is presented on page 1-4 of the *CFRSSI Data Management/Data Validation Plan, revision 2* (ARCO 1992). The objective of the data validation program (page 1-5) of the *CFRSSI DM/DV Plan* is " . . . to provide a standardized framework for conducting reviews of analytical data to ensure compliance with the method and QA/QC provisions of the LAP [Laboratory Analytical Protocol] and QAPP [Quality Assurance Project Plan]". The *CFRSSI DM/DV Plan* describes a sophisticated system to assess data in terms of analytical QA/QC compliance and to add data descriptors to analytical values that fall outside specific control windows. This sophisticated system resulted in third-party validation of data. It is suggested that a simplified validation system be implemented as an addenda to the *DM/DV Plan*. The suggested changes are described as follows:

- The analytical laboratory that generates the data is responsible for validation. A simplified validation checklist applicable to the determination of inorganics is suggested as the instrument by which the laboratory can display the results of this validation effort. The checklist is shown as Appendix 1. Validation will include the assignment of laboratory flags, data descriptors, and the assignment of enforcement "E", screening "S", and rejected "R" codes to data values, as appropriate.
- ARCO will be required to affirm to the Agencies that the analytical laboratory will comply with all requirements of the *CFRSSI* documents pertaining to the generation of

and validation of data intended to satisfy data quality objectives of the analytical part of the SAP.

- ARCO will be required to affirm to the Agencies that the laboratory will conduct validation using personnel that meet the requirements for validators as provided on page 3-13 of the *CFRSSI DM/DV Plan.*
- ARCO will be required to demonstrate by contract provision that the laboratory will authorize release of validated data by signature of the laboratory validator and the laboratory QA officer or manager.
- ARCO will be required to demonstrate by contract provision that the laboratory will maintain analytical records in such a manner that an independent audit by EPA is possible.

In addition to suggested change outlined above, it is also suggested that the assessment of Level A/B criteria be simplified and to be conducted by the analytical facility. The Level A/B criteria are stipulated in Appendices to the *CFRSSI DM/DV Plan* and were modified and approved (*letter form Fox to Stash, August 23, 1993*) as an addenda to the *DM/DV Plan.* A simplified checklist (Appendix 2) is suggested as the instrument by which the laboratory can display the results of Level A/B data assessment. It is ARCO's responsibility to ensure that the laboratory validator has all pertinent information and data required to complete the validation process. This includes, but may not be limited to a copy of the Sampling & Analysis Plan, field logs and completed forms, field data, identification of field QC samples, chain-of custody information, and other knowledge required to complete both Level A/B assessments and to validate data.

In the *Data Management/Data Validation Plan* (ARCO 1992) on page 1-7 it is stated that:

> "Following laboratory data validation and Level A/B review, data are assessed to determine the use of the data with respect to the project DQOs".

This assessment process is to be strengthened by using the Data Quality Assessment (DQA) protocols found in *Guidance for the Data Quality Objectives Process, EPA QA/G-4,* and in *Guidance for Data Quality Assessment; Practical methods for data quality assessment, EPA QA/G-9.* The DQA is a determination of whether the DQOs have been satisfied. This is to be accomplished and reported in a formal way in the Data Summary Report (see next section). The DQA involves the application of statistical tools (statistical tools may not always be applicable to certain DQOs) to determine whether the data meet the assumptions under which the DQOs and data collection design were developed, and whether the total error in the data is small enough to allow the decision maker to use the data to support the decision within tolerances set by the decision maker. The DQA process includes the following steps:

Step 1. Review DQOs and sampling design
Step 2. Conduct preliminary data review
Step 3. Select statistical test(s) - as appropriate
Step 4. Verify assumptions
Step 5. Draw conclusions from the data

Changes to Data Summary Reports

Data Summary Reports are to be prepared for all sampling and analysis activities according to the established *Clark Fork River Superfund Site Pilot Data Report for Organic and Inorganic Data* (ARCO 1993). Several changes to this document are suggested. The following elements are contained in the *Pilot Data Report* and would be modified as stated. Under the modified system, not all of the QA/QC related data and information would be reported: however all QA/QC data and information would be maintained by ARCO and EPA would therefore be able to audit this information as appropriate.

Section of Pilot Data Report	Suggested Modifications
TEXT SECTIONS	
Statement of Authenticity	Retain:(Possible update per this addenda)
Executive Summary	Retain
Table 1 - Data Summary with Enforcement, Screening, and Rejected Codes	Retain
Table 2 - Data Summary with Laboratory Qualifiers and Descriptor Codes	Retain
Table 3 - Sample Identification	Retain
Introduction	Retain
Objectives	Retain, and rename as "Investigation Objectives"

Data Quality Objectives and Data Quality Assessment	New Section. The DQOs from the SAP document are to be restated and the results of the DQAs are to be reported. The DQA five step process (Step 1.Review DQOs and sampling design, Step 2.Conduct preliminary data review, Step 3.Select statistical test(s) - as appropriate, Step 4.Verify assumptions, and Step 5.Draw conclusions from the data) is to be followed. If data are found to be lacking in terms of not satisfying DQOs, then corrective action(s) may be suggested. These corrective actions may include, but are not limited to the following: collect more information or data, collect data of higher quality, make changes to the DQOs, or continue decision process recognizing the limitations of the data.
Background	Retain. Simplify by citing existing documents
Investigation Site Description	Retain
Sampling and Analysis Summary	Retain
Table 4 - Sampling Coordinates	Retain
Previous Investigations	Retain. Simplify by citing existing data and information.
Data Quality Objectives	This section was moved as presented above.
Specific Area Name	Retain
Volume Calculations	Retain. Rename as appropriate to reflect type of calculations that may be made.
Deviations from Sampling and Analysis Plan	Retain
Completeness	Retain
References	Retain
APPENDIX A - INORGANIC DATA QA/QC REVIEW	
QA/QC Review of Inorganic Data for (Study Name) Investigation	Retain

Executive Summary	Retain
QA/QC Review of CLP Program for Inorganic Data	Retain. Rename "QA/QC Review of Inorganic Data"
Summary of CLP Data	Retain. Rename "Summary of Laboratory Inorganic Data"
Level A/B Criteria	Retain. Require only checklist as shown in Appendix 2 to this Attachment
Table A-1 Summary of ____ Investigation Natural Samples	Retain
Table A-2 Definitions of Data Flags, Qualifiers, and Descriptors for Inorganic Data	Retain
Justification	Retain
Sample Set	Retain
Completeness	Retain
Analytical Methods	Retain
Sample Digestion Group	Delete.
Table A-3	Delete
Table A- 4	Delete
LABORATORY DATA VALIDATION FOR INORGANIC DATA	
Data Validation	Delete. Use Checklist in Appendix 1
CLP QA/QC	Delete. Use Checklist in Appendix 1
Holding Times	Delete. Use Checklist in Appendix 1
Calibration	Delete. Use Checklist in Appendix 1
Blanks	Delete. Use Checklist in Appendix 1
Table A - 5	Delete.
ICP Interference Checks	Delete. Use Checklist in Appendix 1
Laboratory Control Sample	Delete. Use Checklist in Appendix 1
Duplicate Sample Result	Delete. Use Checklist in Appendix 1
Matrix Spike Sample Result	Delete. Use Checklist in Appendix 1

ICP Serial Dilution	Delete. Use Checklist in Appendix 1
Table A-6	Delete
Table A-7	Delete
Table A-8	Delete
Table A-9	Delete
GFAA QC	Delete. Use Checklist in Appendix 1
FIELD QUALITY CONTROL FOR INORGANIC DATA	
Field Blank Results	Retain. Delete bottle blank as per previous addenda
Field Replicate Results	Retain
Reference Material Results	Retain
Interlaboratory Comparison	Delete. Interlaboratory comparisons are not required as per previous addenda
Table A-10 Field Blank Results	Combine into one table
Table A- 11Field Replicate Results	
Table A- 12 Reference Materials	
Table A-13	Delete
QA/QC REVIEW OF XRF (SPECTRACE) INORGANIC DATA This section of the Pilot Data Report needs to be rewritten to be consistent with the current XRF Laboratory Analytical Protocol (Ashe Analytics 1995).	
APPENDIX B - ORGANIC DATA QA/QC Addenda to this Appendix are not suggested at this time	
APPENDIX C - CLARK FORK DATA MANAGEMENT SYSTEM DATA This Appendix is to be retained	

APPENDIX 1

Inorganic Data
Laboratory Data Validation
Quality Assurance/Quality Control Review

Inorganic Data
Laboratory Data Validation
Quality Assurance/Quality Control Review

Site:	Case No.:	Laboratory:
Project:	Sample Matrix:	Analyses:
Sample Dates:	Analysis Dates:	
Data Validator:	Validation Dates:	

---

1. Holding Times

Analyte	Matrix	Holding Time*	Collection date	Analysis date	Holding time met? (Y/N)	Affected data flagged? (Y/N)	CFRSSI descriptor added? (Y/N)

* cite reference for holding time

Were any data flagged because of holding time problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

2. Instrument Calibration

Was instrument successfully calibrated at the correct frequency and with appropriate standards and blanks? Y___ N___
Was Initial Calibration Verification (ICV) performed? Y___ N___
Was ICV within control window of ___ to ___? Y___ N___
Were Continuing Calibration Verifications (CCVs) performed at the frequency of _____? Y___ N___
Were CCVs within control window of ___ to ___? Y___ N___
Describe corrective actions taken because of calibration problems _____
Were any data flagged because of calibration problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

3. Blanks

Was Initial Calibration Blank (ICB) analyzed? Y___ N___
Was ICB within control window of _____? Y___ N___
Were Continuing Calibration Blanks (CCBs) analyzed at the frequency of _____? Y___ N___
Were CCBs within control window of _____? Y___ N___
Were Preparation Blanks (PB) analyzed at the frequency of _____? Y___ N___
Were PBs within control window of _____? Y___ N___
Describe corrective action taken because of blank problems _____
Were any data flagged because of blank problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

4. ICP Interference Check Sample

Was ICP Interference Check Sample (ICS) analyzed at the frequency of _____? Y___ N___
Were ICS results within the control window of _____? Y___ N___
Describe corrective actions taken because of ICS results _____
Were any data flagged because of ICS problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

5. Laboratory Control Sample

Was Laboratory Control Sample (LCS) analyzed at the frequency of _____? Y___ N___
What was the source of the LCS? _____
Were LCS results within the control window of _____ to _____? Y___ N___
Describe corrective actions taken because of LCS results _____
Were any data flagged because of LCS problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

6. Duplicate Sample Results

Was Laboratory Duplicate Sample (LDS) analyzed at the frequency of _____? Y___ N___
Were results of LDS within the control window of _____? Y___ N___

Describe corrective actions taken because of LDS results _____
Were any data flagged because of LDS problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

7. Matrix Spike Sample Results

Was Laboratory Matrix Spike Sample (LMS) analyzed at the frequency of _____? Y___ N___
Were results of LMS within the control window of _____ to ____? Y___ N___
Describe corrective actions taken because of LMS results _____
Were data flagged because of LMS problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

8. ICP Serial Dilution

Was ICP Serial Dilution (SD) analyzed at the frequency of _____? Y___ N___
Were results of SD within the control window of _____? Y___ N___
Describe corrective actions taken because of SD results _____
Were any data flagged because of SD problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

9. Graphite Furnace Atomic Absorption Quality Control

Was graphite furnace AA scheme followed? Y___ N___
Did duplicate injections agree within the control window of ____? Y___ N___
Were spike recoveries for PB and LCS within control windows of _____? Y___ N___
Were Method of Standard Additions (MSA) results correctly calculated, at the appropriate levels and were correlation coefficients < 0.995? Y___ N___
Were any data flagged because of GFAA problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

10. XRF Quality Control

Was energy calibration performed at the frequency of ____? Y___ N___
Were initial and continuing calibrations (SRMs) performed at the frequency of _____? Y___ N___
Were initial and continuing calibrations (SRMs) results within control windows? Y___ N___
Was laboratory duplicate analysis performed at the frequency of ____? Y___ N___
Were laboratory duplicate results within control window of _____? Y___ N___
Was laboratory replicate analysis performed at the frequency of ____? Y___ N___
Were laboratory replicate results within control window of _____? Y___ N___
Was cross-contamination check sample analyzed at the frequency of _____? Y___ N___
Was cross-contamination check sample results within control window of _____? Y___ N___
Was sand blank analysis performed at the frequency of ____? Y___ N___
Was sand blank result within control window of_____? Y___ N___
Were any data flagged because of XRF problems? Y___ N___
Were CFR SSI descriptor/value added to any affected data? Y___ N___

11. Field QC Samples

Field Blanks

Were field blanks submitted as specified in the Sampling & Analysis Plan? Y___ N___
Were results for field blanks within controls windows of _____? Y___ N___
Were any data flagged because of field blank problems? Y___ N___

Field Duplicates

Were field duplicates submitted as specified in the Sampling & Analysis Plan? Y___ N___

Field Standards

Were field standards (Standard Reference Materials or Performance Evaluation Samples) submitted as specified in the Sampling & Analysis Plan? Y___ N___

12. Overall Assessment

Are there analytical limitations of the data that users should be aware of? Y___ N___
If so, explain: _____

13. Authorization of Data Release from the Laboratory

Laboratory Data Validator

Name: _____

Signature: _____

Laboratory QA Officer/Manager

Name: _____

Signature: _____

Date: _____ Date: _____

APPENDIX 2

LEVEL A/B Criteria Checklist

Level A/B Screening

I. General Information

Site:
Project:
Client:
Samplers:
Sample Matrix:
Sampling Date(s):

Laboratory:
Case No.:
Analyses:
Analyses Date(s):
Reviewer:
Screening Date(s):

II. Screening Results

Data are:
1) Unusable ---------
2) Level A _____
3) Level B _____

III. Level A Screening

Criteria	Complete	Missing	Not Applicable	Comment
1. Sampling date				
2. Sample team/or leader				
3. Physical description of sample location				
4. Sample depth (soils)				
5. Sample collection technique				
6. Field preparation technique				
7. Sample preservation technique				
8. Sample shipping records				
9. Laboratory analysis data				

IV. Level B Screening

Criteria	Complete	Missing	Not Applicable	Comment
1. Field instrumentation methods and standardization				
2. Sample container preparation				
3. Laboratory methods reference				
4. Analysis of field replicates (1/20 minimum)				
5. Field custody documentation				
6. Shipping custody documentation				
7. Laboratory custody documentation				
8. Designated lab sample custodian				
9. Traceable sample designation number				
10. Field notebook(s), custody records in secure repository				
11. Completed forms				
12. Field/lab compatibility of measurements				
13. Analytical holding times				
14. Proper and decontaminated sampling equipment				
15. Sample storage in laboratory				

Reviewer Signature: _____
QA Officer/Manager Signature: _____

APPENDIX 3

Current EPA Quality Assurance/Quality Control Documents