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Draft Residential Metals Abatement Program Quality Assurance Project Plan (Non-Residential Parcels - Indoor Dust)

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Atlantic Richfield Company and Butte-Silver Bow County

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Atlantic Richfield Company and Butte-Silver Bow County

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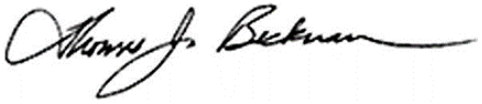

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Acronyms and Abbreviations

Name	Description
Agencies	U.S. Environmental Protection Agency and Montana Department of Environmental Quality
AR	Atlantic Richfield Company
BPSOU	Butte Priority Soils Operable Unit
BSB	Butte-Silver Bow
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFRSSI	Clark Fork River Superfund Site Investigation
COC	constituents of concern
DEQ	Montana Department of Environmental Quality
DM/DV	Data Management/Data Validation
DSR	Data Summary Report
DQA	Data Quality Assessment
DQO	Data Quality Objective
EDD	electronic data deliverable
GPS	Global Positioning System
HAZWOPER	hazardous waste operations and emergency response
HEPA	high-efficiency particulate air
HVS3	high-volume small surface sampler
ICP-MS	inductively coupled plasma mass spectrometry
LCS	laboratory control sample
MDL	method detection limit
mg/kg	milligrams per kilogram
MS	matrix spike
MSD	matrix spike duplicate
LMS	laboratory matrix spike
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
Program	Butte-Silver Bow County Multi-Pathway Residential Metals Abatement Program
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RL	reporting limit

RMAP	Residential Metals Abatement Program
ROD	Record of Decision
RPD	relative percent difference
SDG	Sample Delivery Group
SOP	standard operating procedure
USEPA	U.S. Environmental Protection Agency
XRF	x-ray fluorescence

APPROVAL PAGE

Butte Priority Soils Operable Unit Residential Metals Abatement Program Quality Assurance Project Plan (Non-Residential Parcels – Indoor Dust)

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The Quality Assurance Project Plan is effective on date of approval.

DISTRIBUTION LIST

Butte Priority Soils Operable Unit Residential Metals Abatement Program Quality Assurance Project Plan (Non-Residential Parcels – Indoor Dust)

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1. INTRODUCTION

The Butte-Silver Bow County (BSB) Multi-Pathway Residential Metals Abatement Program (RMAP) (BSB and Atlantic Richfield 2020) (hereafter referred to as the Program or the RMAP) is designed to mitigate exposure of residents of the Butte Priority Soils Operable Unit (BPSOU), the larger Butte community as a whole, as well as rural residential development within the Silver Bow Creek/Butte Area Superfund Site to sources of arsenic, lead, and mercury contamination. The current Program boundary (depicted as the 2020 RMAP Area Boundary) is shown on Figure 1.

The contamination may originate from both mining-related (waste rock, tailings, aerial emissions) and non-mining-related sources. The Program uses remediation and abatement of contaminated properties, and community awareness and education to ensure its effectiveness.

The Program requires systematic sampling of residential yard soil and interior dust within the BPSOU. Presently, no interior dust data for schools is available. For areas outside of BPSOU, but within the 2020 RMAP Area Boundary (Figure 1), the Program also requires systematic sampling of playground and play areas (e.g., schools and parks). Interior assessments and sampling of interior dust in non-residential schools, preschools, and non-residential daycares (see Figure 2) will be addressed in this Quality Assurance Project Plan (QAPP). A separate QAPP addresses external soil sampling of non-residential parcels (schools, parks, non-residential daycares) that fall under the RMAP umbrella. Additionally, a separate QAPP addresses the assessment of residential RMAP parcels/properties.

The Program contains additional institutional control measures regarding education, outreach, and tracking programs related to remedial activities at residential properties, as further described in the BPSOU *Institutional Controls Implementation and Assurance Plan (ICIAP)* (Atlantic Richfield 2019a).

1.1 Purpose

The *BPSOU Quality Management Plan (QMP)* (Atlantic Richfield 2016) provides guidance to ensure quality environmental data collected for the BPSOU meet requirements mandated by the U.S. Environmental Protection Agency (USEPA). The purpose of this QAPP is to provide guidance for future RMAP indoor sampling and analyses of non-residential properties (e.g., schools, preschools, and non-residential daycares) and to describe the quality assurance/quality control (QA/QC) policies and procedures to be used during these efforts. This QAPP functions as the RMAP sampling and analysis plan for all future non-residential sampling activities. A separate QAPP has been developed to address residential BPSOU RMAP parcels (including residential daycares and commercial properties containing living space).

This QAPP includes standard recognized elements referenced in the *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5* (USEPA 2001); the *Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G4* (USEPA 2006a); and the *EPA Region 8 QA Document Review Crosswalk* checklist (USEPA 2017) provided in Appendix A. This QAPP includes the following four key elements:

- Program management and organization (Section 2)
- Measurement and data acquisition (Section 3)
- Assessment and oversight (Section 4)
- Data review and usability (Section 5)

The sections below provide the project elements and include details for planning, sampling, and analyses within the Program areas. Sections in this QAPP expand on or reference information in other site-wide documents and present project-specific requirements.

2. PROGRAM MANAGEMENT AND ORGANIZATION

This section addresses Program and project administrative functions as well as project background, objectives, and documentation requirements for sampling and analyses activities on each project site within the Program area. Figure 3 summarizes the project personnel involved in the planning, approval, and implementation of this QAPP. Project personnel roles are described below. Responsibilities of personnel in each of these roles are described below.

2.1 Agency Oversight

The USEPA and Montana Department of Environmental Quality (DEQ) (the Agencies) are responsible for project oversight, review, and approval of all Program-generated sampling data and subsequent site-specific remediation plans. The USEPA or a USEPA contractor will provide oversight during site reconnaissance and sampling activities. The USEPA Remedial Project Manager is Nikia Greene and the DEQ Project Officer is Daryl Reed.

The Agencies also review sampling results above action levels listed in Table 1, and project completion reports.

2.2 Atlantic Richfield Company

Atlantic Richfield Company (Atlantic Richfield) provides Program funding through an Allocation Agreement between BSB and Atlantic Richfield. The Atlantic Richfield Liability Manager, Mike Mc Anulty, must authorize all reclamation activities under the Program. An Atlantic Richfield project representative, or designated alternate, may complete a site walkthrough and assist with site-specific work plan approval of all reclamation projects prior to implementation.

At this time, it is anticipated that Atlantic Richfield will elect to self-perform portions of the RMAP sampling and analyses work in consultation with BSB representatives.

2.3 Butte-Silver Bow County Department of Reclamation and Environmental Services

BSB is responsible for supporting the indoor dust investigation effort at schools and daycares, maintaining Program data, and supporting any future abatement activities. Key individuals comprising the BSB County Department of Reclamation and Environmental Services are shown on Figure 3.

2.4 Analytical Laboratory

Pace Analytical Laboratories, LLC, contracted to work on this Program's project, must ensure that the laboratory's QA personnel are familiar with this QAPP and are performing the analytical and QC work as specified per laboratory methods and this QAPP. Laboratory QA personnel are responsible for reviewing final analytical reports produced by the laboratory, coordinating the laboratory analyses schedule, and supervising in-house chain-of-custody procedures.

2.5 Data Validation Consultant

The data validation consultant Environmental Standards, Incorporated provides independent third-party QA oversight and will be primarily responsible for assessing/monitoring the data collection and analysis activities performed by project personnel relative to this QAPP. The consultant is responsible for:

- Evaluating accuracy and condition of sample receipt documentation;
- Coordinating receipt of data packages and electronic data deliverables (EDD) from the laboratories;

- Routinely communicating with the laboratories regarding status and resubmission of data deliverables;
- Coordinating the activities of staff chemists who are validating laboratory-produced data in a manner consistent with the QAPP validation protocols;
- Performing senior review of reports;
- Downloading unqualified EDDs and uploading qualified EDD from/to the Atlantic Richfield (AR) EQuIS database; and
- Notifying the Quality Assurance Officer of issues relating to the quality or validity of laboratory data, and/or delivery schedules.

In addition, the data validation consultant will complete a Level A/B review during the verification process for field documentation related to samples collected for laboratory analyses for determination of screening or enforcement quality data for each school. Finally, the data validation consultant will complete field and laboratory audits in accordance with the QAPP.

2.6 Indoor Dust Investigation Consultant

ERM, the environmental consultant contracted to perform the indoor dust investigations. is responsible for developing planning documents (QAPP, field sampling plans, health and safety plans, etc.), performing the indoor dust investigations, and preparing summary reports to document the results of the indoor dust investigations. The environmental consultant will work with all the entities listed above during the successful completion of the investigation. Elsie King is the ERM Quality Manager responsible for maintaining the official, approved QAPP.

2.7 Problem Definition and Background

The USEPA has included schools (public and private schools, daycares, and preschools) in the RMAP in the First Amendment to the Administrative Order (USEPA Docket No. Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA]-08-2011-0011). Currently, there is no indoor dust data for schools and indoor school dust sampling will be performed to determine if indoor dust levels of lead, arsenic, and mercury are above the current residential cleanup levels. Contamination of schools described herein may originate from both mining-related (waste rock, tailings, aerial emissions) and non-mining-related sources (e.g., lead paint or broken mercury thermometers). This component of the RMAP Program evaluates arsenic, lead, and mercury present in interior dust.

Sampling and assessment are needed to determine remediation or abatement requirements if:

- Accessible interior dust exceeds solid media action levels in areas currently accessible to students or daycare children. Accessible dust is surface dust located in areas that are commonly occupied by students or daycare children, such as classrooms, hallways, bathrooms, and other areas (e.g., cafeterias) within the school or daycare.
- Inaccessible space dust exceeds solid media action levels in areas mainly accessible to facility staff. Inaccessible dust is surface dust found in locations such as boiler or mechanical rooms, tops of ceiling tiles, janitorial closets, on ventilation system ductwork or vents, and storage rooms in areas that are not commonly accessed or occupied by students or daycare children.
- For buildings constructed in or before 1980, dust in attics and/or crawlspaces exceeds solid media action levels where there is an exposure pathway to an interior occupied space. Information on attics and/or crawlspaces with elevated dust levels should made available to facility personnel performing maintenance activities to mitigate the potential for future exposures.

This QAPP was developed in response to the Agencies 2006 *Record of Decision, Butte Priority Soils Operable Unit, Silver Bow Creek/Butte Area NPL Site* (BPSOU ROD) (USEPA 2006b) and *Explanation of Significant Differences to the 2006 Butte Priority Soils Operable Unit Record of Decision* (USEPA 2011a). This QAPP was also developed in response to the Agencies 2020 Unilateral Administrative Order Amendment (UAO Amendment) for "Partial Remedial Design/Remedial Action Implementation and Certain Operation and Maintenance at the Butte Priority Soils Operable Unit/Butte Site (EPA Docket No. CERCLA-08-2011-0011) (USEPA 2020a). The UAO Amendment expanded the RMAP boundary (see Figure 1) and also expanded the Program to include schools, parks, and daycare facilities.

2.8 Project Description and Schedule

The Program is designed to mitigate exposure to sources of arsenic, lead, and mercury contamination to residents of the BPSOU and the 2011 Residential Metals Expanded Area (Expanded Area) shown in Figure 1. Contamination in the Expanded Area may originate from both mining-related (waste rock, tailings, aerial emissions) and non-mining-related sources.

In 2019, the Program was expanded to perform both residential attic and yard sampling within the 2020 RMAP Area Boundary provided on Figure 1. Specific exclusion areas are also identified on Figure 1. Sampling residential yards and attics outside of the BPSOU but within the expanded boundary will be performed on a test-by-request basis. In 2020, the Program boundary was expanded further, and the scope modified to include schools as additional property types to the RMAP statement of work.

Components of the Program include environmental sampling and remediation, long-term tracking and data management, and education and outreach. Medical monitoring is conducted as a sister program to the Program. Long-term tracking and data management ensures properties will be sampled, evaluated, and remediated, if necessary. The tracking portion provides a record of changes in ownership and notes permits issued by BSB government for remodeling homes in which attic dust sampling found contamination above action levels, but a pathway did not exist when the assessment was completed. The long-term tracking and data management will be continued for the life of the Program. The BPSOU *Final Data Management Plan* (Atlantic Richfield 2017) describes data management. The BPSOU Data Management Plan is being updated and the 2020 version of the document is currently under review. The final, approved version of the Data Management Plan will ultimately be the governing document for this QAPP. Only validated data will be uploaded to the Program database.

The Program stipulates sampling residential yard and school playground soil, interior dust, for all constituents of concern (COC) and interior air monitoring for mercury vapor within the BPSOU. The Program includes systematic sampling of additional specific areas within the 2020 RMAP Area such as parks and play areas, schools, and commercial areas with accessible (living and interior school) space based on site-specific conditions and evidence of exposure pathways. Program eligibility is described in the *Revised Final Multi-Pathway Residential Metals Abatement Program (RMAP) Plan* (BSB and Atlantic Richfield Company, 2020).

2.8.1 Project/Task Description

This QAPP will guide data collection activities at the schools in 2021 and 2022. Data generated from the samples will be used to address questions regarding arsenic, lead, and mercury in interior dust that may be identified within the schools and the potential for students and school personnel to contact interior dust with arsenic, lead, and mercury at concentrations that exceed residential cleanup levels (250 milligrams per kilogram [mg/kg] arsenic, 1,200 mg/kg lead, and 147 mg/kg mercury). No interior dust data for schools are currently available. This sampling will address that data gap.

This work is designed to be in general conformance with the residential dust indoor sampling previously conducted by AR. AR conducted this sampling to address concerns by the community over potential arsenic, lead, and mercury concentrations in interior dust.

2.8.2 Project Schedule

A high-level indoor school dust investigation and remediation schedule is provided on Figure 4.

2.9 Quality Objectives and Criteria

This section discusses the internal QC and review procedures used to ensure that all data collected for this project are of known quality. The Data Quality Objectives (DQO) were developed in accordance with the USEPA's *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA 2006a). The DQOs are statements that define the type, quality, quantity, purpose, and use of data to be collected. The USEPA developed a seven-step process to establish DQOs to help ensure that data collected during a field sampling event are adequate to support reliable site-specific decision-making (USEPA 2001; USEPA 2006a). The sections below outline the QAPP DQOs.

2.9.1 Data Quality Objectives

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The process also ensures justification of the resources required to generate the data. The DQO process consists of seven steps of which the output from each step influences the choices that will be made later in the process:

- Step 1: State the Problem.
- Step 2: Identify the Goals of the Study.
- Step 3: Identify the Information Inputs.
- Step 4: Define the Boundaries of the Study.
- Step 5: Develop the Analytic Approach.
- Step 6: Specify Performance or Acceptance Criteria.
- Step 7: Develop the Plan for Obtaining Data.

During the first six steps of the process, the planning team develops decision/performance criteria that will be used to develop the data collection design. The final step of the process involves developing the data collection design based on the information from the other steps. The following provides a brief discussion of these steps and their application to this sampling effort.

Step 1: State the Problem. *The purpose of this step is to describe the problem to be studied so that the focus of the investigation will not be ambiguous.*

> **Describing the problem**. Properties in Butte and within the 2020 RMAP Expanded Area (see Figure 1) have the potential to be contaminated by historical mining activities and related contaminants. The proximity of properties to mining wastes and operations may have resulted in contamination of non-residential properties such as schools, preschools, and non-residential daycare facilities.
>
> The presence of contaminants and exposure pathways, related and non-related to historical mining activities, may result in a health-based risk to users of non-residential properties.

Establishing the planning team. Project personnel, roles, and responsibilities are detailed in Sections 2.1 through 2.6 of this document.

Describing the conceptual model of the potential hazard. Historical surface and underground mining activities resulted in the presence of contaminants in soil and interior dust around Butte due to waste dumping and deposition of aerial emissions from smelters/mills. Other, non-mining sources (e.g., lead-based paint, broken mercury thermometers) have also resulted in contamination in some areas. Contaminants in soil may be transferred to indoor dust when people enter the building (e.g., carried in on shoes or clothing) or through open doors and windows via windblown airborne particulates. People may contact contaminated dust at non-residential properties through pathways such as inhalation, which can also result in incidental ingestion when dust particles are inhaled and then swallowed, and through incidental ingestion due to hand-to-mouth contact with dust-laden surfaces. When people contact contaminated dust, they may be exposed to contaminants, which could pose a health risk if concentrations are above health-protective concentrations. The residential lead, arsenic, and mercury soil action levels established for the Program account for and are applicable to indoor dust contribution to total exposures. The Program has also established a residential action level for mercury vapors in indoor air. In order to investigate this problem, data quantifying contaminant concentrations in indoor dust, and when applicable, mercury vapor, will need to be collected, compared to the appropriate project action levels, and used for remedial decision-making.

Identifying available resources, constraints, and deadlines. Atlantic Richfield (Section 2.2), BSB (Section 2.3), and their support contractors will provide necessary project resources (financial and staffing) to properly implement the Program. Project schedule details are provided in Section 2.8 and 2.8.1.

Step 2: Identify the Goals of the Study. *This step identifies what questions the study will attempt to resolve and what actions may result.*

Key elements/questions. The Program requires that all area schools and non-residential daycare facilities within the BPSOU be sampled and assessed based on the sample decision framework specified on Figure 5. The goal is to use best efforts to obtain access to all applicable non-residential schools, daycares, and preschools within the 2020 RMAP Expanded Area (see Figure 1) to complete an interior dust investigation. Exterior soil sampling at schools, preschools, and non-resident daycares was addressed in a separate QAPP (ARCO/BSB 2021). Interior dust investigation/sampling are addressed in this QAPP.

Specifying the primary question. The primary question to be addressed is the following:

Are indoor dust concentrations of arsenic, lead, and/or mercury at these non-residential properties present at levels that may pose a risk to human health (e.g., above the action levels)? If action levels are exceeded, can the source of the exceedance be ascertained (e.g., historic smelter emissions, lead-based paint, track-in from outside, historic mining operations, or some other source)?

Specifically, these study questions can be detailed and broken down further as follows:

i. Are indoor dust concentrations of arsenic, lead, and/or mercury in currently accessible areas of non-residential properties greater than the BPSOU soil/dust action levels?

ii. Are indoor dust concentrations of arsenic, lead, and/or mercury in inaccessible areas of non-residential properties greater than the BPSOU soil/dust action levels?

iii. Do attics and/or crawlspaces have dust concentration of arsenic, lead, and/or mercury greater than the BPSOU soil/dust action levels?

iv. Is lead, arsenic, and/or mercury being tracked into schools from outside sources?

v. If mercury dust concentrations exceed the action level, are mercury vapor concentrations in indoor air greater than the BPSOU mercury vapor action level?

Determining alternative actions. For all schools and daycares, indoor dust shall be collected from entrance floor mats and floor surfaces in accessible areas. For buildings constructed prior to 1980, indoor dust shall be collected from inaccessible surfaces and attics/crawlspaces. As appropriate, opportunistic sampling of visible surface dust will be performed in accessible areas when present. Possible alternative actions, as depicted in Figure 5, are as follows:

- Take no action. If indoor dust concentrations of lead, arsenic, and mercury are below their respective BPSOU residential soil/dust action level, no further action is needed.
- Perform indoor mercury vapor sampling: if mercury dust results exceed the BPSOU residential soil/dust action level, indoor mercury vapor sampling would be necessary.
- Perform lead paint analysis. If lead dust concentrations exceed the BPSOU residential soil/dust action level, interior and/or exterior paint analysis may be necessary to identify the lead source.
- Complete remedial action. If indoor dust concentrations of lead, arsenic, and/or mercury are greater than or equal to their respective BPSOU residential soil/dust action level, remedial actions would be necessary. Remedial actions would consist of indoor dust removal or containment. Removal action may include location- and media-specific cleaning, use of a remediation grade/high-efficiency particulate air (HEPA) filter vacuum, carpet replacement, insulation replacement, or other appropriate means. Containment measures may include the use of sealants, coverings, or other physical migration pathway termination options.

Specifying the decision statement. The decision statement is as follows:

- Determine whether mercury vapor sampling is required.
- Determine whether lead paint analysis is required.
- Determine whether remedial action (indoor dust removal or containment) is required.

Step 3: Identify the Information Inputs. *The purpose of this step is to identify the informational variables that will be required to resolve the decision statements and determine which variables require environmental measurements.*

Identifying the type of information that is needed to resolve the decision statement. Arsenic, lead, and mercury concentrations should be determined through sampling indoor dust from non-residential RMAP properties (schools, preschools, and non-residential daycares). The goal of indoor dust collection and analysis is to obtain a reliable estimate of the average concentration of a COC in dust over a specified decision unit area where exposure may occur, for comparison to the appropriate action level for that area. The relationship between the average COC concentration and the action level provides the input needed to resolve the decision statements outlined in Step 2 in order to determine whether abatement is required for non-residential RMAP dust.

Information about the use of, or the presence of exterior soil COC action level exceedances at, the different schools/daycares should inform the sampling design for each property. Property use information should be used to make decisions about the appropriate sample count/density (such as a representative number of floors to be sampled).

Sample coordinates and location information such as the property type (e.g., school, preschool, non-residential daycare), sample type (e.g., floor mat, floor surface, accessible surface), and area sampled (e.g., entrance, classroom, gym, inaccessible area, etc.) should also be documented so that sample results are linked to specific locations to inform remediation decisions. This information will also inform the use of specific data. For example, entrance floor mat and inaccessible area samples are useful for determining the source of contaminants present in dust, while floor or accessible surface samples provide data to assess potential exposures. If chips from building interior lead-based paint are identified in a sampled area, this should also be documented as it is likely to influence lead concentrations in dust.

Identifying the number of variables to be collected. Arsenic, lead, and mercury concentrations (in mg/kg) should be determined for each dust sample collected from entrance floor mats, accessible floor surfaces and inaccessible surface locations, and attics/crawlspaces. Other variables to be collected include:

- Areas sampled (i.e., which rooms)
- Potential exposure routes between occupied spaces and attics/crawlspaces
- Time of year and antecedent weather conditions
- Mercury vapor concentrations in indoor air
- Lead concentrations for interior and exterior paint

Identifying the appropriate action levels. Action levels developed for BPSOU soils are also applicable for dust. For Butte, there are no school-specific soil action levels. Therefore, the basis of the existing soil action levels (as presented in the BPSOU ROD) was reviewed to determine which type of action level is likely to be the most applicable and adequately protective level to employ in making cleanup decisions for the schools. The non-residential soil action level for lead (2,300 mg/kg) has historically been applied to address waste rock dumps and source areas, which are different from the types of materials expected at schools. The recreational soil action level for arsenic (1,000 mg/kg) was developed based on a dirt-bike riding scenario, which is an activity that is quite different from anticipated use of school property. There is no non-residential soil action level for mercury.

Based on a review of the basis of the soil action levels, the residential soil action levels should be employed in evaluating the dust sampling results for the schools. The application of the residential action levels is conservative for a school scenario; however, use of more conservative action levels is appropriate, especially considering the school setting and community sensitivity to childhood exposures. The use of the residential action levels in making cleanup decisions for interior dust is consistent with what has been done historically for Butte parks and exterior school/daycare surface soils.

The BPSOU residential action levels (arsenic: 250 mg/kg, lead: 1,200 mg/kg, mercury: 147 mg/kg) will be utilized for all work completed under this QAPP (see Table 1). The BPSOU residential action level for mercury vapor is 0.43 micrograms per cubic meter.

Identifying appropriate sampling and analysis methods. Multiple sampling strategies (discrete, defined surface area, composite, etc.) should be considered for potential use on this project. Given the large areas contemplated for this project, exclusive discrete sampling may not be the most appropriate option given its common deficiencies including poor spatial coverage, inadequate sample density, or data that cannot be used to statistically represent the entire area of interest with a reasonable level of confidence.

X-ray fluorescence (XRF) has been used historically to analyze arsenic and lead concentrations in Butte soils and may be helpful during interior dust investigations. This method provides a quick output that can be used for immediate decision-making. However, it is less sensitive than laboratory analytical methods, and cannot be used for mercury analysis. Because samples must be packaged and shipped on ice (<6 °C) to a laboratory for mercury analysis, it is more practical to have all three metals analyzed by the laboratory via inorganic analyses. Inorganic analyses data from an analytical laboratory can also be validated. Expedited laboratory analysis (5 to 7 business day turn around on data and Level 2 data packages and 10 to 12 business day turn around on data and Level 4 data packages) and data validation (7 business day turn around after data packages are received) options should be investigated in order to achieve the project assessment and remediation goals.

Step 4: Define the Boundaries of the Study. *The purpose of this step is to define the spatial and temporal boundaries of the problem.*

Specifying the target population. The 2020 RMAP/Program area addressed under this QAPP will include indoor dust within schools and non-residential daycares identified on Figure 1.

Describing what constitutes a sampling unit. Sampling units should be defined based on interior school use information. Sampling unit extents are defined as the maximum area to be sampled to support decision-making (see Step 3). The USEPA's Superfund Lead-Contaminated Residential Sites Handbook (USEPA 2003), previous RMAP QAPP, and procedures for sampling schools in nearby Anaconda were reviewed to inform sampling unit extents appropriate for the interior dust investigation. The recommendations below were developed consistent with USEPA recommendations, other RMAP sampling efforts, and sampling of schools where similar types of contamination are present. These recommended sampling unit extents should inform development of the sampling plans for each appropriate school or daycare building.

Sampling units should be defined based on the area where dust may be contacted (for accessible spaces) or from which a pathway might occur (for inaccessible spaces). Because dust and vapor can move around within an indoor space, the samples collected from these media should be representative of the entire space where students and faculty spend time. For example, the routinely accessible interior space where students and faculty may contact dust includes entryways, hallways, classrooms, etc.; all of these spaces together should be considered part of the sampling unit since they are connected and transfer between areas can occur. If part of the school or daycare has a different use, such as a gymnasium or lunch room separated from the classrooms and hallways, or if the accessible space is apparently separated by dedicated entrances, the areas within the structure should be considered separate sampling units because different exposures may be applicable for each. Interior inaccessible spaces from which a pathway to accessible spaces may originate include attics and crawl spaces. As with accessible spaces, since dust can move around within an attic or crawl space, the sampling unit should include the whole space. Pathways for transport of dust from inaccessible space to accessible space within the schools and daycares should be determined during pre-sampling site visits and re-confirmed, as necessary, during subsequent dust sampling visits. The onsite USEPA representative will be consulted to determine the number of representative rooms and hallways for dust sample collection at each school/daycare.

Time frame for collecting data and making the decision. The temporal boundaries of the investigation include the time from when evaluation and sampling actions begin at each property to the time these actions are completed. Interior school/daycare sampling should be completed when school is in session, in a manner that does not interfere with student learning. Outreach meetings should be conducted with each school to better understand individual schedule

restraints (beginning and end of the school day and any after-school activities, construction projects, etc.) The collection of floor mat dust samples will occur during a season when track-in will be maximized (e.g., moist spring conditions).

Specifying the scale for decision-making. For the non-residential RMAP schools/daycares, the sampling unit extents for each building subarea should be specified as the maximum area for decision-making to identify any location where arsenic, lead, or mercury concentrations are above health-protective action levels and need to be remediated. By setting the decision unit equal to the sampling unit, decisions to remediate can be made for subareas of a building, rather than on a building-wide basis, and any subarea with analyte concentrations above action levels can be addressed even if building-wide remediation is not warranted.

Step 5: Develop the Analytic Approach. *The purpose of this step is to define the parameters of interest and integrate any previous DQO inputs into a single statement that describes a logical basis for choosing among alternative actions.*

Identifying the population parameters most relevant for making inferences and conclusions on the target population. Arsenic, lead, and mercury concentrations should be measured for each sampling unit as determined by analysis of each corresponding dust sample collected. The concentration measured in each sampling unit is the population parameter that should be used to make inferences and conclusions for each decision unit (i.e., the decision unit should be set equal to the sampling unit to support health-protective decision-making).

Specifying the theoretical decision rule. The theoretical decision rule is as follows. If the analyte concentration measured in the sampling unit (i.e., the average concentration within each decision unit for either arsenic, lead, or mercury) exceeds the appropriate residential action level detailed in Table 1, then remedial action to remove or contain the dust must be performed. This includes accessible spaces and inaccessible spaces where a pathway exists allowing dust transport to accessible spaces.

Step 6: Specify Performance or Acceptance Criteria. *The purpose of this step is to identify baseline conditions, limits, and ranges for decisions and consequences of decision errors.*

The decision question identified in Step 2 is: Are dust concentrations of arsenic, lead, and/or mercury at non-residential properties present at levels that may pose a risk to human health (e.g., above the action levels)? In this case, the baseline condition for each decision unit is that the analyte concentration in dust is below the action level, and the alternative condition is that there is an exceedance. Because this is a decision question, the potential exists for decision error to occur due to variability and uncertainty in the data. Potential decision errors include Type I (or false positive) and Type II (or false negative) errors. In the context of the RMAP non-residential sampling decision question, a false positive would mean determining that the arsenic, lead, or mercury concentration in dust is above the action level when in fact it is not. Consequences of this type of error include unnecessary remedial action and increased costs. A false negative would mean concluding that the arsenic, lead, or mercury concentration in dust is below the action level when it is actually above the action level. Consequences of this type of error include leaving dust in place that contains a metal at concentrations above the action level, resulting in a potential risk to human health.

Because the goal of the RMAP is to protect human health, the tolerance for making a Type II (false negative) error is lower than the tolerance for making a Type I (false positive) error.

Therefore, a sampling design and analysis method that minimizes the potential for false negative decision errors should be selected. Due to the potential for work to occur over more than one semester and the need to make decisions on a building-by-building, or room-by-room basis, the

experiment-wise error rate will likely be difficult to assess and efforts should be made to reduce the Type II error rate at the decision unit, rather than at the project-wide level.

When discrete sampling methods are used and the resulting population of sample data representing each decision unit are compared to a standard using hypothesis testing, the chance of making a Type I error can be reduced by setting a lower significance level (i.e., a lower Type I error rate). The chance of making a Type II error is reduced by setting a higher statistical power. The significance level and power can be raised or lowered to control the probability of each type of error depending on the tolerance for each. With this type of approach, there is a set tolerance for reaching a conclusion (the action level is or is not exceeded) that is correct for most, but not all, values in a population. Typically, the probability of a Type I error is lower than that of a Type II error; for example, a significance level of 0.05 and a power of 80 percent (0.2 probability of Type II error) are often selected. It can be difficult to obtain the sample size needed to achieve a much higher statistical power due to limitations such as the area available for sampling and associated analytical costs.

For the non-residential RMAP, the tolerance for Type II decision errors is lower than that for Type I errors. Because of the difficulties in lowering the Type II error rate that are associated with approaches such as hypothesis testing, an alternative approach may be preferable. Instead of addressing the decision question through hypothesis testing or estimating an upper confidence limit on the mean concentration using a population of discrete samples collected across a non-residential building (i.e., setting the entire building as the decision unit), the size of the decision unit can be reduced to maximize the potential to find an exceedance where present (i.e., to lower the Type II error rate). If each sample result is compared individually to the action level, this eliminates the chance for a percentage of the sample results to be incorrectly identified as being below the action level, as can occur when the entire population is being compared across a larger decision unit.

In addition to lowering the potential for Type II errors, study error should be minimized through proper training of the field sampling team, sample documentation and handling, the use of appropriate analytical methods that achieve method detection limits (MDLs) below the action levels, analysis of field and analytical QC samples, analysis of precision, accuracy, and other measurement performance criteria (described in detail in Section 2.9.2), and data validation.

Decisions should be made using data that meet the performance and acceptance criteria; if these criteria are not met, corrective action steps should be taken.

Step 7: Develop the Plan for Obtaining Data. *The purpose of this step is to develop an optimized plan to complete the task.*

Selecting the sampling design. The data collection scheme is designed to ensure that the information will be of sufficient quality and quantity to determine the component(s) of individual schools, preschools, and non-residential daycares requiring remedial action (and the extent to which remedial action is required). The information and outputs generated in Steps 1 through 6 of the DQO process informed selection of the optimized approach for dust sampling and analyses at non-residential RMAP properties described in this final step of the process. The data collection design (sampling program) is described in detail in Section 3.

Specifying the QA/QC procedures. Sufficient data quality will be achieved through the field and laboratory quality control measures (Sections 3.9 and 3.10) including the use of appropriate sample collection, handling, and chain-of-custody procedures and laboratory analytical methods, quality control sample analysis (field and laboratory), assessment of the performance criteria

described in Section 2.9.2, following the corrective action procedures detailed in Sections 4.1 and 4.2, and analytical data validation (Section 5).

2.9.2 Measurement Performance Criteria for Data

Measurement performance criteria are established by defining acceptance criteria and quantitative or qualitative goals (e.g., control limits) for precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) of measurement data. The definitions of PARCCS are provided below. Acceptance limits are detailed in Section 3.9.2 for each measurement performance criteria. Equations for calculation of precision, accuracy, and completeness are provided in Table 2. Additional QC acceptance criteria are provided in Table 3.

2.9.2.1 Precision

Precision is the amount of scatter or variance that occurs in repeated measurements of a particular analyte. Precision is assessed using the relative percent difference (RPD) between a primary sample result and its paired field or laboratory duplicate sample result (for field and laboratory precision, respectively). For example, perfect precision would be a 0 percent RPD between the primary sample result and its paired field or laboratory duplicate sample result (both samples have the same analytical result). For these sampling events, precision will be assessed based on laboratory prepared and field duplicate sample analysis.

2.9.2.2 Accuracy/Bias

Accuracy is the ability of the analytical procedure to determine the actual or known quantity of a particular substance in a sample. Accuracy is assessed based on the percent recovery and percent difference of various laboratory QC samples. Perfect percent recovery is 100 percent and perfect percent difference is 0 percent (the analysis result is exactly the known concentration of the QC sample). The laboratory control sample (LCS) and laboratory matrix spike (LMS) are used to measure accuracy, based on the percent recovery of the LMS and LCS. Additional laboratory QC samples (serial dilution samples, interference check samples, calibration standards, calibration blanks and method blanks) may be used to assess accuracy as appropriate to the analytical method.

Bias is the systematic or persistent distortion of a measurement process that causes error in one direction (e.g., consistently higher or lower than the true concentration). As with accuracy, analytical bias can also be assessed based on percent recovery of laboratory QC samples. Sampling bias is addressed by use of proper sampling design and methods.

2.9.2.3 Representativeness

Representativeness is the degree to which sample data represent a characteristic of a population, parameter, or environmental condition. Representativeness is a qualitative parameter that is most concerned with proper design of the sampling and analytical schemes. Representativeness is achieved by determining the number and locations of samples and the appropriate sampling techniques needed to depict, as accurately and precisely as necessary, the conditions being measured. Representativeness deals with protocols for sample storage, preservation, and transportation; analyzing samples with appropriate methods, techniques, and instrumentation; and using the methods to document these protocols. Representativeness will be achieved through judicious selection of sampling locations and methods. This QAPP requires that samples are representative of the medium being sampled and that there are enough samples to meet the project DQOs and satisfy the project remedial action design elements.

2.9.2.4 Comparability

Data comparability is defined as the measure of the confidence with which one data set can be compared to another. Comparability is a qualitative parameter but must be considered in the design of the sampling plan and selection of analytical methods, QC protocols, and data reporting requirements. Comparability will be ensured by analyzing samples obtained in accordance with this QAPP and applicable laboratory standard operating procedures (SOP), as well as the Program SOPs, which are comparable to the sampling methods used during previous investigations at the site (Appendix B contains various field and laboratory SOPs). All data will be reported in units consistent with standard reporting procedures so that the results of the analyses can be compared with results from previous investigations. Dust data will be reported in units of mg/kg.

2.9.2.5 Completeness

Completeness is a measure of the amount of valid data obtained from the measurement system. Proposed sample collection points may fail to produce usable data for many reasons (e.g., non-traceable sample identification, sample container breakage, elevated storage temperature, exceeded sample holding time, or data loss). When samples are analyzed, but the data are rejected, the numerator of this calculation becomes the number of valid results minus the number of possible results rejected. Valid data are data not rejected or deemed unusable during the data validation process. Completeness describes the amount of valid data that meets the DQOs for representativeness, accuracy, and precision versus the amount of data obtained or considered necessary to achieve a specific level of confidence in decision-making. For relatively clean, homogeneous matrices, data would be expected to be 100 percent complete. As matrix complexity and sample heterogeneity increases, however, completeness may decrease. Based on the complexity of sample matrices anticipated to be collected from the project sites; the analytical data completeness goal following validation is stated to be greater than or equal to 90 percent and will be generated on a Sample Delivery Group (SDG) basis.

Project completeness with regard to the collection of samples and identified data gaps will be addressed by the data generators and users. A goal of 90 percent is anticipated for each project location (e.g., each school location).

In order to more accurately depict the percent analytical completeness, individual analyte completeness will be calculated and reported. In the event re-analyses are performed by the laboratory, only a single analytical set (possibly a mixture of original and re-analyses data based on usability) will be included in the analytical completeness calculation so as not to count duplicate data. Valid results used to meet completeness objectives are those results that provide a defensible estimate of the true concentration of an analyte in a sample. These valid results include data that are not qualified and data that are qualified but that can still be used to meet project objectives. Invalid data are those results for which there is an indication that the prescribed sampling or analytical protocol was not followed, or results did not meet QC specifications.

2.9.2.6 Sensitivity

Sensitivity is related to the ability to compare analytical results with project-specific action levels. Analytical quantitation limits for the sample analytes should be below the level of interest to allow an effective comparison. The MDLs for arsenic, lead and mercury are included in Table 1.

Achieving proper sensitivity (i.e., reporting limits [RL]) will depend on instrument sensitivity and potential matrix effects. Data sensitivity is the ability of the analytical method to differentiate the target analyte from instrument “noise.” It is important to monitor the instrument performance to verify consistent instrument performance at the low end of the calibration range. Instrument sensitivity will be monitored through analysis of method blanks and calibration check samples. Project data will be reported to the MDL with

variations due to sample amount digested, potential dilutions and percent moisture correction for mercury analysis. The MDLs are below the action limits defined in the DQO steps above.

Additional details regarding bias, sensitivity, and QC acceptance criteria are included in Section 3.9.2.

2.10 Special Training

All ERM field personnel will review the requirements of this QAPP and receive training on Program-related tasks during a project meeting held prior to the beginning of fieldwork. A review of sampling procedures and requirements will be completed prior to field activities so that sample collection and handling methods are performed in according to QAPP requirements. Field personnel will be trained in proper use of field equipment, sample collection tools, etc., and procedures according to field data collection SOPs (Appendix B) and methods described in the Program. Field personnel performing sampling activities or members who can potentially contact contaminated materials should receive hazardous waste operations and emergency response (HAZWOPER) training.

One hard copy of the approved version of this QAPP will be maintained for reference in the field vehicle and/or field office. All field team personnel will have access to Portable Document Format (.pdf) files of the complete QAPP.

2.11 Documents and Records

This section describes procedures for documentation management and record keeping for this QAPP from initial record generation through final data formatting and storage. All sampling data conducted for all media under the Program and records of property access requests are housed within the Program (RMAP) database. The Program database is housed in an Access Structured Query Language (SQL) server database and maintained by BSB. Document backups are contained in the BPSOU document SharePoint and USEPA document repository. Refer to the BPSOU *Final Data Management Plan* (Atlantic Richfield 2017 or most current revision) for additional details regarding data management, backup, and storage. Atlantic Richfield and BSB will coordinate Agency testing of the Program database with the Program architects and primary users in a manner to minimize provision of written comments and the potential misinterpretation of those comments. All data collected during interior dust investigation of the Butte RMAP schools, preschools, and non-residential daycares, as described in this QAPP will be uploaded to the Program database.

2.11.1 Property Access Agreements

An executed sampling access agreement (see Appendix C) must be obtained before sampling takes place. Program access agreements are also described in detail within the *Institutional Controls Implementation and Assurance Plan (ICIAP)* (Atlantic Richfield 2019a). The agreements represent a temporary agreement between Atlantic Richfield and school/daycare officials stating that Atlantic Richfield and its contractors are permitted to conduct certain sampling activities at the specified school/daycare. Completed agreements will be photocopied, scanned, and the electronic version stored. The status of property access will be tracked in the Program database tracking system. A copy of the access agreements (Appendix C) will also be included in the project record files.

2.11.2 Field Documentation

Field documentation provides a description of site conditions during sampling activities and provides a permanent record of all field activities. Field documentation will primarily be achieved through field notes, data collection forms or electronic means (i.e., field tablets). Field documentation includes a sample location map that shows school buildings, rooms, structures, and features relevant to the interior dust sampling effort.

Documentation for each site will include the information listed below, at a minimum:

- A description of the field task
- Time and date fieldwork started
- Location and description of the work area including sketches, if possible, map references, and references to photographs collected
- Names and titles of field personnel
- Name, address, and phone number of any field contacts or site visitors (e.g., Agency representatives, auditors, etc.)
- Details of the fieldwork performed with special attention noted to any deviation from the QAPP or applicable field SOPs. Such deviations will be brought to the attention of and discussed with Agency field oversight personnel. If the deviations are deemed to be minor by the Agency representative, a resolution and path forward will be determined in the field. If the Agency representative determines that the deviation is major in scope, it will be his/her responsibility to elevate the question internally and to receive Agency direction.
- All field measurements made (e.g., areas sampled, HVS3 pressure readings, micro-vacuum flow rates, sample masses)
- Personnel and equipment decontamination procedures

For any field sampling work, the field documentation will include all applicable items from the Level A/B assessment checklist (see Section 5.1.2.1 and Appendix D). At a minimum this includes documentation of the following:

- Sample team and/or leader
- Sample location, and traceable sample designation number
- Sample type collected
- Date and time of sample collection
- Sampling method, particularly any deviations from the field SOPs (Appendix B)
- Documentation or reference of preparation procedures for reagents or supplies that will become an integral part of the sample (if any used in the field); specify if sample bottles/preservatives are not provided by the laboratory and certified as cleaned
- Collection of field duplicates and information on the associated parent sample
- Decontamination of sampling equipment
- Sample custody documentation
- Sample preservation (if used)

Sufficient information should be recorded to allow the sampling event to be reconstructed without having to rely on the sampler's memory.

A report containing all the above-listed information will be provided to the school/daycare official and the information recorded in the Program database and tracking system and uploaded to cloud-based databases managed by BSB (BPSOU *Final Data Management Plan* [Atlantic Richfield 2017]). Sample results will be validated, and Agency approved prior to submission to property owners unless otherwise approved by the Agencies.

2.11.3 Field Photographs

Field personnel will use a digital camera to take photographs at the site. Photographs may be taken of sampling locations, field activities, and documenting site conditions, as necessary.

Photographs should include a scale in the picture when practical. Documentation of all photographs taken during sampling activities will be recorded in a bound field logbook or appropriate field collection device and will specifically include the following for each photograph taken:

- The date, time, and site identification
- A brief description of the subject and the fieldwork portrayed in the picture
- Sequential number of photograph

Electronic files will be placed in project files with copies of supporting documentation from the bound field logbooks/data collection device.

2.11.4 Chain-of-Custody Records

Each sample collected will be assigned a unique sample number, and the sample container will be labeled with sample designation number, date and time of collection, and requested analyses. Then the information will be recorded in the field documentation. Chain-of-custody records document the traceability of samples from the time of collection until final disposition. After samples have been collected, they will be maintained under strict chain-of-custody protocols in accordance with the SOPs (Appendix B). A chain-of-custody record will be initiated by the individual physically in charge of the sample collection. The chain-of-custody form may be completed concurrently with the field sampling or before shipping or hand delivery of samples to the laboratory. The sampler is personally responsible for the care and custody of the samples until they are shipped, or hand delivered to the laboratory. When transferring the sample possession, the individual relinquishing and receiving the sample will sign and record the date and time of day on the chain-of-custody record.

A copy of each as-transmitted chain-of-custody form will be scanned and stored on a hard drive. Chain-of-custody records will also be copied to the project record files (refer to Section 3.15). The chain-of-custody records will be included in the laboratory data packages.

2.11.5 Analytical Laboratory Records

Results received from the laboratories will be documented both in report form and in an electronic format. Laboratory documentation includes laboratory confirmation reports such as information on how samples have been batched, the analyses requested, data packages containing the laboratory report and the EDD, and any change requests or corrective action requests. Section 5.1.2.2 lists the laboratory reporting requirements in detail. The deliverable (data package or report) issued by the laboratory must include data necessary to complete Stage 2B and Stage 4 validation of laboratory results. Original reports and electronic files received from laboratories will be maintained with the Program quality records. Refer to the BPSOU *Final Data Management Plan* (Atlantic Richfield 2017) for additional requirements.

2.11.6 Project Data Reports

Upon receipt of laboratory results and completion of the data review/validation process, all analytical data will be uploaded into a Program database and submitted to the Agencies for review and approval. For the school sampling portion of this project, these data would be anticipated to be submitted on a per school/daycare basis to decrease the turnaround time required for reporting as much as possible. Upon receiving Agency approval, the sample results (for all analytes) will be reported to school/daycare officials

along with a letter explaining what the results indicate (see result letter templates in Appendix E). The action levels for arsenic, lead, and mercury will be reported along with sample results.

Following landowner notification, sample results will be used to develop an individual site work plan for each school/daycare remedial action where sample results exceeded BPSOU action levels (Table 1). In addition to the "real time" submittals described above, all sampling data will be forwarded to the Agencies for review and approval in the form of a Data Summary Report (DSR). This DSR will include figures displaying location of buildings/rooms sampled, analytical results, and copies of all field data. As described above, all sampling data will reside in the project records.

Sampling for remedial design/remedial action under the RMAP will be documented through an interior dust sampling DSR submitted for review and approval by the Agencies. Sample data, with their laboratory and data usability qualifiers, will be maintained electronically by BSB/Atlantic Richfield and reported in an interior dust sampling report. The interior dust sampling report will be a DSR prepared based on the guidelines in *Clark Fork River Superfund Site Investigations (CFRSSI) Pilot Data Report Addendum* (AERL 2000) following interior dust data collection. The final report will describe the interior dust sampling activities, provide a summary of the data obtained, discuss the results of data validation, and provide a detailed listing of any deviations from the QAPP. The DSR will also include a data usability assessment for laboratory data. A data summary table with all the samples and analyte concentrations listed, along with the laboratory- and data validation-assigned qualifiers will also be included. The Level A/B checklists, laboratory data validation checklists, and data validation summary will provide an overall assessment of the quality and usability of the data. Furthermore, the DSR will also contain copies of all analytical reports, EDDs, and data validation reports. The DSR will be submitted to the Agencies for review approximately 3 months after all data validation activities are completed for the interior dust sampling.

2.11.7 Quality Records

Quality records are defined as completed, legible documents that furnish objective evidence of the quality of items or services, activities affecting quality, or the completeness of data. These records will be organized and managed by the consultant, and will include the following at a minimum:

- This QAPP and any approved revisions or addenda
- Approved versions of the Health and Safety Plan and any addenda
- Copies of field SOPs for field data collection, with any updates, revisions, or addenda to those SOPs
- Incoming and outgoing project correspondence (letters, telephone conversation records, and faxes)
- Copies of completed access agreements (Appendix C) for the individual schools/daycares sampled
- Individual school/daycare maps, including any field drawings and field photographs
- Field documentation forms
- Copies of all field documentation/records
- Copies of all sample chain-of-custody forms
- Copies of all laboratory agreements and amendments
- Laboratory data packages (electronic version)
- Documentation of field and/or laboratory audit findings and any corrective actions
- Draft and final delivered versions of all reports and supporting procedures such as statistical analyses, numerical models, etc.

3. MEASUREMENT AND DATA ACQUISITION

This section addresses all aspects of project design and implementation for generating and acquiring data. Adhering to the procedures provided in Appendix B in this QAPP and described in this section result in conformance to requirements specified in the appropriate methods or procedures for sampling, sample handling, laboratory analyses, field and laboratory QC, instrument/equipment testing, inspection, maintenance, instrument/equipment calibration, data management, and data security.

3.1 Property Access

Non-residential RMAP sampling will occur at public and private schools, daycares, and preschools. Prior to conducting any sampling or cleanup activities, access must be provided from authorized school/daycare officials in the form of an executed sampling access agreement (see Appendix C).

Any dispute concerning access should be brought to the attention of the Agencies. It is essential to begin access procurement as early as possible in the remedial process to avoid potentially lengthy delays. If access for response work cannot be reasonably obtained, the USEPA may choose to use its authorities under CERCLA to secure access, as provided in the current Unilateral Administrative Order (USEPA 2011b) and any updated Unilateral Administrative Orders.

3.2 RMAP Indoor Dust Sampling Design

The primary goal of the sampling is to provide data to measure concentrations of COCs in dust in representative accessible areas within the schools and daycares in the Program area. All school/daycare RMAP dust sampling work will be conducted in accordance with Figure 5, and as described below to determine the presence of the COCs listed in Table 1. Field personnel will follow the procedures in the SOPs (Appendix B) and will record all information in the field logbook/data collection device. The procedures for RMAP dust sampling are summarized below.

3.2.1 Sample Locations

Sample locations will be defined in individual school/daycare field sampling plans or grouped school/daycare field sampling plans developed separately from this QAPP.

3.2.2 Entrance Floor Mat Dust Sampling

Schools and daycares typically use floor mats just inside the buildings at points of entry to reduce tracking of dirt through the interiors. The field sampling team will consult with USEPA to obtain replacement mats for collection of dirt at building entrances. At all schools/daycares replacement mats will be put in place the week prior to the interior sampling to collect samples under typical conditions to determine if COCs are being tracked into the schools. This will provide useful information should concentrations of COCs be found above the residential cleanup levels in the accessible interior floor and surface dust samples. Results from floor mat sampling are intended to provide information on the potential source of those contaminants (interior versus exterior), not to measure exposure.

3.2.3 Floor Surface Sampling

A representative number of floors will be vacuumed under typical conditions to obtain dust samples for analysis of COCs in readily accessible interiors within the schools/daycares. These data will be compared to residential cleanup levels to determine if COCs are present in concentrations exceeding cleanup levels. If dust is not present in sufficient concentrations to sample or if the concentrations are below the residential cleanup levels, potential exposure to COCs in interior dust will be considered negligible and no additional investigation will be required of the school interiors.

3.2.4 Surface Dust Sampling

3.2.4.1 Accessible Surface Sampling

Floor surface sample results will be used to assess surface dust in accessible areas of schools and daycares. However, there may be circumstances where an opportunistic micro-vacuum surface dust sample may be collected to provide useful information on surface dusts within accessible areas (e.g., top of cabinets, bookshelves) if visible dust is observed. These surface sampling results will be used to determine if arsenic, lead, and/or mercury is present in concentrations exceeding cleanup levels.

3.2.4.2 Inaccessible Surface Sampling

For buildings constructed prior to 1980 (that have not undergone remodeling or had an interior remediation since this time), micro-vacuum surface dust samples will be collected from areas typically inaccessible to students (e.g., boiler or mechanical rooms, tops of ceiling tiles, janitorial closets, ventilation system ductwork or vents, storage rooms, I-beams, etc.). These sample results are intended to provide information on exposure potential to facility staff performing maintenance or other functions in these areas. In addition, these samples may also provide information on the potential source of contaminants if elevated concentrations are present in floor dust samples.

3.2.4.3 Attic and Crawlspace Sampling

For buildings constructed prior to 1980 (that have not undergone remodeling or had an interior remediation since this time), micro- vacuum surface dust samples will be collected from attic and crawlspaces if there is an exposure pathway to an occupied space. These dust samples will provide information on the potential source of contaminants if elevated concentrations are present in floor dust samples.

3.2.5 Grab Samples

Grab dust samples may be collected at certain locations where sufficient quantities of dust are present, or where composite vacuum sampling cannot be completed due to sample media limitations (i.e., insulation in attics). In these instances, dust samples may be collected using new, disposable paintbrushes and properly decontaminated dust pans.

3.3 RMAP Indoor Soil Sampling

All RMAP soil sampling work inside school properties will be conducted as described below to determine the presence of the COCs listed in Table 1. Field personnel will follow the procedures in the SOPs (Appendix B) and will record all information in the field logbook/data collection device. The procedures for RMAP soil sampling are summarized in section 3.3.1 and 3.5.5.

3.3.1 Earthen Basements

For non-residential earthen basement sampling components, subsamples will be collected from a minimum of 3 subsample locations or at a rate of approximately 5 subsamples per 5,000 square feet (ft^2) in surface area per sampling component, whichever is greater. Subsamples from these locations will be composited in the field, and a single composite sample from the 0- to 2-inch depth interval will be analyzed for arsenic, lead, and mercury. Each subsample should have similar mass so that each location is equally represented in the total sample mass. The maximum area represented by a single composite sample will be 1,200 ft^2 (meaning a maximum of 10 subsamples will be collected from any non-residential sampling component) (see Figure 2).

3.4 Mercury Vapor Sampling

When RMAP mercury vapor sampling is required, the procedures to be used will be included in an agency approved site-specific field sampling plan.

3.5 Field Procedures

The field sampling includes floor mat, floor surface, surface sample dust, and earthen basement soil collection. Each of these activities is described below. Digital photographs with a minimum resolution of at least 640x480 pixels will be taken at each sample site and appropriate information will be recorded in the field logbook following the protocols set forth in the SOPs in Appendix B. The location of the sample will be sketched in the field book.

3.5.1 Floor Mat Sampling

Floor mats will be placed just inside the main entryways of the schools/daycares 1 week prior to performing interior dust sampling. The mats will be secured with duct tape to make sure they are not cleaned or removed. Placement of the mats will be coordinated with the school/daycare. The mats will be checked daily and will be left in place for a period of 5 days, or until the surface appears to be overloaded with tracked dirt, whichever comes sooner. At the end of the 5-day period or when the mat becomes overloaded, it will be sampled in place. The mat will be vacuumed by the high-volume small surface sampler (HVS3) by subjecting it to three to four passes over the entire carpeted area of the mat, until all the dust has been removed. The HVS3 high-volume vacuum will be used to collect dust from the mat as specified in ASTM International (ASTM) D5438-17, *Standard Practice for Collection of Floor Dust for Chemical Analysis* (Appendix B). A floor mat blank sample will be collected at the beginning of each sampling event as described in Section 3.10.5.

There is a possibility that due to weather conditions (frozen ground, spring snowstorm, etc.) that insufficient soil will be tracked in to generate dust. In that event, a second floor mat sampling event will be scheduled later when school is session. The decision to conduct a second round of floor mat sampling event will be made by AR and USEPA after obtaining the first round of sampling results.

3.5.2 Floor Surface Sampling

Dust sampling will be performed on flooring in a representative number of typically accessible interior spaces. The locations will be selected following a field reconnaissance of the school/daycare buildings, and as specified in an Agency-approved Field Sampling Plan. The HVS3 vacuum will be used to collect dust from the flooring as specified in ASTM D 5438-17, *Standard Practices for Collection of Floor Dust for Chemical Analysis* (Appendix B). Before samples are collected, the date of the last cleaning will be determined and recorded on the sampling form. The sampling team will vacuum the selected floor location until enough dust (ideally 6 to 8 grams) has been collected. The sampling team will then estimate the floor area sampled so that an estimate of dust density can be provided in the data summary report. Acceptable methods to estimate floor area include counting floor tiles or using a measuring tape.

Based on the type of surface, the HVS3 will be set up to the appropriate pressure drop and flow rate. The sample collection bottle will be pre-weighed and recorded and attached to the vacuum. Sampling will attempt to collect 6 to 8 grams of dust to allow an adequate amount for duplicates, matrix spikes (MS), and re-analysis. This may be difficult due to local COVID-19 pandemic cleaning requirements. A minimum of 2 grams of dust is typically needed to perform laboratory analysis for both USEPA Methods 6020B and 7471B. If a smaller amount is collected, the RLs may be elevated, and it may not be possible to analyze both methods. The analysis of arsenic and lead will be prioritized over the mercury analysis. The HSV3 will be cleaned with reagent grade methanol between each sample per the ASTM D 5438-17 specification.

3.5.3 Surface Sampling

Dust samples will be collected from a representative number of typically inaccessible areas within the schools/daycares. The locations to be sampled will be determined by a field reconnaissance of the buildings and documented in Agency-approved field sampling plans. Samples will typically be micro-vacuumed from multiple sub-locations (a minimum of two) within the area sampled to form a composite sample, typically in the same room or space (e.g., mechanical room). Samples in inaccessible locations with heavy dust may also be collected using a disposable paintbrush and properly decontaminated dustpan

The samples will be collected using a micro-vacuum as specified in ASTM D 7144-21, *Standard Practice for Collection of Surface Dust by Micro-vacuum Sampling for Subsequent Determination of Metals and Metalloids* (Appendix B). The micro-vacuum collects dust using a collection nozzle attached to a filter holder (sampling cassette) connected to an air sampling pump. Samples will be collected on 37-millimeter (mm) two-piece air sampling cassettes with matched-weight mixed cellulose ester (MCE) filters. Prior to sampling, ten unused filters (from the same filter lot) will be weighed to establish an average filter weight. Sample weights will be calculated by subtracting the average filter weight from the measured filter plus sample weight for each sample. A separate filter cassette will be collected for each method: USEPA Methods 6020B and 7471B. A minimum sample mass of 0.05 grams will be needed for each method. Filter lot blank samples will be analyzed for arsenic, lead, and mercury prior to use of the cassettes in the field. A sampling pump flow rate of 2.5 liters per minute (L/min) will be used initially for surface dust sampling. If this does not allow collection of adequate sample mass, the flow rate will be increased to 6.0 ± 0.5 L/min.

3.5.4 Grab Samples

Grab samples may be collected using a disposable paintbrush and properly decontaminated dustpan. Other opportunistic samples may be collected with the HVS3 or micro-vacuum, based on observations by the field sampling team and any accompanying oversight.

3.5.5 Soil Samples

Field personnel/samplers will record all information in the field logbook/data collection device. The decision to collect additional “opportunistic” samples will be made in the field by the sampling crew personnel and/or Agency personnel during the time of sampling. All RMAP residential soil samples will be shipped to a certified laboratory for analyses. Sampling crew personnel will follow the steps listed below:

1. Ensure that an executed sample request form (refer to Section 2.11.1 and Section 3.1) exists prior to beginning any sampling event.
2. Visually inspect the property to determine the number of polygons needed for composite sampling.
3. Take photographs to create a record to document the pre-sampling condition of all portions of the property scheduled to be sampled. At the end of the project, a copy of the record is provided to the owner. Copies will also be made available for review by the Agencies.
4. Create a scaled sample location map of each basement that shows boundaries of exposed soil. The sample location map will be developed using conventional and representative methods (i.e., computer or tablet devices). Use measuring devices (standard measuring tape, or laser measuring devices) to accurately measure basement features within an accuracy of approximately plus or minus 2.0 feet. Divide each basement into polygons for sampling and identify these areas on the map. All subsample locations will be plotted on the sample location map by sampling crews in the field. The map should include the following at a minimum:

- Surface area applicable to each individual basement component
- Number of subsamples required from each basement component (based upon component surface area).
- Surface area applicable to the exposed basement soil boundary of each property
- Location of miscellaneous structures (walls, doors).
- Any noticeably dissimilar soil material types or surface conditions (i.e., bare ground areas, areas where paint chips were observed, locations of obvious imported fill materials, etc.).

5. For each composite sample, label the bag with the correct sample identification number (see Section 3.8).
6. Collect composite samples as dictated by the Sample Location Map (placing each composite sample in the corresponding bag).
7. Follow chain of custody procedures outlined in the Sample Management work instructions (Attachment C).
8. Ensure all sampling identification information is entered into the Program's database tracking system.
9. Duplicate field samples will be collected as described in Section 3.10.1

3.6 Field Equipment

The following field equipment is required:

- QAPP, field notebook, pens, camera, and batteries
- Maps of proposed sampling locations and Global Positioning System (GPS)
- HSV3 vacuum floor sampler (1)
- Surface dust micro-vacuum (1)
- Tweezers to remove hair balls and dust balls from samples, dry brush, and wet wipes
- Floor mats
- Heavy-duty contractor trash bags and duct tape
- Digital scale for weighing sample bottles before and after vacuuming
- Sample bottles for HVS3 vacuum
- Filters for micro-vacuum
- Paper towels, deionized water, sprayer, lab-grade methanol
- Health and safety gear (work gloves, flashlight, safety glasses, first aid kit, and ear protection, as the HVS3 is noisy)

3.7 Sample Handling and Chain of Custody

After collection and labeling, the samples will be maintained under strict chain-of-custody protocols, in accordance with the sample packaging SOP (Appendix B). The field sampling personnel will complete a chain-of-custody form for each individual school/daycare shipment/delivery (i.e., batch of coolers) of samples to be delivered to the laboratory for analysis. The coolers containing dust samples will be shipped from the field on ice to the Pace Analytical Laboratory located in Minneapolis, Minnesota (1700

Elm Street SE, Minneapolis, MN 55414) for analysis. Jennifer Anderson is the Pace Analytical point of contact.

The sampler is responsible for initiating and filling out the chain-of-custody form. The chain of custody for a shipment/delivery will list only those samples in that shipment/delivery. Any documentation, including chain of custody, should be placed inside a re-sealable plastic bag, within the shipment/delivery container. Coolers that are to be shipped will be custody sealed, securely taped shut, and have a shipping label securely adhered to the cooler.

The sampling personnel whose signature appears on the chain-of-custody form is responsible for the custody of the samples from the time of sample collection until custody of the samples is transferred to a designated laboratory, a courier, or to another project employee for the purpose of shipping the samples to the designated laboratory. Custody is transferred when both parties to the transfer complete the portion of the chain of custody under "Relinquished by" and "Received by." Signatures, printed names, company names, dates, and times are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the third sheet (pink copy), photocopy, or electronic copy of the chain of custody. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will also be used to document the sample custody, and its identification number will be entered on the chain of custody.

Copies, receipts, and carbons of bills of lading will be retained as part of the permanent documentation in the project file. It is not necessary for courier personnel to sign the chain of custody.

Upon receipt by the laboratory, the samples will be inspected for sample integrity. The chain of custody will be immediately signed, dated, and reviewed by laboratory personnel to verify completeness. Any discrepancies between the chain of custody and sample labels and any problems or questions noted upon sample receipt will be communicated immediately to the field team leader. The laboratory will provide the field team leader and/or the consultant QA manager with a copy of the chain of custody and associated sample-receipt information within 2 working days of receipt of samples. The sample-receipt information routinely provided will include sample receipt date, sample IDs transcribed from the chain-of-custody sample matrix type, and list of analyses to be performed for each sample. Broken custody seals, damaged sample containers, sample labeling discrepancies between container labels and the chain-of-custody form and analytical request discrepancies will be noted on the chain-of-custody form. This information is reviewed by the data validation consultant to verify sample labeling and resolve integrity issues. The field team leader and QA manager will be notified of any such problems and the discrepancies or non-conformances resolved and addressed before the samples are analyzed.

The laboratory will be responsible for following their internal custody procedures from the time of sample receipt until sample disposal. Samples and extracts will be stored in a secure area controlled by the laboratory's designated sample custodian. Samples will be removed from the shipping container and stored in their original containers unless damaged. Damaged samples will be disposed of in an appropriate manner after notifying the field team leader and consultant QA manager, and authorization to dispose is received and documented. In addition, samples will be stored after completion of analyses in accordance with contractual requirements.

3.8 Sample Identification

The RMAP sample identification procedures are detailed in this section. An alphanumeric coding system will be used to uniquely identify each sample collected during RMAP sampling events. Sample identifiers will begin with the matrix, followed by the RMAP Database School ID. The School ID is a unique identifier that is associated with a specific property (address and/or geocode specific). Following the School ID will be the parcel component, location number, QC code (when applicable), and sample date. The sample ID format is [school ID]- [matrix]- [component type]-##[QC code]-YYYYMMDD.

RMAP Database School ID: (example of S-0001)

Site Property Codes:

S – School

D – Daycare

P – Preschool

School ID:

0001 – Associated with a specific address or geocode

Matrix:

D – Dust

S - Soil

Component: Component IDs will be derived on a site-specific basis during development of the FSP Sample Location Map and refined by the sampling team (as necessary). Examples of Component IDs are listed below.

A – Attic

AV – Air Vent

CS – Crawlspace

CT – Ceiling Tile

F – Floor

FM – Floor Mats

G – Grab

O - Other

S – Surface

QC Codes:

D – Field Duplicate

An example sample identification would be S-0001-D-AV-02-20211205. This indicates that the sample was collected at the school with the School ID S-0001 (corresponding to a physical address and/or geocode), was a dust sample collected in an air vent at location number two on December 5, 2021

The sample identification for a field duplicate collected at this location would be S-0001-D-AV-02D-20211205.

3.9 Analyses Methods

The subsections below describe analytical methods the laboratory must use to analyze RMAP samples.

3.9.1 Dust Sample Analysis Methods

All RMAP dust samples will be analyzed to determine metal concentrations via standard laboratory analytical methodologies for arsenic, lead, and mercury. Sample preparations and analyses will be in accordance with the referenced USEPA analytical method specifications as well as standard laboratory practices. The dust samples will be digested according to modified USEPA Method 3050B, and arsenic

and lead concentrations will be determined per USEPA Method 6020B (inductively coupled plasma mass spectrometry [ICP-MS]). Mercury concentrations will be determined per USEPA Method 7471B (Manual Cold-Vapor Technique).

3.9.2 Laboratory Quality Control Samples

As outlined above in Section 3.9.1, RMAP dust samples will be analyzed to determine metals concentrations (arsenic, lead, and mercury) via standard laboratory analytical methodologies. Laboratory QC procedures are outlined below.

The analyses calibration procedures and frequencies of QC samples are specified in the laboratory's SOPs (see Appendix B). Instrument QC samples include calibration verification standards, calibration blanks, and contract required detection limit standards. ICP-MS QC samples also include tuning standards, interference check standards, and internal standards.

Laboratory QC samples will be analyzed in addition to the calibration samples with each QC batch. Laboratory QC samples are introduced into the measurement process to evaluate laboratory performance and sample measurement bias. Control samples may be prepared from environmental samples or generated from standard materials in the laboratory.

Laboratory method blanks, LCSs, analytical duplicates, and serial dilutions at a frequency of 1 each per 20 field samples. If less than 20 field samples are submitted, then 1 set of these QA/QC samples will still be run with a set of less than 20 samples. MS samples will be analyzed when additional amounts of dust are collected. For filter samples, an additional filter for MSs or duplicates must be provided for each method analyzed. When additional samples are not provided for dust, a LCS duplicate may also be included. A second MS sample is not necessary for all laboratory QC batches that already have one MS/matrix spike duplicate (MSD).

3.9.2.1 Laboratory Blanks

Method blanks will be used to monitor laboratory processes and performance. A method blank is a volume of deionized water or a specified weight of inert material for solid samples that is carried through the entire sample preparation and analyses procedures. The method blank volume or weight will be approximately equal to the sample volumes or sample weights being processed. Method blanks are used to monitor interference caused by constituents in solvents and reagents and on glassware and other sampling equipment. Method blank results outside of specified control limits will be re-run/re-digested and re-analyzed with all associated samples and/or flagged by the laboratory per the QC requirements of the analytical method.

Initial and continuing calibration blanks are also analyzed every 10 samples and samples are re-analyzed within compliant blank analyses. All elements of interest must be evaluated to +/- the RL for USEPA Method 6020B.

3.9.2.2 Laboratory Control Samples

An LCS, or a blank spike, is an aqueous or solid control sample of known composition that is analyzed using the same sample preparation, reagents, and analytical methods employed for the Program samples. The LCS is obtained from an outside source or is prepared in the laboratory by spiking reagent water or a clean solid matrix from a stock solution that is different from that used for calibration standards. The LCS is the primary indicator of process control used to demonstrate whether the sample preparation and analytical steps are in control, apart from sample matrix effects. If the LCS recovery falls outside the specified control limits, the LCS is re-analyzed once. If re-analysis of the LCS fails, all samples affected by the failing LCS elements need to be re-digested and re-analyzed.

3.9.2.3 Analytical Duplicates

Analytical duplicates are samples that are split in the laboratory at some step in the measurement process and then carried through the remaining steps of the process. Duplicate analyses provide information on the precision of the operations involved. Analytical duplicates are a pair of subsamples from a field sample that are taken through the entire preparation and analyses procedure; any difference between the results indicates the precision of the entire method in the given matrix. Analyses of analytical duplicates and MSDs monitor the precision of the analytical process. The frequency of analyses, precision goals, and corrective action information pertaining to analytical duplicates are provided in the laboratory SOPs (Appendix B). If the analytical duplicate precision falls outside the specified control limits, the samples will be re-run and/or flagged by the laboratory per the QC requirements of the analytical method.

3.9.2.4 Serial Dilutions

Serial dilutions are performed in conjunction with USEPA Method 6020B to determine whether significant physical or chemical interferences exist due to sample matrix. A serial dilution is performed by analyzing a 5-fold dilution of a field sample (field blanks may not be used) and calculating the percent difference between the original determination and the serial dilution result. Serial dilutions are only applicable for analyte concentrations that are greater than 50 times the MDL. The frequency of analyses, precision goals, and corrective action information pertaining to serial dilutions are provided in the laboratory SOPs in Appendix B.

3.9.2.5 Matrix Spikes

Laboratory MS samples are used to evaluate potential sample matrix effects on the accurate quantitation of an analyte using the prescribed analytical method. The MS/MSDs are prepared by adding an analyte to a subsample of a field sample before sample preparation and analyses. A percent recovery is calculated from the concentrations of the analyte in the spiked and un-spiked samples. A post-digestion spike is performed on any elements that fail to meet criteria. If the percent recovery for the MS and MSD falls outside the control limits, the results are flagged by the laboratory that they are outside acceptance criteria along with the parent sample.

For dust samples collected with the micro-vacuum method, additional filter cassettes will be required for MS analyses. If adequate dust is not present, the analysis of MSs on filter cassette samples will not be included.

3.9.2.6 Additional Quality Control Samples

The laboratory will also analyze ICP-MS interference check, internal standards, and ICP-MS instrument tunes as part of the analytical sequence for USEPA Method 6020B. These instrument QC samples will be evaluated against the method requirements during data validation.

Table 3 contains acceptance criteria for the QC samples detailed above.

3.10 Field Quality Control Samples

Field QC samples are used to identify any biases from transportation, storage, and field handling processes during sample collection and to determine sampling precision. All field QC samples will be delivered with field samples to the laboratory. This section includes brief descriptions of the QC samples to be collected during sampling activities along with frequency, collection, and analytical instructions.

Sampling protocols will be consistent with the field SOPs included in Appendix B and will include 1 field duplicate collected for every 20 primary samples or once per sampling event (e.g., once per sampling

day), whichever is more frequent (in accordance with Level A/B field screening/data review criteria, Appendix D). Sampling equipment for soils and indoor dust filter cassettes are anticipated to be "one time use"; therefore, no external contamination blank/cross-contamination blank samples will be submitted. The HVS3 vacuum equipment is decontaminated between samples; equipment blank samples will be collected to ensure decontamination procedures are effective. Any deviation from the SOPs or this QAPP will be identified in the logbook/data collection device and discussed in the interior dust sampling DSR.

3.10.1 Field Duplicate (Dust Samples)

Field duplicate samples associated with dust sampling will be collected as side-by-side duplicates in separate cartridges rather than a split sample. Each duplicate sample will have its own sample number. Both the original and duplicate sample will be analyzed for identical chemical parameters. The results of the field duplicate will be compared to determine laboratory precision. Field duplicate samples will be collected at a frequency of 1 per 20 samples.

The RPD field precision goal for dust field duplicates will be 35 percent for sample pairs with both sample results being greater than five times the RL. For dust field duplicate/primary sample pairs with one or both sample results being less than five times the RL, an absolute difference of less than or equal to two times the RL (difference less than or equal to two times the RL) will be used as the precision goal. Laboratory precision goals are laboratory specific.

3.10.2 Filter Blanks

Filter blanks are collected to determine if micro-vacuum dust samples for metals analysis are collected with metals-free filters. A filter blank is a randomly selected filter cassette from a manufactured lot. For this sampling effort, one filter blank will be selected at random from each lot number of cassettes to be used for the collection of micro-vacuum dust samples. The filter blank remains unopened prior to being submitted to the laboratory. The entire batch of cassettes may be rejected if any metals are detected in a lot blank.

3.10.3 Field Blanks

Field blanks are collected to evaluate potential contamination introduced during sample collection, shipping and handling, or analysis. For this sampling effort, field blanks for surface dust and air will be collected at a rate of one each per school. Field blanks are collected by removing the end cap of the sample cassette to expose the filter in the same area where sample collection occurs for about 30 seconds before re-capping the sample cassette. The field blanks are then analyzed for metals.

3.10.4 Equipment Blanks

Equipment blanks are collected to evaluate potential cross-contamination between samples collected with the HVS3 vacuum. For this sampling effort, equipment blanks will be collected at a rate of one per sampling event. Equipment blanks will be collected after the first sample has been collected and the HSV3 has been decontaminated. Approximately five grams of acid-washed glass beads will be poured through the sample collection chamber into the sample catchment container.

3.10.5 Floor Mat Blanks

Floor mat blanks are collected to evaluate potential contamination introduced from the floor mats used for dust collection. For this sampling effort, floor mat blanks will be collected at a rate of one per sampling event. Approximately five grams of acid-washed glass beads will be poured onto a floor mat and then collected with the HSV3 vacuum.

3.11 Sample Disposal

Dust samples shipped to the laboratory for analyses will be held until the laboratory analyses have been completed, the Agencies have reviewed and approved all subsequent project laboratory data and work plans, and the sample hold times have expired. At this point, the laboratory may dispose of samples. Any excess sample mass that was not included in the aliquot submitted to the laboratory will be subject to the same disposal criteria. The laboratory will notify ARCO/BSB when they will be disposing of samples.

3.12 Instrument/Equipment Testing, Inspection, and Maintenance

To document continual quality performance of any instruments or equipment, the testing, inspection, and maintenance activities listed in the sections below will be performed and recorded.

3.12.1 Field Equipment

Field equipment will be examined daily to certify that it is in proper operating order prior to its use. Equipment, instruments, tools, and other items requiring preventative maintenance will be serviced in accordance with the manufacturer's specified recommendations. Field equipment will be cleaned and safely stored between each use. Any routine maintenance recommended by the equipment manufacturer will also be performed and documented in field logbooks.

Equipment will be inspected, and the calibration checked, if applicable, before it is transported to a field setting for use.

3.12.2 Laboratory Equipment

Instruments used by the laboratories will be maintained in accordance with each laboratory's QA plan and analytical method requirements. All analytical measurement instruments and equipment used by the laboratory will be controlled by a formal calibration and preventative maintenance program.

The laboratories will keep maintenance records and make them available for review, if requested, during laboratory audits. Laboratory preventative maintenance will include routine equipment inspections and calibrations at the beginning of each day or each analytical batch, per the laboratory's internal SOPs and method requirements.

3.13 Inspection/Acceptance of Supplies and Consumables

All supplies and consumables received for the project (e.g., sampling equipment, supplies, etc.) will be checked for damage and other deficiencies that would affect their performance. The types of equipment that will be needed to complete sampling activities are described in the relevant SOPs. Inspections of field supplies will be performed by the ERM field team leader.

The personnel at each laboratory will be responsible for performing inspections of laboratory supplies in accordance with their QA plan.

3.14 Non-Direct Measurement Data Acquisition Requirements

Non-direct measurement data include information from site reconnaissance, literature searches, previous sampling events, and interviews. The acceptance criteria for such data include a review by someone other than the author. Any measurement data included in information obtained from these sources will determine further action at the Site only to the extent that those data can be verified.

Types of data being used for the indoor dust assessments include but are not limited to:

- As-built floor plans of schools and daycares

- Interviews. School or daycare employees will be interviewed prior to the sampling event to determine building usage and determine appropriate sample locations
- Surveys. Visual surveys of the properties will be made by the field team during the sampling event and documented following ERM protocols for site photography and field notes

3.15 Data Management Procedures

This section describes the management of data for the project including field and laboratory data. The Program quality records will be maintained by the data management division manager, as described in the BPSOU *Final Data Management Plan* (Atlantic Richfield 2017).

These records, either electronic or hard copy in form, may include the following:

- Project work plans with any approved modifications, updates, and addenda
- Individual school/daycare maps (hard copy or scanned field drawings and electronic files)
- Individual school/daycare result letters (both no action and remedial action required)
- Project QAPP, including this QAPP, with any approved modifications, updates, addenda, and corrective or preventative actions
- Access agreements from school officials
- Field documentation
- Chain-of-custody records
- Laboratory documentation (results received from the laboratory will be documented both in report form and in an electronic format)
- Data validation documentation
- Annual completion report

Hard copy field and laboratory records will be maintained in the project's central data file, where original field and laboratory documents are filed chronologically for future reference. These records are also scanned to produce electronic copies. The electronic versions of these records are maintained on a central server system with backup scheduled daily.

Before field and laboratory data are incorporated into the Program databases, the data and supporting documentation will be subject to appropriate review to document the accuracy and completeness of original data records. Field data that have been reviewed in a hard-copy format will be entered into electronic data files for upload to the Program database. All manual data entry into an electronic format will be reviewed by a separate party before the information is incorporated. Laboratory EDDs and related data packages will be reviewed as part of the internal data review process. The data management division manager, or designated alternate, will be responsible for ensuring data integrity prior to Program database uploads. Following these review steps, field and laboratory electronic data files will be imported to the Program database.

Standardized data import formats and procedures will be used to upload both field and laboratory data into the Program database. An existing EDD format will be used for data upload. Standardized parameter names, numerical formats, and units of measure may be applied to the original information to facilitate comparability across all datasets and within the Program database. Data management activities for the RMAP are further defined in the BPSOU *Data Management Plan* (Atlantic Richfield 2017).

3.15.1 Requests for Data

Requests for data can be made to the data management division manager or to the Agencies who can access data directly through the secure Program database. Refer to the *Institutional Controls Management System Plan* (BSB and Atlantic Richfield 2019b) for additional details and specific examples of the Program's database and tracking system. The *Institutional Controls Management System Plan* (BSB and Atlantic Richfield Company 2019b) is in Appendix F of the *Institutional Controls Implementation and Assurance Plan (ICIAP)* (BSB and Atlantic Richfield 2019a).

4. ASSESSMENT AND OVERSIGHT

Assessment and oversight of data collection and reporting activities are designed to verify that sampling and analyses are performed in accordance with the procedures established in this QAPP. The USEPA or a USEPA contractor will provide oversight during site reconnaissance and sampling activities. The audits of field and laboratory activities include two independent parts: internal and external audits. Internal audits may be conducted by Atlantic Richfield's contractor Environmental Standards, Inc. as necessary. External audits may be performed by the Agencies as necessary. Audits are not currently scheduled for this project.

Performance and system audits of field and laboratory data collection and reporting procedures are described in this section.

4.1 Corrective Actions

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC performance, which can affect data quality. Corrective action can occur during field activities, laboratory analyses, and data assessment. A corrective action template is provided in Appendix F.

Non-conforming equipment, items, activities, conditions, and unusual incidents that could affect data quality and attainment of the project's quality objectives will be identified, controlled, and reported in a timely manner. For the purpose of this QAPP, a non-conformance is defined as a malfunction, failure, deficiency, or deviation that renders the quality of an item unacceptable or indeterminate in meeting the project's quality objectives.

Corrective action in the laboratory may occur prior to, during, and after initial analyses. Several conditions such as broken sample containers, preservation or holding-time issues, and potentially high-concentration samples may be identified during sample log-in or just prior to analyses.

Corrective actions to address these conditions will be taken in consultation with the Atlantic Richfield Liability Manager, the consultant project manager, and/or the consultant QA manager. If corrective action requests are not in complete accordance with approved project planning documents, the USEPA will be consulted, and concurrence will be obtained before the change is implemented, or new samples may be obtained.

If during analyses of the samples the associated laboratory QC results fall outside of the project's performance criteria, the laboratory should initiate corrective actions immediately. Following consultation with laboratory analysts and section leaders, it may be necessary for the contract laboratory's QA officer to approve implementing a corrective action. These conditions may include dilution of samples, additional sample extract cleanup, or automatic re-injection/re-analysis when certain QC criteria are not met, etc. If the laboratory cannot correct the situation that caused the non-conformance and an out-of-control situation continues to occur or is expected to occur, then the laboratory will immediately contact the Atlantic Richfield Liability Manager, the consultant project manager, and/or the consultant QA manager and request instructions regarding how to proceed with sample analyses.

Completion of any corrective action should be evidenced by data once again falling within the project's performance criteria. If this is not the case, and an error in laboratory procedures or sample collection and handling procedures cannot be found, the results will be reviewed by the consultant QA manager to assess whether re-analysis or re-sampling is required.

All corrective actions taken by the laboratory will be documented in writing by the laboratory project manager and reported to the consultant QA manager. If corrective action requests are not in complete accordance with approved project planning documents, the USEPA will be consulted, and concurrence

will be obtained before the change is implemented. All corrective action records will be included in the Program quality records.

4.2 Corrective Actions during Data Assessment

The need for corrective action may be identified by any member of the project team during data assessment. Potential types of corrective action may include re-sampling by the field team, re-analyses of samples by the laboratory, or re-submitting data packages with corrected clerical errors. The appropriate and feasible corrective actions are dependent upon the ability to mobilize the field team and whether the data to be collected is necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded). If corrective action requests are not in complete accordance with approved project planning documents, the USEPA will be consulted, and concurrence will be obtained before the change is implemented. Corrective actions of this type will be documented by the consultant QA manager on a Corrective Action Report (Appendix F) and will be included in any subsequent reports.

4.3 Reports to Management

Upon receipt of laboratory results and completion of the data review/validation process, all analytical data will be uploaded into the Program database and submitted to the Agencies for review and approval. For the school sampling portion of this project, these submittals would be anticipated to be submitted on a per school basis to decrease the turnaround time required for landowner reporting as much as possible. Upon receiving Agency approval, the sample results (for all analytes) will be reported to school and daycare officials along with a letter explaining what the results indicate (see result letter templates in Appendix E). The action levels for arsenic, lead, and mercury will be reported along with sample results.

After site investigations and remedial actions are complete, the consultant QA manager will prepare an interior dust sampling DSR summarizing the sampling activities. The laboratory and data validation turnaround times for providing sample results will be expedited in order to achieve project assessment and remediation goals while also allowing timely completion of the DSR. This is estimated to be a 5 to 7 business day turnaround time on lab data and Level 2 data packages and 10 to 12 business day turn around on lab data and Level 4 data packages. Data validation is estimated to be a 7-business day turnaround time after data packages are received from the lab. The report will describe specific field sampling activities performed during implementation of the QAPP. Each report will include field documentation, documentation of field QC procedures, results of all field and laboratory data, data validation results, and data usability assessments.

A separate report will be prepared by the consultant QA manager, as needed, to communicate the results of performance evaluations or program audits to identify specific significant QA issues and provided to the USEPA for review. Any corrective action reporting described in Section 4.2 above will be summarized and included as appropriate.

5. DATA REVIEW AND USABILITY

The following sections address the final project checks conducted after the data collection phase of the project is completed to confirm that the data obtained meet the project objectives and to estimate the effect of any deviations on data usability for the express purposes of achieving the stated DQOs (Section 2.9.1). Data review/validation process under this QAPP is streamlined to support the post-BPSOU ROD (USEPA 2006b) decision-making process. The analytical data collected under this QAPP and produced by analytical laboratories will undergo a combination of Stage 4 and 2B data validation which are described in section 5.2. The field documentation will be subject to Level A/B criteria review, and analytical data will be validated per the *Clark Fork River Superfund Site Investigation (CFRSSI) Data Management/Data Validation Plan* (CFRSSI DM/DV Plan) (ARCO 1992a), the *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data* Review (USEPA 2020b), and the project DQOs. Data review and validation will be conducted by a qualified technical consultant who is independent from the sampling consultant (i.e., an individual other than the individual who performed sampling).

5.1 Data Review, Verification, and Validation

This section describes the review, verification, and validation process for field data and laboratory data. The section also details laboratory data reporting requirements, which describe how results are conveyed to data users.

5.1.1 Data Review Requirements

Data review is performed by the data producer to determine if the data have been recorded, transmitted, and processed correctly.

5.1.1.1 Field Data Review

Raw field data will be entered in field logbooks/data collection device and reviewed for accuracy and completeness by the field team leader before those records are considered final. The overall quality of the field data from any given sampling round will be further evaluated during the process of data reduction and reporting. The field data will be reviewed quarterly by the consultant QA manager, or designated alternate.

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Field data review will include verification that any QC checks and calibrations, if necessary, are recorded properly in the field logbooks/data collection device and that any necessary and appropriate corrective actions were implemented and recorded. Such data will be recorded in the field logbook/data collection device immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, the field team leader will review the field logbooks/data collection device to determine whether any transcription errors have been made by the field crew. If transcription errors have been made, the field team leader and field crew will address the errors to provide resolution.

As appropriate, field measurement data will be entered into electronic files for import to the Program database. Data entries will be made from the reviewed logbooks/data collection device, and all data entries will be reviewed for accuracy and completeness by a separate party before the electronic file is provided to the Program database manager. Electronic files of field measurement data will be maintained as part of the project's quality records.

5.1.1.2 Laboratory Data Review

Internal laboratory data reduction procedures will be according to each laboratory's quality management plan. At a minimum, paper records will be maintained by the analysts to document sample identification number and the sample tag number with sample results and other details, such as the analytical method used (e.g., method SOP #), name of analyst, the date of analysis, matrix sampled, reagent concentrations, instrument settings, and the raw data. These records will be signed and dated by the analyst. Secondary review of these records by the laboratory supervisor (or designee) will take place prior to final data reporting. The laboratory is responsible for assigning appropriate flags/qualifiers in accordance with the analytical method and internal laboratory SOPs.

5.1.2 Data Verification Requirements

Data verification is the process for evaluating the completeness, correctness, and conformance/ compliance of a specific data set against the method, procedural, or contractual specifications.

5.1.2.1 Field Data Verification

The Level A/B review (see checklist in Appendix D), as described in the CFRSSI DM/DV Plan (ARCO 1992a) and the DM/DV Addendum (AERL 2000), will be used in the verification process for field documentation related to samples collected for laboratory analyses.

Level A criteria includes:

- Sampling date
- Sample team and/or leader
- Physical description of sample location
- Sample collection technique
- Field preparation technique
- Sample preservation technique
- Sample shipping records

Level B criteria includes:

- Field instrumentation methods and standardization complete
- Sample container preparations
- Collection of field duplicates
- Proper and decontaminated sampling equipment
- Field custody documentation
- Shipping custody documentation
- Traceable sample designation number
- Field notebook(s), custody records in secure repository
- Complete field forms

5.1.2.2 Laboratory Data Verification

The laboratory will prepare Level 2 and Level 4 data packages for transmittal of results and associated QC information to the Atlantic Richfield Liability Manager or consultant designee within a standard turnaround time unless otherwise required.

These data packages will be prepared in general accordance with the *EPA Contract Laboratory Program Statement of Work for Superfund Analytical Methods (Multi-Media, Multi-Concentration) SFAM01.1* (USEPA 2020c). Deviations from these specifications may be acceptable based on the SW-846 methods provided the report presents all the requested types of information in an organized, consistent, and readily reviewable format.

Each data package, as described above, will be accompanied by an EDD prepared by the laboratory. A non-validated EDD is uploaded to the BP RM EQuIS database by the laboratory to capture the laboratory supplied EDD. Once the laboratory supplied EDD is loaded, the data validator is notified and downloads the non-validated EDD from the database for the verification and validation process. Once data verification and validation is complete, the qualifiers will be added to the downloaded EDD, the enforcement “E” and screening “S” qualifiers are added and the revised EDD is uploaded to the database by the validator for final reporting.” Additional laboratory QC data can be included in the EDD. The EDDs will be cross-checked against corresponding data reports to confirm consistency in results reported in these two separate formats. This cross-check will take place as part of the data verification process. All data will be submitted in both Level 2 and Level 4 format.

5.1.2.3 Resolution of Deficiencies

Any deficiencies found during the verification process will be discussed with the data producer and may be resolved with a revised data package.

5.1.3 Data Validation Requirements

The purpose of analytical data validation is to provide an assessment of data quality. Data validation will be performed by qualified, independent data validation personnel, who are not associated with data collection or sampling responsibilities, and that have applicable training. Data validation categorizes data as acceptable for use, unacceptable for use, or qualified for select use. The validation effort routinely identifies data use limitations and corrects reporting and quantitation errors. The data packages provided for validation will be evaluated for compliance with respect to the requested analytical methods and/or the QAPP and completeness of requested deliverables. Concurrent with the data validation efforts, analytical data usability will also be assessed. Analytical data usability is the determination of whether a data set is sufficiently complete and of sufficient quality for further evaluation by the data user as detailed in Section 5.3 of the QAPP to support a decision or action.

The data will be validated during the data validation process with guidance from the CFRSSI QAPP (ARCO 1992b), the CFRSSI DM/DV Plan (ARCO 1992a), the CFRSSI DM/DV Plan Addendum (AERL 2000), the *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (USEPA 2020b), laboratory-specific QC criteria, and/or method-specific criteria where applicable. The use of the functional guidelines versions listed above is important to maintain consistency between data validation and qualification of data currently being performed and future work to be performed under the RMAP. It should be noted that the USEPA National Functional Guidelines, which were developed for the validation of data generated in accordance with the Contract Laboratory Program, are not directly applicable to the type of analyses/protocols associated with the analyses for this project. USEPA National Functional Guidelines qualifies data based on strict contractual Contract Laboratory Program method requirements and acceptance criteria, which may not be consistent with the requirements and acceptance criteria presented in SW-846 methods. Data validators will apply the

USEPA guidelines as appropriate, assess the data relative to method QC protocols and DQOs in this QAPP, and use professional judgment according to the documents listed above. Finally, reason codes for qualification will be included in the data validation report and entered to the qualified EDD.

5.2 Verification and Validation Methods

The Level A/B assessment checklists included in Appendix D are based on the CFRSSI DM/DV Plan Addendum (AERL 2000) guidance and will be used for field data verification as detailed in Section 5.1.2.1.

Data qualifiers will follow those used in the *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review* (USEPA 2020b). Data validation for each laboratory data package will be documented on the data validation checklists based on the CFRSSI DM/DV Plan Addendum (AERL 2000) guidance (Appendix G).

The data validator will be responsible for reviewing field documentation associated with sample collection, conducting the verification and validation of laboratory-produced data, and completing a data validation report, which will be reviewed by the consultant project manager and QA manager. The data validation reports for each SDG will be included as an appendix to the DSR.

Qualifiers that may be applied to the data during the data validation process are listed in Table 5-1.

Table 5-1: Validation Qualifiers

Qualifier	Definition
U	The analyte was analyzed for, but was not detected above the level of the adjusted detection limit or quantitation limit, as appropriate.
J	The analyte was positively identified; the associated numerical value is an estimate of the concentration of the analyte in the sample. This will also include results reported between the MDL and RL.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
UJ	The analyte was not detected above the sample MDL. However, the MDL is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
No Flag	Result accepted without qualification.

5.2.1 Differences between Stage 2B and Stage 4 Validation

The content and scope of the Stage 2B and Stage 4 data validation will be performed with guidance from *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, OSWER No. 9200.1-85, EPA 540-R-08-005, 13* (USEPA 2009). The major difference between Stage 2B and Stage 4 data validation is the detail level of the data evaluation. Stage 4 data validation is an in-depth process that consists of a comparison between raw data and summary forms to check for inconsistencies between reported data and raw data. Stage 2B data validation does not involve evaluating raw data or checking reported data and raw data and assumes that all results and recoveries are correctly reported.

Stage 2B and Stage 4 data validations and reports are generated by an initial reviewer on a per-SDG or sampling location basis from the complete Level 4 data package to ensure completeness and data usability of data packages. Level 2 data packages are a condensed version of final data prior to completion and receipt of Level 4 data packages. Level 2 data packages contain the same information as the Level 4 data packages with the exception that instrumental QC (i.e., instrument tunes and raw data) to support the sample and the QA/QC results are not provided.

Each validation report is reviewed by a senior chemist for accuracy to ensure that the initial reviewer has rigorously evaluated the recoveries/results and applied the applicable qualifiers to the data.

5.2.2 Stage 2B and Stage 4 Validation Procedure

A comprehensive QA review will be performed to independently verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. Stage 4 data validation includes a detailed review and interpretation of the data generated by the laboratory. Stage 4 data validation includes the review of the summary forms for all QC procedures and all sample and quality control raw data (including instrument calibration) to support the results reported. The purpose of a Stage 2B validation is to qualify data based on identified data quality limitations.

For each of the inorganic analytes, the Stage 4 verification and validation checks include an evaluation of the following, as applicable for each analytical method. A Stage 2B validation focuses solely on data usability and does not include a review of raw data.

- Completeness of laboratory data package
- Requested analytical methods performed
- Compliance with the QAPP, analytical method, and analyte list
- Proper sample collection, custody, preservation, and handling procedures
- Holding times
- Reported detection limits
- Dilution factors
- ICP-MS tuning
- Instrument calibration
- Initial and continuing calibration verification standards
- Initial and continuing calibration blanks
- ICP-MS interference check samples
- Method blanks
- LCSs
- RL check standard recoveries
- Field duplicate results
- MS/MSDs (pre-digestion and post-digestion)
- ICP-MS internal standard recoveries
- ICP-MS serial dilutions
- Results verification and reported detection limits

- Sample Preparation and Analytical Run Log

5.2.3 Data Validation Ratios

Initially, 10% of the project data will undergo Stage 4 validation. The data validator will perform Stage 4 data validation on the first SDG of each designated school sampling event to verify that the laboratory is analyzing the project samples in accordance with the applicable analytical methods and QAPP procedures, and is providing all required data deliverables. This process will ensure Stage 4 validation is performed for each school and periodically throughout the entire sampling event. However, in some instances, where multiple small project SDGs containing the same analytical list are being prepared, validation of the first data package of each project school may represent the entire data set for the project, thereby raising the percentage of Stage 4 validation performed. This approach should allow the data validator to identify and have the laboratory correct any non-compliances early on in the data collection process. In the event significant problems or issues are identified during the 10% Stage 4 data validation effort, it may be necessary to increase the percent of data subjected to Stage 4 validation to ensure that all errors and non-compliances have been appropriately corrected. The remaining 90% of the data will be validated at a Stage 2B level. In addition, the Consultant PM can also offer guidance or request greater percentage of Stage 4 data validation as the required level of validation based on project DQOs.

5.3 Reconciliation and User Requirements

A Data Quality Assessment (DQA) process described in the CFRSSI DM/DV Plan Addendum (AERL, 2000) and the Guidance for Data Quality Assessment EPA QA/G-9 (EPA, 2000) will be performed to determine whether the project-specific DQOs have been satisfied. The 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 the statistical test/method. *There are no statistical tests that are planned in the interpretation of the non-residential soils results; laboratory results will be compared directly to action limits defined in the DQOs (Section 2.9.1).*

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 and documented in the data reporting. 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 data limitations.

The PARCCS data quality indicators (Section 2.9.2) will be used when conducting the DQA. If the PARCCS assessment satisfies the project DQOs, then usability of the data will follow the enforcement/screening/unusable data categories as described in the CFRSSI DM/DV Plan (ARCO 1992a):

- Enforcement Quality (Unrestricted Use). Enforcement quality data may be used for all purposes under the Superfund program including the following: site characterization, health and safety, environmental evaluation/cost analysis, remedial investigation/feasibility study, alternatives evaluation, conformational purpose, risk assessment, and engineering design.

- Screening Quality (Restricted Use). Potential uses of screening quality data, depending upon their quality, include site characterization, determining the presence or absence of contaminants, developing or refining sampling and analysis techniques, determining relative concentrations, scoping and planning for future studies, engineering studies and engineering design, and monitoring during implementation of the response action.
- Unusable Data. These data are not usable for Superfund-related activities.

Data that meet the Level A and Level B field data verification criteria and are not qualified as estimated or rejected during the data validation process are assessed as enforcement quality data and can be used for all Superfund purposes and activities. Data that meet only the Level A criteria and are not rejected during the data validation process can be assessed as screening quality data. Screening quality data can be used only for certain activities, which include engineering studies and design. Data that do not meet Level A and/or B criteria, and/or are rejected during the data validation process are designated as unusable. The data are assigned one of the following usability designations defined in Table 5-2.

Table 5-2: Data Usability Designation Definitions

Designation	Definition	Data Validation Criteria	Field Verification Criteria
E	Enforcement quality	No qualifiers, U qualifier, or J qualifier (see note below)	Meets both Level A and B criteria
S	Screening quality	J or UJ qualifier	Meets only Level A criteria
R	Unusable	R qualifier	Does not meet Level A or B criteria

Note: It is appropriate to note that for sample results qualified as estimated "J" by the laboratory because the reported result is between the MDL and RL, values are considered enforcement data if no other qualifiers were required during validation.

The selection process for the appropriate enforcement designation is presented in Table 5-3.

Table 5-3: Enforcement/Screening Designation Selection

Validation Qualifier	Field Screening Criteria		
	Meets Level A and B	Meets Level A	Does not meet Level A or B
No qualifier, U, or laboratory results reported between the MDL and RL with a J qualifier	E	S	R
J, J+, J-, or UJ	S	S	R
R	R	R	R

Results of the QA review and/or validation will be included in any subsequent report, which will provide a basis for meaningful interpretation of the data quality and evaluate the need for corrective actions. The enforcement/screening designations are also added to the qualified AR EQuIS EDDs by the data validation consultant for upload to the AR EQuIS database.

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APPENDIX A QAPP CROSSWALK

APPENDIX B STANDARD OPERATING PROCEDURES

APPENDIX C ACCESS FORMS

APPENDIX D LEVEL A/B FIELD DATA VERIFICATION CHECKLIST

APPENDIX E EXAMPLE RESULT LETTER TEMPLATES

APPENDIX F CORRECTIVE ACTION REPORT

APPENDIX G DATA VALIDATION CHECKLIST

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