Sampling and Analysis Plan For Confirmation Samples at the Central School Campus

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Confirmation Samples at the Central School Campus
600 1st Street West
Roundup, Musselshell County, Montana

WON: 15475.006.001.0020

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LIST OF ACRONYMS

ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AOC	Analyte of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
ARM	Administrative Rules of Montana
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
CMBC	Central Montana Brownfields Coalition
COC	Chain-of-Custody
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
Ft/ft	Feet per Foot
GPS	Global Positioning System
HASP	Health and Safety Plan
HUD	U.S. Housing and Urban Development Department
IDW	Investigation-Derived Waste
LBP	Lead-Based Paint
LDL	Laboratory Detection Limit
LF	Linear Feet
LQL	Laboratory Quantitation Limit
MDEQ	Montana Department of Environmental Quality
Mg/cm^2	Milligrams per Square Centimeter
MQO	Measurement Quality Objective
N/A	Not Applicable
NIOSH	National Institute for Occupational Safety and Health
OERR	Office of Emergency and Remedial Response
OSHA	Occupational Safety and Health Administration
PAL	Project Action Limit
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCM	Phase Contrast Microscopy
PPE	Personal Protective Equipment
PPM	Parts per Million
PQL	Practical Quantitation Limits
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RACM	Regulated Asbestos-Containing Material
RBSL	Risk Based Screening Level
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SMDC	Snowy Mountain Development Corporation
SOP	Standard Operating Procedure

LIST OF ACRONYMS

SOW	Scope-of-Work
SF	Square Foot
START	Superfund Technical Assessment and Response Team
TBD	To Be Determined
TCLP	Toxicity Characteristic Leaching Procedure
TEM	Transmission Electron Microscopy
WESTON	Weston Solutions, Inc.
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

Snowy Mountain Development Corporation (SMDC) has contracted Weston Solutions, Inc. (WESTON®) to compile and review data from previous reports and develop this Sampling and Analysis Plan (SAP) for asbestos abatement and lead paint stabilization work at the Central School Campus (Site) in Roundup, Musselshell County, Montana. SMDC and Musselshell County are working with developers independent of WESTON to redevelop the property. SMDC was awarded a Brownfields Assessment grant from the United States Environmental Protection Agency (EPA) to support the reuse and/or redevelopment of Brownfields sites in SMDC's jurisdiction.

The Site, located at 600 1st St. West, Roundup, Montana, is part of Roundup School District #55 Central School Campus (Figure 1). The Site consists of four (4) separate buildings, referred to as the Elementary School (Building 1), Multi-Purpose Room (Building 2), Classroom Annex (Building 3), and the Music Room (Building 4), which are shown in Figure 2. The Site is located in an area surrounded by residential properties. The Site is approximately two acres in size and is located at 46.44744°N latitude and -108.5442°W longitude.

The main Elementary School Building is on the National Register of Historic Places and features a sandstone exterior. Both the Multi-Purpose Room and Classroom Annex were brick additions made to the Elementary School building over 50 years after it was originally built. All four (4) buildings had been utilized by School District #55, until August 2016, when construction of a new school was finished.

The purpose of this SAP is to document the safe abatement of all identified Asbestos Containing Materials (ACM) and Lead-Based Paint (LBP) at the Site. This SAP will provide site specific instructions for conducting confirmation sampling to assure the successful completion of all abatement and stabilization activities in accordance with Certified Code of Federal Regulations Title 40, subpart 31.45 (40 CFR 31.45) – Quality Assurance.

Due to the historically significant nature of the Elementary School Building, modifications to the abatement approach may need to be made in order to not alter, destroy or change the historic elements of the building. These modifications will be described in a future revision of the SAP once the State Historic Preservation Office (SHPO) has shared their findings. Therefore, the findings may result in not *all* of the identified LBP being abated and may require encapsulation or other alternative technique to prevent human health exposure.

The specific field sampling and chemical analysis information pertaining to the Site is addressed in this SAP, in accordance with *Final Project-Wide Quality Assurance Project Plan CMBC Central Montana Brownfields Coalition* (Tetra Tech, 2016). A copy of the Quality Assurance Project Plan (QAPP) is included as Attachment A. The following EPA documents were used as guidance for completing this SAP: *EPA Sampling and Analysis Plan Guidance and Template, Version 3, Brownfields Assessment Projects* (R9QA/008.1), August 2012; *EPA Requirements for Quality Assurance Project Plans* (QA/R-5), March 2001(reissued 2006); *Guidance for Quality Assurance Project Plans* (QA/G-5), December 2002; and *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, QA/G-4), February 2006.

This SAP describes the project and data use objectives, data collection rationale, quality assurance (QA) goals, and requirements for sampling and analysis activities. The SAP also defines the sampling and data collection methods that will be used for this project. The SAP is intended to accurately reflect the planned data-gathering activities for this specific project. Site conditions and additional SMDC, EPA, and/or Montana Department of Environmental Quality (MDEQ) direction once the abatement and stabilization work begins may warrant modifications.

1.1 PROJECT MEMBER ROLES AND RESPONSIBILITIES

The following is a list of project personnel and their responsibilities. Table 1-1 provides contact information for SMDC and WESTON project personnel.

- **SMDC Brownfields Project Manager/Grantee QA Manager –** Ms. Karen Sweeney will be responsible for ensuring the project meets the goals of the developers. She will provide technical review, input on the SAP, and escort WESTON personnel and subcontractors performing field work.

- **WESTON Program Manager:** The WESTON Program Manager is Mr. Mark Bell. Mr. Bell is responsible for the overall management of the contract including cost, schedule, and technical quality.

- **WESTON Project Manager:** Mr. Hayden Janssen is the WESTON Project Manager. Mr. Janssen is responsible for all tasks assigned to WESTON by SMDC. He will work with SMDC to ensure project goals are met, the SAP is reviewed and the field investigation is implemented.

- **WESTON QA Manager:** Ms. Jenny O'Mara is the WESTON QA Manager and will work with the WESTON Project Manager. Ms. O'Mara is responsible for ensuring the project QA goals are met. She will review laboratory data and data collected from the field investigation to ensure accuracy with this SAP. Ms. O'Mara will be functioning independently from the field team that is collecting the data and will be responsible for maintaining the official, approved SAP.

- **WESTON Field Manager:** The WESTON Field Manager, Ms. Sarah Ricard, will be responsible for overseeing field subcontractors, to ensure compliance with the remediation contract, and generating field documentation of field activities. Ms. Ricard will serve as the independent oversight of the abatement contractor.

- **Northern Industrial Hygiene (NIH):** The air monitoring and air clearance testing will be performed by NIH, an independent contractor separate from the abatement contractor.

- **Abatement Subcontractor:** The contract for abatement services will be directly awarded by SMDC. WESTON will prepare a bid package to assist SMDC in procuring abatement services. The abatement contractor will be tasked with completely abating all identified ACM and LBP at the Site, as well as procuring laboratory services for confirmation sampling.

Table 1-1 Key Project Personnel Contact Information

Title/Responsibility	Name/Email Address	Phone Number
Snowy Mountain Development Corporation (SMDC)		
SMDC Brownfields Project Manager/ Grantee QA Manager	Karen Sweeney smdckaren@midrivers.com	(406) 535-2591
Weston Solutions, Inc. (WESTON)		
WESTON Program Manager	Mark Bell Mark.Bell@WestonSolutions.com	(303) 729-6153
WESTON Project Manager	Hayden Janssen Hayden.Janssen@WestonSolutions.com	(406) 502-1570 Ext. 2507
WESTON QA Manager	Jenny O'Mara Jenny.Omara@WestonSolutions.com	(406) 502-1570 Ext. 2504
WESTON Field Manager	Sarah Ricard Sarah.Ricard@WestonSolutions.com	(406) 202-8910 (mobile)
WESTON Subcontractors		
Abatement Contractor	TBD	TBD

1.2 PROJECT TASKS & SCHEDULES

Table 1-2 provides a tentative schedule of dates for field work based upon availability (i.e., abatement contractor). These dates may change pending actual availability as the field work tasks approach.

Table 1-2 Project Activities and Proposed Schedule of Completion

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Develop a Draft SAP	WESTON	May 30, 2017	June 7, 2017	Draft SAP	June 7, 2017
SMDC, U.S. EPA, MDEQ, Review of Draft SAP	SMDC	June 8, 2017	July 2017	Comments on Draft SAP	June 2017
Address Comments/Develop Final SAP	WESTON	June 2017	June 2017	Final SAP	5 Days from receipt of comments
Develop Bid Package for Abatement Contractor	WESTON	June 2017	June 2017	Bid Package	21 Days from receipt of approved-SAP
Develop/Approval of WESTON HASP	WESTON	July 2017	July 2017	HASP	July 2017
Mobilization	WESTON	July 2017	July 2017	N/A	N/A
Field Activities	WESTON	July/August 2017	July/August 2017	Field Notes/Activity Updates	N/A
Demobilization	WESTON	July/August 2017	July/August 2017	N/A	N/A
Develop Draft Summary Memo	WESTON	Fall 2017 Upon completion of sample collection	Fall 2017	Draft Summary Memo	Fall 2017
SMDC, U.S. EPA, MDEQ, Review of Draft Summary Memo	SMDC	Fall 2017 Upon receipt of Draft Summary Memo	Fall 2017	Comments on Draft Summary Memo	Fall 2017

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Address Comments/Develop Final Summary Memo	WESTON	Fall 2017 Upon receipt of comments on Draft Summary Memo	Fall 2017	Final Summary Memo	Fall 2017

2.0 PROJECT BACKGROUND

2.1 PHYSICAL SETTING

The Site is approximately two acres in size and is located at 600 1st Street West Roundup, Montana, at 46.44744°N latitude and -108.5442°W longitude. As shown on Figure 2, the property contains four (4) buildings which are described below.

- **Elementary School (Building 1):** The Central School Elementary Building is an approximately 20,000 square foot (SF) three-story building, with a basement, which was completed in 1913. It is on the National Register of Historic Places and features a sandstone exterior.

- **Multi-Purpose Room (Building 2):** Constructed in 1962, the Multi-Purpose room is a brick addition that is approximately 4,000 SF, which features a gym and kitchen.

- **Classroom Annex (Building 3):** The Classroom Annex is a brick structure of approximately 5,000 SF, and was the last structure added in 1975.

- **Music Room (Building 4):** The Music Room is an approximately 4,600 SF single-story building with an unfinished basement. The exact construction date is unknown for this building; however, it was likely constructed prior to the 1970s. This building was previously a grocery store which was later repurposed to be a music room for the Central School Campus (WESTON, 2016a).

2.2 OPERATIONAL HISTORY

The Central School Campus was utilized as a school from 1911 to 2016. The property is currently owned by School District #55. Musselshell County, in cooperation with SMDC and School District #55, is currently planning on converting the Multi-Purpose room into a senior center and the Classroom Annex into a foodbank and second-hand store. Renovation plans for the Elementary School, which is on the National Register of Historic Places, are currently being made.

2.3 PREVIOUS INVESTIGATIONS / REGULATORY INVOLVEMENT

A number of previous investigations and assessments are known to have been completed at the Site. Owing to the age of the structures and existing information relating to ACM, a Phase II Environmental Site Assessment (ESA) was conducted by WESTON in 2016 (WESTON, 2016). Analytes of Concern (AOCs) identified at the Site include ACM and LBP. Supplementary information regarding the findings from previous investigations and reports reviewed is included in Attachment B. The following subsections provide a summary of investigations that have occurred at the Site and are organized by environmental media sampled. The following Tables showing locations and amounts of known AOCs in each building were prepared by WESTON for the 2016 Phase II ESA.

2.3.1 Asbestos Containing Material

Elementary School (Building 1): Based on the 2016 visual inspection/supplemental assessment by Superfund Technical Assessment and Response Team (START) (WESTON, 2016) and reviews of both the 2005 Asbestos Hazard Emergency Response Act (AHERA) inspections (NIH, 2005) and 2016 AHERA re-inspection reports (NIH, 2016), ACM is not present in the Elementary School Building. Previous AHERA inspections had identified ACM in the Elementary School Building; however, it has since been abated. ACM is not considered to be an AOC in relation to the Elementary School Building.

Multi-Purpose Room (Building 2): Based on the 2016 visual inspection/supplemental assessment by START and reviews of both the 2005 AHERA inspections and 2016 AHERA re-inspection reports, asbestos is present at the Multi-Purpose Room Building. ACM is considered to be an AOC in relation to the Multi-Purpose Room Building. The following Table 2-1 indicates the current and/or previously identified type, location, condition, and current estimated extent of ACM in SF or units identified in the Multi-Purpose Room.

Table 2-1 ACM Locations in Multi-Purpose Room (Building 2)

Identified ACM: 2005 AHERA Inspection	Location	Condition	2016 AHERA Re-inspection Notes	START Phase II ESA Notes	2017 Estimated Volume / Extent (Approximate)
Boiler door rope gasket	Boiler room	Non-Friable	Removed	Replaced with caulking	N/A
Floor tile	Gym area, kitchen, storage, lobby, corridor, etc.	Non-Friable	Present in good condition with some wear	Present in good condition with some wear	2,890 SF
Pipe Joint Insulation	Storage closet and boiler room	Friable	Present in good condition	Present in good condition	34 fittings
Vibration Dampener	Storage room	Non-Friable	Present in good condition	Present in good condition	4 SF

Classroom Annex (Building 3): Based on the 2016 visual inspection/supplemental assessment by START and reviews of both the 2005 AHERA inspections and 2016 AHERA re-inspection reports, asbestos is present in the Classroom Annex Building. ACM is considered to be an AOC in relation to the Classroom Annex Building. The following Table 2-2 indicates the current and/or previously identified type, location, condition, and estimated extent of ACM in SF or units identified in the Classroom Annex Building.

Table 2-2 ACM Locations in Classroom Annex (Building 3)

Identified ACM: 2005 AHERA Inspection	Location	Condition	2016 AHERA Re-inspection Notes	START Phase II ESA Notes	2017 Estimated Volume / Extent (Approximate)
Linoleum	Girl's restroom and small restroom	Non-Friable	Present in good condition	Present in good condition	148 SF
Pipe Joint Insulation	Janitor's closet	Friable	Present in good condition	Present in good condition	Three fittings

Music Room (Building 4): Based on the 2016 visual inspection/supplemental assessment by START and reviews of both the 2005 AHERA inspections and 2016 AHERA re-inspection reports, asbestos is present in the Music Room Building. Of the 39 samples submitted for laboratory analysis during the 2016 Phase II ESA, a total of six samples were determined to be "positive" (>1% asbestos) for asbestos. The following Table 2-3 indicates the locations and estimated extent of ACM identified at the Site. Based on the results of the ESA, ACM is present in the building. ACM is considered to be an AOC in relation to the Music Room.

Table 2-3 ACM Locations in Music Room (Building 4)

ACM Material	2017 Estimated Volume / Extent (Approximate)	Location
Door Caulk	10 LF	Coolers
Drywall	250 SF	Northern storage area partition
Plaster	1,000 SF	Northern sections

2.3.2 Lead-Based Paint

Elementary School (Building 1): Based on the X-ray fluorescence (XRF) results from the 2016 Phase II ESA conducted by WESTON, elevated lead concentrations are present on ceilings, door components, exterior surfaces, trim, walls, and window components throughout the building. Although there was a positive reading on the exterior (bell tower), lead-in-soil was not of concern because the location of the positive readings was in the bell tower and no bare soil is present at the surface. The following Table 2-4 lists the location, current surface paint color, and estimated extent in SF or linear feet (LF) of LBP present at the Elementary School. LBP is considered to be an AOC at the Elementary School Building.

Table 2-4 LBP Locations in Elementary School (Building 1)

Location	Current Surface Paint Color	Estimated Extent
Exterior		
Built-in (bell tower wheel)	White	30 SF
Ceiling	White	80 SF
Wall	White	150 SF
Mezzanine		
Ceiling	White	90 SF
Wall	Light Blue	120 SF
	White	840 SF
	Yellow	430 SF
Second Level		
Wall	Cream	1,750 SF
	Light Blue	630 SF
	Pink	650 SF
	White	1,050 SF
Window Sill	White	5 SF
Main Level		
Ceiling	Light Blue	90 SF
	White	90 SF
Door Frame	Cream	20 LF
	White	20 LF
Trim	Blue	40 LF
	White	10 LF
Wall	Cream	940 SF
	Light Blue	580 SF
	Light Gray	450 SF
	White	370 SF
Window Sill	Cream	10 SF
	White	5 SF

Location	Current Surface Paint Color	Estimated Extent
Basement		
Door Frame	Aqua	20 LF
	Brown	20 LF
	White	20 LF
Door Jamb	Brown	20 LF
	Gray	20 LF
Wall	Aqua	50 SF
	Brown	200 SF
	Green	200 SF
	White	400 SF
Window Frame	Green	10 SF

Multi-Purpose Room (Building 2): Based on the XRF results from the 2016 Phase II ESA conducted by WESTON, elevated lead concentrations are present on ceilings, door components, floor, and walls throughout the building. Elevated lead readings were also identified on various ceramic tiles in the kitchen area and the girl's bathroom attributable to the glazing since no paint is present on the tiles. Although there was a positive reading on the exterior door, lead-in-soil is not of concern because pavement covers the ground in this area and no bare soil is present around the location of the readings. The following Table 2-5 lists the location, current surface paint color/tile color, and estimated extent in SF or LF of LBP present at the Multi-Purpose Room Building. LBP is considered to be an AOC at the Multi-Purpose Room Building.

Table 2-5 LBP Locations in Multi-Purpose Room (Building 2)

Location	Current Surface Paint Color / Tile Color	Estimated Extent
Exterior		
Door	Cream	40 SF
	White	40 SF
	Yellow	60 SF
Boiler Room		
Wall	Brown	120 SF

Location	Current Surface Paint Color / Tile Color	Estimated Extent
Main Level		
Ceiling	Cream	310 SF
Door Jamb	Light Blue	20 LF
Floor	Red (tile)	100 SF
Wall	Brown	200 SF
	Cream (tile)	1,000 SF

Classroom Annex (Building 3): Based on the XRF results from the 2016 Phase II ESA conducted by WESTON, no elevated lead concentrations are present on painted surfaces in the Classroom Annex Building. LBP is not considered to be a COC at the Classroom Annex Building.

Music Room (Building 4): Based on the XRF results from the 2016 Phase II ESA conducted by WESTON, elevated lead concentrations are present on the ceiling, walls, trim, window components, and door components throughout the building. The following Table 2-6 lists the location, current surface paint color, and estimated extent in SF or LF of LBP present at the Site. Based on the results of the XRF survey, LBP is present at the building and is considered to be an AOC in relation to the Site.

Table 2-6 LBP Locations in Music Room (Building 4)

Location	Current Surface Paint Color	Estimated Extent
Exterior		
Door	Red	10 SF
	White	40 SF
Door Frame	White	30 LF
Door Jamb	Red	15 LF
	White	30 LF
Exterior (Continued)		
Wall	White	10 SF
Window Frame	White	110 LF
Basement		
Door	Green	10 SF

Location	Current Surface Paint Color	Estimated Extent
Main Level		
Ceiling	White	800 SF
Door	Black	5 SF
	Cream	15 SF
	White	40 SF
Door Frame	White	15 LF
Trim	Green	25 SF
Wall	Cream	300 SF
	Green	350 SF
	Light Blue	100 SF
Window Frame	Green	10 LF
Window Sash	Cream	5 LF
	Green	5 LF

Lead-in-Soils: Since there were positive XRF readings for lead on the exterior surface of the Music Room building adjacent to bare soil, lead-in-soil samples were taken to evaluate any potential effect on the surface soil quality. Based on the laboratory results, lead concentrations did not exceed any comparison standards within the dripline on the east side of the building. Lead-in-soil is not considered an AOC in relation to the Site (WESTON, 2016b and 2017c).

2.4 IMPACT ON HUMAN HEALTH AND/OR THE ENVIRONMENT

Environmental contaminants (or AOCs) and affected media related to historical activities include ACM and LBP. Potential exposure of human receptors to the AOCs in building materials may occur during future redevelopment activities, through direct contact, inhalation of dust, or ingestion of friable ACM or deteriorating LBP by children.

ACM and LBP are identified as a concern during building remodeling/repurposing. ACM and LBP will be addressed in the abatement plan (to be completed by the abatement contractor). Confirmation sampling for these analytes will occur following abatement by licensed contractor.

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3.0 WORK PLAN

An MDEQ-approved work plan is not required for this project since there is no petroleum contamination on-site. This ACM and LBP abatement work will be conducted in compliance with MDEQ asbestos regulations and a Montana Accredited Asbestos Inspector (WESTON) will oversee the abatement activities. A permit from the Asbestos Control Program will be obtained by the abatement contractor and the asbestos removal will be completed by persons with Montana Contractor/Supervisor or Worker accreditation. All activities will be conducted in accordance with Montana Statute 75-2-501 and ARM 17.71.301-405 (MDEQ Asbestos Control Program, 2016).

As noted above, the Elementary School (Building 1) is a historic site, therefore recommendations from the State Historic Preservation Office (SHPO) on the best approach as to not alter, destroy or change historic elements of the building are forthcoming. It may be necessary to follow the Secretary of the Interior's Standard for the Treatment of Historic Properties and that will likely affect the abatement approach for the building. If needed, a modification to this section of the SAP will be prepared once the SHPO recommendations are available to outline the modified approach.

During the abatement project, if additional suspected ACM or LBP is discovered that was not previously identified, the abatement contractor should stop work and notify WESTON immediately. WESTON will notify SMDC to discuss a plan of action. This action may include additional sampling by WESTON and additional abatement, if needed.

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4.0 PROJECT AND DATA QUALITY OBJECTIVES

Systematic planning for environmental data collection incorporates the definition of project tasks and Data Quality Objectives (DQOs) to ensure the information generated is acceptable and sufficient for the intended use. Establishment of DQOs for this project followed the processes as set forth in the *Guidance on Systematic Planning Using the Data Quality Objective Process*, EPA QA/G-4, February 2006. A DQO worksheet is provided in Attachment C.

4.1 MEASUREMENT QUALITY OBJECTIVES

Measurement quality objectives (MQOs) are performance criteria derived from DQOs that establish the usability of analytical data. The MQOs incorporate field and laboratory protocols used to evaluate data quality indicators (DQIs) with performance and acceptance criteria. The review and validation process will determine whether data is usable based upon DQIs and establish whether MQOs are satisfied.

DQIs are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of the data. The principal DQIs are precision, accuracy, representativeness, comparability, and completeness (PARCC). DQI acceptance criteria with respect to AOCs and Action Levels will be discussed with the identified laboratory for the project. DQI goals for this project will be in accordance with Section 4.0 of the CMBC Programmatic QAPP (Attachment A) and are depicted on Table 3-1.

4.2 DATA REVIEW AND VALIDATION

Due to the limited scope, limited duration, and investigative nature of this project, the data will not undergo data validation by a third party. Data will undergo verification by the WESTON QA Manager. Laboratory data verification will be in compliance with the CMBC Programmatic QAPP (Attachment A).

Problems or questions about analytical data quality that may require corrective action will be brought to the attention of the laboratory in writing from the WESTON Project Manager. The request may be initiated if QC results exceed method or project criteria, if reporting or flagging errors are identified, or to request information that has not been reported. The laboratory's response shall include a written explanation of the problem, a plan and a schedule for corrective action, and/or a re-issuance of laboratory reports or electronic data files. If significant data quality problems have occurred and the data are critical to decision making, reanalysis of samples may be required, or recollected and reanalyzed at the discretion of WESTON and/or SMDC.

4.3 DATA MANAGEMENT

All field notes, field data sheets, laboratory reports, and data validation reports will be checked for transcription errors and omissions. Transcription error checks and data collection and maintenance will be conducted by the WESTON Project Manager and/or WESTON QA Manager.

4.4 PROJECT DELIVERABLES

All project deliverables (e.g. Summary Memo) will be peer reviewed prior to release to SMDC. In time-critical situations, the peer review may be concurrent with the release of a draft document to SMDC. Errors discovered in the peer review process will be reported by the reviewer to the originator of the document, who will be responsible for corrective action.

The Project Manager will review project documentation (field logs/logbooks, chain of custody forms, etc.) to ensure the SAP was followed and that sampling activities were adequately documented. The Project Manager will document deficiencies and will be responsible for corrective actions.

Table 4-1 Project Reporting Limits and Data Quality Indicators for ACM and LBP Confirmation Samples

Analyte Or Criteria	Project Action Limit (PAL)	PAL Reference	Project Quantitation Limit (PQL) Goal	Laboratory Quantitation Limit	Laboratory Detection Limit
ACM	>1% Asbestos	AHERA	Trace	Trace	Trace
ACM Air Sampling Criteria	For PCM analysis: less than or equal to 0.01 fibers per cm3 of air. For TEM analysis: less than or equal to the average concentration of 70 structures per sq mm for 5 samples collected within the work area.	AHERA	Trace	Trace	Trace
LBP (Paint Chip)	>1 mg/cm^2	HUD	N/A	N/A	N/A
LBP (Wipe Samples)	If the cloth does not match and is darker than the cleaning verification card, re-clean the windowsill as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of 40 CFR 745, Subpart E.	40 CFR 745, Subpart E	N/A	N/A	N/A
Visual Inspection	Observe the entire project area to verify that the contractor has removed all visible ACM and LBP waste, dust and debris from the work area. Require re-cleaning as needed.	N/A	N/A	N/A	N/A

AHERA – Asbestos Hazard Emergency Response Act

HUD – U.S. Housing and Urban Development Department

Mg/cm2 – Milligrams per square centimeter

N/A – Not applicable

ACM – Asbestos Containing Material

LBP – Lead Based Paint

PCM: Phase contract microscopy

TEM: Transmission Electron Microscopy

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5.0 SAMPLING DESIGN AND RATIONALE

Clearance sampling will be conducted by the selected abatement subcontractor after the ACM and LBP has been abated. Laboratory analytical data along with visual inspections and wipe sampling will be used to determine if the areas are clear of all ACM and LBP. The following sections describe the selection of sampling locations.

5.1 ACM

Following abatement of the known ACM identified in the Phase II ESA (WESTON, 2017), confirmation sampling will be conducted to ensure total removal of ACM prior to beginning renovations on the buildings. At the conclusion of ACM removal, a final visual inspection and air clearance sampling will be conducted at the Site. The visual inspection will be performed by an AHERA-certified and MDEQ-accredited inspector.

Refer to Attachment A for the SOP for Asbestos Final Air Clearance sampling for proper procedures in executing the ACM SAP for confirmation sampling. All known locations for ACM are presented on Figures 3 through 11. Photographs from the Phase II ESA are provided in Attachment E. The ACM identified in these locations will be removed during the abatement. Following the abatement, confirmation sampling will be conducted according to the procedures in the Administrative Rules of Montana, Title 17, Chapter 74, Subchapter 3, Rule 17.74.357 (ARM 17.74.357) for clearing asbestos projects.

The concentration of asbestos fibers in air clearance samples collected must be less than or equal to 0.01 fiber per cubic centimeter of air for each of five samples collected within the work area, if analyzed by phase contrast microscopy (PCM). The PCM analysis must be conducted using methods by National Institutes for Occupational Health and Safety (NIOSH) 7400. If PCM analysis is used and greater than 0.01 fiber per cubic centimeter is detected, transmission electron microscopy (TEM) analysis may be used to confirm detected fibers are asbestos (i.e., PCM may detect fibers other than asbestos). The TEM analysis must be conducted using EPA's interim TEM analytical methods provided in 40 CFR 763, subpart E, Appendix A.

5.2 LBP

Following the abatement of known LBP from the Phase II ESA (WESTON, 2017), a visual inspection and confirmation sampling will be conducted by an abatement subcontractor to ensure total removal of LBP prior to beginning renovations on the buildings. All known locations for LBP are presented in Figures 3-Figure 11. Photographs from the Phase II ESA are provided in Attachment E. The LBP identified in these locations will be removed during the abatement. To ensure work areas are safe for occupancy, cleaning verification is required by the Renovation, Repair and Painting Rule (40 CFR 745, Subpart E). If additional paint sampling is required, a copy of the Standard Operating Procedure for Surface Paint Sample Collection can be found in Attachment D.

For interior projects, a Certified Renovator (in this case the LBP contractor) must perform a visual inspection per the EPA's 2008 Lead Renovation, Repair and Painting Rule. The certified renovator will determine whether dust, debris or residue is still present. If dust, debris or residue is present, these conditions must be removed by re-cleaning, and another visual inspection must be performed. After a successful visual inspection, a certified renovator must verify that each windowsill, uncarpeted floors, and countertops/surfaces in the work area have been adequately cleaned. Verification is completed by wiping the windowsills, uncarpeted floors, and countertops/surfaces with a wet, disposable cleaning cloth. These cloths will then be compared to a cleaning verification card. If the cloth does not match and is darker than the cleaning verification card, the sample location must be re-cleaned and then sampled again. If the cloth matches or is lighter than the cleaning verification card, the sample location has been adequately cleaned.

For exterior projects, a Certified Renovator must perform a visual inspection per the EPA's 2008 Lead Renovation, Repair and Painting Rule. The certified renovator will determine whether dust, debris or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris or residue is present, these conditions must be eliminated and another visual inspection must be performed.

6.0 FIELD METHODS AND PROCEDURES

Procedures summarized in the following Sections pertain to acquisition of ACM and LBP confirmation samples at the Site. The equipment necessary to perform sample collection, and field screening procedures used to augment the sampling decisions, are also included. All procedures will be conducted under the applicable conditions of the Site-Specific Health and Safety Plan (HASP), to be created, maintained, and adhered to by the abatement contractor, prior to beginning fieldwork.

6.1 FIELD EQUIPMENT

Equipment necessary to obtain the environmental samples for LBP and ACM removal activities are summarized in Table 6-1 and Table 6-2, respectively. Additional field equipment may be used that is not listed in Table 6-1 depending on field conditions and selected abatement contractor's preference. Field personnel will ensure all equipment is in proper working order prior to starting field work.

Table 6-1 Sampling Equipment for ACM Clearance Samples (PCM, NIOSH Method 7400)

Equipment	Dedicated
Personal protection equipment (PPE)	No
High volume pump	No
Primary calibration device	No
25-mm, three-piece cassette with ca. 50-mm electrically conducted extension cowl and cellulose ester filter, 0.45-1.2-um pore size	Yes
IAQ pump stand	No
High-speed leaf blower	No
Electric fan	No
Extension cords and power strips	No
Duct tape	No
Air sample calibration sheet	Yes
Final visual inspection checklist	Yes
Sharpies/pens	No
Digital camera	No

Table 6-2 Sampling Equipment for LBP Clearance Sampling (EPA Method 6020)

Equipment	Dedicated
Personal protection equipment (PPE)	No
Cleaning verification card	No
Disposable Camera	No
Disposable lead dust wipes (individually wrapped)	Yes
Field Sheets	Yes
Markers/pens	No
Trash bags	Yes
Re-sealable storage bags	Yes
Calculator	No
Sanitary wipes	No

6.2 ACM CONFIRMATION SAMPLING PROCEDURES

ACM clearance sampling will be conducted in accordance with the SOP for *Asbestos Final Air Clearance Sampling* as outlined in the QAPP (Attachment A, Appendix B). Step-by-step procedures are listed below.

1) Conduct the final visual inspection:
    a. PPE will be worn while conducting the visual inspection;
    b. Perform an initial walk-through of the abatement area, accompanied by the Competent Person for the removal area;
    c. Observe the entire asbestos project area to verify that the asbestos contractor has removed all visible asbestos-containing material, dust, and debris from the work area;
    d. Require the necessary re-cleaning by the asbestos project contractor and conduct subsequent visual inspection that verifies that the asbestos project contractor has removed all ACM identified in the asbestos project permit and related ACM, dust, and debris from the work area; and
    e. Complete a signed, written affidavit verifying that the asbestos project contractor has removed all ACM identified in the asbestos project permit and related ACM, dust, and debris;
    f. Prepare a diagram of the abatement area, identifying general features within the containment or removal area.

2) Collect air samples:

   a. Once the work area has passed the final visual inspection, calibrate instruments and select sample locations:

      i. For an asbestos project with more than a single isolated work area within a large space contained by four walls and a ceiling, the owner or operator of a renovation or demolition activity shall ensure the isolated work areas are sampled by taking at least one air sample within each isolated work area. If more than five isolated work areas are used in a space contained by four walls and a ceiling, at least five aggressive air samples must be collected. The first four air samples must be gathered from those isolated work areas where the greatest potential for asbestos exposure exists; the fifth sample must be taken in the last isolated work area in which the asbestos project occurred;

      ii. For asbestos projects employing glove bags, the owner and operator of the renovation or demolition activity shall have at least one aggressive air sample collected in the immediate area of each glove bag, with at least five air samples collected for each space contained by four walls and a ceiling. If more than five glove bags were used in a space contained by four walls and a ceiling, at least five air samples are required for that space. The five samples must be gathered from areas where the greatest potential for asbestos exposure exists.

   b. Once sample locations have been identified, set up the IAQ pump stand and attach the pump to the cassette;

   c. Sweep an air stream from a high-speed blower across all surfaces in the work area for a time adequate to disturb air in all areas of the work area prior to beginning final air clearance sampling;

   d. Ensure the air is continually agitated, creating maximum air disturbance in all potentially occupied areas, i.e., continually running fans, during the collection of final air clearance samples. Agitating the air in the work area prior to final air clearance sampling is not required for unoccupied areas such as crawl spaces;

   e. Immediately after agitating the air in the work area, begin collecting at least five final clearance air samples in the work area by following the procedures listed below;

      i. Collect samples by using an air sampling pump capable of drawing a volume that is equal to or greater than 1,199 liters of air through each of the five millimeter filters, at a rate equal to or greater than one liter and less than ten liters per minute for TEM samples and equal to or greater than one liter and less than 16 liters per minute for PCM samples;

      ii. Ensure that the flow rate for each sampling pump is calibrated at the beginning and end of the sampling period; and,

iii. Ensure air sampling cassettes are placed four to six feet above the floor at a 45 degree angle down. The cassettes must be uniformly distributed throughout the work area.

f. Persons conducting a final visual inspection and final air clearance sampling and testing shall record the following;

i. The names of the asbestos contract/supervisor and the person or persons conducting the final visual inspection and final air clearance sampling;

ii. The name and address of the Site;

iii. The number of the asbestos project permit issued by the MDEQ;

iv. The date of final visual inspection and final air clearance sampling;

v. Whether the work area was addressed;

vi. The number of samples collected;

vii. The location of where each sample is collected;

viii. The sample ID;

ix. The sample pump number or ID;

x. Sample collection start and stop times;

xi. Sample pre-calibration flow rates, post-calibration flow rates, and total sample flow rate averages.

xii. The type of samples (i.e., PCM); and,

xiii. A statement of whether the final visual inspection and final air clearance sampling has documented the completion of the asbestos project.

6.3 LBP CONFIRMATION SAMPLING PROCEDURES

6.3.1 INTERIOR REMOVAL

Per EPA's 2008 Lead Renovation, Repair and Painting Rule, a Certified Renovator must perform a visual inspection to determine whether dust, debris, or residue is still present. If dust, debris, or residue is present, these conditions must be removed by re-cleaning, and another visual inspection must be performed. After a successful visual inspection, a certified renovator must verify that each windowsill in the work area has been adequately cleaned, using the following procedure:

1) Wipe the windowsill with a wet disposable cleaning cloth that is damp to the touch. If the cloth matches, or is lighter than the cleaning verification card, the windowsill has been adequately cleaned.

- If the cloth does not match and is darker than the cleaning verification card, re-clean the windowsill as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of 40 CFR 745, Subpart E, then either use a new cloth or fold the used cloth in such a way that an

unused surface is exposed, and wipe the surface again. If the cloth matches or is lighter than the cleaning verification card, that windowsill has been adequately cleaned.

- If the cloth does not match and is darker than the cleaning verification card, wait for one hour or until the surface has dried completely, whichever is longer.
- After waiting for the windowsill to dry, wipe the windowsill with a dry disposable cleaning cloth. After this wipe, the windowsill has been adequately cleaned.

2) Wipe uncarpeted floors and countertops within the work area with a wet disposable cleaning cloth. Floors must be wiped using an application device with a long handle and a head to which the cloth is attached. The cloth must remain damp at all times while it is being used to wipe the surface for post-renovation cleaning verification. If the surface within the work area is greater than 40 square feet, the surface within the work area must be divided into roughly equal sections that are each less than 40 square feet. Wipe each such section separately with a new wet disposable cleaning cloth. If the cloth used to wipe each section of the surface within the work area matches the cleaning verification card, the surface has been adequately cleaned.

- If the cloth used to wipe a particular surface section does not match the cleaning verification card, re-clean that section of the surface as directed in paragraphs (a)(5)(ii)(B) and (a)(5)(ii)(C) of 40 CFR 745, Subpart E, then use a new wet disposable cleaning cloth to wipe that section again. If the cloth matches the cleaning verification card, that section of the surface has been adequately cleaned.
- If the cloth used to wipe a particular surface section does not match the cleaning verification card after the surface has been re-cleaned, wait for 1 hour or until the entire surface within the work area has dried completely, whichever is longer
- After waiting for the entire surface within the work area to dry, wipe each section of the surface that has not yet achieved post-renovation cleaning verification with a dry disposable cleaning cloth. After this wipe, that section of the surface has been adequately cleaned.
- When the work area passes the post-renovation cleaning verification, remove the warning signs.

6.3.2 EXTERIOR REMOVAL

Per the EPA's 2008 Lead Renovation, Repair and Painting Rule, a Certified Renovator must perform a visual inspection to determine whether dust, debris, or residue is still present on surfaces in and below the work area, including windowsills and the ground. If dust, debris, or residue is present, these conditions must be eliminated and another visual inspection must be performed. When the area passes the visual inspection, remove the warning signs.

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7.0 SAMPLE CONTAINERS, PRESERVATION, PACKAGING AND SHIPPING

The types of sample containers required for ACM and LBP confirmation sampling are described below. All ACM and LBP sampling and sample shipment will take place in accordance with the Final Project-Wide QAPP CMBC (Attachment A).

7.1 ACM SAMPLES

Air samples collected for analysis will be collected in a 25-mm, three-piece cassette with ca. 50-mm electrically conducted extension cowl and cellulose ester filter, 0.45-1.2-µm pore size. After collection of the samples, the end caps will be replaced on the cassette and placed into a re-sealable bag. One cassette is needed per sample location and does not require any preservation. For most locations, five field samples and one field blank per removal area are considered sufficient. These samples will be analyzed using the NIOSH 7400 method. The COC will be filled out appropriately and the samples shipped to the laboratory for analyses. All ACM air sampling will take place in accordance with the Final Project-Wide QAPP CMBC (Attachment A).

7.2 LBP SAMPLES

Confirmation samples following a LBP abatement are taken using a wet, disposable cleaning cloth. This cloth is then compared to a cleaning verification card in accordance with 40 CFR 745, Subpart E. These samples are analyzed on site by a Certified Renovator with oversight by WESTON and do not require shipment to a laboratory. All surfaces within the work area must be wipe sampled and pass comparison with the cleaning verification card before the LBP abatement can be considered complete.

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8.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of abating the known ACM and LBP and collecting environmental samples at the Site, field personnel will generate several different types of potentially contaminated construction waste and investigation-derived wastes (IDW), including the following:

- Used PPE consisting of Tyvek coveralls, gloves, booties, etc.
- Construction wastes from ACM and LBP abatement activities
- Disposable sampling equipment

All Asbestos Containing Waste that is generated during abatement activities will be transported and disposed of in accordance with MDEQ ARM 17.74.369. Waste Disposal for IDW will be dependent upon the classification of waste as either RCRA hazardous or RCRA nonhazardous waste. Waste will be disposed of at the appropriate landfill or facility based upon its classification.

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9.0 SAMPLE DOCUMENTATION

9.1 FIELD NOTES

Record keeping in the field will be accomplished through a combination of field logs/data sheets, logbooks, and photographs. The level of detail and types of field records will vary according to the types of information necessary for decision inputs.

9.1.1 Field Logbooks

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. Logbooks are bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions. At a minimum, the following information will be recorded, if applicable, during the collection of each sample:

- Sample location/description;
- Sampler's name(s);
- Date and time of sample collection;
- Type of sample (e.g., ACM);
- Classification of sample materials according to the applicable conditions or intended use of the information;
- Type of sampling equipment used;
- Field instrument readings and calibration readings for any equipment used, and equipment model(s) and serial number(s);
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.);
- Sample preservation;
- Sample identification numbers and any explanatory codes, and chain-of-custody form numbers;
- Shipping arrangements (overnight air bill number); and,
- Name(s) of recipient laboratory.

In addition to sampling information, the following specific information may also be documented in the field records for each day of sampling:

- Team members and their responsibilities;
- Time of arrival on-site and time of Site departure;
- Subcontractors and equipment in use, delivered, or removed, as applicable;

- Other personnel on-Site;
- Summary of any meetings or discussions with any potentially responsible parties, or representatives of any Federal, State, or other regulatory agency;
- Telephone conversations pertaining to conduct of activities or potential effects to the scope of work;
- Deviations from sampling plans or site safety plan procedures;
- Changes in personnel and responsibilities, as well as reasons for the change;
- Levels of safety protection;
- Record of photographs; and,
- Waste generation logs appropriate for different types of media involved.

A review of field records will be performed immediately upon conclusion of field activities to ensure all records are retained and potential discrepancies noted. Electronic copies of field records will be generated to minimize potential loss of hard copy material.

9.1.2 Photographs

Photographs will be taken at all sampling locations. They will serve to verify information entered in the field records. The following information will be recorded in a logbook or separate field photography log for each photograph:

- Time, date, location, and weather conditions;
- Direction photograph is taken;
- Description of the subject photographed; and,
- Name of person taking the photograph.

Hard copy reproductions of representative photographs will be included with written annotations in the final Summary Memo.

9.1.3 Site Features and Sample Locations

Formal surveying of property boundaries, Site features, or topography will not be performed with respect to benchmarks or survey zones for this project. However, measurements of significant Site features may be collected using a tape or measuring wheel with respect to reference points.

Maps or figures generated from the field data will be plotted at a scale appropriate to the property.

9.2 SAMPLE LABELING

Samples collected for analyses will be labeled in a clear and precise way for proper identification in the field and tracking in the laboratory. Sample labels will be affixed to the sample containers with a unique, identifiable name to allow retrieval and sample cross referencing. The sample identification system is as follows:

ACM confirmation samples collected will be identified using the project name, work area number, and sample number as described below.

Example ACM Confirmation Air Samples: CSC-AIR01-02, *where*
CSC = Project Name (Central School Campus)
AIR01 = Sample Matrix (Air Confirmation Sample) And Work Area Number
02 = Sample Number

Work Area numbers will be recorded for reference in a log book and/or located on a floor plan that will be provided in the final summary memo.

9.3 SAMPLE CHAIN-OF-CUSTODY FORMS AND CUSTODY SEALS

All sample shipments for analyses will be accompanied by a COC record. Forms will be completed and sent daily with the samples for each laboratory and each shipment.

The COC form will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped or delivered to the laboratory, the custody of the samples will be the responsibility of WESTON's Field Manager. The sampling team leader or designee will sign the COC form in the "relinquished by" box and note date, time, and air bill number (if samples are being shipped).

The sample numbers for all samples and duplicates will be documented on the COC form (see Section 8.2). A copy will be kept for WESTON's master files. The COC must include the following:

- Sample identification numbers;
- Site name;
- Sample date;
- Number and volume of sample containers;
- Required analyses;
- Signature and name of samplers;
- Signature(s) of any individual(s) with control over samples;
- Note(s) indicating special holding times and/or detection limits; and,
- Note indicating samples must be reported in dry weight.

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10.0 QUALITY CONTROL

The following sections describe the Quality Control (QC) samples that may be collected to support the sampling activities. For this project, all QC sampling will take place in accordance with the EPA-approved Final Project-Wide QAPP CMBC (Attachment A).

10.1 FIELD QUALITY CONTROL SAMPLES

Field QC samples are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals: assessment of field contamination and assessment of sampling variability to satisfy DQI acceptance criteria. For Asbestos air clearance sampling, at least one field blank will be collected (or 10% of the total samples, whichever is greater) for each set of samples collected.

10.2 LABORATORY QUALITY CONTROL SAMPLES

Laboratory QC samples, where necessary, are analyzed as part of standard laboratory QC protocols. The laboratory monitors the precision and accuracy of the results of its analytical procedures through analysis of QC samples.

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11.0 FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to this plan. When appropriate, the SMDC Project Manager will be notified of the modifications, and a verbal approval will be obtained before implementing the modifications. Changes to the approved plan will be documented in the final Summary Memo.

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12.0 FIELD HEALTH AND SAFETY PROCEDURES

Field activities will be conducted in accordance with Site-specific HASPs. WESTON will develop a Site-specific HASP, and the selected abatement contractor will also develop their own HASP. Both HASPs will comply with 29 CFR 1910.120. Daily health and safety briefings with all personnel working on-Site will be completed to discuss the day's scope of work and hazards that may occur.

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13.0 REFERENCES

*A complete list of previous reports and analytical data reviewed by WESTON is included in Attachment B. References below are general guidance documents followed to complete the SAP.

United States Environmental Protection Agency (EPA), *Management of Investigation-Derived Wastes During Site Inspections.* EPA/540/G-91/009. Office of Emergency and Remedial Response (OERR) Directive 9345.3-02. May, 1991.

EPA, 1987. *Code of Federal Regulations for Asbestos-Containing Materials in Schools,* 40 C.F.R§ 763.80, October 30, 1987.

EPA, 1988. *Code of Federal Regulations for Post-Award Requirements,* 40 C.F.R§ 31.45, March 11, 1988.

EPA, 2002. *Guidance for Quality Assurance Project Plans*, EPA QA/G-5. December, 2002.

EPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objective Process,* USEPA QA/G-4. February, 2006.

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EPA, 2010. *Code of Federal Regulations for Residential Property Renovation,* 40 C.F.R§ 745.80, June 1, 1998.

EPA, 2012. *EPA Sampling and Analysis Plan Guidance and Template, Version 3, Brownfields Assessment Projects* (R9QA/008.1), August 2012.

Montana Department of Environmental Quality, 2011. *Rule 17.74.369 ARM Transportation and Disposal of Asbestos-Containing Waste.* October 28, 2011.

NIOSH, 1994, *Asbestos and Other Fibers by PCM: Method 7400, Issue 2*. August, 2004.

Northern Industrial Hygiene, Inc., 2005a. *AHERA Re-inspection Report*. April 6, 2005.

Northern Industrial Hygiene, Inc. 2005b. *Asbestos Abatement Monitoring Report.* August 5, 2005.

Tetra Tech, Inc. (Tetra Tech), 2016. *FINAL Project-Wide Quality Assurance Plan Central Montana Brownfields Coalition.* Revised July 27, 2016.

Tetra Tech, Inc. (Tetra Tech), 2012. *Standard Operating Procedures for Asbestos Inspections.* Revised November 29, 2012.

Weston Solutions, Inc. (WESTON), 2017. *Phase I Environmental Site Assessment for Central School Campus, 600 1st Street West, Roundup, Musselshell County, Montana.* February 17, 2017.

Weston Solutions, Inc. (WESTON), 2017b. *Phase II Environmental Site Assessment for Central School Campus Music Room, 600 1st Street West, Roundup, Musselshell County, Montana.* February 17, 2017

Weston Solutions, Inc. (WESTON), 2017c. *Phase II Environmental Site Assessment for Central School Campus- Elementary School, Multi-Purpose Room and Classroom Annex Buildings*, 600 1st Street West, Roundup, Musselshell County, Montana. February 17, 2017

FIGURES

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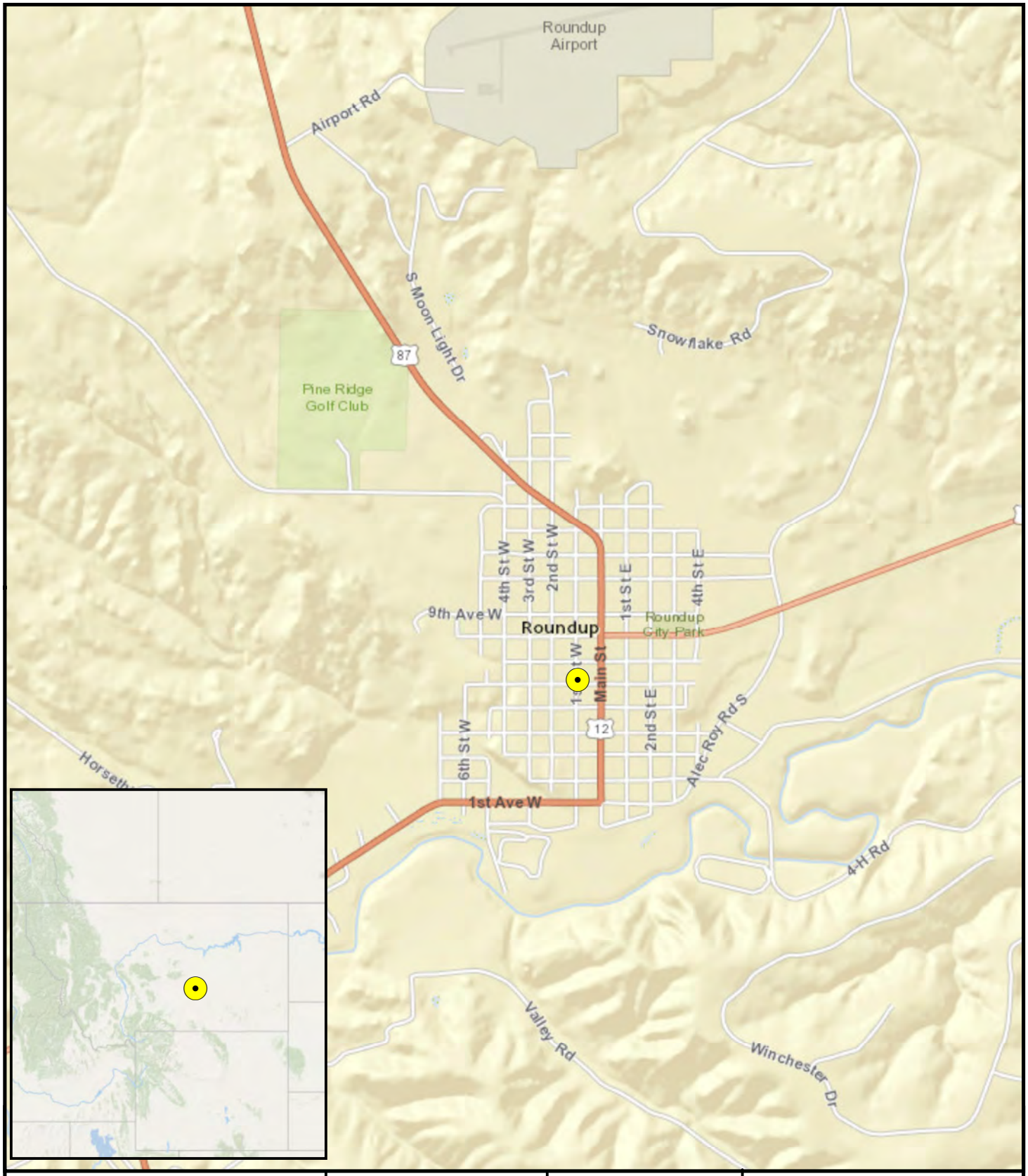


Legend

Site Location

0 0.2 0.4 0.8 Miles

N

Prepared for:
Snowy Mountain Development Corp.

Prepared By:
Weston Solutions, Inc.
805 N. Last Chance Gulch
Helena, MT

FIGURE 1
SITE VICINITY MAP
CENTRAL SCHOOL CAMPUS
600 1ST STREET WEST
MUSSELSHELL COUNTY
ROUNDUP, MONTANA

Date: 6/7/2017

Legend

Site Boundary

0 20 40 80 Feet

N

Prepared for:
Snowy Mountain
Development Corp.

Prepared By:
Weston Solutions, Inc.
805 N. Last Chance Gulch
Helena, MT

FIGURE 2
SITE LAYOUT MAP
CENTRAL SCHOOL CAMPUS
600 1ST STREET WEST
MUSSELSHELL COUNTY
ROUNDUP, MONTANA

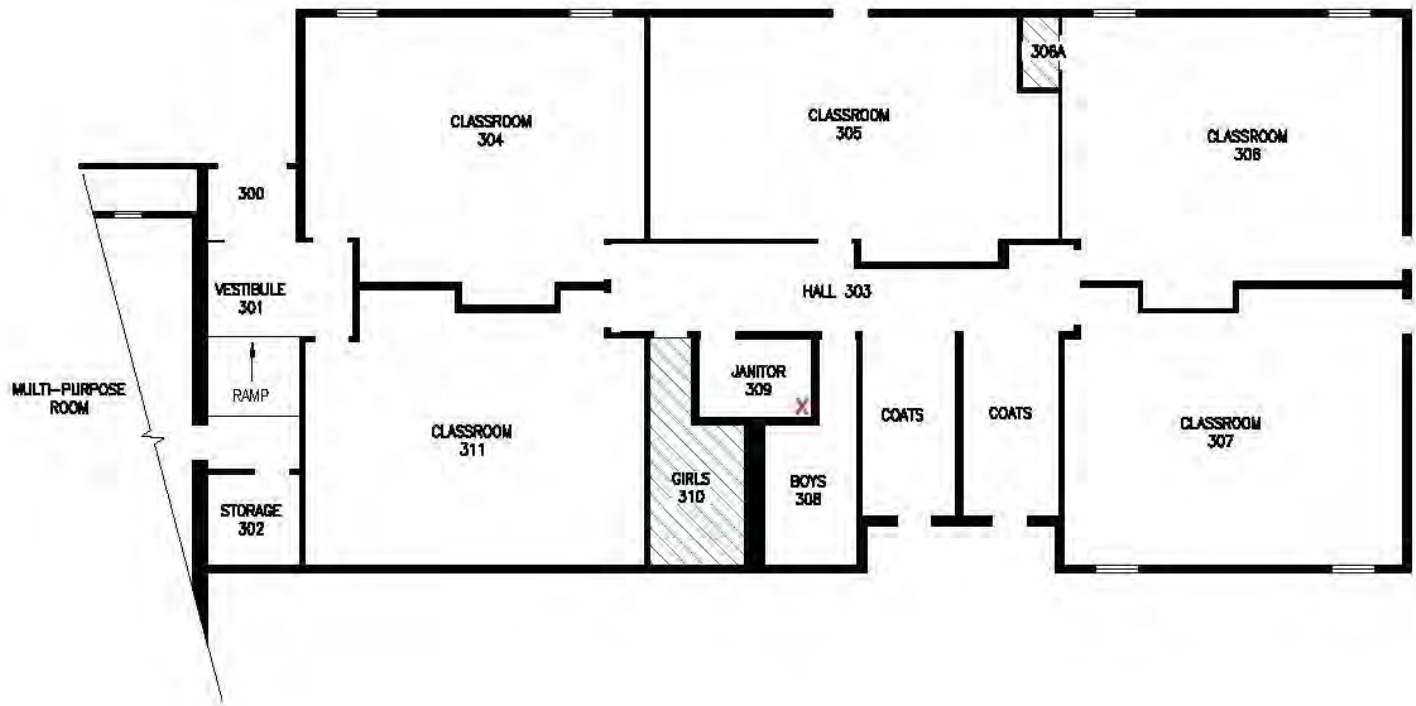
Date: 6/7/2017

LEGEND:

ACM ASBESTOS CONTAINING MATERIAL

ACM LINOLEUM

X ACM MUDDED ELBOWS (APPROX)



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Prepared for: Snowy Mountain Development Corp.

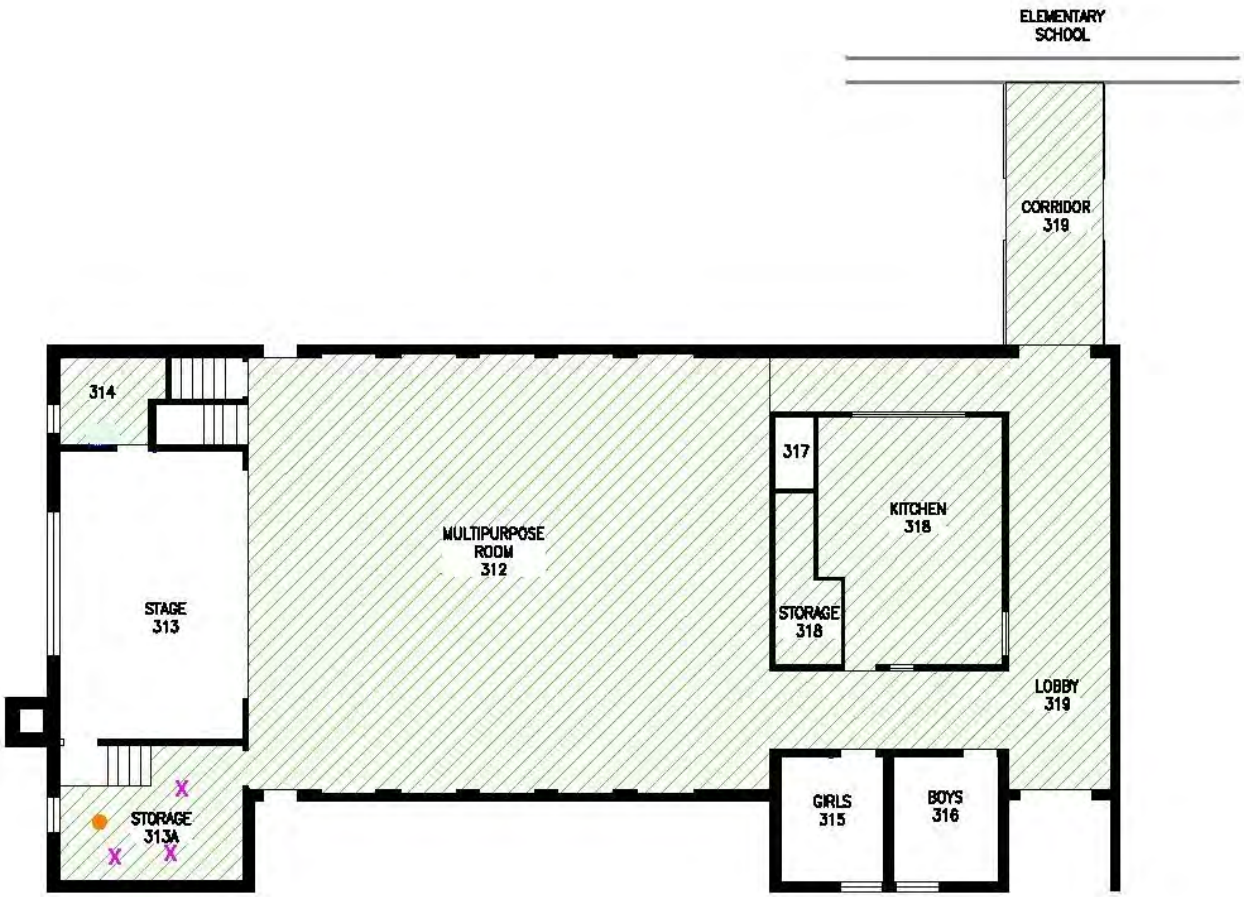
Prepared By: Weston Solutions, Inc. 805 N. Last Chance Gulch Helena, MT

ACM LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – CLASSROOM ANNEX
ROUNDUP, MT.
ASBESTOS SURVEY (Weston, 2016)

DATE: June 1, 2017

SCALE: N.T.S.

Figure 3



LEGEND:

ACM ASBESTOS CONTAINING MATERIAL

ACM FLOOR TILE

X ACM MUDDED PIPE JOINTS (APPROX)

● ACM VIBRATION DAMPENER

N

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Helena, MT

ACM LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – MULTI PURPOSE ROOM
ROUNDUP, MT.
ASBESTOS SURVEY (Weston, 2016)

DATE: June 1, 2017

SCALE: N.T.S.

Figure 4

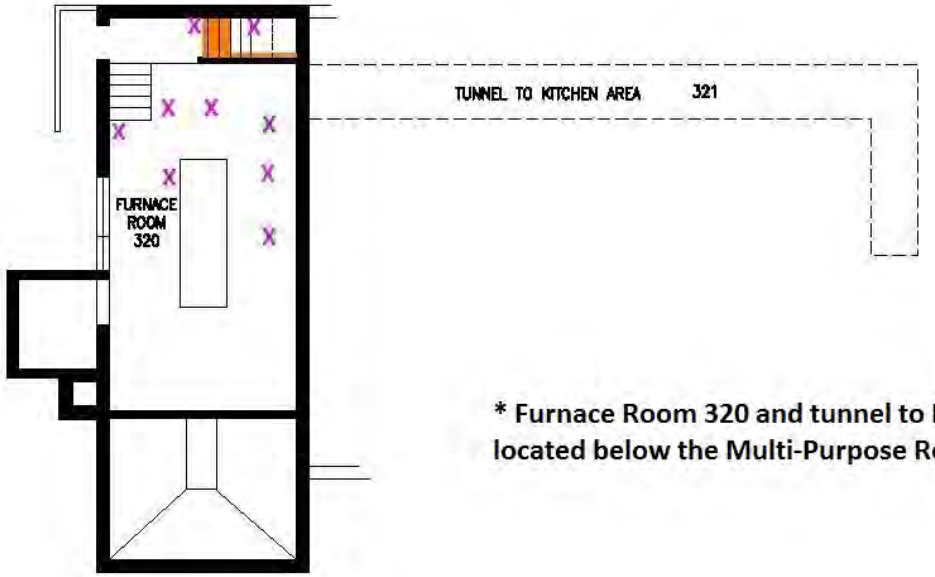
LEGEND:

ACM ASBESTOS CONTAINING MATERIAL

LBP LEAD BASED PAINT

X ACM MUDDED PIPE JOINTS (APPROX)

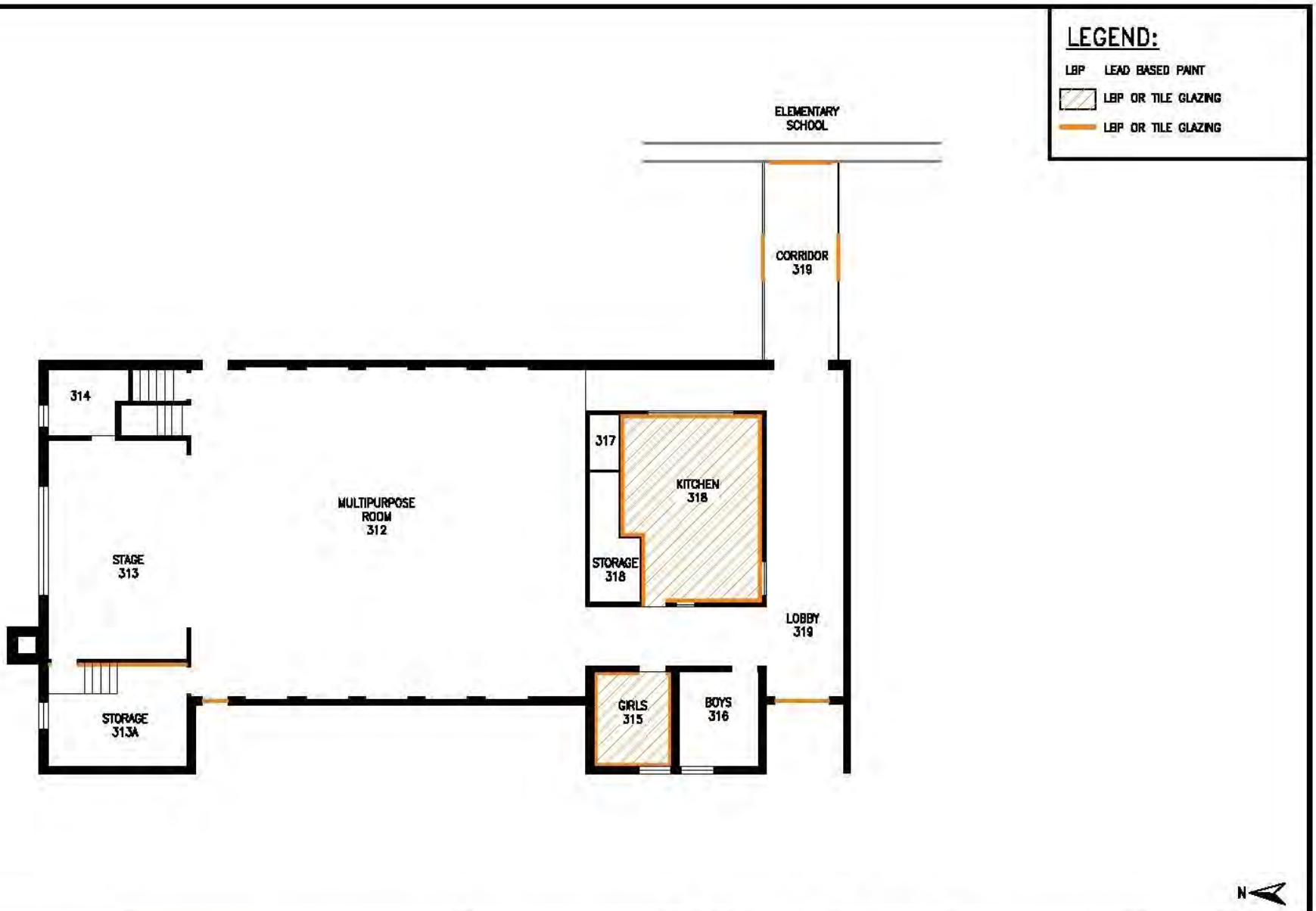
LEAD BASED PAINT



*** Furnace Room 320 and tunnel to Kitchen Area 321 located below the Multi-Purpose Room.**

N

Prepared for: Snowy Mountain Development Corp.	Prepared By: Weston Solutions, Inc. 805 N. Last Chance Gulch Helena, MT	ACM AND LBP LOCATION AND EXTENT CENTRAL SCHOOL CAMPUS – BOILER ROOM ROUNDUP, MT. ASBESTOS AND LEAD BASED PAINT SURVEY (Weston, 2010)	DATE: June 1, 2017 SCALE: N.T.S.	Figure 5



Prepared for:
Snowy Mountain Development Corp.

Prepared By:
Weston Solutions, Inc.
805 N. Last Chance Gulch
Helena, MT

LBP LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – MULTI PURPOSE ROOM
ROUNDUP, MT.
LEAD BASED PAINT SURVEY (Weston, 2016)

DATE: June 1, 2017
SCALE: N.T.S.

Figure 6

LEGEND:

LBP LEAD BASED PAINT

LEAD BASED PAINT

N

Prepared for:
Snowy Mountain Development Corp.

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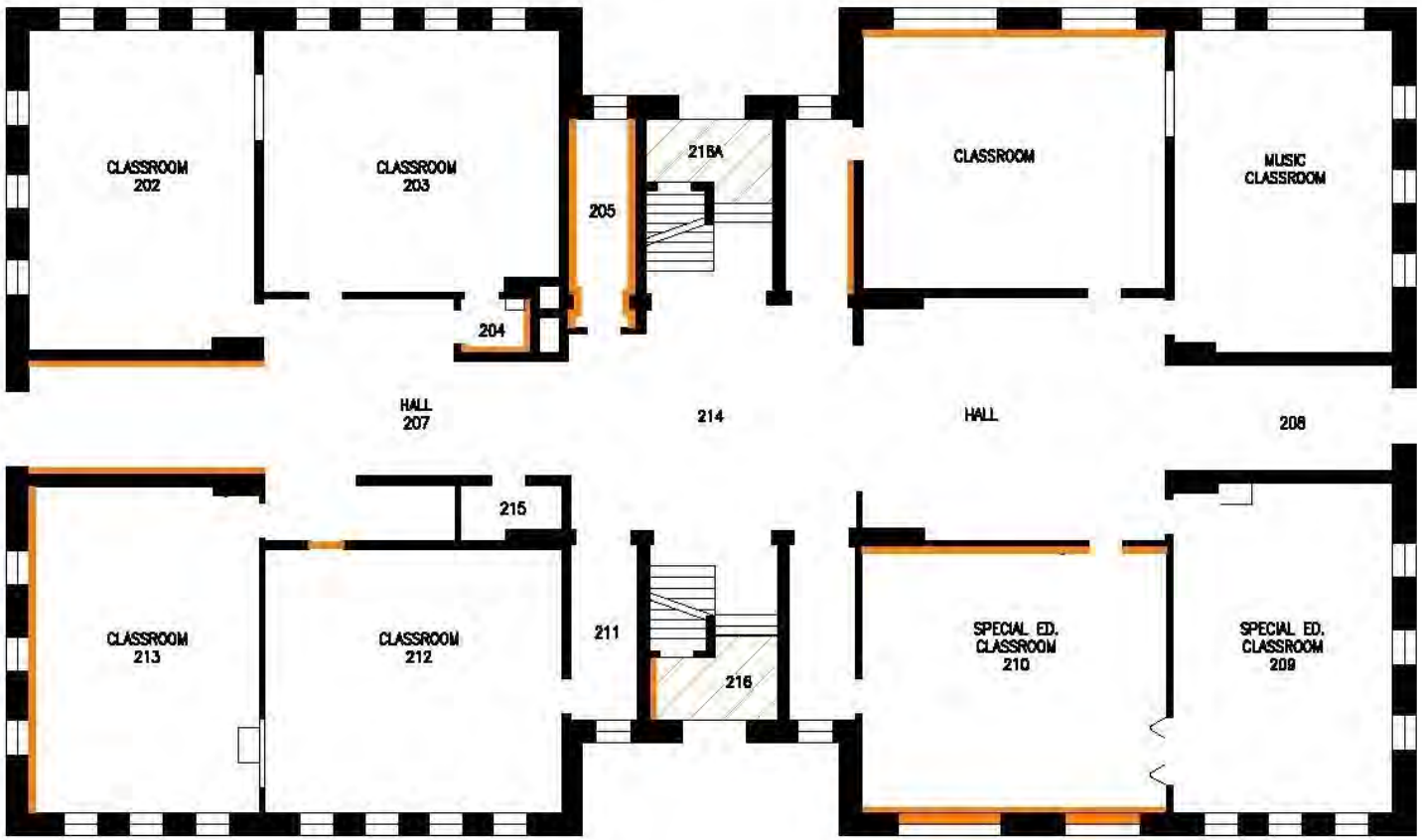
LBP LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – ELEMENTARY SCHOOL–BASEMENT
ROUNDUP, MT.
ASBESTOS SURVEY (Weston, 2016)

DATE: June 1, 2017

SCALE: N.T.S.

Figure 7



LEGEND:

LBP LEAD BASED PAINT

LEAD BASED PAINT

LEAD BASED PAINT EXTENT

N

Prepared for:
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LBP LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – ELEMENTARY SCHOOL–MAIN FLOOR
ROUNDUP, MT.
LEAD BASED PAINT SURVEY (Weston, 2016)

DATE: June 1, 2017

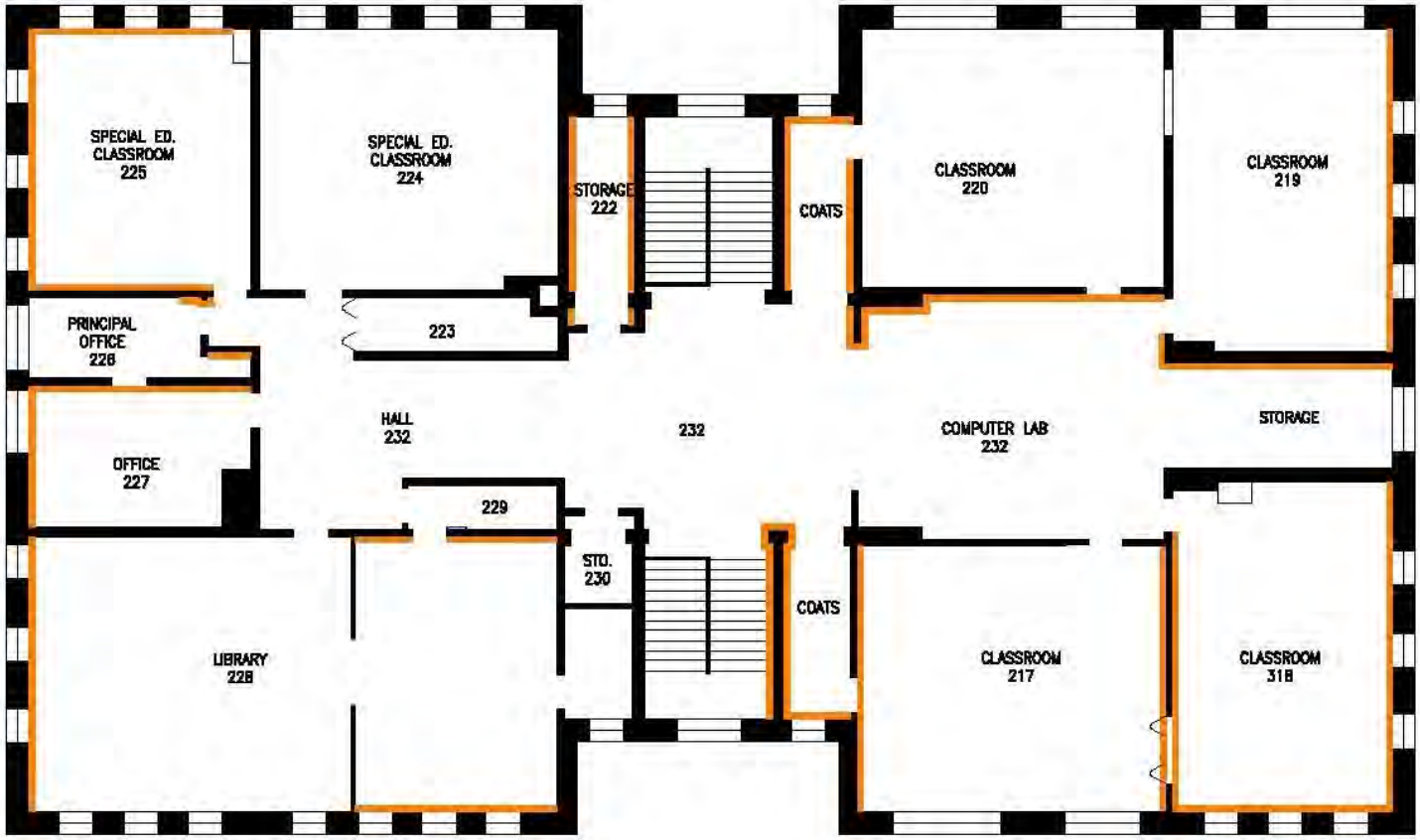
SCALE: N.T.S.

Figure 8

LEGEND:

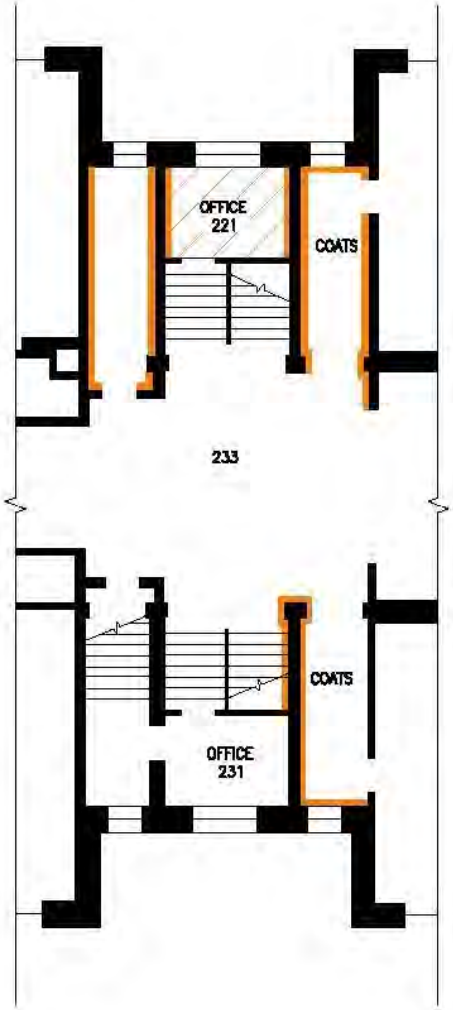
LBP LEAD BASED PAINT

LEAD BASED PAINT



N

Prepared for: Snowy Mountain Development Corp.	Prepared By: Weston Solutions, Inc. 805 N. Last Chance Gulch Helena, MT	LBP LOCATION AND EXTENT CENTRAL SCHOOL CAMPUS – ELEMENTARY SCHOOL–SECOND FLOOR ROUNDUP, MT. LEAD BASED PAINT SURVEY (Weston, 2016)	DATE: June 1, 2017 SCALE: N.T.S.	Figure 9



LEGEND:

LBP LEAD BASED PAINT

LEAD BASED PAINT

LEAD BASED PAINT EXTENT

N

Prepared for:
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LBP LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – ELEMENTARY SCHOOL–MEZZANINE
ROUNDUP, MT.
LEAD BASED PAINT SURVEY (Weston, 2016)

DATE: June 1, 2017

SCALE: N.T.S.

Figure 10

LEGEND:

LBP LEAD BASED PAINT

LEAD BASED PAINT

LEAD BASED PAINT EXTENT

N

Prepared for:
Snowy Mountain Development Corp.

Prepared By:
Weston Solutions, Inc.
805 N. Last Chance Gulch
Helena, MT

LBP LOCATION AND EXTENT
CENTRAL SCHOOL CAMPUS – ELEMENTARY SCHOOL–BELL TOWER
ROUNDUP, MT.
LEAD BASED PAINT SURVEY (Weston, 2016)

DATE: June 1, 2017

SCALE: N.T.S.

Figure 11

ATTACHMENT A

Programmatic Quality Assurance Project Plan, Central Montana Brownfields Coalition

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FINAL Project-Wide Quality Assurance Project Plan Central Montana Brownfields Coalition

Tetra Tech Project No. 114-560531
Revision Date: July 27, 2016

PRESENTED TO

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8/2/16

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Reviewed by:

8/11/16

Stephanie Shen — Date
U.S. EPA, Delegated QA Project Manager

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APPENDIX F Data Validation Checklist

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
%R	Percent Recovery
ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response Act
ARM	Administrative Rules of Montana
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
C	Completeness
CERCLA	Comprehensive Environmental Response Compensation Liability Act
CLP	Contract Laboratory Response Program
CMBC	Central Montana Brownfields Coalition
COC	Contaminants of Concern
COPC	Contaminant of Potential Concern
CRQL	Contract Required Quantitation Limit
DAF	Dilution Attenuation Factor
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
ESA	Environmental Site Assessment
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HUD	United States Department of Housing and Urban Development
iATL	International Asbestos Testing Laboratory
LBP	Lead-Based Paint
LCS	Laboratory Control Sample
MBAC	Montana Business Assistance Connection
MADEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
MS	Matrix Spike
NESHAP	National Emission Standards for Hazardous Air Pollutants
OSHA	U.S. Occupational Safety and Health Administration
P	Number of measurements/data points planned

Acronyms/Abbreviations	Definition
PAH	Polynuclear Aromatic Hydrocarbons
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCBs	Polychlorinated Biphenyls
PCM	Phase Contrast Microscopy
piC/L	Picocuries per Liter
PLM	Polarized Light Microscopy
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RBCA	Risk-Based Corrective Action
RBSL	Risk Based Screening Level
RLF	Revolving Loan Fund
RPD	Relative Percent Difference
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SMDC	Snowy Mountain Development Corporation
SOP	Standard Operating Procedure
SSL	Soil Screening Limit
V	Number of Valid Measurements/Data Points Obtained
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbons
XRF	X-Ray Fluorescence Spectrometer

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) prepared this project-wide Quality Assurance Project Plan (QAPP) for the Central Montana Brownfields Coalition (CMBC) to guide quality assurance and quality control (QA/QC) procedures for completion of Phase I and II Environmental Site Assessments (ESAs) and sampling for cleanup projects at sites within the designated 11-county CMBC project area boundary (**Figure 1**, **Appendix A**). These projects are being completed through a U.S. Environmental Protection Agency (EPA) Brownfields Revolving Loan Fund (RLF). This QAPP will also apply to any future Brownfields Hazardous Substance and Petroleum Assessment Grant funds, if awarded. This QAPP is to be used by CMBC and contractors conducting assessments or confirmation sampling for CMBC's brownfields grant.

There are several organizations directly participating in this project. These include Snowy Mountain Development Corporation (SMDC), Montana Business Assistance Connection (MBAC), the City of Lewistown, EPA, the Montana Department of Environmental Quality (MDEQ), various site owners, and other interested parties including the public. Currently, Tetra Tech is the Qualified Environmental Professional (QEP) and all contractors will be hired directly by CMBC. Effective project management will ensure that stakeholders agree upon a well-defined assessment and cleanup approach and that sufficient data are collected to make decisions related to redevelopment.

This QAPP is a comprehensive document to guide site assessment. Assessment activities for the project area may include investigation and confirmation sampling of contaminants of concern (COCs) in soil and groundwater, methamphetamine (meth), asbestos-containing materials (ACM), lead-based paint (LBP), lead dust, lead-in-drinking water, and radon. A project-specific sampling and analysis plan (SAP) will be prepared that specifies the type of investigation and methods used for each site assessment. Together this project-wide QAPP and the site-specific SAPs constitute the site assessment work plan.

Upon completion of each assessment, a report will be prepared that will present the methods of investigation, results of each field investigation, data evaluation, summary of cleanup activities, and recommendations for further assessment or remedial actions, as needed. Each report will be complete with data tables; figures showing the site location, site map, and investigation and remediation sampling locations; proof of construction activities; analytical data reports; field forms; boring, test pit and/or monitoring well logs. Analytical results for samples collected during assessments will be evaluated for precision, accuracy, representativeness, and completeness.

The sections in this introduction present the project organization and define the responsibilities of various project participants. This section also describes data quality objectives (DQOs) for the assessments (overall goals of the project) which are defined to guide identification of specific tasks used to collect the data necessary to support decision-making.

1.1 PROJECT ORGANIZATION

The overall project managers for brownfield funded projects is Ms. Karen Sweeney, Program Coordinator for CMBC, and Ms. Kathie Bailey, the Coalition Chair for the CMBC. Mr. Nicholas Sovner is the current Tetra Tech Project Manager for this project and will coordinate assessment and cleanup work, and Ms. Natalie Morrow of Tetra Tech is the current Quality Assurance (QA) Officer. **Figure 2** (**Appendix A**) presents a project organization chart. Responsibilities of key project personnel are summarized below.

<u>CMBC Program Coordinator – Karen Sweeney:</u> Ms. Sweeney is responsible for project decision making, budgeting, grant management, and reviews all project planning documents.

<u>CMBC Chair – Kathie Bailey:</u> Ms. Bailey is responsible for coordination between CMBC stakeholders and approves all project documents.

EPA Project Manager – Stephanie Shen: Ms. Shen reviews and approves all project sites, the QAPP and Sampling Analysis Plans (SAPs), and provides technical assistance with CMBC's overall management of the Brownfields EPA grant(s).

MDEQ Brownfields Coordinators – Jason Seyler/Brandon Kingsbury: Mr. Seyler is the State Regulator for Montana Hazardous Substance Brownfields sites and Mr. Kingsbury is the State Regulator for Petroleum Brownfields sites. MDEQ coordination will occur with MDEQ on sites where MDEQ has a regulatory interest, where petroleum fund reimbursement will be sought, or where the property owner is seeking a brownfields no further action letter from MDEQ.

QEP Project Manager: The QEP Project Manager is responsible for project coordination as the liaison with CMBC, EPA, MDEQ, and consulting team members; field planning; problem solving and decision making; QA during project activities; overseeing assessment activities and review and preparation of project documents. This position reviews all chain-of-custody forms and analytical data, ensures analytical data meet current standards for accuracy and precision, and ensures compliance with State requirements and guidance. This position also maintains the official approved QAPP.

QEP QA Officer: The QEP QA Officer will provide QA/QC during project activities and preparation of documents. This position reviews analytical data to meet current standards for accuracy and precision. Although employed by the same entity to ensure continuity of institutional knowledge, the QEP QA Officer is always independent of the QEP Project Manager and any data generating activities.

QEP Health and Safety Officer: The QEP Health and Safety Officer ensures work crews comply with federal Occupational Safety and Health Administration (OSHA) safety requirements.

1.2 PERSONNEL TRAINING REQUIREMENTS

All QEP field staff will have the appropriate training for the project which they are working. Trainings and certifications may include but not be limited to:

- OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour certification with 8-hour annual refresher;
- MDEQ Accredited Asbestos Inspectors and/or Contractor Supervisors; and,
- EPA Accredited Lead Inspectors and Risk Assessors.

The QEP Health and Safety Officer is responsible for organizing trainings and annual refreshers for staff and ensuring certifications are current. This information is maintained in the QEP office.

1.3 PROJECT OBJECTIVES

The QEP provides all field services at approved sites within the CMBC project boundaries. The objectives of the brownfields program are to ensure that all remedial activities meet a standard of care acceptable to EPA, MDEQ, OSHA, and other applicable regulatory entities. The QEP will provide the following services to support this goal:

- Review the prime consultant's work plans, SAPs, and reports (if work is conducted by a firm other than the QEP), subcontractor bids, conduct site inspections, and conduct additional sampling where necessary.
- Prepare work plans, SAPs, and reports that present results related to any investigation or cleanup activities where QEP is the prime consultant.

1.4 PROJECT SCHEDULE

This project involves providing QEP services on select sites that have been deemed eligible by EPA and that have known or perceived contamination of hazardous substances and/or petroleum contamination.

Individual project schedules will be dependent upon:

- Date of approval of the final site-specific SAPs and Health and Safety Plans (HASPs);
- Date assessment activities commence;
- Unanticipated field and weather conditions;
- The need for further assessment;
- Turn-around-time on analytical results;
- Subcontractor availability;
- Additional requirements by EPA, MDEQ, and CMBC; and
- The length of the EPA and CMBC review and comment periods on project documents.

The QAPP is valid for the duration of the cooperative agreement between EPA and CMBC, and will be evaluated annually to ensure it is up to date.

1.5 DISTRIBUTION LIST

The QEP Project Manager will provide a copy of the most current approved QAPP via email (electronic copy), regular mail, or by hand delivery (electronic version on CD and/or hard copy) to the following individuals:

- Karen Sweeney/Kathie Bailey, SMDC, 613 NE Main Street, Lewistown, MT, 59457
- Brian Obert/Eric Seidenstecker, MBAC, 225 Cruse Avenue, Suite D, Helena, MT 59601
- Nicholas Sovner/Natalie Morrow, Tetra Tech, 303 Irene Street, Helena, MT 59601
- Stephanie Shen, EPA Region 8, 1595 Wynkoop Street, Denver, CO, 80202
- Jason Seyler/Brandon Kingsbury, MDEQ, PO Box 200901, Helena, MT 59620-0901
- Future contractors or subcontractors hired to conduct sampling for CMDC brownfields grant projects

1.6 PROJECT DESCRIPTION

The boundaries for this project includes the following 11 counties: Broadwater, Fergus, Gallatin, Golden Valley, Judith Basin, Lewis and Clark, Meagher, Musselshell, Park, Petroleum, and Wheatland. Grant funds will be used for site assessment and cleanup, public outreach, redevelopment planning, and programmatic expenses related to CMBC's RLF and assessment (if funded) program.

Phase I ESA reports will be completed as part of the CMBC Brownfields Project and will be conducted in general accordance with Standard E 1527-13 issued by the American Society of Testing and Materials (ASTM) and will conform to EPA's Standards and Practices for All Appropriate Inquiries - Final Rule published November 1, 2013. Phase II ESA reports will be conducted in general accordance with the ASTM Standard Practice for Environmental Site Assessment Process E1903-11.

Results of investigations completed under this QAPP will be reviewed and compared to applicable federal and state regulatory action levels and screening levels to evaluate whether additional investigation/remediation work is needed (see Section 1.7.5). The purpose of comparing results with action and/or screening levels is to evaluate the potential for risk to and potential need for protection of human health and/or the environment based on the concentrations of contaminants in media at the site and potential future re-use of the site.

1.7 DATA QUALITY OBJECTIVES

DQOs for this project were developed to ensure data quality and to define procedures for data collection. In addition, site-specific DQOs are identified in the individual SAPs. The site-specific DQOs will describe the site conceptual model, including potential sources, pathways, and receptors, based on the most likely future land use.

DQOs were developed following the recommendations in EPA guidance documents (EPA 2006; EPA, 1998). The DQO process allows the QEP to determine the level of data quality required for specific data collection activities and to estimate the costs associated with the activities.

1.7.1 Problem Statement

CMBC is interested in identifying potential contamination issues associated with individual sites selected for assessment and cleanup. The QEP has identified common contaminants of potential concern (COPCs) that are likely associated with sites that may be investigated as part of this brownfield project. The focus will be hazardous substances and petroleum hydrocarbons. Media potentially affected by COPCs at sites within the project area include surface and subsurface soil, groundwater, indoor air quality, and building materials. Additional COPCs and affected media may be identified during the course of each project. In this case, the media and associated COPCs will be identified and described in the site-specific SAPs. **Table 1**, below, presents a summary of the potential media and possible COPCs that may be present as a result of past property uses. Specific media and COPCs that require investigation will be site-specific and identified in each site-specific SAP.

Table 1 - Contaminants of Potential Concern

Investigation Media	Contaminants of Potential Concern
Surface and Subsurface Soil	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, metals, pesticides, herbicides, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs)
Groundwater and Surface Water	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, metals, pesticides, herbicides, PCBs, PAHs
Sediment	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, metals, pesticides, herbicides, PCBs, PAHs
Various Building/ Structure Media	Asbestos, LBP, lead dust, lead-in-drinking water, PCBs, mercury, meth
Soil Vapor/Ambient Air	Petroleum hydrocarbons, volatile and semi-volatile compounds, PAH's

1.7.2 Decision Statement

Site assessments will involve collecting environmental data to support cleanup planning and cleanup for each location. Cleanups will focus on removal of routes of exposure to contamination by human and ecological receptors. To assess the feasibility of cleanup and/or redevelopment, the QEP will evaluate available data and make decisions based on the following decisions statements:

- Do some portions of the site contain contaminants above soil screening levels, groundwater standards or site cleanup levels that would preclude residential, commercial, and/or recreational redevelopment or use?
- Does the contaminated media at the site have the potential to affect human health and/or the environment?
- Are there portions of the site that will not require any assessment or cleanup prior to redevelopment, remodeling or demolition, and/or continued use?

1.7.3 Decision Inputs

Data required to address the decision statements may include physical and chemical characteristics of the contaminant and affected media. Where enough data are available, data requirements may also include estimating contaminant waste volumes. If data are available from previous investigations, the QEP will use the information to identify data gaps and develop the site-specific SAP and, if the data are of acceptable quality, data will be used to assist with final decisions with respect to cleanup. All data collected and evaluated from a site will be compared to applicable state and federal screening levels and standards, or site-specific cleanup levels. General decision inputs for this project are summarized in the table below.

Table 2 - Decision Inputs

Source Materials	Typical Data Parameters	Data Uses
Surface and Subsurface Soil	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, PAHs, PCBs, metals, pesticides, herbicides	Identify contamination areas and evaluate potential risk to human health and the environment by comparing contaminant concentrations to residential and commercial/industrial screening levels. The data will also be used to evaluate potential for contaminants to leach to groundwater.
Groundwater	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, PAHs, PCBs, metals, pesticides, herbicides	Identify areas of contaminated groundwater and evaluate potential risk to human health and the environment by comparing contaminant concentrations to groundwater standards. Water-level elevations will be used to estimate groundwater flow direction(s).
Surface Water	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, PAHs, PCBs, metals, pesticides, herbicides	Identify areas of contaminated surface water and evaluate potential risk to human health and the environment by comparing contaminant concentrations to surface water standards.
Sediment	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, PAHs, PCBs, metals, pesticides, herbicides	Identify contamination areas and evaluate potential risk to human health and the environment by comparing contaminant concentrations to screening levels.
Soil Vapor	Petroleum hydrocarbons, volatile and semi-volatile organic compounds, PAHs	Identify indoor air impacted by vapor intrusion and compare contaminant concentrations to ambient air and screening levels.
Various Building/Structure Media	Asbestos, lead-based paint, lead dust, lead-in-drinking water, mercury, mold, PCBs, meth, radon	Identify areas of contaminated building media and evaluate potential risk to human receptors. Compare contaminant concentrations to appropriate screening levels.

1.7.4 Study Boundary

The study boundary covers 11 Montana counties including: Broadwater, Fergus, Gallatin, Golden Valley, Judith Basin, Lewis and Clark, Meagher, Musselshell, Park, Petroleum, and Wheatland. Vertical boundaries will generally be defined as the mechanical limits of the excavator or backhoe used for subsurface investigations and cleanups and/or the point at which groundwater is encountered in test pits or borings. If a confining zone is encountered, field personnel will be cautious not to compromise the confining or perching zone. A confining or perched zone is described as a low permeability zone greater than 2 feet thick. The low permeability zone is characterized as a unit with significantly lower permeability than the overlying and/or underlying lithologic unit (i.e. clay or silt layer overlain or underlain by gravel). Individual study area boundaries will be identified in the SAPs for each site.

1.7.5 Decision Rule

Several different parameters and regulatory standards will be used to evaluate data collected during sampling. COPC concentrations in samples will be compared to established risk-based standards and screening levels as presented in Table 3. Risks, and the potential need for cleanup and/or corrective action, will be evaluated based on a comparison of a COPC concentration by media of concern to an applicable state or federal risk-based standard or screening level for varying site reuse scenarios. If background metal concentration data for the area is available, results will be compared to background concentrations to further assess potential impacts to human health and/or the environment.

The following table summarizes the media and reference documents for standards and screening levels to be used on this project. The most current reference document, standards and screening levels should be used. Additional guidance documents and reference materials may be required as per EPA and MDEQ direction.

A comparison of site data to screening levels and standards will be completed to guide remedial alternatives analysis and/or recommendations for further site assessment activities. If the assessment work indicates that media is impacted at concentrations above the applicable screening levels or standards for a particular site reuse, then further assessment, remediation, or a site-specific risk assessment may be required. **Appendix C** includes a generic list of analytical methods, and jar/bottle and preservation requirements. The actual number and type of jars/bottles will be laboratory and project specific.

Table 3 - Decision Rule for Risk & Remediation

Media	Standard or Screening Level
Surface and Subsurface Soil	• Soil analyzed for metals require pre-analysis sieving to 250 millimeters (No. 60 sieve). • MDEQ Attachment C Soil Screening Process, Parts 1 and 2 (MDEQ, 2013) in conjunction with EPA Residential and Industrial Regional Screening Levels (RSLs) and Protection of Groundwater Soil Screening Levels (SSLs) table with TR=1E-06 and HQ=1 (EPA 2015). • MDEQ risk-based screening levels (RBSLs; MDEQ 2009); and/or • MDEQ Inorganic Background Threshold Values (BTVs; Hydrometrics 2013).
Groundwater	• Human Health Standards listed in Circular DEQ-7 Montana Numerical Water Quality Standards (MDEQ, 2012); • EPA Maximum Contaminant Levels (MCLs); and/or • MDEQ Tier 1 Risk Based Corrective Action (RBCA) Guidance (MDEQ 2009).
Surface Water	• Human Health and/or Acute and Chronic Aquatic Standards listed in Circular DEQ-7 Montana Numerical Water Quality Standards (MDEQ, 2012);
Sediment	• EPA Region 3 BTAG Freshwater Screening Benchmarks (EPA 2004).
Organic Compounds in Soil Gas and Indoor Air	• OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (EPA 2015); • Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites (EPA 2015); • Montana Vapor Intrusion Guide (MDEQ 2011).
Radon in Indoor Air	• EPA recommended action level (4 pCi/L: https://www.epa.gov/radon)
Building Materials and Air Clearance Testing (asbestos, lead, methamphetamine)	• Administrative Rules of Montana (ARM) 17.74.354; • Asbestos Hazard Emergency Response Act (AHERA), National Emissions Standards for Hazardous Air Pollutants (NESHAP); as promulgated in Title 40, Code of Federal Regulations, Part 763 (40 CFR 763); • U.S. Department of Housing and Urban Development (HUD) EPA Title 40 Code of Federal Regulations (40 CFR), Part 745; • ARM 17.74.506 Methamphetamine Cleanup

1.7.6 Tolerable Limits of Decision Errors

Decision errors are incorrect conclusions about a site caused by using data that are not representative of site conditions due to sampling or analytical error. Limits on decision error are typically established to control the effect of sampling and measurement errors on decisions regarding a site, thereby reducing the likelihood that an incorrect decision is made. The null hypothesis is that a site is contaminated. A false positive decision error is one that decides a site requires cleanup when, in actuality, it does not require cleanup. A false negative decision error is one that decides a site does not require cleanup when, in actuality, it does require cleanup. False positive and negative decision errors should be minimized as much as possible during this project.

Formal limits on decision error are not necessary in areas where the goal of the assessment is to define the boundaries of known contamination (EPA, 1998). This QAPP identifies general field and laboratory methods and sampling strategies that reduce sampling error. Site-specific SAPs will be prepared with details on field sampling and laboratory methods. The total study error will be reduced by collecting an appropriate number of environmental samples deemed necessary by the assessment team that are intended to represent the range of concentrations present at each site in question. The sampling programs will be designed to reduce sampling error by specifying an adequate number and distribution of samples to meet project objectives.

Table B-1 includes a list of potential media to sample and appropriate analytical methods. This list is not all-inclusive. Additional field parameters and methods will be specified in site-specific SAPs. Laboratory methods will be developed and verified in coordination with the analytical laboratory to meet project goals and objectives. This QAPP specifies methods and protocols to reduce both field and laboratory error. It also specifies the requirements for collection of field QC samples to facilitate assessment of data accuracy and precision. In addition, an individual SAP for each site will be prepared that specifies the sampling and analytical methods and protocols to reduce field error.

1.7.7 Sample Design

An individual site-specific SAP will be prepared that outlines the assessment design for each site. The SAP will specify sampling protocols, analytical methods and the types and numbers of samples to be collected during an assessment. The assessment design is based on a review of historical data and information and data from previous investigations completed at each site. If a site or sample location is deemed to be inaccessible due to access restrictions or safety concerns, than the importance of that location will be evaluated and a decision will be made as to whether additional samples in another location should be collected.

The general sampling design for various media is described below.

- Surface and subsurface soil sampling: Surface and subsurface soil sample results will be used to evaluate concentrations of COPCs in surface and subsurface soil at brownfields sites. Results will also be used to identify direct and indirect routes of exposure and human-health risk based on contaminant type and concentration, and potential site reuse scenarios. MDEQ defines surface soil as soil from the ground surface to 2 feet below ground surface (bgs) and subsurface soil as soil greater than 2 feet bgs. Soil results will also be evaluated to determine the potential for contaminants to leach to ground water.
- Groundwater sampling: Groundwater sample results will be used to evaluate concentrations of COPCs at sites and to evaluate potential direct and indirect routes of exposure to human health and the environment.
- Vapor Intrusion Sampling: Samples for petroleum hydrocarbons and volatile organic compounds (VOCs) will be collected to evaluate for the occurrence of vapor intrusion from contaminated soil and/or groundwater beneath a structure.
- Building materials: Concentrations of COPCs (asbestos, lead, mold, PCBs, mercury, radon, meth) will be evaluated in building materials to assess routes of exposure and risk to human health under current conditions and during potential remodeling or demolition work.

The project report will reconcile the information from the investigation that is critical and what is for information purposes only. All information collected in the field and analytical data is considered critical.

2.0 MEASUREMENT DATA ACQUISITION

The following section describes tasks related to data acquisition. This includes the sampling process, quality control procedures and requirements, equipment operation, data management, and record keeping.

2.1 SAMPLING PROCESS

Field personnel will collect samples of various media during this brownfields project. Sample collection will include the potential use of a variety of equipment, including excavating equipment, hand tools, and hand-held measurement devices (i.e. photoionization detector, X-ray fluorescent device, etc.). Samples will be handled under standard preservation and chain-of-custody procedures. **Table B-1** (**Appendix B**) lists the most common analytical methods expected for the field investigations. **Table B-2** (**Appendix B**) presents a summary of sampling media and applicable Tetra Tech Standard Operating Procedures (SOPs). **Appendices C** and **D** provide sample preservation information and analytical laboratory quality assurance documentation, respectively. **Appendix E** provides copies of the SOPs. The SOPs are general in nature, as such, modifications may be required to meet individual site-specific assessment needs.

2.2 QUALITY CONTROL

QC samples will include both field and laboratory samples, as described in the following sections.

2.2.1 Field Quality Assurance/Quality Control Sampling

Field QC samples collected during the assessment will include field duplicates, equipment rinsate blanks, field blanks, and trip blanks (where appropriate). The purpose of analyzing QC samples is to meet DQOs specified in Section 1.3, above. **Table B-3** (**Appendix B**) presents a summary of the field QA/QC objectives and sample frequency. QC samples will be handled, preserved and shipped consistent with the natural samples and/or per laboratory requirements. Each QC sample type is discussed below.

Field Duplicates

Field duplicate soil and water samples will consist of blind field duplicates collected at a frequency of one duplicate for every 20 natural samples. If less than 20 samples are collected, one field duplicate per day per sample matrix will be collected. They will be collected for the purposes of evaluating project sample precision. The field duplicate samples will be: 1) collected, containerized and preserved consistent with the natural sample; 2) analyzed for the same constituents as the natural sample; and 3) submitted blind to the laboratory. Soil samples will be homogenized as much as possible, but care will be taken to minimize the level of mixing when sampling for volatile constituents.

Field duplicates for lead risk assessments will be collected in accordance with HUD guidelines, at a ratio of one duplicate for each 10 natural wipe samples collected. If less 10 natural wipe samples are collected, one wipe field duplicate sample will be collected per day. For radon assessments, field duplicates will be collected at a ratio of one per 10 natural samples. Field duplicates for meth assessments will be collected at a ratio of one duplicate for each 10 natural wipe samples collected.

Field Blanks

Field blanks will be collected at a frequency of one per 20 natural samples to evaluate whether contaminants have been introduced into the samples during sampling handling and decontamination procedures. If less than 20 samples are collected, one field blank per day per sample matrix will be collected. Field blank samples will be obtained by pouring deionized or distilled water into a sampling container at the sampling point. The water used will be from the same source of water used to decontaminate field equipment. Field blanks will be analyzed for the same constituents as the natural samples. The field blanks will be preserved, packaged, and sealed as per laboratory requirements and handled in the same manner as the natural samples. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory. The time and date of the field blank will be documented in the field log to associate it with the corresponding natural samples.

Equipment Rinsate Blanks

Equipment rinsate blanks will be collected at a frequency of one per 20 natural samples for each media. Equipment rinsate blanks will be collected where: 1) field equipment either requires decontamination; or 2) in the case of disposable equipment such as tubing and field filters, where sample water runs through sampling equipment. A separate sample number and station number will be assigned to each sample, and it will be submitted blind to the laboratory. The time and date of the field blank will be documented in the field log to associate it with the corresponding natural samples. The collection methods are described below:

- Water Sampling: Where tubing and/or filters are used, the decontamination source water (i.e. clean deionized water) will be pumped through clean tubing and clean filter (where applicable) and the rinsate blank collected in laboratory-provided sample containers.
- Soil/Waste/Sediment Sampling: For equipment such as trowels and shovels or other sampling devices, the equipment will be decontaminated. Once the equipment has been decontaminated, decontamination source water (i.e., clean deionized water) will be rinsed over the equipment and collected in the appropriate laboratory-supplied sample containers. The sample will be preserved as required.

Trip Blanks

Trip blank samples will be prepared in the laboratory and will consist of Volatile Organic Analysis (VOA) vials filled with de-ionized water. One trip blank will accompany each cooler containing samples requiring analysis for volatile constituents. The trip blanks will be recorded on the chain-of-custody form along with the accompanying natural and QC samples. The trip blanks will be shipped to the sampling office, transported to the field by the sampling crew, and returned to the laboratory along with the field samples for analysis. The trip blanks will be analyzed for the same volatile constituents as the field samples (i.e., VOCs). Analytical data obtained from the trip blanks will be used to evaluate if analytes are introduced to field samples during sample transport.

2.2.2 Laboratory Quality Assurance/Quality Control

Three analytical laboratories may be used for this project; Energy Laboratories, Inc. for soil and water samples, International Asbestos Testing Laboratories, Inc. (iATL) for lead and asbestos samples, and ALS Environmental for meth wipe samples, and VOC and petroleum hydrocarbon air samples. If an alternative laboratory is to be used for a given project it will be identified in the site-specific SAP. Documentation of laboratory quality assurance is presented in **Appendix D**, full QA/QC manuals are available upon request.

2.3 EQUIPMENT OPERATION, CALIBRATION, AND STANDARDIZATION

All field and laboratory equipment will be operated, maintained, calibrated, and standardized in accordance with EPA and manufacturers' recommended procedures by field personnel. **Appendix E** includes Tetra Tech's applicable SOPs that specify field equipment operation, maintenance, calibration, and standardization procedures. Corrective actions will be taken promptly upon identification of potential problems with data

acquisition or measurement. Field equipment malfunctions will be identified promptly and corrected by the field team leaders. Corrective actions will be documented in the field notes and may include equipment recalibrations or replacement. All measurements recorded since the last successful calibration will be flagged and evaluated on an individual basis. If possible, flagged measurements will be retaken with properly functioning equipment. The QEP Project Manager will be advised of all deficiencies and corrective actions.

Table B-1 (**Appendix B**) and the site-specific SAPs will prescribe the analytical methods to be used at each investigation area. The selected analytical method(s) define QC requirements and how the laboratory must analyze each sample. Laboratory equipment malfunctions are handled according to EPA analytical method specifications. Laboratory QC samples (calibration samples, method blanks, matrix spike samples, laboratory control samples, and laboratory duplicates) will be handled according to EPA analytical method specifications. Laboratory corrective actions will be included on laboratory analytical reports. **Appendix D** contains documentation from the laboratory QA/QC manuals. Full copies of these documents are available upon request. The Energy Laboratories, Inc. QA/QC manual is available on-line at: http://www.energylab.com/QualityControlList.asp?branch=Helena.

2.4 DATA MANAGEMENT

Analytical data will be provided to the QEP in both electronic and hard copy. Hard copy reports will be stored in the project files. Analytical laboratory data for the project will be downloaded directly into a Microsoft Access or Excel database from electronic, formatted laboratory data. The QEP will manually enter field parameter measurements into the database. Backups will be created prior to entry of new data in the database to prevent loss of data during the data reduction process. Any electronic survey or global positioning system (GPS) data will be archived in the same manner as electronic analytical data (SOP-41, **Appendix E**).

This QAPP may also be used for due diligence reports such as Phase I Environmental Site Assessments. For these reports secondary data may be used to gather information. Secondary data is defined as data that were collected for a different purpose than that for which they are now being used. Sources include but are not limited to Environmental Data Resources reports, Digital Sanborn Maps, and Montana Cadastral.

Field descriptions of lithologic characteristics, observations, and other site data will be entered onto appropriate field forms during the field investigation and filed in designated project files in the QEP's office. The QA Officer will maintain quality control of data transfer into the database by verifying the accuracy of a minimum of 10% of the entries placed in the database. The QEP Project Manager will be responsible for data archival and retrieval.

2.5 DOCUMENT CONTROL

The QA Officer will be responsible for ensuring that project personnel have the current versions of the SAP and QAPP and other project planning documents. The QEP Project Manager will also maintain current project files and project documents. Project files will be maintained on the QEP's server through the end of our contract with SMDC.

Final documents will be delivered to CMBC in electronic format on CD. Documents will be archived by the QEP on both CD and on a server and be available for retrieval through the end of our contract with SMDC. After this date, documents may be obtained from the CMBC Program Coordinator.

Electronic copies of all reports will be stored on the QEP's servers, hard copies will be maintained in the archive folders for at least 10-years.

3.0 DATA REVIEW, VERIFICATION, AND ASSESSMENT AND OVERSIGHT ELEMENTS

The QEP Project Manager will be responsible for oversight of project activities. CMBC will be updated at the end of each assessment and/or cleanup, or sooner if necessary. Updates provided will include a summary of project activities to date. On a monthly basis, the QEP Project Manager will provide CMBC with a written project status report.

An internal audit of field procedures may be performed by the QEP QA Officer. If completed, the internal audit will include a review of procedures selected for the sampling program, a review of the QA/QC samples required, and a review of training requirements. The laboratory is required to have written procedures addressing internal QA/QC as specified in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Contract Lab Program (CLP) protocol.

Corrective actions will be taken promptly upon identification of potential problems with data acquisition or measurement. Field equipment malfunctions will be identified promptly and corrected by the field team leaders. Corrective actions will be documented in the field notes. Laboratory equipment malfunctions are handled according to EPA analytical method specifications. Laboratory QC samples (calibration samples, method blanks, matrix spike samples, laboratory control samples, and laboratory duplicates) will be handled according to EPA analytical method specifications. Laboratory corrective actions will be included on analytical laboratory reports.

4.0 VALIDATION

4.1 DATA REDUCTION

Data reduction is the result of grouping similar QC samples and calculating and reporting their recoveries, and will be performed on laboratory data while still in the laboratory. The QEP will work directly with the laboratory's data QA Officer who will review all analytical data associated with each sample. The QEP will receive all QA/QC reports from the analytical laboratory.

The types of laboratory QC data reviewed will include calibration standards, calibration verification, laboratory controls, laboratory duplicates, and laboratory spikes. When EPA methods are used, the applicable data reduction procedures called for in the EPA methods will be used. The assessment reports will include the raw data and a summary of QC data reduction.

4.2 DATA REVIEW

The ability of data to meet DQOs is evaluated with a precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) statement. A PARCCS statement is generated during data evaluation. The following sections define the terms used in the PARCCS statement. PARCCS components will be evaluated using the EPA 2014 National Functional Guidelines for inorganic and organic data review (EPA 2104a and 2014b), or most current versions.

4.2.1 Precision

Precision is the amount of scatter or variance that occurs in repeated measurements of a particular analyte. Precision acceptance and rejection for this project will be based on the relative percent difference (RPD) of the field duplicates. The QEP will evaluate analytical results for the field and duplicate soil samples using the RPD between the two samples when both values of the field/duplicate pair are greater than 5 times the practical quantitation limit (PQL) for a given analyte.

The RPD is given by:

$$RPD\ (\%) = \frac{2\,|S_1 - S_2|}{S_1 + S_2} \times 100$$

where: | | = absolute value of $S_1 - S_2$
S_1 = measured field sample concentration; and
S_2 = measured duplicate sample concentration.

When duplicate analysis results exceed 30% RPD for aqueous solutions and 35% RPD for soil and the analyte concentration in the sample is greater than 5 times the PQL, all results for the analyte exceeding the RPD in the sample delivery group will be considered estimated. The range of acceptable RPDs for precision is presented in Table B-4 (**Appendix B**).

4.2.2 Accuracy

Accuracy is defined as the ability of the analytical procedure to determine the actual or known quantity of a particular substance in a sample. Accuracy acceptance or rejection will be based on the percent recovery (%R) of the matrix spike (MS), and will be based on the percent recovery of the laboratory control sample (LCS). To determine accuracy, the %R for each matrix spike or LCS will be compared to the acceptable range as specified in the applicable laboratory method. Equipment and laboratory blanks may also be analyzed to quantify artifacts introduced during sampling, transport or analysis that may affect the accuracy of the data. In addition, initial and

continuing calibration results may be used to verify that the sample concentrations are accurately measured by the analytical instrument.

The percentage recovery for MS samples is given by:

$$\text{Recovery (\%)} = \frac{SSR - SR}{SA} \times 100$$

Where: SSR = Spiked sample result (measured concentration of the spiked sample)
SR = Sample result (concentration of unspiked sample)
SA = Spike added (amount of spike added)

The percent recovery for surrogate standards and LCSs are given by:

$$\text{Recovery (\%)} = \frac{Found\ value}{True\ value} \times 100$$

Where:
Found value = Concentration of each analyte measured in the analysis of the LCS (the amount recovered)
True value = Concentration of each analyte in the LCS (the original amount)

An overall assessment of accuracy will be made upon completion of the project. Overall accuracy will be stated as the mean %R. Because of the small number of matrix spike and laboratory control samples anticipated, no confidence interval will be calculated. LCS %Rs are method specific. **Table B-4** (**Appendix B**) lists %Rs for matrix spikes. National Functional Guidelines (EPA 2014a and 2014b) will be used to evaluate each situation and determine effects related to %Rs on samples.

4.2.3 Representativeness

The objective in addressing representativeness is to assess whether information obtained during the investigation accurately represents site conditions. Laboratory water blanks, field blanks, and equipment rinsate blanks are used to assess representativeness. Samples may be considered estimated and biased high for results detected between the contract required quantitation limit (CRQL) and 10 times the blank amount or biased low for results detected less than the CRQL. National Functional Guidelines (EPA 2014a and 2014b) will ultimately be used to evaluate each situation and determine effects of blank contamination on samples.

4.2.4 Completeness

The objective in addressing completeness is to assess whether enough data have been collected and enough data are valid to meet the investigation needs. Completeness is assessed by comparing the number of valid sample results to the number of samples collected. The completeness goal of the project is 90%.

Percentage completeness (C) is given by:

$$\text{C (\%)} = \frac{V}{P} X100$$

Where: V = number of valid measurements/data points obtained; and
P = number of measurements/data points planned.

4.2.5 Comparability

The objective in addressing comparability is to assess whether one set of data can be compared to another set of data. Comparability is assessed by determining if an EPA-approved analytical method was used, if values and

units are sufficient for the database, if specific sampling points can be established and documented, and if field collection methods were similar.

4.2.6 Sensitivity

Sensitivity refers to the ability of an analytical procedure to quantify an analyte at a given concentration. The sensitivity requirements should be established such that the laboratory method RL are at or below the relevant and applicable regulatory limits for each COC for the project. The sensitivity for a particular COC should be lower than the applicable standard defined for the site in order to demonstrate compliance with appropriate action levels.

4.3 DATA VALIDATION AND EVALUATION

Data validation consists of completing a review of raw analytical data. The laboratory will validate raw laboratory data using EPA 2014 National Functional Guidelines (EPA 2014a and EPA 2014b), or most current versions, and according to specific analytical method requirements. The analytical laboratory will perform data validation on raw analytical data prior to preparing a final analytical report.

Data evaluation consists of completing a review of laboratory analytical reports that have undergone internal laboratory validation. The objective of data validation and evaluation is to identify any unreliable or invalid laboratory measurements and qualify data for interpretive use. The data evaluation will include review of field QA/QC data and additional review of qualifiers assigned to the data by the analytical laboratory. Additional qualifiers will be assigned to the data, as necessary, based on, but not limited to, precision and accuracy of results, blank contamination, and other factors such as holding time and temperature exceedances. **Table B-5** (**Appendix B**) presents the data qualifiers that will be assigned to results, as necessary.

QEP Project personnel will complete data evaluation checklists based on MDEQ data evaluation guidelines. **Appendix F** presents the data evaluation form for this project. The form provides a guide for review of the laboratory and field procedures and data collected. The review will evaluate whether the following were completed according to SAP/QAPP requirements, EPA guidelines and/or method specifications:

- Chain-of-custody procedures;
- Cooler temperatures;
- Holding times;
- Laboratory QA/QC (i.e. review of results for method blanks, control samples, calibration results, duplicates, MS/MS Duplicate; and review detection limits are met);
- Lab data evaluation will also consider instrument tuning and system performance, calibration results, and detection limits; and,
- Field QA/QC (sample handling, duplicates, and field and equipment blanks).

Knowing the limitations of the data assists the data user when making interpretations. Data with limitations are usable for evaluation as long as the limitations are considered. Evaluation of other field data (pH meter and specific conductivity meter, for example) is not possible because these data have very limited statistical control limits. Professional judgment is required and will be used to assess the impact of field QC on the overall quality and usability of the field data.

4.4 DATA RECONCILIATION

Data reconciliation is performed in the office after data evaluation is complete. Data reconciliation is the generation of the PARCCS statement that assesses the data relative to meeting the DQOs. The QEP will perform this reconciliation as part of the data evaluation and completion of the data evaluation form. Using the PARCCS statement as a basis, reconciliation of data evaluation will be done by comparing evaluation results with project

objectives. If data user requirements are not met on State regulated sites, the QEP Project Manager and QA Manager will confer with the MDEQ on how issues will be resolved and how limitations of the data will be reported. If the site or cleanup is not regulated and data user requirements are not met, the QEP Project Manager and QEP QA Manager will evaluate whether collecting additional data is necessary to meet project DQOs.

5.0 REPORTING

Following completion of each assessment or cleanup project, a report will be prepared by QEP team members that summarizes the work performed and presents the investigation, cleanup, and confirmation sampling results. The report will include tables presenting the data, figures, and appendices that will contain copies of laboratory analytical results with associated data evaluation form, boring or test pit logs, photographs, and other data and information. Data will be compared to the applicable screening levels and standards presented in Section 1.7.3, or other applicable standards or screening levels specified in the site-specific SAP. The report will include an interpretation of analytical results and where assessment data exceeds regulatory standards, cleanup and/or corrective actions will be recommended for clean-up planning. Final documents will be delivered to CMBC in hard copy and electronic format on CD.

Phase I ESA reports will be prepared in accordance with Standard E1527-13 issued by the American Society of Testing and Materials and EPA's Standards and Practices for All Appropriate Inquiries - Final Rule published November 1, 2013 and EPA's August 15, 2013 Federal Register ruling 78 FR 19764.

Release reporting to local, state, and/or federal agencies may be required if results indicate that contamination at the site is exceeds screening/action levels. The QEP Project Manager will notify CMBC of any required reporting and assist CMBC or the property owner, as applicable, with completion of release reporting.

6.0 REFERENCES

American Society for Testing and Materials (ASTM), 2013. E 1527-13, Standard Practice for Phase I Environmental Site Assessment Process. West Conshohocken, Pennsylvania.

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United States Environmental Protection Agency (EPA), 2015b. Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tanks Sites. EPA 510-R-15-001.

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APPENDIX A FIGURES

Document Path: O:\N-S\Snowy Mountain Development Corporation\114-560531 - Project-Wide QAPP\120-GIS\ArcMap\Fig1_BrownsfieldProjectArea_Landscape.mxd

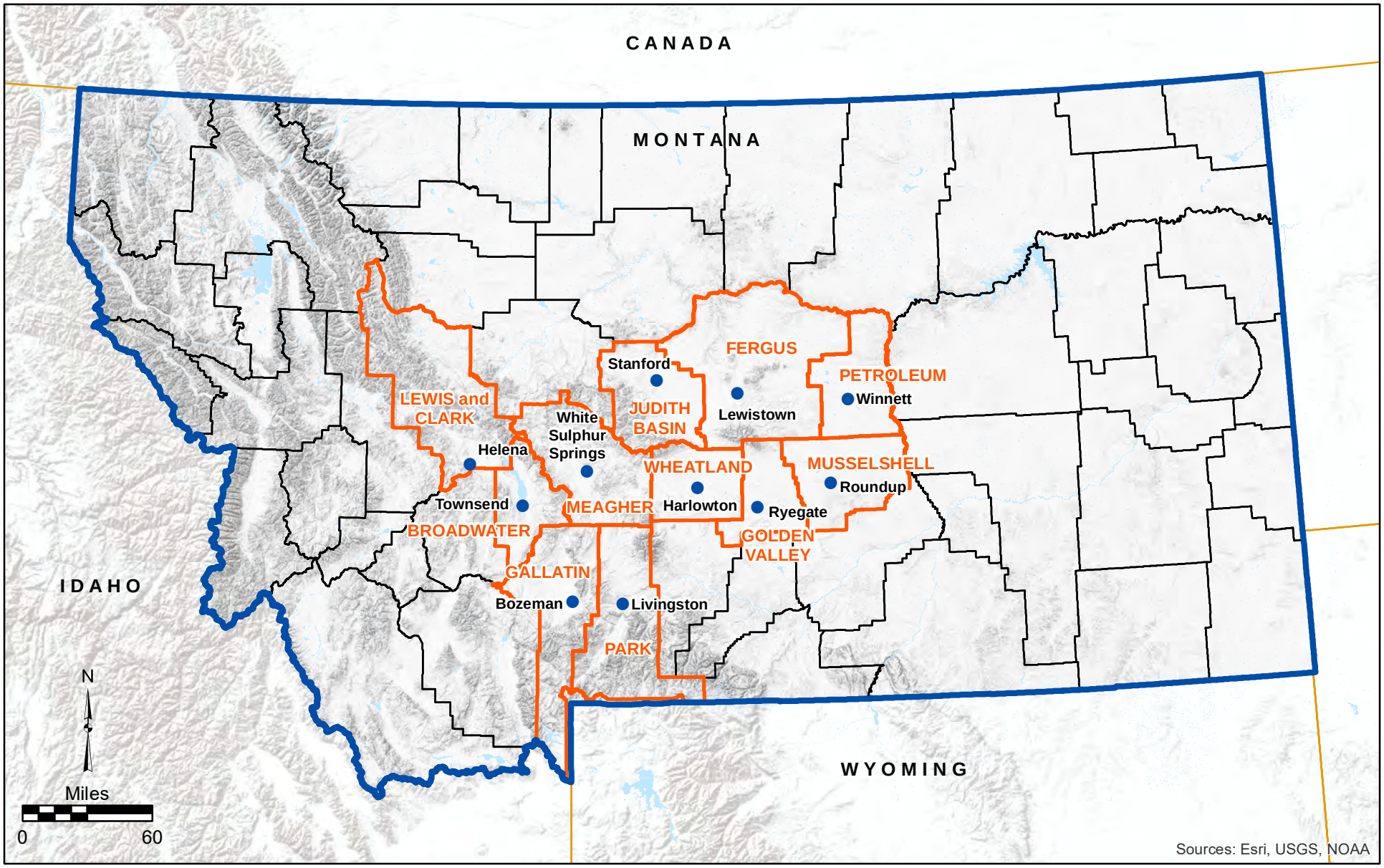
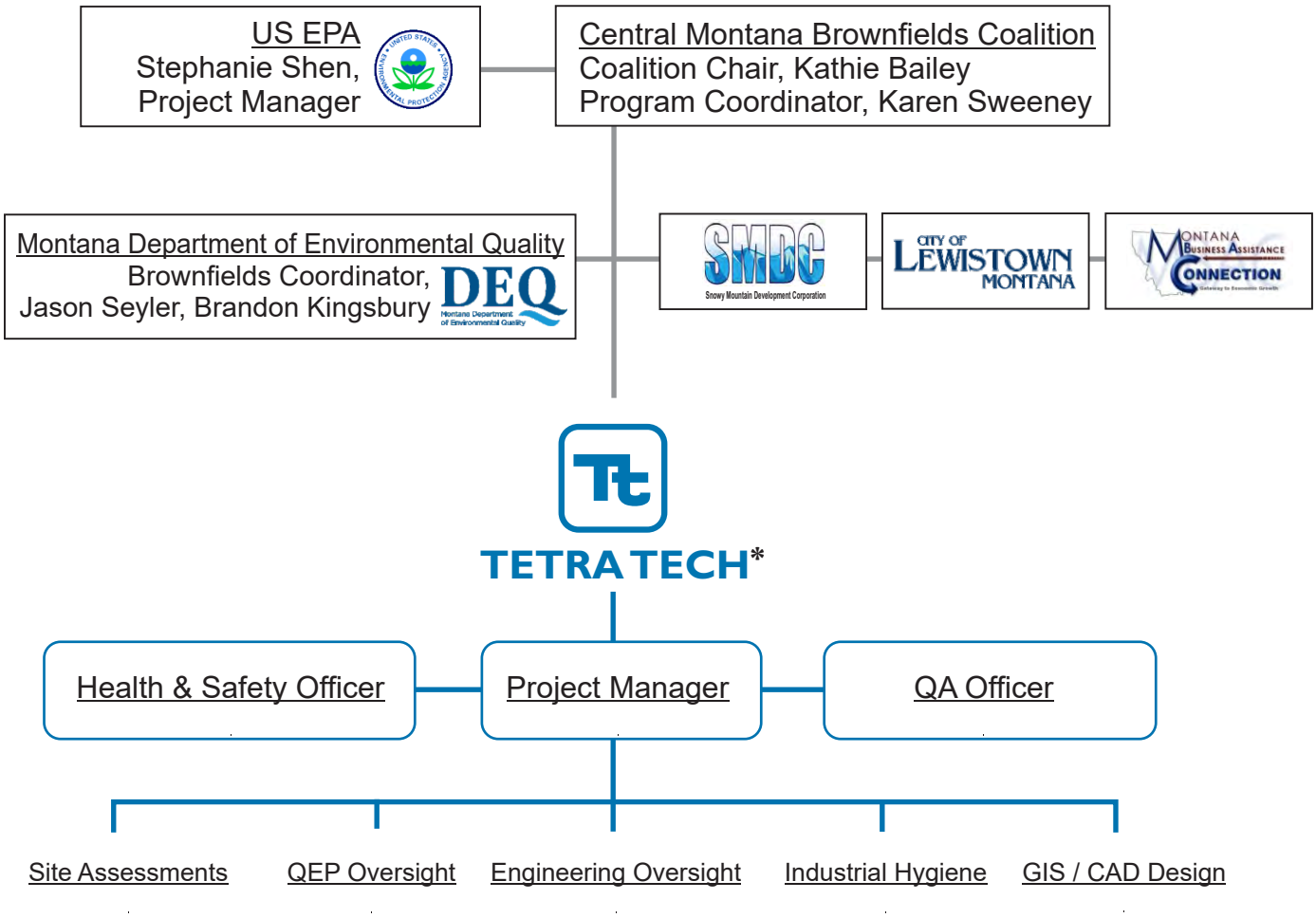


Figure 1
Brownfields Project Area
Central Montana Brownfields Coalition
Project-Wide QAPP



*Tetra Tech is the current Qualified Environmental Professional, all contractor's will be hired by CMBC

Figure 2
Personnel Organizational Chart
Central Montana Brownfields Coalition
Project -Wide QAPP

APPENDIX B TABLES

TABLE B-1
SAMPLING MEDIA AND ANALYTICAL METHODS

SAMPLING MEDIA	ANALYSIS	ANALYTICAL METHODS
Soil	Extractable Petroleum Hydrocarbons Volatile Petroleum Hydrocarbons Volatile Organic compounds Semi-Volatile Organic Compounds Polychlorinated Biphenyls Polynuclear Aromatic Hydrocarbons Pesticides Herbicides Metals Mercury	MADEP-EPH-98 MADEP-VPH-98 8021B 8270C 8082 8270C 8081A 8151A 6010/6020 7471A
Sediment	Extractable Petroleum Hydrocarbons Volatile Petroleum Hydrocarbons Volatile Organic compounds Semi-Volatile Organic Compounds Polychlorinated Biphenyls Polynuclear Aromatic Hydrocarbons Pesticides Herbicides Metals Mercury	MADEP-EPH-98 MADEP-VPH-98 8021B 8270C 8082 8270C 8081A 8151A 6010/6020 7471A
Groundwater & Surface Water	Extractable Petroleum Hydrocarbons Volatile Petroleum Hydrocarbons Volatile Organic compounds Semi-Volatile Organic Compounds Polychlorinated Biphenyls Polynuclear Aromatic Hydrocarbons Pesticides Herbicides Metals Mercury	MADEP-EPH-98 MADEP-VPH-98 8021B 8270C 8082 8270C 8081A 8151A 6010-6020 or 200.7/200.8 7470A
Building Materials	Asbestos Lead-based paint/Lead in dust Lead in water Toxicity Characteristic Leaching Procedure Radon Methamphetamine	PLM, NIOSH 7400 Field XRF and/or 6020 200.7 ASTM E1908-10 Short-term test kit LCMS + ID and/or NIOSH Method 9111
Air and Soil Gas	Volatile Organic Compounds Air Phase Hydrocarbons	EPA TO-15 & TO-15 SIM MADEP APH

Notes:
Sampling media and analysis will be determined on a site-specific basis.
MADEP –Massachusetts Department of Environmental Protection
EPH –Extractable petroleum hydrocarbons
VPH –Volatile petroleum hydrocarbons
PLM –Polarized light microscopy
LC-MS + ID – Liquid Chromatography-Mass Spectrometry with Isotopic Dilution

TABLE B-2
SAMPLING PROCESSES

SAMPLNG PROCESS	STANDARD OPERATING PRODECURES (see Appendix E)
Soil and Sediment Sampling	9, 10, 11, 12, 22, 23, 24, 27, 41
Surface Water Sampling	3, 5, 6, 7, 8, 9, 10, 11, 12, 41
Groundwater Sampling	5, 6, 7, 8, 9, 10, 11, 12, 16, 17, 18, 20, 41, EPA low-flow purge method
Industrial Hygiene Sampling	SOP for Asbestos Inspections and Final Air Clearance Sampling, Applicable ASTM and NIOSH methods (Table B-1)
Soil Vapor/ Ambient Air Sampling	Montana Vapor Intrusion Guide (2011)

TABLE B-3
FIELD QA/QC SAMPLE OBJECTIVES

QC SAMPLE	PURPOSE	FREQUENCY	QA OJECTIVE
Field Duplicate	Measure analytical precision	1 per every 20 samples of each media	Precision (See Section 4.0): 35% RPD for soil/waste 30% RPD for water
Matrix Spike/Matrix Spike Duplicate	Measure analytical accuracy.	1 per every 20 samples of each media	Precision (See Section 4.0): %R is method specific 20% RPD for soil/waste 20% RPD for water
Equipment Rinsate Blanks	Quantify artifacts introduced during sampling, decontamination, transport, from ambient air, in decontamination water supply, or analysis of samples – measure of accuracy and representativeness	1 per 20 samples of each media	Target analytes not detected
Field Blank	Quantify artifacts introduced during sampling, transport, from ambient air, in decontamination water supply, or analysis of samples – measure of accuracy and representativeness	1 per 20 samples	Target analytes not detected
Trip Blanks	Quantify artifacts introduced during sampling, transport, or analysis of samples and in laboratory water supply – measure of accuracy and representativeness	1 per cooler containing samples with volatile constituents (may combine VOC VOAs into one cooler)	Target analytes not detected

RPD = Relative Percent Difference, it is used to evaluate precision (see Section 4.0)
QA/QC= Quality Assurance/Quality Control

TABLE B-4
PRECISION, ACCURACY, AND COMPLETENESS REQUIREMENTS

TYPE	PRECISION		ACCURACY		COMPLETENESS
	SOLID	WATER	SOLID	WATER	
Field/Duplicate	35%	30%	Method specific	Method specific	90%
Laboratory Duplicate	Method Specific	Method Specific	Method specific	Method specific	
Laboratory Surrogate	NA	NA	Method specific	Method specific	

NA = Not Applicable

TABLE B-5
RESULTS AND QUALIFIERS

QUALIFIER	RESULT
< or U	The analyte was analyzed for but not detected at or above the reported sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
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 analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

Reference: National Functional Guidelines for Inorganic Superfund Data Review. EPA, dated August 2014. OSWER 0355.0-131, EPA-540-R-013-001.

APPENDIX C SAMPLE PRESERVATION, ANALYTICAL METHODS AND REPORTING LIMITS

TABLE C-1
SAMPLE PRESERVATION REQUIREMENTS

PARAMETER	PRESERVATION	HOLDING TIME	CONTAINER TYPE & SAMPLE VOLUME
Acidity	Cool, 4ºC	14 days	P/G 200 mls
APH	Ambient	30 days	6-Liter Summa Canister
Alkalinity	Cool, 4ºC	14 days	P/G 200 mls
Ammonia Nitrogen	Cool, 4ºC, H_2SO_4 to pH <2	28 days	P/G 50 mls
BTEX, water	Cool, 4ºC, HCl to pH <2	14 days	2 - 40 ml VOA vials no headspace
BTEX, soil	Cool, 4ºC	14 days	Glass, 100 grams minimal headspace
Biochemical Oxygen Demand	Cool, 4ºC	48 hours	P/G 1000 mls
Bromide	Cool, 4ºC	28 days	P/G 100 mls
Cations (Ca, Mg, Na, K)	HNO_3 to pH <2	6 months	P/G 100 mls
Chemical Oxygen Demand	Cool, 4ºC, H_2SO_4 to pH <2	28 days	P/G 200 mls
Chloride	Cool, 4ºC	28 days	P/G 100 mls
Color	Cool, 4ºC	48 hours	P/G 100 mls
Cyanide	Cool, 4ºC, NaOH to pH<2	14 days	P/G 500 mls
TEH/Diesel Range Organics, water	Cool, 4ºC, HCl to pH <2	7 days to extraction, 40 days to analysis	Glass, 1000 mls
TEH/Diesel Range Organics, soil	Cool, 4ºC	14 days to extraction, 40 days to analysis	Glass, 100 grams
EDB and DBCP	Cool, 4ºC, HCl to pH <2	28 days	2 - 40 ml VOA vials, no headspace
Electrical Conductivity	Cool, 4ºC	28 days	P/G 100 mls
EPH in water	Cool, 4ºC, HCl to pH <2	14 days to extraction, 40 dayts to analysis	Glass, 1000 mls
EPH in soil	Cool, 4ºC	7 days to extraction, 40 dayts to analysis	Glass, 100 grams minimal headspace
Fluoride	Cool, 4ºC	28 days	P/G 100 mls

Gasoline Range Organics, water	Cool, 4ºC, HCl to pH <2	14 days	2 - 40 ml VOA vials, no headspace
Gasoline Range Organics, soil	Cool, 4ºC	14 days	Glass, 100 grams minimal headspace
Halogens, total	none	none given	Glass, 10 grams, minimal headspace
Herbicides by 8150, water	Cool, 4ºC	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Herbicides by 8150, soil	Cool, 4ºC	14 days to extraction, 40 days to analysis	Glass, 100 grams
Hexavalent Chromium	Cool, 4ºC	24 hours	P/G 200 mls
Iodide	Cool, 4ºC	24 hours	P/G 200 mls
Kjeldahl Nitrogen, total	Cool, 4ºC, H_2SO_4 to pH <2	28 days	P/G 100 mls
Metals, dissolved (except mercury)	Filter, then HNO_3 to pH <2	6 months	P/G 500 mls
Metals, dissolved (except mercury)	HNO_3 to pH <2	6 months	P/G 500 mls
Mercury	HNO_3 to pH <2	28 days	P/G 200 mls
Nitrate+Nitrite	Cool, 4ºC, H_2SO_4 to pH <2	28 days	P/G 100 mls
Nitrite	Cool, 4ºC	48 hours	P/G 100 mls
Odor	Cool, 4ºC	24 hours	Glass, 200 mls
Oil and Grease	Cool, 4ºC, H_2SO_4 to pH <2	28 days	Glass, 1000 mls
Organic Carbon, Total	Cool, 4ºC, HCl to pH <2	28 days	Glass, 100 mls
Organic Nitrogen	Cool, 4ºC, H_2SO_4 to pH <2	28 days	P/G 100 mls
Ortho Phosphate	Cool, 4ºC	48 hours	P/G 100 mls
Oxygen, Dissolved	call laboratory Fix O_2 on site	analyze immediately	Glass, 300 mls no headspace
Pesticides/PCBs by 8080/8081, water	Cool, 4ºC	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Pesticides/PCBs by 8080/8081, soil	Cool, 4ºC	14 days to extraction, 40 days to analysis	Glass, 100 grams
pH	Cool, 4ºC	24 hours	P/G 100 mls

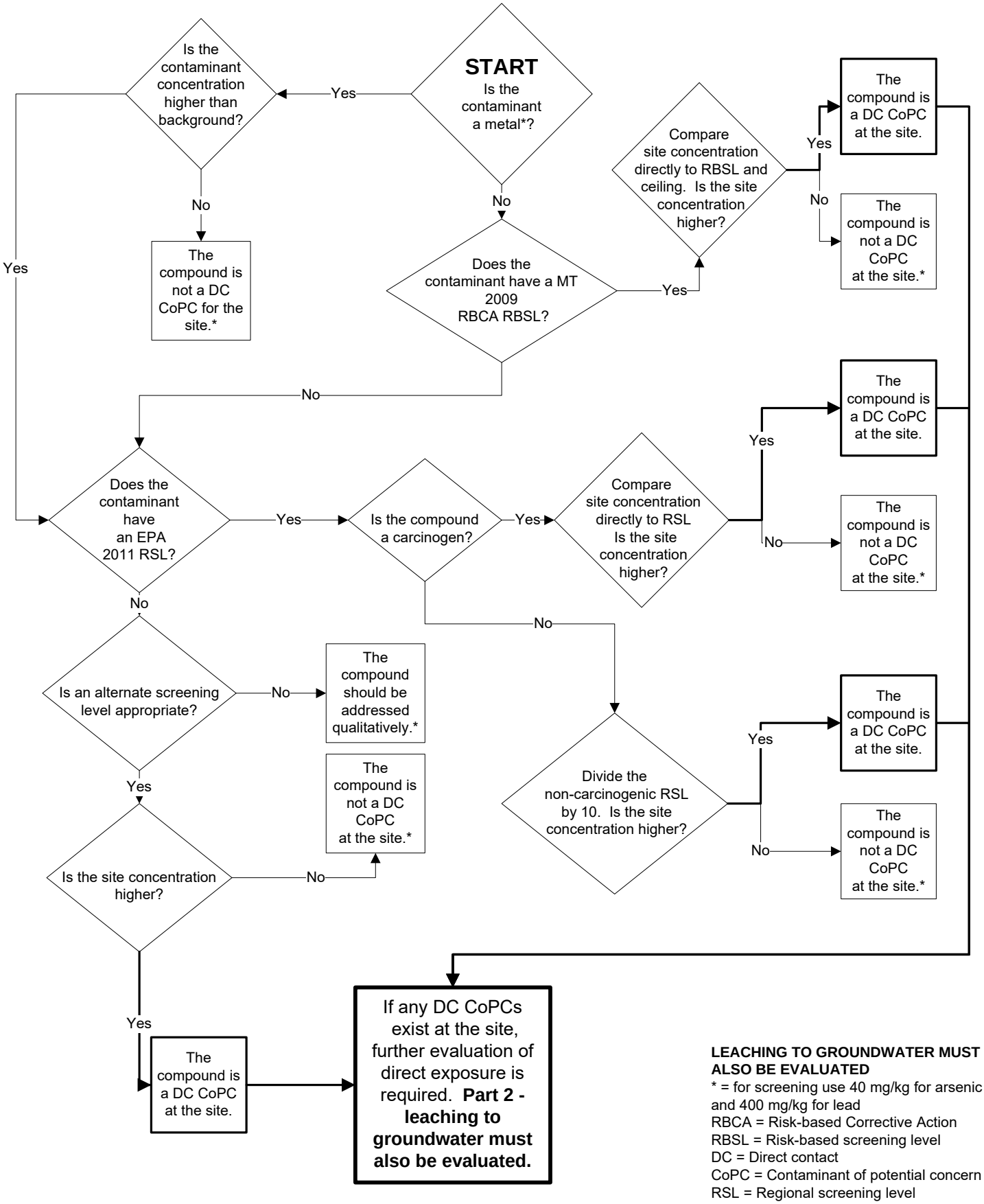
Phenolics	Cool, 4ºC, H_2SO_4 to pH <2	28 days	Glass, 1000 mls
Phosphorus, total	Cool, 4ºC, H_2SO_4 to pH <2	28 days	P/G 100 mls
Total Extractable Petroleum Hydrocarbons (TEH)	Cool, 4ºC, HCl to pH <2	28 days	P/G 1000 mls
Radon (test kits)	Test kits vary-see test kit instructions	2-3 days	radon test kit
Semivolatiles by 8270, water	Cool, 4ºC	7 days to extraction, 40 days to analysis	Glass, 1000 mls
Semivolatiles by 8270, soil	Cool, 4ºC	14 days to extraction, 40 days to analysis	Glass, 100 grams
Solids, settleable	Cool, 4ºC	48 hours	P/G 1000 mls
Solids, total, TDS, TVS, TS, TSS	Cool, 4ºC	7 days	P/G 1000 mls
Sulfate	Cool, 4ºC	28 days	P/G 200 mls
Sulfide	Cool, 4ºC, Zinc Acetate + NaOH to pH>9	7 days	P/G 500 mls
Sulfite	Cool, 4ºC, 1 ml EDTA solution per 100 mls, call lab	analyze immediately	P/G 200 mls, minimal headspace, avoid aeration
Surfactants	Cool, 4ºC	48 hours	P/G 500 mls
TO-15 SIM	Ambient	72 hours	6-Liter Summa Canister
Turbidity	Cool, 4ºC	48 hours	P/G 100 mls
Volatile Organics	Cool, 4ºC, HCl to pH <2	14 days	3 - 40 ml VOA vials, no headspace

Attachment C - Soil Screening Process – **Must Complete Part 1 and Part 2**

June 2011

Part 1 - Direct Exposure

Note: For volatile contaminants in soil or groundwater, vapor intrusion must be evaluated separately.



LEACHING TO GROUNDWATER MUST ALSO BE EVALUATED

* = for screening use 40 mg/kg for arsenic and 400 mg/kg for lead

RBCA = Risk-based Corrective Action

RBSL = Risk-based screening level

DC = Direct contact

CoPC = Contaminant of potential concern

RSL = Regional screening level

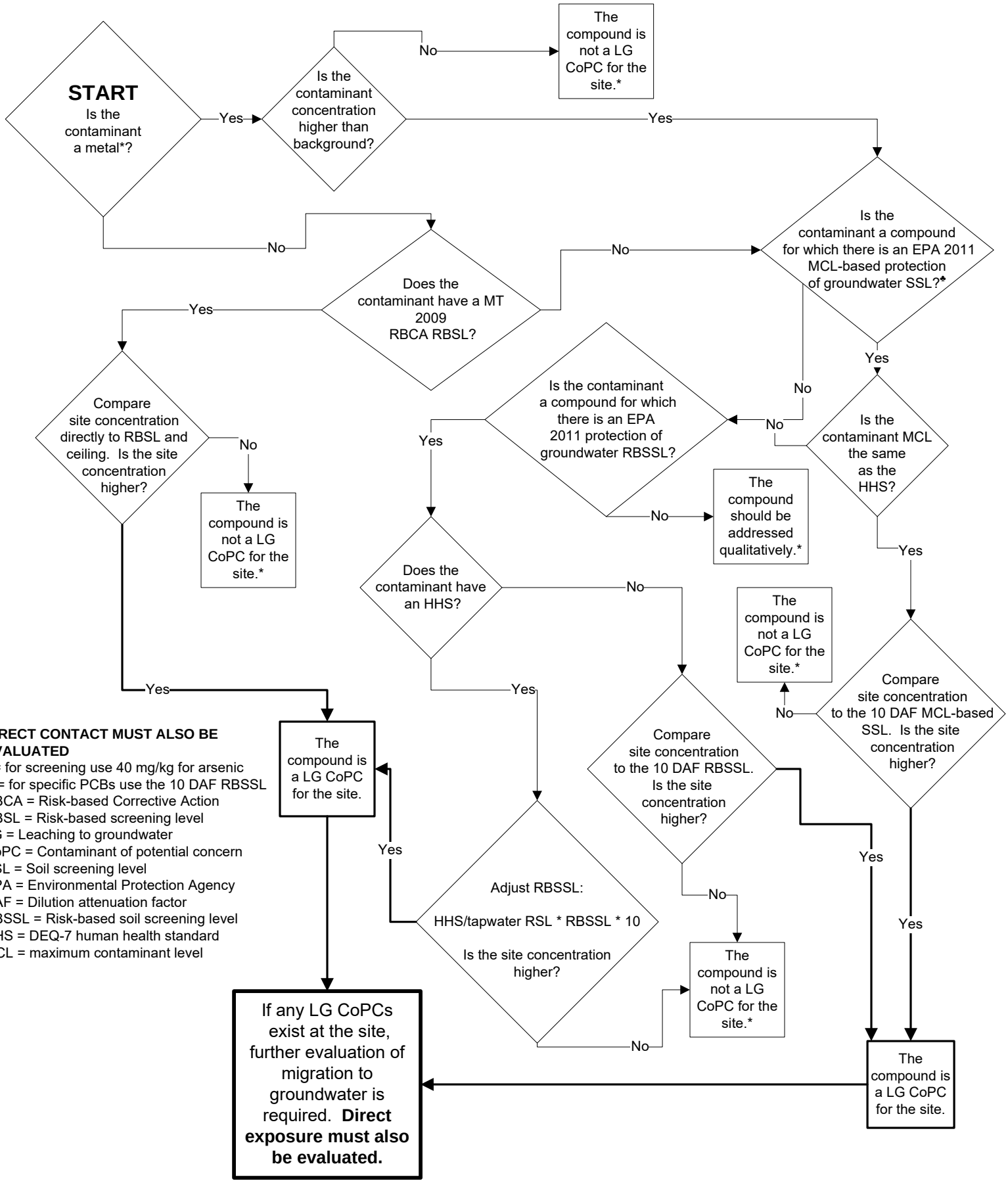
EPA = Environmental Protection Agency

Attachment C - Soil Screening Process – **Must Complete Part 1 and Part 2**

June 2011

Part 2 - Leaching to Groundwater

Note: For volatile contaminants in soil or groundwater, vapor intrusion must be evaluated separately.



DIRECT CONTACT MUST ALSO BE EVALUATED

* = for screening use 40 mg/kg for arsenic
♣ = for specific PCBs use the 10 DAF RBSSL
RBCA = Risk-based Corrective Action
RBSL = Risk-based screening level
LG = Leaching to groundwater
CoPC = Contaminant of potential concern
SSL = Soil screening level
EPA = Environmental Protection Agency
DAF = Dilution attenuation factor
RBSSL = Risk-based soil screening level
HHS = DEQ-7 human health standard
MCL = maximum contaminant level

TABLE 1
TIER 1 SURFACE SOIL (0-2 ft) RBSLs (mg/kg)
(includes default RBSLs)

This table applies to contaminated surface soil from 0-2 feet below ground surface. Distance to water is from the sample depth to the water table. **For VPH compounds at UST sites, default RBSLs (bold) are used to determine if a release has occurred at a site. Default RBSLs apply to the entire soil column and always apply in the absence of adequate information. For EPH compounds, the 200 ppm EPH screen concentration is used to determine if additional analysis (fractionation) is needed.**

Distance to groundwater		**< 10 feet to groundwater**				**10-20 feet to groundwater**				**> 20 feet to groundwater**			
Chemical units (mg/kg = ppm)	**E**	**Residential RBSL (mg/kg)**	**B**	**Commercial RBSL (mg/kg)**	**B**	**Residential RBSL (mg/kg)**	**B**	**Commercial RBSL (mg/kg)**	**B**	**Residential RBSL (mg/kg)**	**B**	**Commercial RBSL (mg/kg)**	**B**
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)													
C5-C8 Aliphatics	n	**60**	dc	200	l	60	dc	300	dc	60	dc	300	dc
C9-C12 Aliphatics	n	**100**	dc	700	dc	100	dc	700	dc	100	dc	700	dc
C9-C10 Aromatics	n	**100**	dc	100	l	100	dc	500	l	100	dc	700	l
MTBE	c	**0.08***	l	0.08*	l	0.2	l	0.2	l	0.3	l	0.3	l
Benzene	c	**0.04****	l	0.04**	l	0.1	l	0.1	l	0.2	l	0.2	l
Toluene	n	**10**	l	10	l	40	l	40	l	60	l	60	l
Ethylbenzene	c	**6**	dc	10	l	6	dc	30	dc	6	dc	30	dc
Xylenes	n	**70**	dc	200	l	70	dc	300	dc	70	dc	300	dc
Naphthalene	c	**4**	dc	9	l	4	dc	20	dc	4	dc	20	dc
Lead Scavengers													
1,2-Dibromoethane (EDB)	c	0.00002	l	0.00002	l	0.00004	l	0.00004	l	0.0001	l	0.0001	l
1,2-Dichloroethane (DCA)	c	0.01	l	0.01	l	0.03	l	0.03	l	0.04	l	0.04	l
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)													
EPH Screen, Fractionate		200		200		200		200		200		200	
C9-C18 Aliphatics	n	200	dc	1,000	dc	200	dc	1,000	dc	200	dc	1,000	dc
C19-C36 Aliphatics	n	20,000	dc	100,000	dc	20,000	dc	100,000	dc	20,000	dc	100,000	dc
C11-C22 Aromatics	n	400	1	400	l	500	dc	1,000	l	500	dc	2,000	l
Acenaphthene	n	200	l	200	l	400	dc	800	l	400	dc	1,000	l
Anthracene	n	2,000	dc	4,000	l	2,000	dc	10,000	l	2,000	dc	20,000	dc
Benz(a)anthracene	c	0.2	dc	2	dc	0.2	dc	2	dc	0.2	dc	2	dc
Benzo(a)pyrene	c	0.02***	dc	0.2	dc	0.02***	dc	0.2	dc	0.02***	dc	0.2	dc
Benzo(b)fluoranthene	c	0.2	dc	2	dc	0.2	dc	2	dc	0.2	dc	2	dc
Benzo(k)fluoranthene	c	2	dc	20	dc	2	dc	20	dc	2	dc	20	dc
Chrysene	c	20	dc	200	dc	20	dc	200	dc	20	dc	200	dc
Dibenzo(a,h)anthracene	c	0.02***	dc	0.2	dc	0.02***	dc	0.2	dc	0.02***	dc	0.2	dc
Fluoranthene	n	300	dc	500	l	300	dc	2,000	l	300	dc	2,000	dc
Fluorene	n	300	dc	600	l	300	dc	2,000	l	300	dc	2,000	dc
Indeno(1,2,3-cd)pyrene	c	0.2	dc	2	dc	0.2	dc	2	dc	0.2	dc	2	dc
Naphthalene	n	4	dc	9	l	4	dc	20	dc	4	dc	20	dc
Pyrene	n	200	dc	2,000	dc	200	dc	2,000	dc	200	dc	2,000	dc

Notes:

E = Effect is either:
n = non-carcinogenic and direct contact RBSLs are based on a hazard quotient of 0.125 for a total hazard index which does not exceed 1, or
c = carcinogenic and direct contact RBSLs are based on a cancer risk of $1X10^{-6}$ for a total cancer risk which does not exceed $1X10^{-5}$.

B = Basis is the most conservative of:
l = leaching from soil to groundwater;
dc = residential direct contact including ingestion, inhalation, and dermal; or
bu = adversely affects beneficial uses (foul odor or taste).

If the leaching pathway is not the most conservative basis, residential or commercial RBSLs apply to surface soil.
* = The best achievable practical quantitation limit (0.20) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.
** = The best achievable practical quantitation limit (0.05) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.
*** = The best achievable practical quantitation limit (0.33) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.

For information regarding odor considerations, please refer to the Odors as a Significant Risk to Public Welfare/Nuisance Condition Section of the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

The RBSLs for soil and water are not designed to be protective of the vapor intrusion (VI) pathway. Please refer to the Vapor Intrusi Indoor Air Section of the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

TABLE 2
TIER 1 SUBSURFACE SOIL (>2 ft) RBSLs (mg/kg)

This table applies to contaminated subsurface soil (>2 feet below the ground surface). Distance to water is from the sample depth to the water table. **For VPH compounds at UST sites, default RBSLs, provided in bold on Table 1, are used to determine if a release has occurred at a site. Default RBSLs apply to the entire soil column and always apply in the absence of adequate information. For EPH compounds the 200 ppm screen concentration is used to determine if additional analysis (fractionation) of the soil sample is needed.**

Distance to groundwater		**< 10 feet to ground water**		**10-20 feet to ground water**		**> 20 feet to ground water**	
Chemical units (mg/kg = ppm)	**E**	**>2 ft Excavation RBSL (mg/kg)**	**B**	**>2 ft Excavation RBSL (mg/kg)**	**B**	**>2 ft Excavation RBSL (mg/kg)**	**B**
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)							
C5-C8 Aliphatics	n	200	l	500	dc	500	dc
C9-C12 Aliphatics	n	1,000	dc	1,000	dc	1,000	dc
C9-C10 Aromatics	n	100	l	500	l	700	l
MTBE	c	0.08*	l	0.2	l	0.3	l
Benzene	c	0.04**	l	0.1	l	0.2	l
Toluene	n	10	l	40	l	60	l
Ethylbenzene	c	10	l	40	l	60	l
Xylenes	n	200	l	600	dc	600	dc
Naphthalene	n	9	l	30	l	50	l
Lead Scavengers							
1,2-Dibromoethane (EDB)	c	0.00002	l	0.00004	l	0.0001	l
1,2-Dichloroethane (DCA)	c	0.01	l	0.03	l	0.04	l
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)							
EPH Screen, Fractionate		200		200		200	
C9-C18 Aliphatics	n	2,000	dc	2,000	dc	2,000	dc
C19-C36 Aliphatics	n	100,000	dc	100,000	dc	100,000	dc
C11-C22 Aromatics	n	400	l	1,000	l	2,000	l
Acenaphthene	n	200	l	800	l	1,000	l
Anthracene	n	4,000	l	10,000	l	20,000	dc
Benz(a)anthracene	c	10	l	50	l	50	dc
Benzo(a)pyrene	c	4	l	5	dc	5	dc
Benzo(b)fluoranthene	c	50	l	50	dc	50	dc
Benzo(k)fluoranthene	c	500	l	500	dc	500	dc
Chrysene	c	2,000	l	5,000	l	5,000	dc
Dibenzo(a,h)anthracene	c	5	dc	5	dc	5	dc
Fluoranthene	n	500	l	2,000	l	2,000	dc
Fluorene	n	600	l	2,000	l	2,000	dc
Indeno(1,2,3-cd)pyrene	c	50	dc	50	dc	50	dc
Naphthalene	n	9	l	30	l	50	l
Pyrene	n	2,000	dc	2,000	dc	2,000	dc

Notes:

E = Effect is either:

n = non-carcinogenic and direct contact RBSLs are based on a hazard quotient of 0.125 for a total hazard index which does not exceed 1, or

c = carcinogenic and direct contact RBSLs are based on a cancer risk of $1X10^{-6}$ for a total cancer risk which does not exceed $1X10^{-5}$.

B = Basis is the most conservative of:

l = leaching from soil to groundwater;
dc = residential direct contact including ingestion, inhalation, and dermal; or
bu = adversely affects beneficial uses (foul odor or taste).

If the leaching pathway is not the most conservative basis, excavation RBSLs apply to subsurface soil.

* = The best achievable practical quantitation limit (0.20) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.

** = The best achievable practical quantitation limit (0.05) is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.

For information regarding odor considerations, please refer to the Odors as a Significant Risk to Public Welfare/Nuisance Condition Section of the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

The RBSLs for soil and water are not designed to be protective of the vapor intrusion (VI) pathway. Please refer to the Vapor Intrusion to Indoor Air Section of the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

TABLE 3
TIER 1 GROUNDWATER RBSLs AND STANDARDS

This table applies to groundwater and consists of DEQ-7 Human Health Standards (HHSs), where available. For compounds without DEQ-7 HHSs, DEQ has developed RBSLs and included them in the table. For EPH compounds, a total extractable hydrocarbon (TEH) concentration of 1,000 µg/L is used to determine if additional analysis (fractionation) is needed. Surface water impacts require a minimum of a Tier 2 evaluation.

Chemical	Effect	Basis	Groundwater Standard or RBSL (µg/l)
For Gasoline and Light Hydrocarbons measured using the Massachusetts Method for Volatile Petroleum Hydrocarbons (VPH)			
TPH ceiling for gasoline and light hydrocarbons			1,000
C5-C8 Aliphatics	n	rb	700
C9-C12 Aliphatics	n	rb	1,000
C9-C10 Aromatics	n	rb	1,000
MTBE	n	hhs	30
Benzene	c	hhs	5
Toluene	n	hhs	1,000
Ethylbenzene	n	hhs	700
Xylenes	n	hhs	10,000
Naphthalene	n	hhs	100
Lead Scavengers			
Ethylene dibromide (EDB)	c	hhs	0.004
1,2, Dichloroethane (DCA)	c	hhs	4
For Diesel and Heavy Hydrocarbons measured using the Massachusetts Method for Extractable Petroleum Hydrocarbons (EPH)			
EPH / TEH Screen fractionation required			1,000
TEH ceiling for diesel and heavy hydrocarbons			1,000
C9-C18 Aliphatics	n	rb	1,000
C19-C36 Aliphatics	n	bu	1,000
C11-C22 Aromatics	n	rb	1,000
Acenaphthene	n	hhs	670
Anthracene	n	hhs	2,100
Benz(a)anthracene	c	hhs	0.5
Benzo(a)pyrene	c	hhs	0.05*
Benzo(b)fluoranthene	c	hhs	0.5
Benzo(k)fluoranthene	c	hhs	5
Chrysene	c	hhs	50
Dibenzo(a,h)anthracene	c	hhs	0.05*
Fluoranthene	n	hhs	130
Fluorene	n	hhs	1,100
Indeno(1,2,3-cd)pyrene	c	hhs	0.5
Naphthalene	n	hhs	100
Pyrene	n	hhs	830

Notes:

Effect is either: n = non-carcinogenic and direct contact RBSLs are based on a hazard quotient of 1, or
c = carcinogenic and direct contact RBSLs are based on a cancer risk $1X10^{-5}$.

Basis is: rb = risk-based screening level;
hhs = DEQ-7 Human Health Standard; or
bu = adversely affects beneficial uses (foul taste or odor).
* = The best achievable practical quantitation limit (0.1 µg/L) may be greater than the human health standard; therefore, if the compound is detected, additional evaluation may be necessary.

DEQ's RBCA policy includes a ceiling concentration of 1,000 µg/l total purgeable hydrocarbons (TPH) for the Gasoline and Light Hydrocarbons and 1,000 µg/l total extractable petroleum hydrocarbons (TEH) for Diesel and Heavy Hydrocarbons .

The RBSLs for soil and water are not designed to be protective of the vapor intrusion (VI) pathway. Please refer to the Vapor Intrusion to Indoor Air Section of the Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases.

CIRCULAR DEQ-7

MONTANA NUMERIC WATER QUALITY STANDARDS

October 2012

Prepared by:
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Montana Department of Environmental Quality
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INTRODUCTION

The Department of Environmental Quality (Department) Circular DEQ-7 (DEQ-7) contains numeric water quality standards for Montana's surface and ground waters. The standards were developed in compliance with Section 75-5-301, Montana Code Annotated (MCA) of the Montana Water Quality Act, Section 80-15-201, MCA (the Montana Agricultural Chemical Groundwater Protection Act), and Section 303(c) of the Federal Clean Water Act (CWA). Together, these provisions of state and federal law require the adoption of narrative and numeric standards that will protect the designated beneficial uses of state waters, such as growth and propagation of fishes and associated wildlife, waterfowl and furbearers, drinking water, culinary and food processing, recreation, and agriculture.

DEQ-7 contains a great deal of information about Montana's numeric standards in a compact form. In addition to providing the numeric water quality standards for each parameter DEQ-7 also contains the following:

- The primary synonyms of each parameter. This section also includes any identification numbers used by the U.S. Environmental Protection Agency (EPA), such as the Resource Conservation and Recovery Act (RCRA) waste number, if available, as the last entry in the synonyms section;
- the Chemical Abstracts Service Registry Number (CASRN) for each chemical, as well as the National Institute for Occupational Safety and Health (NIOSH) and the SAX reference numbers (taken from Dangerous Properties of Industrial Materials, by N. Irving Sax);
- the categorization of each parameter according to the type of pollutant;
- the bioconcentration factor, if known;
- trigger values used to determine "nonsignificant changes in water quality" under Montana's nondegradation policy (ARM 17.30.701-718); and
- required reporting values (RRV). See footnote 19 for a further explanation of RRV usage.

The numeric water quality standards in DEQ-7 have been established for parameters (i.e., "pollutants") in five categories: toxic, carcinogenic, radioactive, nutrients and harmful. An explanation of each of these categories is given below under "Explanation of Terms".

Parameters are listed in alphabetical order. In order to facilitate listing by alphabetical order, parameters that are normally written with the numbers first are listed with the numbers last. For example, 2,4-Dinitrophenol is listed as Dinitrophenol, 2,4-.

There are many explanatory notes following the table portion of DEQ-7. Footnotes referencing the explanatory notes are found in both the table headings and in individual line items. The notes following the table explain various aspects of the standards. For example, the standards for some metals, ammonia, and dissolved oxygen cover a range of values that are computed by using tables or formulas, using such parameters as pH, hardness, or temperature.

The Department will provide hard copies of this document upon request or the document may be retrieved from the Department website at, http://www.deq.mt.gov/wqinfo/Circulars/DEQ-7.PDF. Use of an electronic copy will enable the reader to search for synonyms or CASRN. Such searches will make this document easier to use.

STANDARDS DEVELOPMENT

Montana's numeric water quality standards were developed using guidance from the EPA which includes:

- National Recommended Water Quality Criteria (NRWQC)[1] for the protection of human health and aquatic life, developed under Section 304(a) of the CWA. These include criteria for priority pollutants (PP), non priority Pollutants (NPP), and organoleptic pollutants (OL); and
- Drinking Water Health Advisories (HA) and Maximum Contaminant Levels (MCLs) developed under the Safe Drinking Water Act.[2]

The 2011 versions of NRWQC and Drinking Water Standards and Health Advisories were used to develop the standards in this version of DEQ-7.

Aquatic life criteria take into consideration the magnitude (how much of a pollutant is allowable), duration of exposure to the pollutant (averaging period), and frequency (how often criteria can be exceeded). Acute criteria are based on a one hour exposure event and can only be exceeded once, on average, in a three year period. Chronic criteria are based on a 96 hour exposure and can only be exceeded, on average, once in a three year period. For more information, see EPA's ***Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses.***[3] The techniques used for determining Aquatic Life numeric standards are complex and take a great deal of time to develop. They require a detailed accumulation of scientific evidence from multiple studies, reviewed by experts in their field that may take years to complete. Aquatic Life Standards are added to DEQ-7 as they become available.

Nutrient standards for aquatic life are not included in DEQ-7, but will be addressed in future, separate documentation. Nutrients in the aquatic environment are essential substances (organic or inorganic) which are used by living organisms such as algae or bacteria for cellular metabolism or construction. Examples include nitrogen (typically as ammonia, nitrate, or nitrite) and phosphorus. If present in excessive amounts (which depends on the ecosystem involved), nutrients can produce excessive algal and plant growth, which can lead to undesirable deterioration of beneficial uses of State waters. The human health standards for nitrogenous compounds are still found in DEQ-7 and are listed as toxic compounds.

Human health criteria also have a magnitude, duration and frequency component. The standard assumption in calculating the magnitude of the pollutant for groundwater exposure is that a 70 kg person will consume two liters a day for 70 years. Water consumption is assumed to be the only route of exposure in that time frame. For surface water criteria, two routes of exposure are considered, water consumption and fish consumption. EPA and the Department use a fish consumption rate of 17.5 grams of fish per day.

Other publications used by the Department in the development of standards include: the *1986 Quality Criteria for Water*, EPA 440/5/86-001 (the "Gold Book") and numerous updates; *Toxics Criteria for those States not Complying with Clean Water Act* 303(c)(2)(B); *The National Toxics Rule* [NTR], which was published in the Code of Federal Regulations, 40 CFR 131.36 (1992); and *Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California*, 62 F.R. 42159 [1997].

EXPLANATION OF TERMS

Toxics: A toxin is any chemical which has an immediate, deleterious effect on the metabolism of a living organism. The surface water quality standards for human health toxins are the more restrictive of either the MCL or the NRWQC. The ground water standards for human health toxins are the drinking water MCL or, if an MCL is not available, the NRWQC criteria. If neither an MCL nor an NRWQC criteria is available, an HA will be developed by the Department with the aid of the regional EPA toxicologist.

[1] See http://www.epa.gov/waterscience/criteria/wqctable/
[2] See http://water.epa.gov/drink/standards/hascience.cfm#dw-standards
[3] Available at: http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/

Carcinogens: The Montana Water Quality Act requires that human health standards for carcinogens be the more restrictive of either of the following: (1) the risk-based level of one in one hundred thousand [$1x10^{-5}$] for all carcinogens except arsenic, which is based upon one in one thousand [$1x10^{-3}$]; or, (2) the MCL. For surface water, the risk-based levels in EPA's NRWQC criteria or the MCL was used, or if not available HA information was used. In cases where a risk based level was not available, the most recent oral reference dose (RfD) or cancer potency factor (q1*) in the Integrated Risk Information System (IRIS) was used to compute the standard. In cases where no risk-based levels were available for known carcinogens, the standards in DEQ-7 are based on toxic effects. Ground water standards are based on EPA Drinking Water MCLs or HAs, NRWQC criteria, or IRIS information.

Pesticides: The Montana Agricultural Chemical Ground Water Protection Act requires that federal water quality criteria be adopted as ground water standards for pesticides if they are available. Pesticides are not a separate category in DEQ-7, but are included in either the toxic or carcinogenic categories. The criteria derivation would follow the process described above for those categories. If no MCLs or other federal criteria are available, standards must be developed using available data on health effects RfD and standard assumptions. The standard assumptions are that two liters of water are consumed per day and that adults weighing 70 kilograms are exposed for 70 years (life-long exposure) to a single source of water. When information was available, a relative source contribution (RSC) factor was also applied. The RSC is the percentage of a parameter's intake through drinking water versus other dietary sources. A RSC of 0.2 was used in most cases to develop ground water standards for pesticides. In some cases, no data was available to develop a water quality standard for a pesticide in surface water. In these cases, the ground water standard (developed for a pesticide according to the risk-based analysis provided above) was also adopted as a surface water standard. Other federal data sources were used when the EPA's most recent drinking water regulations and health advisories did not include data for a pesticide.

Bioconcentration: Bioconcentration factors (BCF) are not a separate category in DEQ-7, but are included with each pollutant for which there is a known bioconcentration effect. Bioconcentration is a biological amplification process which results in a higher concentration of a pollutant in a living organism than in the environment to which the organism is exposed. Pollutants such as mercury can be hundreds of times more concentrated in fish tissues than in the water the fish lives in. The calculation of a BCF is complex and is dependent on the age of the organism and the chemistry of its environment. A detailed discussion of bioconcentration can be found in EPA 823-B-94-004 *Guidance for Assessing Chemical Contaminant Data for use in Fish Advisories.*

The human health standards for carcinogens and other parameters that exhibit bioconcentration were developed using the assumption that there are two routes of human exposure: through consumption of water and fish. EPA's water quality criteria are derived using an average fish consumption rate of 17.5 grams/day and water consumption of two liters per day. The Department follows the EPA guidance for fish consumption rates.

Radioactive: All elements that emit alpha, beta, or gamma radiation are regulated in ground water by the EPA. As all forms of radiation are carcinogenic, the calculation of a numeric standard is derived either from MCLs set by the EPA or calculated from the Oral Cancer Slope Factor (OCSF) provided by the EPA Region VIII toxicologist, the use of a risk based level of one in one hundred thousand ($1x10^{-5}$) and the consumption of two liters of water daily for 70 years for an adult weighing 70 kilograms. Unlike pesticides, a relative source correction (RSC) is not applied to the calculation of numeric standards for radioactive substances as discussed in EPA 402-R-11-001, *EPA Radiogenic Cancer Risk Models and Projections.*

Harmful: Pollutants typically classified as harmful include substances or measures which are controlled by both numeric and narrative standards. Examples of numeric standards would be pH, color or bacterial concentration. The numeric standards vary depending on the water body classification for beneficial use. The

use of tables from the footnotes section of DEQ-7 is pivotal to the proper selection of the appropriate standard. Narrative standards are not covered in DEQ-7, but include such parameters as alkalinity, sulfates, chloride, hardness, sediment, and total dissolved solids.

Required Reporting Value: Each pollutant's required reporting value (RRV) is the Department's selection of a laboratory reporting limit that is sufficiently sensitive to meet the most stringent numeric water quality standard. The Department's RRV calculation is modified from EPA Guidance 821-B-04-005, "Revised Assessment of Detection and Quantitation Approaches," and uses method detection limits (MDLs) provided by laboratories. An MDL, as defined in 40 CFR 136 Appendix B, is "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte." EPA's guidance is based on MDL studies conducted at individual labs and recommends multiplying the MDL by 3.18 to calculate the RRV. Since the Department calculates RRVs based on an inter-laboratory study, the guidance has been modified to use the 75th percentile of the MDLs from the labs multiplied by 3.18.

Because DEQ-7 contains numeric standards for pollutants regulated under 40 CFR 136, EPA's Safe Drinking Water Act (SDWA), and EPA's Office of Pesticides, MDLs used to calculate RRVs in DEQ-7 include those from methods in 40 CFR 136 Appendix A, EPA's SDWA methods, and select methods approved by EPA for the analysis of pesticides. It is the responsibility of the sampling entity to ensure that appropriate methods and reporting limits are requested from the laboratory to meet analytical and reporting limit needs. For pollutants with low standards and RRVs, the Department realizes that the RRVs may be below the laboratory's lowest calibration standards. In these cases, laboratories are encouraged to report values down to the RRV when possible, and to qualify data reported below their lowest calibration standard.

RULES CONTAINING MONTANA'S WATER QUALITY STANDARDS

The Administrative Rules of Montana (ARM), 17.30.620 through 17.30.670, contain numeric surface water quality standards that vary with each stream classification. Examples of numeric standards that change under each stream classification include Escherichia coli bacteria, color, turbidity, pH, and temperature.

Both Montana's surface water and ground water rules contain narrative standards (ARM 17.30.620 through 17.30.670 and ARM 17.30.1001 through 17.30.1045). The narrative standards cover a number of parameters, such as alkalinity, chloride, hardness, sediment, sulfate, and total dissolved solids for which sufficient information does not yet exist to develop specific numeric standards. These narrative standards are directly translated to protect beneficial uses from adverse effects, supplementing the existing numeric standards.

CIRCULAR DEQ-7, MONTANA NUMERIC WATER QUALITY STANDARDS(9)

Except where indicated, values are listed as micrograms per liter (µg/L). No number indicates that a standard has not been adopted or information is currently unavailable. A '( )' indicates that a detailed note of explanation is provided.

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Acenaphthene §§ § 3Acenaphthalene § Naphthyleneethylene § 1,8-Ethylenenaphthalene § 1,8-Ethylene Naphthalene § 1,2-Dihydroacenphthylene § Acenphthylene, 1,2-Dihydro-	83-32-9 AB 1255500 AAE750	Toxic			242	670 PP	670 PP		10
Acetochlor (30) §§ § Acenit § Azetochlor § C10925 § Erunit § Harness § MG 02 § MON 097 § Nevirex	34256-82-1	Toxic				140 HA	140 HA		0.4
Acifluorfen §§ Blazer § Tackle § Scepter § as sodium salt	62476-59-9	Carcinogen				10 HA	10 HA	N/A	0.5
Acrolein §§ Aqualine § Biocide § Crolean § Aqualin § Propenal § SHA 00701 § 2-propenal § Acraldehyde § Acrylaldehyde § Acrylic Aldehyde § Ethylene Aldehyde	107-02-8 AS 1050000 ADR000	Carcinogen	3 PP	3 PP	215	60 PP	60 PP	N/A	3
Acrylamide §§ 2-Propenamide § Propenamide§ Acrylic Amide § Ethylenecarboxamide § RCRA Waste Number U007	79-06-1 AS 3325000 ADS250	Carcinogen				0.08 HA	0.08 HA	N/A	0.008
Acrylonitrile §§ Fumigrain § Ventox § ENT 54 § TL 314 § Carbacryl § Cyanoethylene § Vinyl cyanide § Propenenitrile § 2-Propenenitrile § Acrylonitrile monomer § RCRA Waste Number U009	107-13-1 AT 5250000 ADX500	Carcinogen			30	0.51 PP	0.51 PP	N/A	3

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Alachlor (includes metabolites Alachlor ESA and Alachlor OA) (31) §§ Lasso § Lazo § Alator § Alanex § Alochlor § Pillarzo § Metachlor § Chimiclor § SHA 090501 § Methachlor § 2-Chloro-N-(2,6-Diethyl)Phenyl-N-Methoxymethylacetamide § 2-Chloro-2',6'-Diethyl-N-(Methoxymethyl) Acetanilide	15972-60-8 AE 1225000 CFX000	Toxic				2 MCL	2 MCL		0.3
Aldicarb (37) §§ Temik § Temic § Ambush § OMS 771 § Temik G 10 § Aldecarb § Carbamyl § SHA 098301 § Carbanolate § Sulfone Aldoxycarb § Union Carbide 21149 § § Propanal, 2-Methyl-2-(Methylthio)-, O-[(Methylamino)Carbonyl] Oxime RCRA Waste Number P070	116-06-3 UE 2275000 CBM500	Toxic				3 MCL	3 MCL	1	0.4
Aldicarb Sulfone (37) §§ Aldoxycarb § Standak § UC 21865 § Sulfocarb § SHA 110801 § Propionaldehyde, 2-Methyl-2-(Methylsulfonyl)-, O-(Methylcarbomoyl)Oxime § 2-Methyl-2-(Methylsulfonyl) Propanal O-[(Methylamino)Carbonyl] Oxime	1646-88-4 UE 2080000 AFK000	Toxic				2 MCL	2 MCL	2	0.5
Aldicarb Sulfoxide (37) §§	1646-87-3	Toxic				4 MCL	4 MCL	2	0.4

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Aldrin §§ § HHDN § Altox § Drinox § Aldrex § Aldrite § Seedrin § Octalene § SHA 045101 § Hexachlorohexahydro-endo-exo-Dimethanonaphthalene § 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8, 8a-Hexahydro-1,4,5,8-Dimethanonaphthalene § 1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-Hexahydro-endo,exo- § 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-Hexa-Hydro-1,4:5,8-Endo,Exo-Dimethanonaphthalene § RCRA Waste Number P004	309-00-2 IO 2100000 AFK250	Carcinogen	1.5 PP		4,670	$4.9x10^{-4}$ PP	0.02 HA	N/A	0.1
Alpha Emitters (11) §§ § Gross Alpha § Adjusted Gross Alpha	Multiple	Carcinogen / Radioactive				15 picoC /liter MCL	15 picoC /liter MCL	N/A	
alpha-Chlordane §§ -Chlordane § cis-Chlordan § cis-Chlordane § c (cis)-Chlordane § Chlordane, cis-Isomer	5103-71-9 PB 9705000 CDR675	Carcinogen			14,100	0.008 HA	1 HA	N/A	0.006

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
alpha-Hexachlorocyclohexane §§ § a-BHC § alpha-BHC § HCH-alpha § alpha-HCH § alpha-Lindane § a Hexachlorocyclohexane § alpha-Benzenehexachloride § alpha-Hexachlorocyclohexane § Benzene Hexachloride-alpha-isomer § alpha-1,2,3,4,5,6-Hexachlorocyclohexane § Cyclohexane, alpha-1,2,3,4,5,6-Hexachloro- § 1-alpha,2-alpha,3-beta,4-alpha,5-beta,6-beta-Hexachlorocyclohexane § Cyclohexane, alpha-1,2,3,4,5,6-Hexachloro-, (1-alpha, 2-alpha, 3-beta, 4-alpha, 5-beta, 6-beta)-	319-84-6 GV 3500000 BBQ000	Carcinogen			130	0.026 PP	0.026 PP	N/A	0.03
Aluminum, dissolved, pH 6.5 to 9.0 only (9) §§ Al	7429-90-5 BD 0330000 AGX000	Toxic	750 NPP	87 NPP				30	9
Ametryn §§ Ametrex	834-12-8	Toxic				60 HA	60 HA		6
Aminomethylphosphonic Acid (AMPA) § Glyphosate metabolite §§		Toxic				2,000 HA	2,000 HA		200
Aminopyralid § 4-amino-3,6-dichloropyridine-2carboxilic acid, § 4 amino-3,6 dichlro-2-pyridinecarboxilic acid § Milestone	150114-71-9	Toxic				4,000 HA	4,000 HA		0.2
Ammonia [total ammonia nitrogen (NH3-N plus NH4-N)] as ug/L N §§ § Ammonia Anhydrous § Anhydrous Ammonia § Spirit of Hartshorn	7664-41-7 BO 0875000 AMY500	Toxic	(7)(8) NPP	(7)(8) NPP				10	70

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Ammonium Sulfamate §§	7773-06-0	Toxic				2,000 HA	2,000 HA		200
Anthracene (PAH) §§ Paranaphthalene § Green Oil § Anthracin § Tetra Olive N2G	120-12-7 CA 9350000 APG500	Toxic			30	8,300 PP	2,100 HA	0.04	10
Antimony §§ Sb § Antimony Black § Antimony Regulus § C.I. 77050 § Stibium	7440-36-0 CC 4025000 AQB750	Toxic			1	5.6 PP	6 MCL	0.4	0.5
Arsenic (36) §§ As § Arsenicals § Arsenic-75 § Arsenic Black § Colloidal Arsenic § Grey Arsenic § Metallic Arsenic	7440-38-2 CG 0525000 ARA750	Carcinogen	340 PP	150 PP	44	10 MCL	10 MCL	N/A	1
Asbestos, fibers longer than 10 microns in length §§ § Amianthus § Amosite (Obs.) § Amphibole § Asbestos Fiber § Fibrous Grunerite § NCI CO8991 § Serpentine, includes Chrysotile, Actinolite, Aurosite, Anthophyllite, Crocidolite, and Tremolite	Multiple	Carcinogen				$7x10^6$ fibers /liter MCL	$7x10^6$ fibers /liter MCL	N/A	

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Atrazine (includes metabolites deethyl atrazine, deisopropyl atrazine, and deethyl deisopropyl atrazine) (32) §§ § Aatrex § Aktikon § Atrasine § Atred § Candex § Crisatrina § Crisazine§ Cyazin § Fenamin § Fenamine § Zeaphos § Fenatrol § Gesaprim § Hungazin § Inakor § Primatol § Malermais § Radazin § Radizine § Shell Atrazine herbicide § Strazine § Zeazine § SHA 080803 § 1-Chloro-3-Ethylamino-5-Isopropylamino-2,4,6-Triazine § s-Triazine, 2-Chloro-4-Ethylamino-6-Isopropylamino- § 2-Chloro-4-Ethylamino-6-Isopropylamino-s-Triazine	1912-24-9 XY 5600000 PMC325	Toxic				3 MCL	3 MCL	0.1	0.3
Azinophos and degredate azinphos methyl oxon metiltriazotion § Azimil § Bay 9027 § Bay 17147 § Carfene § Cotnion-methyl § Gusathion § Gusathion-M§ Guthion § Methyl-Guthion	961-22-8	Toxic				10 HA	10 HA		0.1
Azoxystrobin §§ § azoksystrobin § Azoxistrobin § Azoxistrobina § Azoxystrobin (BSI, ISO) § azoxystrobine § Azoxystrolin	131860-33-8	Toxic				1,000 HA	1,000 HA		0.03
Barium §§ Ba	7440-39-3 CA 8370000 BAH250	Toxic				1,000 NPP	1,000 NPP	2	3
Bentazon Methyl §§ § Basagran	25057-89-0	Toxic				200 HA	200 HA		3

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Benzene §§ § Phene § Benzol § Benzolene § Pyrobenzol § Carbon Oil § SHA 109301 § Coal Naphtha § Motor Benzol § Phenyl hydride § Cyclohexatriene C § Caswell Number 077 § EPA Pesticide Chemical Code 008801 § NCI C55276 § RCRA Waste Number U019	71-43-2 CY 1400000 BBL250	Carcinogen			5.2	5 MCL	5 MCL	N/A	0.6
Benzidine §§ § p,p'-Bianiline § 4,4'-Bianiline § 4,4'-Biphenyldiamine § p,p'-Diaminobiphenyl § 4,4'-Diaminodiphenyl § 4,4'-Biphenylenediamine § 4,4'-Diphenylenediamine § Biphenyl, 4,4'-Diamino- § 4,4'-Diamino-1,1'-Biphenyl § (1,1'-Biphenyl)-4,4'-Diamine § NCI C03361 § RCRA Waste Number U021	92-87-5 DC 9625000 BBX000	Carcinogen			87.5	$8.6x10^{-4}$ PP	$8.6x10^{-4}$ PP	N/A	5
Benzo(g,h,i)perylene (PAH) §§ § 1,12-Benzoperylene § 1,12-Benzperylene § Benzo(ghi)Perylene	191-24-2 DI 6200500 BCR000	Toxic			30			0.076	10
Benzo[a]Pyrene (PAH) §§ § BaP § 3,4-BP § Benz(a)Pyrene § Benzo-a-Pyrene § 3,4-Benzpyrene § 6,7-Benzopyrene § 3,4-Benzopyrene § 3,4-Benz(a)Pyrene § Benzo(d,e,f)Chrysene	50-32-8 DJ 3675000 BCS750	Carcinogen			30	0.038 PP	0.05 HA	N/A	0.06

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Benzo[b]Fluoranthene (PAH) §§ § B(b)F § Benzo(b)Fluoranthene § Benzo(e)Fluoranthene § 2,3-Benzfluoranthene § 3,4-Benzfluoranthene § 3,4-Benzofluoranthene § 2,3-Benzofluoranthene § 2,3-Benzofluoranthrene § Benz(e)Acephenanthrylene § 3,4-Benz(e)Acephenanthrylene	205-99-2 CU 1400000 BAW250	Carcinogen			30	0.038 PP	0.5 (29) HA	N/A	5
Benzo[k]fluoranthene (PAH) §§ § Benzo(k)Fluoranthene § 8,9-Benzofluoranthene § Dibenzo(b,jk)Fluorene § 2,3,1'8'-Binaphthylene § 11,12-Benzofluoranthene § 11,12-Benzo(k)Fluoranthene	207-08-9 DF 6350000 BCJ750	Carcinogen			30	0.038 PP	5 (29) HA	N/A	0.1
Benzo[a]anthracene (PAH) §§ § Tetraphene § Benzanthracene § Benzoanthracene § Naphthanthracene § 1,2-Benzanthrene § Benz(a)Anthracene § Benzo(a)Anthracene § 1,2-Benzanthracene § Benzo(b)Phenanthrene § 1,2-Benzoanthracene § Benzanthracene, 1,2- § 1,2-Benz(a)Anthracene § 2,3-Benzophenanthrene § RCRA Waste Number U018	56-55-3 CV 9275000 BBC250	Carcinogen			30	0.038 PP	0.5 (29) HA	N/A	0.1
Beryllium §§ Be § Beryllium-9 § Glucinum § RCRA Waste Number P015	7440-41-7 DS 1750000 BFO750	Carcinogen			19	4 MCL	4 MCL	N/A	0.8

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Beta Emitters (11) §§ § Gross Beta	Multiple	Carcinogen / Radioactive				0.4 mrem /yr MCL	0.4 mrem /yr MCL	N/A	
Beta-Chloronaphthalene §§ 2-Chloronaphthalene § ß-Chloronaphthalene § Naphthalene, 2-Chloro- § 2 Chlornaftalen § A13-01537 § CCRIS 5995 § HSDB 4014 § Halowax § EINECS 202-079-9 § RCRA waste number U047	91-58-7 QJ 2275000 CJA000	Toxic			202	1,000 PP	1,000 PP	0.94	10
beta-Hexachlorocyclohexane §§ § ß-BHC § beta-BHC § HCH-beta § beta-HCH § ß-Lindane § beta-Lindane § Hexachlorocyclohexane, beta- § trans-alpha-Benzenehexachloride § Cyclohexane, 1,2,3,4,5,6-Hexachloro-, beta- § 1-alpha,2-beta,3-alpha,4-beta,5-alpha,6-beta-Hexachlorocyclohexane § Cyclohexane, 1,2,3,4,5,6-Hexachloro-, (1-alpha, 2-beta, 3-alpha, 4-beta, 5-alpha, 6-beta)- § Benzenehexachloride, trans-alpha- § beta-1,2,3,4,5,6-Hexachlorocyclohexane	319-85-7 GV 4375000 BBR000	Carcinogen			130	0.091 PP	0.091 PP	N/A	0.02

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Bis(2-Chloroisopropyl) Ether §§ § DCIP § NCI C50044 § Dichlorodiisopropyl Ether § 2,2'-Oxybis(1-Chloropropane) § Bis (2-Chloroisopropyl) ether § Propane, 2,2'-Oxybis(2-Chloro- § Propane, 2,2'-Oxybis[1-Chloro- § 2',2'-Dichlorodiisopropyl Ether § Dichlorodiisopropyl Ether (DOT) § Bis(2-Chloro-1-Methylethyl) Ether § RCRA Waste Number U027 Reregistration decision CAS-RN	108-60-1 KN 1750000 BII250 39638-32-9	Toxic			2.47	1,400 PP	1,400 PP	0.8	10
Bis(2-Chloroethoxy)Methane §§ § Bis(ß-Chloroethyl)Formal	111-91-1 PA 3675000 BID750	Toxic			0.64			0.5	10
Bis(Chloroethyl)Ether §§ § BCEE § DCEE § Clorex § Chlorex § Chloroethyl Ether § Dichloroethyl Ether § Dichloroethyl Oxide § Bis(Chloroethyl) Ether § Di(2-Chloroethyl) Ether § Bis (Chloroethyl) Ether § Bis(2-Chloroethyl) Ether § Bis(ß-Chloroethyl) Ether § ß,ß'-Dichloroethyl Ether § 2,2'-Dichloroethyl Ether § Bis (2-Chloroethyl) Ether § 1,1'-Oxybis(2-Chloro)Ethane § Ethane, 1,1'-Oxybis[2-Chloro- § beta,beta'-Dichloroethyl Ether § 1-Chloro-2-(beta-Chloroethoxy)Ethane § RCRA Waste Number U025	111-44-4 KN 0875000 BIC750	Carcinogen			6.9	0.3 PP	0.3 PP	N/A	5

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Bis(Chloromethyl)ether §§ § BCME § bis-CME § Chloromethyl Ether § Oxybis(Chloromethane) § Bis (Chloromethyl) Ether § sym-Dichlorodimethyl Ether § 1,1'-Dichlorodimethyl Ether § Dimethyl-1,1'-Dichloroether § Chloro(Chloromethoxy) Methane § RCRA Waste Number P016	542-88-1 KN 1575000 BIK000	Carcinogen			63	0.001 NPP	0.001 NPP	N/A	$1x10^{-4}$
Bromacil §§ Hyvar §	314-40-9	Carcinogen				90 HA	90 HA	N/A	0.03
Bromate	7789-38-0	Carcinogen				10 MCL	10 MCL	N/A	1
Bromodichloromethane (HM) §§ Dichlorobromomethane § BDCM § NCI C55243 § Methane, bromodichloro- § Dichloromonobromomethane § Monobromodichloromethane	75-27-4 PA 5310000 BND500	Carcinogen			3.75	5.5 PP	10 HA	N/A	0.6
Bromoform (HM) §§ Tribromomethane § NCI C55130 § Methane, Tribromo- § Methenyl Tribromide § RCRA Waste Number U225	75-25-2 PB 5600000 BNL000	Carcinogen			3.75	43 PP	80 HA	N/A	5
Bromoxynil §§	1689-84-9	Carcinogen				3.4 HA	3.4 HA	N/A	0.3

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Butyl Benzyl Phthalate §§ § BBP § Sicol 160 § Unimoll BB § Palatinol BB § Santicizer 160 § Butylbenzylphthalate § Butylbenzyl Phthalate § Benzyl Butyl Phthalate § n-Benzyl Butyl Phthalate § Benzyl n-Butyl Phthalate § Phthalic Acid, Benzyl Butyl Ester § Butyl Phenylmethyl 1,2-Benzenedicarboxylate § 1,2-Benzenedicarboxylic Acid, Butyl Phenylmethyl Ester § NCI C54375	85-68-7 TH 9990000 BEC500	Carcinogen			414	1,500 PP	1,500 PP	N/A	10
Butylate §§ Sutan §	2008-41-5	Toxic				400 MCL	400 MCL		0.02
Cadmium §§ Cd § C.I. 77180 § Colloidal Cadmium	7440-43-9 EU 9800000 CAD000	Toxic	0.52 @25 mg/L hardness (12) PP	0.097 @25 mg/L hardness (12) PP	64	5 MCL	5 MCL	0.1	0.03
Carbaryl §§ Sevin §	63-25-2	Toxic				700 HA	700 HA	2	1
Carbofuran §§ § Yaltox § Euradan § Furadan § Curaterr § Furacarb § SHA 090601 § Niagra 10242 § 2,2-Dimethyl-7-Coumaranyl N-Methylcarbamate § 2,2-Dimethyl-2,3-Dihydro-7-Benzofuranyl N-Methylcarbamate § Carbamic Acid, Methyl-, 2,3-Dihydro-2,2-Dimethyl-7-Benzofuranyl Ester	1563-66-2 FB 9450000 FPE000	Toxic				40 MCL	40 MCL	1	1

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Carbon Tetrachloride §§ Freon 10 § R 10 § Univerm § Tetrasol § Fasciolin § Flukoids § Necatorina § Necatorine § Halon 104 § Tetraform § Carbon Tet § Benzinoform § Carbon Chloride § Perchloromethane § Tetrachloromethane § Methane Tetrachloroide § RCRA Waste Number U211	56-23-5 FG 4900000 CBY000	Carcinogen			18.75	2.3 PP	3 HA	N/A	0.6
Carboxin §§ Vitavax §	5234-68-4	Toxic				700 HA	700 HA	1	70
Chloramben §§ Vegiben §	133-90-4	Toxic				100 HA	100 HA		0.5
Chlordane §§ Termex § Belt § Niran § Dowchlor § Chlortox § Chlordan § Clordano § Chlor Kil § Toxichlor § Octa-Klor § Ortho-Klor § SHA 058201 § Gold Crest C-100 § Chlordane, Technical § Octachloro-4, 7-Methanohydroindane § Octachlorodihydrodicyclopentadiene § Octachloro-4,7-Methanotetrahydroindane-4,7-Methylene Indane § 4,7-Methanoindan, 1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro- § 4,7-Methano-1H-Indene § RCRA Waste Number U036	57-74-9 PB 9800000 CDR750	Carcinogen	1.2 PP	0.0043 PP	14,100	0.008 PP	1 HA	N/A	0.1
Chlorimuron Ethyl §§ Classic §	90982-32-4	Toxic				700 HA	700 HA	0.1	0.1
Chlorine, total residual §§ Cl § Bertholite § Chlorine, molecular § Molecular Chlorine	7782-50-5 FO 2100000 CDV750	Toxic	19 NPP	11 NPP		4,000 MCL	4,000 MCL		100

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Chlorite	7758-19-2	Toxic				1,000 MCL	1,000 MCL		100
Chlorobenzene §§ Monochlorobenzene § MCB § Chlorobenzol § Chlorbenzene § Phenyl Chloride § Benzene Chloride § Benzene, Chloro- § Monochlorbenzene § NCI C54886 § RCRA Waste Number U037	108-90-7 CZ 0175000 BBM750	Toxic			10.3	100 MCL	100 MCL	0.5	0.8
Chlorodibromomethane §§ Monochlorodibromomethane § CDBM § NCI C55254 § Methane, Dibromochloro- § Dibromochloromethane (THM)	124-48-1 PA 6360000 CFK500	Carcinogen			3.75	4 PP	4 PP	N/A	0.6
Chloroethane §§ Ethyl Chloride § Aethylis § Aethylis Chloridum § Anodynon § Chelen § Chlorethyl § Chloridum § Chloryl § Chloryl Anesthetic § Ether Chloratus § Ether Hydrochloric § Ether Muriatic § Hydrochloric Ether § Kelene § Monochlorethane § Muriatic Ether § Narcotile § NCI C06224	75-00-3 KH 7525000 EHH000	Toxic						0.52	
Chloroform (THM) §§ Trichloromethane § TCM § Freon 20 § Trichloroform § R-20 Refrigerant § Methenyl Chloride § Formyl Trichloride § Methyl Trichloride § Methane Trichloride § Methane, Trichloro- § Methenyl Trichloride § NCI CO2686§ RCRA Waste Number U044	67-66-3 FS 9100000 CHJ500	Carcinogen			3.75	57 PP	70 HA	N/A	0.9

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Chlorophenol, 2- §§ Phenol, 2-Chloro § o-Chlorophenol § 2-Chlorophenol § Phenol, o-Chloro- § RCRA Waste Number U048	95-57-8 SK 2625000 CJK250	Toxic			134	81 PP	81 PP	0.3	10
Chlorophenyl Phenyl Ether, 4- §§ § 4- Chlorophenyl Phenyl Ether	7005-72-3	Toxic with BCF >300			1,200				10
Chlorsulfuron §§ Glean §§ Telar	64902-72-3	Toxic				1,750 HA	1,750 HA		0.02
Chlorothalonil §§ Bravo §	1897-45-6	Carcinogen				100 HA	100 HA	N/A	0.05
Chlorpyrifos §§ Dursban § Ethion § Brodan § Eradex § Lorsban § Pyrinex § NA 2783 § Piridane § DowCo 179 § SHA 059101 § Ethion, dry § Chlorothalonil § Chlorpyrifos-Ethyl § O,O-Diethyl O-3,5,6-Trichloro-2-Pyridyl Phosphorothioate § Phosphorothioic Acid, O,O-Diethyl O-(3,5,6-Trichloro-2-Pyridyl) Ester	2921-88-2 TF 6300000 DYE000	Toxic	0.083 NPP	0.041 NPP		20 HA	20 HA	0.25	0.1
Chromium, all forms §§ Cr § Chrome	7440-47-3 GB 4200000 CMI750	Toxic				100 MCL	100 MCL	1	10
Chromium, hexavalent §§ Chromium (VI) §	18540-29-9	Toxic	16 PP	11 PP	16				2
Chromium, trivalent §§ Chromium (III) §	16065-83-1	Toxic	579 @ 25mg/L hardness (12) PP	27.7 @ 25 mg/L hardness (12) PP	16			1	3

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Chrysene (PAH) §§ § Benz(a)Phenanthrene § Benzo(a)Phenanthrene § 1,2-Benzphenanthrene § 1,2-Benzophenanthrene § 1,2,5,6-Dibenzonaphthalene § RCRA Waste Number U050	218-01-9 GC0700000 CML810	Carcinogen			30	0.038 PP	50 (29) HA	N/A	0.1
cis-1,2-Dichloroethylene §§ § 1,2-Dichloroethylene § cis-Dichloroethylene § cis-1,2-Dichloroethene § 1,2,cis-Dichloroethylene § ethylene, 1,2-Dichloro-, (z)-	156-59-2 KV 9420000 DFI200	Toxic				70 MCL	70 MCL	0.002	0.9
cis-1,3-Dichloropropene §§ Telone II § 1,3-Dichloropropene § 1,3-Dichloropropylene § (Z)-1,3-Dichloropropene § cis-1,3-Dichloropropylene § 1-Propene, 1,3-Dichloro-, (Z)-	10061-01-5 UC 8325000 DGH200	Carcinogen			1.91	3.4 HA	4 HA	N/A	0.6
Clopyralid §§ Stinger §	1702-17-6	Toxic				1,000 HA	1,000 HA	1	0.3
Color §§	N/A	Harmful				(18)	(18)	N/A	5 UNITS
Copper §§ Cu § Allbri Natural Copper § ANAC 110 § Arwood Copper § Bronze Powder § CDA 101 § CDA 102 § CDA 110 § CDA 122 § C.I. 77400 § C.I. Pigment Metal 2 § Copper Bronze § 1721 Gold § Gold Bronze § Kafar Copper § M1 (Copper) § M2 (Copper) § OFHC Cu § Raney Copper	7440-50-8 GL 5325000 CNI000	Toxic	3.79@ 25mg/L hardness (12) PP	2.85@ 25 mg/L hardness (12) PP	36	1,300 PP	1,300 PP	0.5	2
Cyanazine §§ Bladex	21725-46-2	Toxic				1 HA	1 HA		0.02

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Cyanide, total §§ § Cyanide § Isocyanide § Cyanides, includes soluble salts and complexes § RCRA Waste Number P030	57-12-5 GS 7175000 COI500	Toxic	22 PP	5.2 PP	1	140 PP	200 MCL		3
Dacthal §§ DCPA §	1861-32-1	Toxic				70 HA	70 HA	0.025	1
Dalapon §§ Revenge § Dalpon § Unipon § Dowpon § Radapon § Basinex § Ded-Weed § Dalacide § Gramevin § Crisapon § Dalpon Sodium § 2,2-Dichloropropionic Acid § SHA 28902, for sodium salt § SHA 28901, for dalapon only Propionic Acid, 2,2-Dichloro- § Sodium 2,2-Dichloropropionate § a-Dichloropropionic Acid § a,a-Dichloropropionic Acid § alpha-alpha-Dichloropropionic Acid	75-99-0 UF 0690000 DGI400	Toxic				200 MCL	200 MCL	1.3	3
Dalapon, sodium salt §§ Dalpon § Unipon § Dowpon § Radapon § Revenge § Basinex § Ded-Weed § Dalacide § Gramevin § Crisapon § Dalpon Sodium § Sodium Dalapon § 2,2-Dichloropropionic Acid § SHA 28902, for sodium salt § SHA 28901, for dalapon only § Propionic Acid, 2,2-Dichloro- § Sodium 2,2-Dichloropropionate § alpha-alpha-Dichloropropionic Acid	127-20-8 UF 1225000 DGI600	Toxic				200 MCL	200 MCL	1.3	3

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Demeton §§ Systox § Bay 10756 § Bayer 8169 § Demox § Diethoxy Thiophosphoric Acid Ester of 2-Ethylmercaptoethanol § O,O-Diethyl 2-Ethylmercaptoethyl Thiophosphate § O,O-Diethyl O(and S)-2-(Ethyl-Thio)Ethyl Phosphorothioate Mixture § E 1059 § ENT 17,295 § Mercaptophos § Systemox § Systox § ULV § Demeton-O + Demeton-S	8065-48-3 TF 3150000 DAO600	Toxic		0.1 NPP		1.4 HA	1.4 HA	0.25	0.01
Di(2-Ethylhexyl)Phthalate (PAE) §§ Bis(2-Ethylhexyl)Phthalate § BEHP § DEHP § Octoil § Fleximel § Flexol DOP § Kodaflex DOP§ Ethylhexyl Phthalate § Diethylhexyl Phthalate § 2-Ethylhexyl Phthalate § Di(Ethylhexyl)phthalate § Di(2-Ethylhexyl)phthalate § Bis (2-Ethylhexyl) Phthalate § Bis(2-Ethylhexyl)-1,2-Benzene-Dicarboxylate § 1,2-Benzenedicarboxylic Acid, Bis(2-Ethylhexyl)Ester	117-81-7 TI 0350000 BJS000	Carcinogen			130	6 MCL	6 MCL	N/A	2

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Di(2-Ethylhexyl)Adipate §§ Hexanedioic Acid § DEHA § BEHA § Bisoflex DOA § Effemoll DOA § Ergoplast AdDO § Flexol A 26 § PX-238 § Reomol DOA § Vestinol OA § Wickenol 158 § Kodaflex DOA § Monoplex DOA § NCI C54386 § Octyl Adipate § Dioctyl Adipate § Di-2-Ethylhexyl Adipate § Di (2-Ethylhexyl) Adipate § Bis(2-Ethylhexyl) Adipate § Adipic Acid, Bis(2-Ethylhexyl) Ester § Hexanedioic Acid, Bis(2-Ethylhexyl) Ester	103-23-1 AU 9700000 AEO000	Carcinogen				300 HA	300 HA	N/A	6
Diazinon §§	333-41-5	Toxic	0.17 NPP	0.17 NPP		0.6 HA	0.6 HA	0.25	0.03
Dibenz[a,h]Anthracene (PAH) §§ § DBA § DB(a,h)A § Dibenz(a,h)Anthracene § Dibenzo(a,h)anthracene § 1,2:5,6-Benzanthracene § Dibenzo (a,h) Anthracene § 1,2,5,6-Dibenzanthracene § 1,2:5,6-Dibenz(a)Anthracene § RCRA Waste Number U063	53-70-3 HN 2625000 DCT400	Carcinogen			30	0.038 PP	0.05 (29) HA	N/A	0.1
Dibromoethane, 1,2- §§ Ethylene Dibromide § DBE § EDB § Nephis § Kopfume § Celmide § E-D-Bee § Soilfume§ Bromofume § Dowfume 40 § SHA 042002 § Pestmaster § Soilbrom-40§ Dibromoethane § Ethylene Bromide § Glycol Dibromide § 1,2-Dibromoethane § 1,2-Ethylene Dibromide § RCRA Waste Number U067	106-93-4 KH 9275000 EIY500	Carcinogen				0.004 HA	0.004 HA	N/A	0.01

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dibutyl Phthalate §§ § DPB § Celluflex DPB § Elaol § Hexaplas M/B § Palatinol C§ Polycizer DBP § PX 104 § Staflex DBP § Witcizer § SHA 028001 § Butylphthalate § N-Butylphthalate § Di-n-Butylphthalate § Di-n-Butylphthalate § Dibutyl-o-Phthalate § Di-n-Butyl Phthalate § RCRA Waste Number U069 § Phthalic Acid Dibutyl Ester § Dibutyl 1,2-Benzene Dicarboxylate § 1,2-Benzenedicarboxylic Acid Dibutyl Ester § 1,2-Benzenedicarboxylic Acid, Dibutyl Ester § Benzene-o-Dicarboxylic Acid Di-n-Butyl Ester	84-74-2 TI 0875000 DEH200	Toxic			89	2,000 PP	2,000 PP	0.25	10
Dicamba §§ Banvel §	1918-00-9	Toxic				200 HA	200 HA	0.28	0.7
Dichlorobenzene, 1,2- §§ DCB § ODB § ODCB § Dizene § Cloroben § Chloroben § Chloroden § Termitkil § Dilatin DB § Dowtherm E § Dilantin DB § o-Dichlorobenzene § Orthodichlorobenzene § ortho-Dichlorobenzene § Special Termite Fluid § Benzene, 1,2-Dichloro- § RCRA Waste Number U070	95-50-1 CZ 4500000 DEP600	Toxic			55.6	420 PP	600 MCL	0.02	10
Dichlorobenzene, 1,3- §§ Benzene, 1,3-Dichloro § M-Dichlorobenzene § m-Dichlorobenzene § meta-Dichlorobenzene § 1,3-Dichlorobenzene-	541-73-1 CZ 4499000 DEP699	Toxic			55.6	320 PP	600 HA	0.006	5

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dichlorobenzene, 1,4- §§ Benzene, 1,4-Dichloro- § 1,4- Dichlorobenzene § PDB § PDCB § NCI C54955 § Evola § Paradi § Paradow§ Persia-Perazol § Paracide § Parazene § Paramoth § Santochlor § Paranuggets § di-Chloricide § Para Chrystals § p-Dichlorobenzene § Caswell Number 632 § Paradichlorobenzene § para-Dichlorobenzene- § p-Chlorophenyl Chloride § EPA Pesticide Chemical Code 061501 § RCRA Waste Number U070 § RCRA Waste Number U071 § RCRA Waste Number U072	106-46-7 CZ 4550000 DEP800	Toxic			55.6	75 MCL	75 MCL		5
Dichlorobenzidine, 3,3'- §§ DCB § C.I. 23060 § Curithane C126 § Dichlorobenzidine § o,o'-Dichlorobenzidine § Dichlorobenzidine Base § Benzidine, 3,3'-Dichloro- § 3,3'-Dichloro-4,4'-Diaminodiphenyl § 3,3'-Dichloro-(1,1'-Biphenyl)-4,4'-Diamine § 1,1'-Biphenyl-4,4'-Diamine, 3,3'-Dichloro- § RCRA Waste Number U073	91-94-1 DD 0524000 DEQ400	Carcinogen			312	0.21 PP	0.21 PP	N/A	5

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dichlorodifluoromethane (HM) §§ Freon 12 § F 12 § R 12 § FC 12 § Halon § CFC-12 § Arcton 6 § Electro-CF 12 § Eskimon 12 § Frigen 12 § Gentron 12 § Isceon 122 § Kaiser Chemicals 12 § Ledon 12 § Ucon 12 § Propellant 12 § Refrigerant 12 § Fluorcarbon-12 § Difluorodichloromethane § Methane, dichlorodifluoro- § RCRA Waste Number U075	75-71-8 PA 8200000 DFA600	Toxic			3.75	1,000 HA	1,000 HA	0.05	0.8
Dichloroethane, 1,2- §§ Ethylene Chloride § EDC § Brocide § 1,2-DCE § NCI C00511 § Dutch Oil § Dutch Liquid § Dichloremulsion § Di-Chlor-Mulsion § 1,2-Bichlorethane § 1,2-Dichlorethane § Ethane Dichloride § 1,2-Bichloroethane § Ethylene Dichloride § 1,2-Dichloroethane § Ethane, 1,2-Dichloro- § 1,2-Ethylene Dichloride § alpha,beta-Dichloroethane § RCRA Waste Number U077	107-06-2 KI 0525000 DFF900	Carcinogen			1.2	3.8 PP	4 HA	N/A	0.5
Dichloroethylene, 1,1- §§ Vinylidene Chloride § VDC § 1,1-DCE § Sconatex § NCI C54262 § 1,1-Dichloroethene § Vinylidene Chloride § 1,1-Dichloroethylene § Vinylidene Dichloride § Ethene, 1,1-Dichloro- § Vinylidene Chloride II § Dichloroethylene, 1,1- § Ethylene, 1,1-Dichloro- § RCRA Waste Number U078	75-35-4 KV 9275000 DFI000	Carcinogen			5.6	7 MCL	7 MCL	N/A	0.7

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dichlorophenol, 2,4- §§ Phenol, 2,4-Dichloro § DCP § 2,4-DCP § NCI C55345 § 2,4-Dichlorophenol § RCRA Waste Number U081	120-83-2 SK 8575000 DFX800	Toxic			40.7	77 PP	77 PP	10	10
Dichlorophenoxyacetic Acid, 2,4- §§ Dichlorophenoxyacetic Acid § 2,4-D § Salvo § Phenox § Farmco § Amidox § Miracle § Agrotect § Weedtrol § Herbidal § Ded-Weed § Lawn-Keep § Fernimine § Crop Rider § Dichlorophenoxyacetic Acid, 2,4- § Acetic Acid, (2,4-Dichlorophenoxy)- § 2,4-Dichlorophenoxyacetic Acid, salts and esters	94-75-7 AG 6825000 DFY600	Toxic				70 MCL	70 MCL	0.02	1
Dichloropropane, 1,2- §§ Propylene Chloride § 1,2-Dichloropropane § NCI C55141 § Propylene Dichloride § Caswell Number 324 § Propane, 1,2-Dichloro- § a,ß-Propylene Dichloride § alpha,beta-Dichloropropane § EPA Pesticide Chemical Code 029002 § RCRA Waste Number U083	78-87-5 TX 9625000 DGF600	Toxic			4.11	5.0 PP	5 MCL		0.7

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dichloropropene, 1,3- §§ Telone II § Telone § NCI C03985 § Vidden D § Dichloropropene § a-Chloroallyl Chloride § g-Chloroallyl Chloride § 1,3-Dichloropropene § 1,3-Dichloropropylene § 1,3-Dichloro-2-Propene § Propene, 1,3-Dichloro- § Telone II Soil Fumigant § 3-Chloropropenyl Chloride § alpha,gamma-Dichloropropylene	542-75-6 UC 8310000 CEF750	Carcinogen			1.91	3.4 PP	4 HA	N/A	0.3
Dichlorprop §§ § Canapur DP § Basagran DP § Cornox RX § Hedonil DP § Kildip § Mayclene § Polyclene § Weedone DP § Polytox	120-36-5	Toxic				300 HA	300 HA		1
Dieldrin §§ § Alvit § Quintox § Octalox § Illoxol § Dieldrex § NCI C00124 § Dieldrite § Hexachloroepoxyoctahydro-endo,exo-Dimethanonaphthalene § 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-Octahydro-2,7:3,6-Dimethanonaphth(2,3-b)Oxirene § 2,7:3,6-Dimethanonaphth(2,3-b)Oxirene, 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-Octahydro- § SHA 045001 § 1,4:5,8-Dimethanonaphthalene § RCRA Waste Number P037	60-57-1 IO 1750000 DHB400	Carcinogen	0.24 PP	0.056 PP	4,670	$5.2x10^{-4}$ PP	0.02 HA	N/A	0.02

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Diethyl Phthalate §§ § Anozol § Neantine § Solvanol § NCI C60048 § Placidole E § Ethyl Phthalate § Diethylphthalate § Diethyl-o-Phthalate § 1,2-Benzenedicarboxylic Acid, Diethyl Ester § RCRA Waste Number U088	84-66-2 TI 1050000 DJX000	Toxic			73	$1.7x10^4$ PP	$1.7x10^4$ PP	0.25	10
Difenoconazole §§ § 1-[2-[2-chloro-4-(4-chlorophenoxy)phenyl1]-4-methyl-1,3-dioxolan-2ymethyl]-1H-1,2,4-triazole § CGA169374 § Dividend § Dragon § Plover § Score § Score EC250	119446-68-3	Carcinogen				70 HA	70 HA	N/A	0.06
Dimethenamid and degredate demethenamid OA § 2-Chloro-N-(2,4-dimethyl-3-thienyl)-N-(2-methoxy-1-methylethyl)acetamide § San 682H § Frontier herbicide § EPA pesticide Code 129051	87674-68-8	Carcinogen				400 HA	400 HA	N/A	0.03
Dimethoate §§	60-51-5	Toxic				7 HA	7 HA		6
Dimethrin §§	70-38-2	Toxic				2,000 HA	2,000 HA		200

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dimethyl Phthalate §§ § DMP § NTM § ENT 262 § Mipax § Avolin § Fermine § Solvanom § Solvarone § Palatinol M § Methyl Phthalate § Dimethylphthalate § Phthalic Acid, Dimethyl Ester § Dimethyl Benzene-o-Dicarboxylate § Dimethyl 1,2-Benzenedicarboxylate § 1,2-Benzenedicarboxylic Acid, Dimethyl Ester	131-11-3 TI 1575000 DTR200	Toxic			36	$2.7x10^5$ PP	$2.7x10^5$ PP	0.04	10
Dimethylphenol, 2,4- §§ Phenol, 2,4-Dimethyl- § m-Xylenol § 2,4-Xylenol § 4,6-Dimethylphenol § Caswell Number 907A § 2,4-Dimethyl Phenol § 1-Hydroxy-2,4-Dimethylbenzene § 4-Hydroxy-1,3-Dimethylbenzene § EPA Pesticide Chemical Code 086804 § RCRA Waste Number U101	105-67-9 ZE 5600000 XKJ500	Toxic			93.8	380 PP	380 PP	10	10
Dinitro-o-Cresol, 4,6- §§ Dinitrocresol § Detal § Sinox § DNOC § Arborol § Capsine § Dinitrol § Trifocide § Antinonin § Winterwash § Dinitro-o-Cresol § 2,4-Dinitro-o-Cresol § 4,6-Dinitro-o-Cresol § o-Cresol, 4,6-dinitro- § 2-Methyl-4,6-Dinitrophenol § 4,6-Dinitro-2-Methylphenol § 2,4-Dinitro-6-Methylphenol § 3,5-Dinitro-2-Hydroxytoluene § Phenol, 2-Methyl-4,6-Dinitro- § Caswell Number 390 § RCRA Waste Number P047	534-52-1 GO 9625000 DUT400	Toxic			5.5	13 PP	13 PP		10

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dinitrophenol, 2,4- §§ Phenol, 2,4-Dinitro § Nitro § Kleenup § Aldifen § 2,4-Dinitrophenol § 2,4-DNP § Chemox PE § Maroxol-50 § Solfo Black B § alpha-Dinitrophenol § Dinitrophenol, 2,4- § Tertrosulphur Black PB § 1-Hydroxy-2,4-Dinitrobenzene § RCRA Waste Number P048	51-28-5 SL 2800000 DUZ000	Toxic			1.5	69 PP	69 PP	13	60
Dinitrotoluene, 2,4- §§ Toluene, 2,4-Dinitro § 2,4-DNT § NCI C01865 § 2,4-Dinitrotoluol - § Benzene, 1-Methyl-2,4-Dinitro- § RCRA Waste Number U105	121-14-2 XT 1575000 DVH000	Carcinogen			3.8	1.1 PP	1.1 PP	N/A	0.2
Dinitrotoluene, 2,6- §§ Toluene-dinitro § 2,4-DNT § Methyl-1,3-Dinitrobenzene § RCRA Waste Number U106	606-20-2 XT 1925000 DVH400	Carcinogen				0.5 HA	0.5 HA	N/A	0.2
Dinoseb §§ § DNBP § DBNF § Aretit § Basanite § Caldon § Sparic § Kiloseb § Spurge § Premerge § Dinitro § Hel-Fire § SHA 037505 § Dow General § Sinox General § Dow General Weed Killer § Vertac General Weed Killer § 2-sec-Butyl-4,6-Dinitrophenol § Dinitro-Ortho-Sec-Butyl Phenol § 2-(1-Methylpropyl)-4,6-Dinitrophenol § 4,6-Dinitro-2-(1-Methyl-n-Propyl)Phenol§ Phenol, 2-(1-Methylpropyl)-4,6-Dinitro- § RCRA Waste Number P020	88-85-7 SJ 9800000 BRE500	Toxic				7 MCL	7 MCL	0.19	1

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Dioxin Chlorinated Dibenzo-p-dioxins and Chlorinated Dibenzofurans Calculation of an equivalent concentration of 2,3,7,8-TCDD is to be based on congeners of CDDs/CDFs and the toxicity equivalency factors (TEF) in van den Berg, M: et al. (2006) The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences 93(2):223-241.	1746-01-6	Carcinogen			5,000	$5x10^{-9}$ (10) PP	$2x10^{-6}$ (10) HA	N/A	footnote (10)
Diphenamid §§	957-51-7	Carcinogen				200 HA	200 HA	N/A	20
Diphenylhydrazine, 1,2- §§ Hydrazine, 1,2-Diphenyl- § Hydrazobenzene § NCI C01854 § N,N'-Bianiline § Benzene, Hydrazodi- § (sym)-Diphenylhydrazine § 1,2-Diphenylhydrazine § RCRA Waste Number U109	122-66-7 MW 2625000 HHG000	Carcinogen			24.9	0.36 PP	0.36 PP	N/A	0.04
Diquat §§ § Actor § Feglox § Deiquat § Reglone § Aquacide § Dextrone § Paraquat § Preeglove § SHA 032201 § Weedtrine-D § Diquat Dibromide § Ethylene Dipyridylium Dibromide § 1,1-Ethylene 2,2-Dipyridylium Dibromide § 5,6-Dihydro-Dipyrido(1,2a,1c)Pyraziniu m Dibromide § 9,10-Dihydro-8a,10a-Diazoniaphenanthrene(1,1'-Ethylene-2,'-Bipyridylium)Dibromide	2764-72-9 DWX800 JM 5690000	Toxic				20 MCL	20 MCL	0.44	2

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Disulfoton §§ § Disyston	298-04-4	Toxic				0.3 HA	0.3 HA	0.07	0.09
Diuron §§ § Karmex	330-54-1	Toxic				10 HA	10 HA	1	0.5
Endosulfan (39) §§ § NCI C00566 § Malixv § Ensure § Beosit § Endocel § Thiodan § Cyclodan § Crisulfan § Benzoepin § Thiosulfan § SHA 079401 § Chlorthiepin § Endosulfan (mixed isomers) § Hexachlorohexahydromethano 2,4,3-Benzodioxathiepin-3-Oxide § 1,4,5,6,7,7-Hexachloro-5-Norbornene-2,3-Dimethanol Cyclic Sulfite § 5-Norbornene-2, 3-Dimethanol, 1,4,5,6,7,7-Hexachloro Cyclic Sulfite § RCRA Waste Number P050	115-29-7 RB 9275000 BCJ250	Toxic	0.11 PP	0.056 PP	270	62 PP	62 PP	0.014	see Cis and trans isomers
Endosulfan, I (39) (the cis isomer of Endosulfan) §§ § Thiodan I § Endosulfan-I § Alpha-Endosulfan § alpha-Endosulfan	959-98-8	Toxic	0.11 PP	0.056 PP	270	62 PP	62 PP		0.02
Endosulfan, II (39)(the trans isomer of endosulfan) §§ § Thiodan II § Endosulfan-II § Beta-Endosulfan § beta-Endosulfan	33213-65-9	Toxic	0.11 PP	0.056 PP	270	62 PP	62 PP	0.004	0.02
Endosulfan Sulfate §§ § 6,9-Methano-2,3,4-Benzodioxathiepin, 6,7	1031-07-8	Toxic			270	62 PP	62 PP	0.05	0.05

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Endothall §§ § Hydout § Hydrothal-47 § Aquathol § SHA 038901 § Accelerate § Tri-Endothal § Endothal Hydout § 3,6-Endooxohexahydrophthalic Acid § Phthalic Acid, Hexahydro-3,6-endo-Oxy- § 7-Oxabicyclo(2,2,1)Heptane-2,3-Dicarboxylic Acid § 1,2-Cyclohexanedicarboxylic Acid, 3,6-endo-Epoxy- § RCRA Waste Number P088	145-73-3 RN 7875000 EAR000	Toxic				100 MCL	100 MCL	1	2
Endrin §§ § NCI C00157 § Endrex § Mendrin § Nendrin § Hexadrin § SHA 041601 § Compound 269 § 1,2,3,4,10,10-Hexachloro-6,7-Epoxy-1,4,4(a)5,6,7,8,8a-Octahydro-endo § 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-Octahydro-2, 7:3,6-Dimethanonaphth[2,3-b]oxirene § 1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-Hexachloro-6,7-Epoxy-1,4,4a,5,6,7,8,8a-Octahydro-Endo,Endo- § RCRA Waste Number P051	72-20-8 IO 1575000 EAT500	Toxic with BCF >300	0.086 PP	0.036 PP	3,970	0.059 PP	2 MCL		0.006
Endrin Aldehyde §§	7421-93-4	Toxic with BCF >300			3,970	0.29 PP	0.29 PP		0.03

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Epichlorohydrin §§ § ECH § Epoxy Propane § - Epichlorohydrin § Chloromethyloxirane § RCRA Waste Number U041 § y-Chloropropyleneoxide § 2-Chloropropylene Oxide § Glycerol Epichlorhydrin § 2,3-Epoxypropyl Chloride § 1-Chlor-2,3-Epoxypropane§ 3-Chlor-1,2-Epoxypropane	106-89-8 TX 4900000 CGN750	Carcinogen				30 HA	30 HA	N/A	3
Escherichia coli (Bacteria)	N/A	Harmful				(13)	Less than 1 (6)	N/A	1 per 100ml
Ethion §§ Phosphorodithioic acid, S,S'-methylene O,O,O',O'-tetraethyl ester § Diethion § Embathion § Ethanox § Ethiol 100 § Ethodan § Ethopaz § ethyl methylene phosphorodithioate § FMC-1240 § Fosfatox E § Fosfono P § HSDB 399 § Hylemox § KWIT § NIA 1240 § Niagara 1240 § Nialate § Phosphotox E § RP 8167 § Rhodocide § Rodocid § Vegfru fomisate	563-12-2	Toxic				4 HA	4 HA		0.3
Ethofumesate §§ 2-Ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate § BRN 5759730 § CR 14658 § Caswell #427BB § HSDB 7451 § Nortron § Progress § Tramat	26225-79-6	Toxic				9,000 HA	9,000 HA		0.08
Ethylbenzene §§ § EB § NCI C56393 § Ethylbenzol § Phenylethane § Ethyl Benzene § Benzene, Ethyl	100-41-4 DA 0700000 EGP500	Toxic			37.5	530 PP	700 MCL	0.002	1

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Fenamiphos §§ § Nemacur	22224-92-6	Toxic				2 HA	2 HA		0.2
Fenbuconazole §§ 1H-1,2,4-Triazole-1-propanenitrile,alp-ha-(2-(4-chlorophenyl)ethyl)-alpha-phenyl- § 4-(4-chlorophenyl)-2-(1H-1,2,4-triazol-1-ylmethyl)butyronitrile	114369-43-6	Carcinogen				100 HA	100 HA	N/A	0.02
Fipronil §§ §HSDB 7051 §MB 46030 §RM1601 §Regent §UNII-QGH063955F	120068-37-3	Carcinogen				1 HA	1 HA	N/A	0.004
Flucarbazone §§ Flucarbazone § 1H-1,2,4-Triazole-1carboxamide, 4,5-dihydro-3-methoxy-4-methyl-5-oxo-N((2-(trifluoromethoxy) phenyl)sulfonyl)-	145026-88-6	Toxic				3,000 HA	3,000 HA		300
Flucarbazone sulfonamide §§ §	37526-59-3	Toxic				3,000 HA	3,000 HA		300
Fluometuron §§ § Flo-Met	2164-17-2	Carcinogen				90 HA	90 HA	N/A	0.5
Fluoranthene §§ § Idryl § Benzo(jk)Fluorene § Benzo(j,k)Fluorene § 1,2-Benzacenaphthene § 1,2-(1,8-Naphthylene)Benzene § Benzene, 1,2-(1,8-Naphthalenediyl)- § RCRA Waste Number U120	206-44-0 LL 4025000 FDF000	Toxic BCF >300			1,150	130 PP	130 PP		10
Fluorene (PAH) §§ § 9H-Fluorene § Diphenylenemethane § o-Biphenylenemethane § 2,2'-Methylenebiphenyl	86-73-7	Toxic			30	1,100 PP	1,100 PP	0.25	5

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Fluoride §§ Flourine § Fluoride § Fluoride(1-) § Perfluoride § Fluoride Ion § Fluorine, Ion § Soluable§ Fluoride § Hydrofluoric Acid, on(1-) § RCRA Waste Number P056	16984-48-8 ~~NIOSH:~~ LM 6290000 FEX875	Toxic				4,000 MCL	4,000 MCL	5	200
Fluroxypyr	69377-81-7	Toxic				7,000 HA	7,000 HA		0.1
Fonofos §§ § Dyfonate	944-22-9	Toxic				10 HA	10 HA		1
Gamma Emitters (11) §§	Multiple	Carcinogen / Radioactive				0.4 mrem /yr MCL	0.4 mrem /yr MCL	N/A	
gamma-Chlordane §§ § Chlordane, beta-Isomer	5566-34-7	Carcinogen			14,100	0.008 HA	1 HA	N/A	0.006
gamma-hexachlorocyclohexane §§ Lindane § BHC § -BHC § Gamene § Lintox § Lentox § Hexcide § Aparsin § Agrocide § Afcide § BHC-gamma § gamma-BHC § HCH-gamma § gamma-HCH § Hexachlorocyclohexane § gamma-Hexachlorobenzene § gamma-Benzenehexachloride § gamma-Benzene Hexachloride § Hexachlorocyclohexane-gamma § Hexachlorocyclohexane (gamma)	58-89-9 GV 4900000 BBQ500	Toxic	0.95 PP		130	0.2 MCL	0.2 MCL		0.02
Gases, dissolved, total-pressure (20) §§	Multiple	Toxic	110% of saturation						

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Glyphosate §§ § Jury § Honcho § Rattler § Weedoff § Roundup § Glifonox § n-(Phosphonomethyl)-Glycine § Glycine, n-(Phosphonomrthyl)- § Glyphosate plus inert ingrediants § MON 0573	1071-83-6 MC 1075000 PHA500	Toxic				700 MCL	700 MCL	6	6
Glyphosate Isopropylamine Salt §§ § SHA 103601	38641-94-0	Toxic				700 HA	700 HA	6	70
Guthion §§ § DBD § NCI C00066 § Carfene § Gothnion § Azinphos § Crysthyon § Gusathion § Bay 17147 § Methylazinphos § Methyl Guthion § Methyl-Guthion § Azinphos-Methyl § Azinphos Methyl § Caswell Number 374 § o,o-Dimethylphosphorodithioate S-Ester § Benzotriazinedithiophosphoric Acid Dimethoxy Ester § Phosphorodithioic Acid, O,O-Dimethyl Ester, S-Ester with 3-(Mercaptomethyl)-1,2,3-Benzotriazin-4(3H)-One § EPA Pesticide Chemical Code 058001	86-50-0 TE 1925000 ASH500	Toxic		0.01 NPP					0.1
Haloacetic acids (38) § Dichloroacetic acid (79-43-6) § Trichloroacetic acid (76-03-9) § Chloroacetic acid (79-11-8) § Bromoacetic acid(79-08-3) §Dibromoacetic acid (631-64-1)	various	Carcinogen				60 MCL	60 MCL	N/A	1

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Heptachlor §§ § NCI C00180 § Drinox § Heptamul § Agroceris § Heptagran § SHA 04481 § Rhodiachlor § Velsicol-104 § 3,4,5,6,7,8,8a-heptachlorodicyclopentadiene § Dicyclopentadiene, 3,4,5,6,7,8,8a-Heptachloro- § 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-Tetrahydro-4,7-Methanol-1H-Indene § 4,7-Methano-1H-Indene, 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-Tetrahydro- § 1(3a),4,5,6,7,8,8-Heptachloro-3a(1),4,7,7a-Tetrahydro-4,7-Methanoindene § RCRA Waste Number P059	76-44-8 PC 0700000 HAR000	Carcinogen	0.26 PP	0.0038 PP	11,200	$7.9x10^{-4}$ PP	0.08 HA	N/A	0.02
Heptachlor Epoxide §§ § HCE § Velsicol 53-CS-17 § Epoxyheptachlor § 1,4,5,6,7,8,8-Heptachloro-2,3-Epoxy-2,3,3a,4,7,7a-Hexahydro-4,7-Methanoindene § 2,5-Methano-2H-Indeno[1,2b]Oxirene, 2,3,4,5,6,7,7-Heptachloro-1a,1b,5,5a,6,6a-Hexahydro- (alpha, beta, and gamma isomers)	1024-57-3 PB 9450000 EBW500	Carcinogen	0.26 PP	0.0038 PP	11,200	$3.9x10^{-4}$ PP	0.04 HA	N/A	0.01
Hexachlorobenzene §§ § HCB § Amatin § Smut-Go § Sanocide § Anticarie § Bunt-Cure § Bunt-No-More § Perchlorobenzene § Phenyl Perchloryl § No Bunt Liquid § Julin's Carbon Chloride § Co-op Hexa § Hexa C.B. § Benzene, Hexachloro-	118-74-1 DA 2975000 HCC500	Carcinogen			8,690	0.0028 PP	0.2 HA	N/A	0.03

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Hexachlorobutadiene §§ § 1,3-Hexachlorobutadiene § 1,3-Butadiene, Hexachloro- § 1,1,2,3,4,4-Hexachloro-1,3-Butadiene § 1,3-Butadiene, 1,1,2,3,4,4-Hexachloro- § HCBD § Dolan-Pur § Perchlorobutadiene § RCRA Waste Number U128	87-68-3 EJ 0700000 PCF000	Carcinogen			2.78	4.4 PP	5 HA	N/A	0.5
Hexachlorocyclohexane §§	608-73-1	Carcinogen				0.123 NPP	0.123 NPP	N/A	0.01
Hexachlorocyclopentadiene §§ § HEX § HCP § PCL § C-56 § HCCPD § NCI C55607 § Hexachloropentadiene § Perchlorocyclopentadiene § 1,3-Cyclopentadiene, 1,2,3,4,5,5-Hexachloro- § RCRA Waste Number U130	77-47-4 GY 1225000 HCE500	Toxic			4.34	40 PP	50 MCL	1	5
Hexachloroethane §§ § Avlotane § Distokal § Distopan § Distopin § Egitol § Falkitol § Fasciolin § NCI C04604 § Phenohep § Mottenhexe § Perchloroethane § Hexachloroethylene § Ethane, Hexachloro- § Carbon Hexachloride § Ethane Hexachloride § Ethylene Hexachloride § 1,1,1,2,2,2-Hexachloroethane § RCRA Waste Number U131	67-72-1 KI 4025000 HCI000	Carcinogen			86.9	14 PP	30 HA	N/A	1
Hexazinone §§	51235-04-2	Toxic				400 HA	400 HA	1	0.02

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Hydrogen Sulfide §§ § Stink Damp § Sulfur Hydride § Hydrogen Sulphide § Dihydrogen Sulfide § Dihydrogen Monosulfide § Hydrogen Sulfuric Acid § Hydrosulfuric Acid § Sulfurated Hydrogen § RCRA Waste Number U135	7783-06-4 MX 1225000 HIC500	Toxic		2 NPP					20
Hydroxyatrazine §§ § Hydroxydechloroatrazine	2163-68-0	Toxic				70 HA	70 HA		7
Imazalil (Parent name Enilconazole) §§ 1-(2-(2,4-dichlorophenyl)-2-(2-propenyloxy)ethyl)-1H-imidazole § Enilconazole § BRN 054683 § Caswell #497AB § Chloramizol § Deccozil § Secozil S 75 § Fungaflor § HSDB 6672 § R 23979 § EPA Pesticide Code 111901	35554-44-0	Carcinogen				6 HA	6 HA	N/A	0.6
Imazamethabenz-methyl ester (includes the metabolite imazamethabenz methyl acid) (33) §§ Assert §	81405-85-8	Toxic				400 HA	400 HA		40
Imazamox §§ § Ammonium salt of imazamox	114311-32-9	Toxic				$2x10^4$ HA	$2x10^4$ HA		0.04
Imazapic §§ Imazapic § AC263222, Cadre, Imazameth, Imazamethapyr, Imazmethapyr	104098-48-8	Toxic				4,000 HA	4,000 HA		0.01
Imazapyr §§ Arsenal §	81334-34-1	Toxic				$2.1x10^4$ HA	$2.1x10^4$ HA		0.01

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Imazethapyr §§ 3-pyridinecarboxilic acid, 2-(4,5-dihydro-4-methyl-4-(1-methylethyl)-5oxo-1H-imidazol-2-yl)-5-ethyl- § AC 263,499 § CL263499 § HSDB 6678 § Pivot § Pursuit § EPA Pesticide Code# 128922	81335-77-5	Toxic				$2x10^4$ HA	$2x10^4$ HA		0.03
Imidacloprid §§	105827-78-9 138261-41-3	Toxic				400 HA	400 HA		0.07
Indeno(l,2,3-cd)pyrene (PAH) §§ § o-Phenylenepyrene § 2,3-Phenylenepyrene § 2,3-o-Phenylenepyrene § Indeno (l,2,3-cd) Pyrene § 1,10-(o-Phenylene)Pyrene § 1,10-(1,2-Phenylene)Pyrene § RCRA Waste Number U137	193-39-5 NK 9300000 IBZ000	Carcinogen			30	0.038 PP	0.5 (29) HA	N/A	0.08
Iron §§ Fe § Ancor EN 80/150+A622 § Armco Iron	7439-89-6 NO 4565500 IGK800	Harmful (aquatic life)		1,000 NPP				N/A	20
Isophorone §§ § Isoforon § NCI C55618 § Isoacetophorone § alpha-Isophorone § 1,1,3-Trimethyl-3-Cyclohexene-5-One § 3,5,5-Trimethyl-2-Cyclohexene-1-One § 3,5,5-Trimethyl-2-Cyclohexone	78-59-1 GW 7700000 IHO000	Carcinogen			4.38	350 PP	400 HA	N/A	10
Lead §§ Pb § C.I. 77575 § C.I. Pigment Metal 4 § Glover § Lead Flake § Lead 22 § Omaha § Omaha & Grant § SI § SO	7439-92-1 OF 7525000 LCF000	Toxic	13.98 @ 25 mg/L hardness (12) PP	0.545 @ 25 mg/L hardness (12) PP	49	15 MCL	15 MCL	0.1	0.3

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
m-Xylene §§ § m-Xylol § 1,3-Xylene § meta-Xylene § m-Dimethylbenzene § m-Methyltolulene § 1.3-Dimethylbenzene § 1,3 Dimethyl Benzene	108-38-3 ZE 2275000 XHA000	Toxic			1.17	$1x10^4$ MCL	$1x10^4$ MCL	0.5	2
Malathion §§ § Formal § Sumitox § Emmatos § Celthion § Forthion § Malacide § Kop-Thion § Calmathion § Carbethoxy § NCI C00215 § Carbethoxy Malathion § SHA 057701 § Phosphothion § S-1,2-Bis(Ethoxycarbonyl)Ethyl-O,O-Dimethyl Thiophosphate § O, O-Dimethyl-S-(1,2-Dicarbethoxyethyl) Dithiophosphate § O,O-Dimethyl S-1,2-Di(Ethoxycarbamyl)Ethyl Phosphorodithioate § Succinic Acid, mercapto-, diethyl ester, S-Ester with O,O-Dimethyl Phosphorodithioate	121-75-5 WM 8400000 CBP000	Toxic		0.1 NPP		100 HA	100 HA		0.09
MCPA §§ 4-chloro-2 methylphenoxy acetic acid	94-74-6	Toxic				~~4~~ HA	~~4~~ HA		0.008

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
MCPP §§ 2-(4-chloro-2-methylphenoxy)propionic acid § Mecoprop § 2M 4KhP § 2M-4CP § Anicon B § Anicon P § CMPP § Caswell #559 § Celatox CMPP § iso-Cornox § Isocarnox § Kilprop § Liranox § Mechlorprop § Mecomec § Mecopar § Mecopeop § Mecoper § Mecopex § Mecoprop § Mecoturf § Mecprop § Mepro § Methoxone § Morogal § Okultin § Proponex-pluse § RD 4593 § Rankotex § Runcatex § SYS 67 Mecmin § U 46 KV fluid § Vi-Par § Vi-Pex § EPA pesticide Code #031501	7085-19-0 93-65-2	Toxic				300 HA	300 HA		0.007
Mercury §§ Hg § Colloidal Mercury § Mercury, Metallic § NCI C60399 § Quick Silver § RCRA Waste Number U151	7439-97-6 OV 4550000 MCW250	Toxic with BCF >300	1.7 PP	0.91 PP	5,500	0.05 PP	2 MCL		0.005
Metalaxyl § Ridomil §	57837-19-1	Toxic				600 HA	600 HA	3.5	0.04
Methamidophos §§ Monitor §	10265-92-6	Toxic				2 HA	2 HA		0.2
Methomyl §§ Lannate §	16752-77-5	Toxic				200 HA	200 HA	1	1

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Methoxychlor §§ § DMDT § Metox § Moxie § Methoxcide § NCI C00497 § Methoxy-DDT § Dimethoxy-DDT § 1,1,1-Trichloro-2,2-Bis(p-Methoxyphenyl)Ethane § Benzene, 1,1'-(2,2,2-Trichloroethylidene)Bis[4-Methoxy- § 1,1'-(2,2,2-Trichloroethylidene)Bis[4-Methoxybenzene] § Ethane, 1,1,1-Trichloro-2,2-Bis(p-Methoxyphenyl)- § RCRA Waste Number U247	72-43-5 KJ 3675000 DOB400	Toxic		0.03 NPP		40 MCL	40 MCL		0.02
Metsulfuron Methyl §§ Ally §	74223-64-6	Toxic				2,000 HA	2,000 HA	0.1	0.08
Methyl Bromide §§Bromomethane (HM) § EDCO § Celfume § Dowfume § Methogas § SHA 053201 § Brom-O-Sol § Brom-O-Gas § Terr-O-Gas § Halon 1001 § Terr-O-Cide § Bromo-O-Gas § Bromo Methane § Methylbromide § Methane, Bromo- § Monobromomethane § RCRA Waste Number U029	74-83-9 PA 4900000 BNM500	Toxic			3.75	47 PP	10 HA	0.11	1
Methyl Chloride §§ Chloromethane § Arctic § Monochloromethane § RCRA Waste Number U045	74-87-3 PA 6300000 CHX500	Toxic			3.75	30 HA	30 HA	0.08	1
Methylene chloride §§ Dichloromethane (HM) § R 30 § DCM § Freon 30 § Aerothene MM § NCI C50102 § Solmethine § Methane Dichloride § Methane, Dichloro- § 1,1-Dichloromethane § Methylene Bichloride § Methylene Dichloride	75-09-2 PA 8050000 MDR000	Carcinogen			0.9	5 MCL	5 MCL	N/A	2

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Metolachlor (includes the metabolites metolachlor ESA and metolachlor OA (34) §§ Dual §	51218-45-2	Carcinogen				700 HA	700 HA	N/A	0.2
Metribuzin §§ Sencor §	21087-64-9	Toxic				200 HA	200 HA	10	0.1
Mirex §§ § NCI C06428 § Dechlorane § Bichlorendo § Ferriamicide § Perchloropentacyclodecane § Dodecachloropentacyclodecane § Hexachlorocyclopentadiene Dimer § Cyclopentadiene, Hexachloro-, Dimer § Perchloropentacyclo(5.2.1.0[sup 2,6].0[sup 3,9].0[sup 5,8])Decane § Dodecachlorooctahydro-1,3,4-Metheno-2H-Cyclobuta (c,d)Pentalene § 1,3,4-Metheno-1H-Cyclobuta[cd]Pentalene, 1,1a,2,2,3,3a,4,5,5,5a,5b,6,-Dodecachlorooctahydro-	2385-85-5 PC 8225000 MQW500	Carcinogen		0.001 NPP		1 NPP	1 NPP	N/A	0.01
MTBE §§ Methyl Tertiary-Butyl Ether	1634-04-4	Harmful				30 (21)	30 (21)	N/A	1
Myclobutanil §§ § EPA PCC 128857 § Nova § Rally § Systhane § Systhane 12E § Systhane 6 Flo	88671-89-0	Toxic				200 HA	200 HA		0.03

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
N-Nitrosodimethylamine §§ Dimethylnitrosamine A707 § DMN § NDMA § DMNA § Nitrosodimethylamine § Dimethylnitrosoamine § N-Nitrosodimethylamine § N,N-Dimethylnitrosamine § Methylamine, N-Nitrosodi- § Dimethylamine, N-Nitroso- § N-Methyl-N-Nitrosomethanamine § Methamine, N-Methyl-N-Nitroso- § Methanamine, N-Methyl-N-Nitroso- § RCRA Waste Number P082	62-75-9 IQ 0525000 DSY400	Carcinogen			0.026	0.0069 PP	0.0069 PP	N/A	5
N-Nitrosodiphenylamine §§ § NDPA § NDPhA § Vultrol § Curetard A § NCI C02880 § Redax § TJP § Retarder J § Vulcalent A § Vulcatard § Vultrol § Nitrosodiphenylamine § Diphenylnitrosamine § N,N-Diphenylnitrosamine § N-Nitroso-N-Phenylaniline § Diphenylamine, N-Nitroso- § Benzenamine, N-Nitroso-N-Phenyl-	86-30-6 JJ 9800000 DWI000	Carcinogen			136	33 PP	33 PP	N/A	10
n-Dioctyl Phthalate §§ § DNOP § PX-138 § Vinicizer 85 § Dinopol NOP § n-Octyl Phthalate § Octyl Phthalate § Dioctyl Phthalate § Di-n-Octyl Phthalate § Di-sec-Octyl Phthalate § 1,2-Benzenedicarboxylic Acid, Dioctyl Ester § RCRA Waste Number U107	117-84-0 TI 1925000 DVL600	Carcinogen						N/A	10

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
N-Nitrosodi-N-Propylamine §§ § DPN § DPNA § NDPA § Dipropylnitrosamine § N-Nitrosodipropylamine § Di-n-Propylnitrosamine § Dipropylamine, N-Nitroso- § N-Nitrosodi-n-propylamine § N-Nitroso-di-n-propylamine § 1-Propanamine, N-Nitroso-n-Propyl- § RCRA Waste Number U111	621-64-7 JL 9700000 DWU600	Carcinogen			1.13	0.05 PP	0.05 PP	N/A	5
N-Nitrosopyrrolidine §§ § NPYR § NO-pyr § N-N-pyr § 1-Nitrosopyrrolidene § Pyrrolidine, 1-Nitroso- § Tetrahydro-N-Nitrosopyrrole § Pyrrole, Tetrahydro-N-Nitroso- § RCRA Waste Number U180	930-55-2 UY 1575000 NLP500	Carcinogen			0.055	0.16 NPP	0.16 NPP	N/A	0.02
Naphthalene §§ Moth Balls § Mighty 150 § NCI C52904 § Naphthene § White Tar§ Naphthalin § Tar Camphor § Caswell Number 587 § EPA Pesticide Chemical Code 055801 § RCRA Waste Number U165	91-20-3 QJ 0525000 NAJ500	Carcinogen			10.5	100 HA	100 HA	N/A	10
Nickel §§ Ni § C.I. 77775 § Ni 270 § Nickel 270 § Ni 0901-S § Ni 4303T § NP 2 § Raney Alloy § Raney Nickel	7440-02-0 QR 5950000 NCW500	Toxic	145@ 25mg/L hardness (12) PP	16.1 @ 25 mg/L hardness (12) PP	47	100 HA	100 HA	0.5	2
Nicosulfuron §§ Accent §	111991-09-4	Toxic				9,000 HA	9,000 HA	0.01	0.03

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Nitrate (as Nitrogen[N]) §§ NO3	14797-55-8	Toxic	(8)	(8)		$1x10^4$ NPP	$1x10^4$ NPP	surface water 5000, ground water, see ARM 17.30.715	20
Nitrate plus nitrite (as Nitrogen[N]) §§ NO3 + NO2	See nitrate and nitrite	Toxic	(8)	(8)		$1x10^4$ MCL	$1x10^4$ MCL	surface water 5000, ground water, see ARM 17.30.715	20
Nitrite (as Nitrogen[N]) §§ NO2	14797-65-0	Toxic	(8)	(8)		1,000 MCL	1,000 MCL	4	10
Nitrobenzene §§ § NCI C60082 § Mirbane Oil § Nitrobenzol § Oil of Mirbane § Benzene, Nitro- § Essence of Myrbane § RCRA Waste Number U169	98-95-3 DA 6475000 NEX000	Carcinogen			2.89	17 PP	17 PP	N/A	10
Nitrogen, total inorganic (as Nitrogen[N]) §§ the sum of ammonia, nitrite, and nitrate	See ammonia, nitrate and nitrite	Nutrient	(8)	(8)				10	10
Nitrophenol, 4- §§p-Nitropheno (DOT)l § 4-Hydroxynitrobenzene § NCI C55992) § RCRA Waste Number U170	100-02-7 SM 2275000 NIF000	Toxic			3.31	60 HA	60 HA	2.4	60
o-Nitrophenol §§ § 2-Nitrophenol oxynitrobenzene	88-75-5 SM 2100000 NIE500	Toxic			2.33			0.45	10
Nitrosamines §§ -Nitrosamide § -NSC223080	35576-91-1	Carcinogen				0.008 NPP	0.008 NPP	N/A	$8x10^{-4}$

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Nitrosodibutylamine, N §§ Dibutylnitrosamine § -1-Butanamine § BRN 1760378 § CCRIS 217 § EINECS 213-101-1 § HSDB 5107 § N-butyl-N-nitroso-1-butamine § NDBA § NSC 6830 § RCRA waste number U172	924-16-3	Carcinogen				0.063 NPP	0.063 NPP	N/A	3
Nitrosodiethylamine, N §§ Diethylnitrosamine § -BRN 1744991 § CCRIS 239 § DEN § EINECS 200-226-1 § Ethanamine, N-ethyl-N-nitroso § HSDB 4001 § NDEA § NSC 132 § RCRA waste number U174	55-18-5	Carcinogen				0.008 NPP	0.008 NPP	N/A	$8x10^{-4}$
Nonylphenol §§ § 2,6-Dimethyl-4-heptylphenol § Hydroxyl No. 253	25154-52-3	Toxic	28 NPP	6.6 NPP					0.7
o-Xylene §§ § o-Xylol § 1,2-Xylene § ortho-Xylene § o-Methyltoluene § o-Dimethylbenzene § 1,2-Dimethylbenzene § 1,2-Dimethyl Benzene	95-47-6 ZE 2450000 XHJ000	Toxic			1.17	$1x10^{4}$ MCL	$1x10^{4}$ MCL	0.5	1

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Oxamyl §§ § D-1410 § DPX 1410 § Insecticide-Nematicide 1410 § Vydate § Thioxamyl § Methyl 2-(Dimethylamino)-N- § Vydate L, Insecticide/Nematicide § ({[Methylamino]Carbonyl} Oxy)-2-Oxoethanimidothioate § 2-Dimethylamino-1-(Methylthio)Glyoxal O-Methylcarbamoylmonozime § Methyl N',N'-Dimethyl-N-({Methylcarbamoyl}Oxy)-1-Thiooxamimidate § N',N'-Dimethyl-N-[(Methylcarbamoyl)oxy]-1-Methylthiooxamimidic Acid	23135-22-0 RP 2300000 DSP600	Toxic				200 MCL	200 MCL	1	1
Oxydemeton Methyl §§ Metasystox R §	301-12-2	Toxic				0.7 HA	0.7 HA	1.4	0.07
Oxygen, dissolved (20) §§ O2 § Oxygen, Compressed § Oxygen, Refrigerated Liquid	7782-44-7 RS 2060000 OQW000	Toxic	(15)	(15)					0.3 mg/L

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
p,p'-Dichlorodiphenyldichloroethylene §§ DDE § DDE § p,p'-DDE § 4,4'-DDE § NCI C00555 § Dichlorodiphenyldichloroethylene § Dichlorodiphenyldichloroethylene, p,p'- § 2,2'-bis(4-Chlorophenyl)-1,1-Dichloroethylene § 1,1'-(Dichloroethenylidene)bis(4-Chlorobenzene) § 2,2'-bis(p-Chlorophenyl)-1,1-Dichloroethylene § Benzene, 1,1'-(DichloroethenylideneBis[4-Chloro-	72-55-9 KV 9450000 BIM750	Carcinogen			53,600	0.0022 PP	0.0022 PP	N/A	0.02
p,p'-Dichlorodiphenyldichloroethane §§ DDD § TDE § Dilene § NCI C00475 § Rothane § Rhothane § 4,4'-DDD § p,p'-DDD § p,p'-TDE § 4',4'-D-DDD § RCRA Waste Number U060 § Tetrachlorodiphenylethane § Dichlorodiphenyldichloroethane § Dichlorodiphenyl Dichloroethane § 2,2-bis (4-Chlorophenyl)-1,1-Dichloroethane § 1,1-Dichloro-2,2-bis(p-Chlorophenyl) Ethane § 1,1-bis(4-Chlorophenyl)-2,2-Dichloroethane § 2,2-bis(p-Chlorophenyl)-1,1-Dichloroethane § Benzene, 1,1'(2,2-Dichloroethylidene)Bis[4-Chloro-	72-54-8 KI 0700000 BIM500	Carcinogen			53,600	0.0031 PP	0.0031 PP	N/A	0.02

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
p,p'-Dichlorodiphenyltrichloroethane §§ DDT § DDT § 4,4'-DDT § Agritan § Anoflex § Arkotine § Azotox § Bosan Supra § Bovidermol § Chlorophenothan § Chlorophenothane § Chlorophenotoxum § Citox § Clofenotane § Dedelo § § Chlorophenothane § Diphenyltrichloroethane § Dichlorodiphenyltrichloroethane § 4,4'-Dichlorodiphenyltrichloroethane § 1,1,1-Trichloro-2,2,-bis(p-Chlorophenyl) Ethane § 1,1,1-Trichloro-2,2,-bis(p-Chlorophenyl)Ethane	50-29-3 KJ 3325000 DAD200	Carcinogen	0.5 PP	0.001 PP	53,600	0.0022 PP	0.0022 PP	N/A	0.02
p-Bromodiphenyl Ether §§ Benzene, 1-Bromo-4-Phenoxy- § p-Bromodiphenyl Ether § 4-Bromophenoxybenzene § 4-Bromodiphenyl Ether § 1-Bromo-4-Phenoxybenzene § p-Bromophenylphenyl Ether § 4-Bromophenyl Phenyl Ether	101-55-3	Toxic with BCF >300			1,640				10
p-Chloro-m-Cresol §§3-methyl-4-chlorophenol § PCMC § Parol § Aptal § Baktol § Baktolan § Ottafact § Raschit § Rasen-Anicon § Parmetol § Candasetpic § Chlorocresol § Preventol CMK § Parachlorometra Cresol § 4-Chloro-3-methylphenol § 2-Chloro-Hydroxytoluene § Phenol, 4-Chloro-3-methyl- § Chlorophenol, 4-, methyl, 3- § RCRA Waste Number U039	59-50-7 GO 7100000 CFE250	Harmful				3,000 OL	3,000 OL	N/A	10

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
p-Xylene §§ § p-Xylol § Chromar § Scintillar § 1,4-Xylene § para-Xylene § p-Methyltoluene § p-Dimethylbenzene § 1,4-Dimethylbenzene § 1,4-Dimethyl Benzene	106-42-3 ZE 2625000 XHS000	Toxic			1.17	$1x10^4$ MCL	$1x10^4$ MCL	0.5	2
Paraquat Dichloride §§	1910-42-5	Toxic				30 HA	30 HA	0.8	3
Parathion §§ § DNTP § Niran § Phoskil § Paradust § Stathion § Strathion § Pestox Plus § Nitrostigmine § Parathion Ethyl § Parathion-ethyl § Ethyl Parathion § Diethylparathion § Diethyl para-Nitrophenol Thiophosphate § Diethyl-p-Nitrophenyl Monothiophosphate § O,O-Diethyl O-4-Nitrophenyl Thiophosphate § Phosphorothioic Acid, O,O-Diethyl O-(4-Nitrophenyl) Ester § Caswell Number 637 § EPA Pesticide Chemical Code 057501 § RCRA Waste Number P089	56-38-2 TF 4920000,dry-liquid PAC250,dry	Carcinogen	0.065 NPP	0.013 NPP				N/A	0.2
Pentachlorobenzene §§ Benzene, Pentachloro- § QCB- § RCRA Waste Number U183	608-93-5 DA 6640000 PAV500	Toxic with BCF >300			2,125	1.4 NPP	1.4 NPP		5

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			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Pentachlorophenol §§ Penta § PCP § Durotox § Weedone § Chem-Tol § Lauxtol A § NCI C54933 § NCI C55378 § NCI C56655 § Permite § Dowcide 7 § Permacide § Penta-Kil§ Permagard § Penchlorol § Chlorophen § Pentachlorphenol § Pentaclorofenolo § Thompson's Wood Fix § Phenol, Pentachloro- § 2,3,4,5,6-Pentachlorophenol § 1-Hydroxy- 2,3,4,5,6-Pentachlorobenzene	87-86-5 SM 6300000 PAX250	Carcinogen	5.3 @ pH of 6.5 (14) PP	4 @ pH of 6.5 (14) PP	11	1 MCL	1 MCL	N/A	0.1
pH §§	N/A	Harmful	(13)	(13)		(18)	(18)	N/A	
Phenanthrene (PAH) §§ § Phenantrin	85-01-8 SF 7175000 PCW250	Toxic			30			0.01	0.2
Phenol §§ § Baker's P and S Liquid and Ointment § NCI C50124 § Benzenol § Monophenol § Oxybenzene § Phenic Acid § Carbolic Acid § Phenylic Acid § Hydroxybenzene § Hydroxybenzene § Phenyl Alcohol § Phenyl Hydrate § Phenylic Alcohol § Phenyl Hydroxide § Benzene, Hydroxy- § Monohydroxybenzene § RCRA Waste Number U188	108-95-2 SJ 3325000 PDN750	Toxic			1.4	300 OL	300 OL	100	10
Phosphorus, inorganic (20) §§ § Ortho-phosphorus § phosphorus, Ortho- § reactive phosphorus	14265-44-2 7723-14-0	Nutrient	(8)	(8)				1	1

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Picloram §§ Tordon § ATCP § K-Pin § Borolin § Amdon Grazon § NCI C00237 § Tordon 10K § Tordon 22K § Tordon 101 Mixture § 3,5,6-Trichloro-4-Aminopicolinic Acid § 4-Amino-3,5,6-Trichloropicolinic Acid	1918-02-1 TJ 7525000 AMU250	Toxic				500 MCL	500 MCL	0.14	1
Pinoxaden (NOA 407855) (includes metabolites Pinoxaden NOA 407854 and pinoxaden NOA 447204) (35) §§	N/A	Toxic				2,000 HA	2,000 HA		200
Polychlorinated Biphenyls, (sum of all homolog, all isomer, all congener or all Aroclor analyses) §§ PCB's § Aroclor 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1268, 2565, 4465 § Chlophen § Chlorextol § Chlorinated Biphenyl § Chlorinated Diphenyl § Chlorinated Diphenylene § Chloro Biphenyl § Chloro-1,1-Biphenyl § Clophen § Dykanol § Fenclor § Inerteen § Kanechlor 300, 400, 500 § Montar § Noflamol § PCB (DOT) § Phenochlor § Polychlorobiphenyl § Pyralene § Pyranol § Santotherm § Sovol § Therminol FR-1	Multiple	Carcinogen		0.014 PP	31,200	$6.4x10^{-4}$ PP	0.5 MCL	N/A	0.08
Primisulfuron Methyl §§ Beacon § Exceed	86209-51-0	Toxic				2,000 HA	2,000 HA	0.1	200
Prometon §§ Pramitol §	1610-18-0	Toxic				100 HA	100 HA	0.3	0.002

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Pronamide §§ Kerb §	23950-58-5	Carcinogen				50 HA	50 HA	N/A	5
Propachlor §§ Ramrod §	1918-16-7	Toxic				90 HA	90 HA	0.5	0.2
Propane, 1,2-Dibromo-3-Chloro- §§ Dibromochloropropane § 1,2-Dibromo-3-Chloropopane § Fumagon § Fumazone § NCI C00500 § Nemabrom § Nemafume § Nemagon § Nemagone § Nemagone Soil Fumigant § Nemanax § Nemapaz § Nemaset § Nematocide § Nematox § OS 1897 § OXY DBCP § SD 1897 § Caswell Number 287 § 1-Chloro-2,3-Dibromopropane § DBCP § EPA Pesticide Chemical Code 011301 § RCRA Waste Number U066	96-12-8 TX 8750000 DDL800	Toxic				0.2 MCL	0.2 MCL		0.02
Propazine §§	139-40-2	Carcinogen				10 HA	10 HA	N/A	0.03
Propham §§	122-42-9	Toxic				100 HA	100 HA	0.13	0.5
Propioconazole §§ 1-((2-(2,4-dichlorophenyl)-4propyl-1,3-dioxolan-2-yl)methyl)-1H-1,2,4-triazole § Banner § CGA-64250 § Caswell#323EE § Desmel § HSDB 6731 § Orbit § Radar § Tilt § EPA Pesticide # 122101	60207-90-1	Carcinogen				700 HA	700 HA	N/A	70
Propoxur §§ Baygon §	114-26-1	Carcinogen				3 HA	3 HA	N/A	0.4
Prosulfuron §§ Benezenesulfonamide, N(((4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino)carbonyl)-2-(3,3,3-trifluoropropyl)-	94125-34-5	Toxic				100 HA	100 HA		0.02

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Pyrasulfotole §§ pyrasulfotole §	365400-11-9	Toxic				70 HA	70 HA		0.07
Pyrene (PAH) §§ § ß-Pyrine § beta-Pyrene § Benzo(def)Phenanthrene § Benzo[def]Phenanthrene	129-00-0 UR 2450000 PON250	Toxic			30	830 PP	830 PP	0.25	10
Pyroxsulam	422556-08-9	Toxic				7,000 HA	7,000 HA		0.09
Radium 226 §§	13982-63-6	Carcinogen / Radioactive				5 picoC/ liter Note: The sum of Radium 226 and 228. MCL	5 picoC/ liter Note: The sum of Radium 226 and 228. MCL	N/A	
Radium 228 §§	15262-20-1	Carcinogen / Radioactive				5 picoC/ liter Note: The sum of Radium 226 and 228. MCL	5 picoC/ liter Note: The sum of Radium 226 and 228. MCL	N/A	
Radon 222 §§	14859-67-7	Carcinogen / Radioactive				300 picoC/ liter MCL	300 picoC/ liter MCL	N/A	

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Selenium §§ Se § C.I. 77805 § Colloidal Selenium § Elemental Selenium § Selenium Alloy § Selenium Base § Selenium Dust § Selenium Elemental § Selinium Homopolymer§ Selenium Metal Powder, Non-Pyrophoric § Vandex	7782-49-2 VS 7700000 and VS 8310000, colloidal SBO500 and SBP000, colloidal	Toxic	20 PP	5 PP	4.8	50 MCL	50 MCL	0.6	1
Silver §§ Ag § Argentum § C.I. 77820 § Shell Silver § Silver Atom	7440-22-4 NIOSH: VW 3500000 SAX: SDI500	Toxic	0.374 @ 25 mg/L hardness (12) PP		0.5	100 HA	100 HA	0.2	0.2
Simazine §§ § CDT § Herbex § Framed § Bitemol § Radokor § A 2079 § Batazina § Cat (Herbicide) § CET § G 27692 § Geigy 27,692 § Gesaran § Gesatop 50 § Simazine 80W § Symazine § Taphazine § W 6658 § Zeapur § Princep § Aquazine § Herbazin § Tafazine § 2,4-bis(Ethylamino)-6-Chloro-s-Triazine § 1-Chloro, 3,5-Bisethylamino-2,4,6-Triazine § 2-Chloro-4,6-Bis(Ethylamino)-1,3,5-Triazine § 6-Chloro-N,N'-Diethyl-1,3,5-Triazine-2,4-Diyldiamine	122-34-9 XY 5250000 BJP000	Carcinogen				4 MCL	4 MCL	N/A	0.5
Strontium §§	7447-24-6	Toxic				4,000 HA	4,000 HA	100	20

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Styrene §§ § Styrol § Cinnamol § Cinnamene § Cinnamenol § NCI C02200 § Styrole § Strolene § Styron § Stropor § Vinylbenzol § Phenethylene § Phenylethene § Vinylbenzene § Ethenylbenzene § Phenylethylene § Benzene, Vinyl- § Stryene, Monomer	100-42-5 WL 3675000 SMQ000	Carcinogen				100 HA	100 HA	N/A	0.9
Sulfometuron Methyl §§ Oust §	74222-97-2	Toxic				2,000 HA	2,000 HA	0.01	0.02
Sulfosulfuron §§ imidazo(1,2-a)pyridine-3-sulfonamide,N-(((4,6-dimethoxy-2-pyrimidinyl)amino)cabonyl)-2-(ethylsulfonyl)- § Sulfosulfuron (ISO)	141776-32-1	Toxic				300 HA	300 HA		30
Tebuconazole §§ 1H-1,2,4-Triazole-1-ethanol,alpha-(2-(4-chlorophenyl)ethyl)-apha-(1,1-dimethylethyl)- § BAY-HWG 1608 § Elite § Ethyltrianol § Etiltrianol § Fenetrazole § Folicur § LYNX § Preventol A 8 § Raxil § Terbucanazole § Terbutrazole § HWG 1608 § HSDB 7448	107534-96-3	Carcinogen				200 HA	200 HA	N/A	0.04
Tebuthiuron §§ TebuconazoleSpike	34014-18-1	Toxic				500 HA	500 HA	2	0.002
Temperature §§	N/A	Harmful	(13)	(13)				N/A	
Terbacil §§ Sinbar §	5902-51-1	Toxic				90 HA	90 HA	2.2	0.02
Terbufos §§ Counter §	13071-79-9	Toxic				0.9 HA	0.9 HA	0.5	0.07

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Tetrachlorobenzene, 1,2,4,5- §§ Benzene, 1,2,4,5-Tetrachloro- § RCRA Waste Number U207 § 1,2,4,5-Tetrachlorobenzene	95-94-3 DB 9450000 TBN750	Toxic with BCF >300			1,125	0.97 NPP	0.97 NPP		5
Tetrachloroethane, 1,1,2,2- §§ Tetrachloroethane § TCE § Cellon § Westron § Bonoform § sym-Tetrachloroethane § Acetylene Tetrachloride § 1,1,2,2-Tetrachloroethane § Ethane, 1,1,2,2-Tetrachloro- § 1,1-Dichloro-2,2-Dichloroethane § RCRA Waste Number U209	79-34-5 NIOSH: KI 8575000 SAX: ACK500	Carcinogen			5	1.7 PP	2.0 HA	N/A	0.5
Tetrachloroethylene §§ Perchlorethylene § NCI C04580 § PCE § Perk § PERC § ENMA § Dow-Per § Perchlor § Perclene § Perklone § Didakene § Tetra Cap § Percosolve § Perchloroethylene § Tetrachloroethene § Carbon Bichloride § Carbon Dichloride § Ethylene Tetrachloride § Ethylene, Tetrachloro- § 1,1,2,2-Tetrachloroethylene § RCRA Waste Number U210	127-18-4 KX 3850000 TBQ250	Carcinogen			30.6	5 MCL	5 MCL	N/A	0.7
Thallium §§ Tl § Ramor	7440-28-0 XG 3425000 TEI000	Toxic			119	0.24 PP	2 MCL	0.3	0.2
Thifensulfuron Methyl §§ § Pinnacle	79277-27-3	Toxic				910 HA	910 HA	1	90

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Toluene §§ § Antisal 1a § NCI C07272 § Toluol § Tolu-Sol § Methacide § Methylbenzol § Methylbenzene § Phenylmethane § Phenyl-Methane § Methyl-Benzene § Benzene, Methyl § RCRA Waste Number U220	108-88-3 XS 5250000 TGK750	Toxic			10.7	1,000 MCL	1,000 MCL	0.01	1
Toxaphene §§ § Attac 4-2 § Alltox § Alltex § Attac 6 § Toxakil § Agricide § Chem-Phene § Clor Chem T-590 § Compound 3956 § Crestoxo § Estonox § Geniphene § Gy-Phene § Hercules 3956 § Melipax § Motox § PCC § Phenacide § Toxaphene mixture § Chlorinated-Camphene § Camphene, Octachloro- § RCRA Waste Number P123	8001-35-2 XW 5250000 THH750	Carcinogen	0.73 PP	0.0002 PP	13,100	0.0028 PP	0.3 HA	N/A	1
Tralkoxydim (28) §§ Achieve	87820-88-0	Carcinogen	3,750			20 HA	20 HA	N/A	2
trans-1,2-Dichloroethylene §§ § trans-Dichloroethylene § RCRA Waste Number U079 § trans-1,2-Dichloroethane § trans-1,2-Dichloroethene § Dichloroethylene, trans-§ trans-Acetylene Dichloride § 1,2-trans-Dichloroethylene § Ethene, 1,2-Dichloro-, (E)- § 1,2-Dichloroethylene, trans-	156-60-5 KV 9400000 DFI600	Toxic			1.58	100 MCL	100 MCL	0.05	0.6

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
trans-1,3-Dichloropropene §§ Telone II § 1,3-Dichloropropene § 1,3-Dichloropropylene § (E)-1,3-Dichloropropene § trans-1,3-Dichloropropylene § 1-Propene, 1,3-Dichloro-, (E)-	10061-02-6 UC 8320000 DGH000	Carcinogen			1.91	2 HA	2 HA	N/A	0.3
trans-Nonachlor (Chlordane component) §§ § Chlordane, trans-Isomer	39765-80-5	Carcinogen			14,100	0.008 PP	1 HA	N/A	0.1
Triallate §§ § Avadex BW § BRN 1875853 § Dipthal § Far-Go § Triamyl	2303-17-5	Carcinogen				5 HA	5 HA	N/A	5
Triasulfuron §§ Amber	82097-50-5	Toxic				70 HA	70 HA	1	0.03
Tribenuron Methyl §§ Express	101200-48-0	Carcinogen				60 HA	60 HA	N/A	6
Tributyltin (TBT) §§ §Tin-San § Tributylin chloride complex § EPA Pesticide Chemical #083108	56573-85-4	Toxic	0.46 NPP	0.072 NPP					0.007
Trichlorobenzene, 1,2,4- §§ Benzene, 1,2,4-Trichloro- § unsym-Trichlorobenzene § 1,2,4-Trichlorobenzene	120-82-1 DC 2100000 TIK250	Toxic			114	35 PP	70 MCL	0.02	10
Trichloroethane, 1,1,2- §§ Vinyl Trichloride § 1,1,2-Trichloroethane § ß-T § Ethane Trichloride § beta-Trichloroethane § NCI C04579 § Ethane, 1,1,2-Trichloro- § Caswell Number 875A [NLM] § EPA Pesticide Chemical Code 081203 [NLM]§ 1,2,2-Trichloroethane § RCRA Waste Number U227	79-00-5 KJ 3150000 TIN000	Carcinogen			4.5	3 HA	3 HA	N/A	0.7

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Trichloroethane, 1,1,1- §§ Methyl Chloroform § -T § Strobane § Inhibisol § 1,1,1-TCE § Tri-Ethane § Solvent 111 § Aerothene TT § Chloroethene § Chlorten § NCI C04626 § Methylchloroform § Chloroform, Methyl- § 1,1,1-Trichloroethene § alpha-Trichloroethane § Methyltrichloromethane § 1,1,1-Trichloroethane § Ethane, 1,1,1-Trichloro-§ RCRA WAste Number U226	71-55-6 KJ 2975000 TIM750	Toxic			5.6	200 MCL	200 MCL	0.5	0.7
Trichloroethylene §§ § TCE § Triad § Vitran § Algylen § Dow-Tri § Lanadin § Vestrol § Anamenth § Benzinol § Tri-Plus § Tri-Clene § Trichlorethene § Trichloroethene § Trichloroethane § Trichlorethylene § Ethene, Trichloro- § Ethylene Trichloride § Ethylene, Trichloro- § Acetylene Trichloride § 1,1,2-Trichloroethylene § 1,2,2-Trichloroethylene § 1-Chloro-2,2-Dichloroethylene § 1, 1-Dichloro-2-Chloroethylene	79-01-6 KX 4550000 TIO750	Carcinogen			10.6	5 MCL	5 MCL	N/A	0.5

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Trichlorofluoromethane (HM) §§ Freon 11 § F 11 § FC 11 § Arcton 9 § Eskimon 11 § Halocarbon 11 § Algofrene Type 1 § Fluorocarbon Number 11 § NCI C04637 § Isotron 11 § Fluorotrichloromethane § Isceon 131 § Monofluorotrichloromethane § Ucon Refrigerant 11 § Trichloromonofluoromethane § RCRA Waste Number U121	75-69-4 PB 6125000 TIP500	Toxic			3.75	$1x10^4$ HA	$1x10^4$ HA	0.07	0.8
Trichlorophenol, 2,4,5- §§ Dowcide B § 2,4,5-Trichlorophenol § Nurelle § Dowcide 2 § Collunosol § Preventol 1 § NCI C61187 § RCRA Waste Number U230	95-95-4 SN 1400000 TIV750	Toxic			110	1,800 NPP	1,800 NPP	10	60
Trichlorophenol, 2,4,6- §§ Phenachlor § Omal § Phenol, 2,4,6-trichloro- § NCI C02904 § 2,4,6-Trichlorophenol § Dowcide 2S § RCRA Waste Number U231	88-06-2 SN 1575000 TIW000	Carcinogen			150	14 PP	30 HA	N/A	10

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Trichlorophenoxy Proprionic Acid, 2 (2,4,5-) §§ Fenoprop § 2 (2,4,5-Trichlorophenoxy) Proprionic Acid § Kuran § Propon § Silvex § Aqua-Vex § Ded-Weed § Sta-Fast § 2,4,5-TP § Color-Set § Weed-B-Gon § Double Strength § 2,4,5-Trichlorophenoxypropionic Acid § (2,4,5-Trichlorophenoxy)Propionic Acid § 2-(2,4,5-Trichlorophenoxy)-Proprionic Acid § (+/-)-2-(2,4,5-Trichlorophenoxy)propanoic Acid § RCRA Waste Number U233	93-72-1 UF 8225000 TIX500	Toxic				10 NPP	50 MCL	0.075	0.2
Trichlorophenoxyacetic Acid §§ Brush-Rhap § 2,4,5-T (Brush-Rhap)	93-76-5	Toxic				70 HA	70 HA		0.2
Triclopyr §§ 3,4,5-Trichloro-2pyridinyloxyacetic acid § Confront § Dowco 233 § Garlon § Garlon 2 § Garlon 250 § Grazon 250 § Redeem § Release § Turflon § Caswell# 8821 § HSDB 7060 § EPA Pesticide Chemical #116001	55335-06-3	Toxic				400 HA	400 HA		0.5
Trifluralin §§ Treflan § Buckle	1582-09-8	Carcinogen				5 HA	5 HA	N/A	0.5
Trihalomethanes, total §§ § TTHMs	Multiple	Carcinogen				100 MCL	100 MCL	N/A	3
Triticonazole §§	131983-72-7	Toxic				1,000 HA	1,000 HA		0.1
Turbidity (20) §§	N/A	Harmful	(13)	(13)				N/A	1 NTU

Pollutant Element / Chemical Compound or Condition §§ - Primary Synonym § - Other Names	CASRN numbers, NIOSH number, SAX Number (25) (26) (27)	Category (1) (2)	Aquatic Life Standards		Bio-concentration Factor (BCF) (5)	Human Health Standards (17) (16)		Trigger Value (22)	Required Reporting Value (19)
			Acute (3)	Chronic (4)		Surface Water	Ground Water		
Uranium, natural §§ U § Uranium Metal, Pyrophoric	7440-61-1 YR 3490000 UNS000	Carcinogen / Radioactive				30 MCL	30 MCL	N/A	0.2
Vinyl 2-Chloroethyl Ether §§ Vinyl ß-Chloroethyl Ether- § 2-Chloroethyl Vinyl Ether § (2-Chloroethoxy)Ethene § RCRA Waste Number U042	110-75-8 KN 6300000 CHI250	Carcinogen			0.557			N/A	2
Vinyl Chloride §§ § VC § VCM § Chlorethene § Chloroethene § Chlorethylene § Chloroethylene § Ethylene, Chloro- § Monochloroethylene § Ethylene Monochloride § Vinyl Chloride Monomer § Vinyl C Monomer § Trovidur § RCRA Waste Number U043	75-01-4 KU 9625000 VNP000	Carcinogen			1.17	0.25 PP	0.2 HA	N/A	0.4
Xylenes §§ § Xylol § Violet 3 § Mixed Xylenes § Methyl Toluene § Dimethylbenzene § NCI C55232 § Total equals the sum of meta, ortho, and para. § RCRA Waste Number U239	1330-20-7 ZE 2100000 XGS000	Toxic			1.17	$1x10^4$ MCL	$1x10^4$ MCL	0.5	3
Zinc §§ Zn § Blue Powder § C.I. 77945 § C.I. Pigment Black 16 § C.I. Pigment Metal 6 § Emanay Zinc Dust § Granular Zinc § Jasad § Merrillite § Pasco § Zinc, Powder or Dust, non-Pyrophoric § Zinc, Powder or Dust, Pyrophoric	7440-66-6 ZG 8600000 ZBJ000	Toxic	37 @ 25 mg/L hardness (12) PP	37 @ 25 mg/L hardness (12) PP	47	2,000 HA	2,000 HA	5	8

FOOTNOTES

(1) Based on EPA's Integrated Risk Information System (IRIS) categories and includes parameters determined to be toxic (toxin) or carcinogenic (carcinogen). Harmful parameters are not defined by IRIS but are used in DEQ-7 and include biological agents (such as E. coli), those parameters which are detrimental to aesthetics (such as color), parameters that cause taste and/or odor effects (such as MTBE), or parameters that generate physical effects (such as iron).

(2) Chemicals classified by EPA as carcinogens for an oral route of exposure in the drinking water regulations and health advisories (EPA 822-B-96-002 and EPA 820-R-11-002) and those listed as carcinogens in the EPA priority pollutants list. In 2005, the EPA added a new scale to describe carcinogens and both the 1986 and 2005 scales are now in simultaneous use. The classifications considered carcinogenic in the 1986 scale are as follows: A (human carcinogen); B1 or B2 (probable human carcinogens); and C (possible human carcinogen). In the 2005 scale, the following categories are considered carcinogens: H (human carcinogen); L (likely carcinogen); L/N (likely to be carcinogenic above a specified dose) and S (suggestive evidence of carcinogenic potential).

(3) The one-hour average concentration of these parameters in surface waters may not exceed these values more than once in any three year period, on average, with the exception of silver, which, at present, is interpreted as a “not to exceed” value.

(4) The 96 hour average concentration of these parameters in surface waters may not exceed these values more than once in any three year period, on average.

(5) All bioconcentration factors (BCFs) were developed by the EPA as part of the Standards development as mandated by Section 304(a) of the federal Clean Water Act. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix (EPA-822-R-02-012).

(6) The 24 hour geometric mean value must not exceed these values.

(7) Freshwater Aquatic Life Standards for total ammonia nitrogen (µg/L NH_3-N plus NH_4-N).

Because these formulas are non-linear in pH and temperature, the Standard is the average of separate evaluations of the formulas reflective of the fluctuations of pH and temperature within the averaging period; it is not appropriate to apply the formula to average pH and temperature.

1. The one-hour average concentration of total ammonia nitrogen (in µg/L) does not exceed the CMC (acute criterion) calculated using the following equations.

Where salmonid fish are present:

$$\mathbf{CMC} = \frac{0.275}{1 + 10^{7.204 - pH}} + \frac{39.0}{1 + 10^{pH - 7.204}}$$

Or where salmonid fish are not present:

$$\mathbf{CMC} = \frac{0.411}{1 + 10^{7.204 - pH}} + \frac{58.4}{1 + 10^{pH - 7.204}}$$

2. The thirty-day average concentration of total ammonia nitrogen (in µg/L) does not exceed the CCC (chronic criterion) calculated using the following equations.

When fish early life stages[1] are present:

$$CCC = \left(\frac{0.0577}{1 + 10^{7.688 - pH}} + \frac{2.487}{1 + 10^{pH - 7.688}} \right) \times MIN\left(2.85, 1.45 \times 10^{0.028 \times (25 - T)}\right)$$

When fish early life stages[1] are absent:

$$CCC = \left(\frac{0.0577}{1 + 10^{7.688 - pH}} + \frac{2.487}{1 + 10^{pH - 7.688}} \right) \times 1.45 \times 10^{0.028 \times (25 - MAX(T,7))}$$

[1] Includes all embryonic and larval stages and all juvenile forms of fish to 30-days following hatching.

3. In addition, the highest four-day average within the 30-day period should not exceed 2.5 times the CCC.

Table 1. pH-Dependent Values of the CMC (Acute Criterion) Ammonia Standard.

CMC, total ammonia nitrogen (µg/L NH_3-N plus NH_4-N)		
pH	**Salmonids Present**	**Salmonids Absent**
6.5	32600	48800
6.6	31300	46800
6.7	29800	44600
6.8	28100	42000
6.9	26200	39100
7.0	24100	36100
7.1	22000	32800
7.2	19700	29500
7.3	17500	26200
7.4	15400	23000
7.5	13300	19900
7.6	11400	17000
7.7	9650	14400
7.8	8110	12100
7.9	6770	10100
8.0	5620	8400
8.1	4640	6950
8.2	3830	5720
8.3	3150	4710
8.4	2590	3880
8.5	2140	3200
8.6	1770	2650
8.7	1470	2200
8.8	1230	1840
8.9	1040	1560
9.0	885	1320

Table 2. Temperature and pH-Dependent Values of the CCC (Chronic Criterion) for *Fish Early Life Stages Present* and for *Fish Early Life Stages Absent*.

CCC for Fish Early Life Stages Present, total ammonia nitrogen (µg/L NH_3-N plus NH_4-N)										
pH	**Temperature, °C**									
	0	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	6670	6670	6060	5333	4680	4120	3620	3180	2800	2460
6.6	6570	6570	5970	5250	4610	4050	3560	3130	2750	2420
6.7	6440	6440	5860	5150	4520	3980	3500	3070	2700	2370
6.8	6290	6290	5720	5030	4420	3890	3420	3000	2640	2320
6.9	6120	6120	5560	4890	4300	3780	3320	2920	2570	2250
7.0	5910	5910	5370	4720	4150	3650	3210	2820	2480	2180
7.1	5670	5670	5150	4530	3980	3500	3080	2700	2380	2090
7.2	5390	5390	4900	4310	3780	3330	2920	2570	2260	1990
7.3	5080	5080	4610	4060	3570	3130	2760	2420	2130	1870
7.4	4730	4730	4300	3780	3320	2920	2570	2260	1980	1740
7.5	4360	4360	3970	3490	3060	2690	2370	2080	1830	1610
7.6	3980	3980	3610	3180	2790	2450	2160	1900	1670	1470
7.7	3580	3580	3250	2860	2510	2210	1940	1710	1500	1320
7.8	3180	3180	2890	2540	2230	1960	1730	1530	1330	1170
7.9	2800	2800	2540	2240	1960	1730	1520	1330	1170	1030
8.0	2430	2430	2210	1940	1710	1500	1320	1160	1020	897
8.1	2101	2101	1910	1680	1470	1290	1140	1000	879	773
8.2	1790	1790	1630	1430	1260	1110	973	855	752	661
8.3	1520	1520	1390	1220	1070	941	827	727	639	562
8.4	1290	1290	1170	1030	906	796	700	615	541	475
8.5	1090	1090	990	870	765	672	591	520	457	401
8.6	920	920	836	735	646	568	499	439	386	339
8.7	788	788	707	622	547	480	422	371	326	287
8.8	661	661	601	528	464	408	359	315	277	244
8.9	565	565	513	451	397	349	306	269	237	208
9.0	486	486	442	389	342	300	264	232	204	179

*At 15 C and above, the criterion for fish *ELS absent* is the same as the criterion for fish *ELS present*

(8) A plant nutrient, excessive amounts of which may cause violations of Administrative Rules of Montana (ARM) 17.30.637 (1)(e).

(9) Approved methods of sample preservation, collection, and analysis for determining compliance with the standards set forth in DEQ-7 are found in the surface water quality standards (ARM17.30.601, et seq.) and the ground water rules (ARM 17.30.1001, et seq.).

Standards for metals (except aluminum) in surface water are based upon the analysis of samples following a "total recoverable" digestion procedure (EPA Method 200.2, Supplement I, Rev. 2.8, May, 1994).

Standards for alpha emitters, beta emitters and gamma emitters in surface waters are based upon the analysis of unfiltered samples and appropriate EPA approved analysis methods.

Standards for metals in ground water are based upon the dissolved portion of the sample (after filtration through a 0.45 µm membrane filter, as specified in "Methods for Analysis of Water and Wastes" 1983, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, EPA-600/4-79-020, or equivalent). Standards for alpha emitters, beta emitters and gamma emitters in ground water are based upon the analysis of filtered samples and appropriate EPA approved analysis methods.

Standard for organic parameters in surface water and ground water are based on unfiltered samples.

(10) Calculation of an equivalent concentration of 2,3,7,8-TCDD is to be based on congeners of CDDs/CDFs and the toxicity equivalency factors (TEF) in van den Berg, M: et al. (2006) The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences 93(2):223-241. The analysis method to be used is EPA Method 1613, Revision B, Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS), EPA Method 8290, or other method approved by the department on case by case basis. The Required Reporting Value(s) (RRV) for Dioxin and congeners are to be the lowest detection level for the analysis method approved by the Department.

(11) Radionuclides consisting of alpha emitters, beta emitters and gamma emitters are classified as carcinogens. “Alpha emitters” means the total radioactivity due to alpha particle emission. “Beta emitters” means the total radioactivity due to beta particle emission. “Gamma emitters” means the total radioactivity due to gamma particle emission. The emitters covered under this Standard include but are not limited to: Cesium, radioactive Iodine, radioactive Strontium-89 and -90, radioactive Tritium Gamma photon emitters.

(12) Freshwater Aquatic Life Standards for these metals are expressed as a function of total hardness (mg/L, CaCO3). The values displayed in the chart correspond to a total hardness of 25 mg/L. The hardness relationships are:

	Acute = exp.{ma[ln(hardness)]+ba}			**Chronic = exp.{mc[ln(hardness)]+bc}**	
	ma	**ba**		**mc**	**Bc**
Cadmium	1.0166	-3.924		0.7409	-4.719
Copper	0.9422	-1.700		0.8545	-1.702
Chromium (III)	0.819	3.7256		0.819	0.6848
Lead	1.273	-1.46		1.273	-4.705
Nickel	0.846	2.255		0.846	0.0584
Silver	1.72	-6.52			
Zinc	0.8473	0.884		0.8473	0.884

Note: If the hardness is <25mg/L as CaCO3, the number 25 must be used in the calculation. If the hardness is greater than or equal to 400 mg/L as CaCO3, 400 mg/L must be used in the calculation.

(13) This standard is based upon Water-Use Classifications. See Administrative Rules of Montana (ARM), title 17, Chapter 30 - Water Quality, Sub-Chapter 6 - Surface Water Quality Standards.

(14) Freshwater Aquatic Life Standard for pentachlorophenol is dependent on pH. Values displayed in the chart correspond to a pH of 6.5 and are calculated as follows:

Acute = exp[1.005(pH) - 4.869] Chronic = exp[1.005(pH) - 5.134]

(15) Freshwater Aquatic Life Standards for dissolved oxygen in milligrams per liter are as follows:

	Standards for Waters Classified A-1, B-1, B-2, C-1, and C-2		**Standards for Waters Classified B-3, C-3, and I**	
	Early Life Stages[1,2]	**Other Life Stages**	**Early Life Stages[2]**	**Other Life Stages**
30 Day Mean	N/A[3]	6.5	N/A[3]	5.5
7 Day Mean	9.5 (6.5)	N/A[3]	6.0	N/A[3]
7 Day Mean Minimum	N/A[3]	5.0	N/A[3]	4.0
1 Day Minimum[4]	8.0 (5.0)	4.0	5.0	3.0

[1] These are water column concentrations recommended to achieve the required inter-gravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the figures in parentheses apply.
[2] Includes all embryonic and larval stages and all juvenile forms of fish to 30-days following hatching.
[3] N/A (Not Applicable).
[4] All minima should be considered as instantaneous concentrations to be achieved at all times.

(16) Surface or groundwater concentrations may not exceed these values.

(17) Source of the criteria used to derive the standard:
PP = priority pollutant criteria
NPP = non-priority pollutant criteria
OL= organoleptic pollutant criteria
MCL = Maximum contaminant level from the drinking water regulations
HA = health advisory developed from EPA's "Drinking Water Standards and Health Advisories" (October 1996) guidance, using recent scientific evidence and verified by EPA Region VIII toxicologist

(18) The Narrative Standards are located in the Administrative Rules of Montana (ARM) 17.30.601 et seq. and ARM 17.30.1001 et seq.

(19) The required reporting value (RRV) is the Department's selection of a laboratory reporting limit that is sufficiently sensitive to meet the most stringent numeric water quality standard. The RRV shall be used when reporting surface water or ground water monitoring or compliance data to the Department unless otherwise specified by the Department in a permit, approval or authorization issued by the Department. It is the responsibility of the sampling entity to ensure that appropriate methods and reporting limits are requested from the laboratory to meet analytical and reporting limit needs.

(20) Applicable to surface waters only.

(21) Based on taste and odor thresholds given in EPA 822-f-97-008 December 1997.

(22) Trigger Values are used to determine if a given increase in the concentration of toxic parameters is significant or non-significant as per the non-degradation rules ARM 17.30.701 et seq. The acronym "N/A" means "not applicable".

(23) Reserved

(24) Reserved

(25) CASRN is an acronym for the American Chemical Society's Chemical Abstracts Service Registry Number.

(26) The NIOSH RTECS number is a unique number used for identification in the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances.

(27) SAX number, in the format AAA123, is a unique number for identification of materials in the Dangerous Properties of Industrial Materials, authors N. Irving Sax and Richard J. Lewis, publisher Van Nostrand Reinhold.

(28) The sum of the concentrations of tralkoxydim and its breakdown products shall not exceed the standards listed. For a list of known breakdown products, see EPA memorandum "EFED's Section 3 Review for Tralkoxydim (Chemical #121000; Case # 060780; DP Barcodes 0234682, 0234752, 0238697, 0235723 & 0239519)," and the associated "Environmental Fate Assessment for Tralkoxydim."

(29) Ground water human health standard is based on the relative potency for selected PAH compounds listed in Table 8 of the EPA “Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons” July 1993, EPA/600/R-93/089.

(30) The sum of the concentrations of acetochlor and the breakdown products, acetochlor ESA and acetochlor OA, shall not exceed the standards listed.

(31) The sum of the concentrations of alachlor and the breakdown products, alachlor ESA and alachlor OA, shall not exceed the standards listed.

(32) The sum of the concentrations of atrazine and the breakdown products, deethyl atrazine, deisopropyl atrazine, and deethyl deisopropyl atrazine, shall not exceed the standards listed.

(33) The sum of the concentrations of imazamethabenz-methyl ester and the breakdown product, imazamethabenz-methyl acid, shall not exceed the standards listed.

(34) The sum of the concentrations of metolachlor and the breakdown products, metolachlor ESA and metolachlor OA, shall not exceed the standards listed.

(35) The sum of the concentrations of pinoxaden (NOA 407855) and the breakdown products, pinoxaden NOA 407854 and pinoxaden NOA 447204, shall not exceed the standards listed.

(36) The human health criteria for arsenic is the more restrictive of the risk based level of 1 in 1000 [$1x10^{-3}$], or the MCL.

(37) The quantitative combination of two or more of Aldicarb, Aldicarb sulfone and Aldicarb sulfoxide shall not exceed 7 µg/L because each has a similar mode of action.

(38) The quantitative sum of all listed Haloacetic acids is used in determining the total Haloacetic acid concentration.

(39) The sum of the concentrations of Endosulfan and its isomers Endosulfan I and Endosulfan II shall not exceed the standards listed.

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
8.7E-03	I			4.0E-03	I					1	0.1		Acephate	30560-19-1	2.5E+01	n	2.6E+02	c**					8.0E+00	n		1.8E-03	n	
		2.2E-06	I			9.0E-03	I	V		1		1.1E+05	Acetaldehyde	75-07-0	8.2E+00	n	3.4E+01	n	9.4E-01	n	3.9E+00	n	1.9E+00	n		3.8E-04	n	
				2.0E-02	I					1	0.1		Acetochlor	34256-82-1	1.3E+02	n	1.6E+03	n					3.5E+01	n		2.8E-02	n	
				9.0E-01	I	3.1E+01	A	V		1		1.1E+05	Acetone	67-64-1	6.1E+03	n	6.7E+04	n	3.2E+03	n	1.4E+04	n	1.4E+03	n		2.9E-01	n	
						2.0E-03	X			1	0.1		Acetone Cyanohydrin	75-86-5	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n					
						6.0E-02	I	V		1		1.3E+05	Acetonitrile	75-05-8	8.1E+01	n	3.4E+02	n	6.3E+00	n	2.6E+01	n	1.3E+01	n		2.6E-03	n	
				1.0E-01	I			V		1		2.5E+03	Acetophenone	98-86-2	7.8E+02	n	1.2E+04	ns					1.9E+02	n		5.8E-02	n	
3.8E+00	C	1.3E-03	C							1	0.1		Acetylaminofluorene, 2-	53-96-3	1.4E-01	c	6.0E-01	c	2.2E-03	c	9.4E-03	c	1.6E-02	c		7.2E-05	c	
				5.0E-04	I	2.0E-05	I	V		1		2.3E+04	Acrolein	107-02-8	1.4E-02	n	6.0E-02	n	2.1E-03	n	8.8E-03	n	4.2E-03	n		8.4E-07	n	
5.0E-01	I	1.0E-04	I	2.0E-03	I	6.0E-03	I		M	1	0.1		Acrylamide	79-06-1	2.4E-01	c*	4.6E+00	c*	1.0E-02	c*	1.2E-01	c*	5.0E-02	c*		1.1E-05	c*	
				5.0E-01	I	1.0E-03	I	V		1		1.1E+05	Acrylic Acid	79-10-7	9.9E+00	n	4.2E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n	
5.4E-01	I	6.8E-05	I	4.0E-02	A	2.0E-03	I	V		1		1.1E+04	Acrylonitrile	107-13-1	2.5E-01	c**	1.1E+00	c**	4.1E-02	c**	1.8E-01	c**	5.2E-02	c**		1.1E-05	c**	
						6.0E-03	P			1	0.1		Adiponitrile	111-69-3	8.5E+05	nm	3.6E+06	nm	6.3E-01	n	2.6E+00	n					
5.6E-02	C			1.0E-02	I					1	0.1		Alachlor	15972-60-8	9.7E+00	c**	4.1E+01	c*					1.1E+00	c*	2.0E+00	8.7E-04	c*	1.6E-03
				1.0E-03	I					1	0.1		Aldicarb	116-06-3	6.3E+00	n	8.2E+01	n					2.0E+00	n	3.0E+00	4.9E-04	n	7.5E-04
				1.0E-03	I					1	0.1		Aldicarb Sulfone	1646-88-4	6.3E+00	n	8.2E+01	n					2.0E+00	n	2.0E+00	4.4E-04	n	4.4E-04
										1	0.1		Aldicarb sulfoxide	1646-87-3											4.0E+00			8.8E-04
1.7E+01	I	4.9E-03	I	3.0E-05	I			V		1			Aldrin	309-00-2	3.9E-02	c**	1.8E-01	c*	5.7E-04	c	2.5E-03	c	9.2E-04	c*		1.5E-04	c*	
				5.0E-03	I	1.0E-04	X	V		1		1.1E+05	Allyl Alcohol	107-18-6	3.5E-01	n	1.5E+00	n	1.0E-02	n	4.4E-02	n	2.1E-02	n		4.2E-06	n	
2.1E-02	C	6.0E-06	C			1.0E-03	I	V		1		1.4E+03	Allyl Chloride	107-05-1	1.7E-01	n	6.9E-01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		6.7E-05	n	
				1.0E+00	P	5.0E-03	P			1			Aluminum	7429-90-5	7.7E+03	n	1.1E+05	nm	5.2E-01	n	2.2E+00	n	2.0E+03	n		3.0E+03	n	
				4.0E-04	I					1			Aluminum Phosphide	20859-73-8	3.1E+00	n	4.7E+01	n					8.0E-01	n			n	
				9.0E-03	I					1	0.1		Ametryn	834-12-8	5.7E+01	n	7.4E+02	n					1.5E+01	n		1.6E-02	n	
2.1E+01	C	6.0E-03	C							1	0.1		Aminobiphenyl, 4-	92-67-1	2.6E-02	c	1.1E-01	c	4.7E-04	c	2.0E-03	c	3.0E-03	c		1.5E-05	c	
				8.0E-02	P					1	0.1		Aminophenol, m-	591-27-5	5.1E+02	n	6.6E+03	n					1.6E+02	n		6.1E-02	n	
				2.0E-02	P					1	0.1		Aminophenol, p-	123-30-8	1.3E+02	n	1.6E+03	n					4.0E+01	n		1.5E-02	n	
				2.5E-03	I					1	0.1		Amitraz	33089-61-1	1.6E+01	n	2.1E+02	n					8.2E-01	n		4.2E-01	n	
						1.0E-01	I	V		1			Ammonia	7664-41-7					1.0E+01	n	4.4E+01	n						
				2.0E-01	I					1			Ammonium Sulfamate	7773-06-0	1.6E+03	n	2.3E+04	n					4.0E+02	n			n	
						3.0E-03	X	V		1		1.4E+04	Amyl Alcohol, tert-	75-85-4	8.2E+00	n	3.4E+01	n	3.1E-01	n	1.3E+00	n	6.3E-01	n		1.3E-04	n	
5.7E-03	I	1.6E-06	C	7.0E-03	P	1.0E-03	I			1	0.1		Aniline	62-53-3	4.4E+01	n	4.0E+02	c**	1.0E-01	n	4.4E-01	n	1.3E+01	c**		4.6E-03	c**	
4.0E-02	P			2.0E-03	X					1	0.1		Anthraquinone, 9,10-	84-65-1	1.3E+01	n	5.7E+01	c**					1.4E+00	c**		1.4E-02	c**	
				4.0E-04	I					0.15			Antimony (metallic)	7440-36-0	3.1E+00	n	4.7E+01	n					7.8E-01	n	6.0E+00	3.5E-02	n	2.7E-01
				5.0E-04	H					0.15			Antimony Pentoxide	1314-60-9	3.9E+00	n	5.8E+01	n					9.7E-01	n			n	
				4.0E-04	H					0.15			Antimony Tetroxide	1332-81-6	3.1E+00	n	4.7E+01	n					7.8E-01	n			n	
						2.0E-04	I			0.15			Antimony Trioxide	1309-64-4	2.8E+04	n	1.2E+05	nm	2.1E-02	n	8.8E-02	n					
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1	0.03		Arsenic, Inorganic	7440-38-2	6.8E-01	c**R	3.0E+00	c*R	6.5E-04	c**	2.9E-03	c**	5.2E-02	c*	1.0E+01	1.5E-03	c*	2.9E-01
				3.5E-06	C	5.0E-05	I			1			Arsine	7784-42-1	2.7E-02	n	4.1E-01	n	5.2E-03	n	2.2E-02	n	7.0E-03	n			n	
				5.0E-02	I					1	0.1		Asulam	3337-71-1	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.6E-02	n	
2.3E-01	C			3.5E-02	I					1	0.1		Atrazine	1912-24-9	2.4E+00	c*	1.0E+01	c					3.0E-01	c	3.0E+00	2.0E-04	c	1.9E-03
8.8E-01	C	2.5E-04	C							1	0.1		Auramine	492-80-8	6.2E-01	c	2.6E+00	c	1.1E-02	c	4.9E-02	c	6.7E-02	c		6.1E-04	c	
				4.0E-04	I					1	0.1		Avermectin B1	65195-55-3	2.5E+00	n	3.3E+01	n					8.0E-01	n		1.4E+00	n	
				3.0E-03	A	1.0E-02	A			1	0.1		Azinphos-methyl	86-50-0	1.9E+01	n	2.5E+02	n	1.0E+00	n	4.4E+00	n	5.6E+00	n		1.7E-03	n	
1.1E-01	I	3.1E-05	I					V		1			Azobenzene	103-33-3	5.6E+00	c	2.6E+01	c	9.1E-02	c	4.0E-01	c	1.2E-01	c		9.3E-04	c	
				1.0E+00	P	7.0E-06	P			1	0.1		Azodicarbonamide	123-77-3	8.6E+02	n	4.0E+03	n	7.3E-04	n	3.1E-03	n	2.0E+03	n		6.8E-01	n	
				2.0E-01	I	5.0E-04	H			0.07			Barium	7440-39-3	1.5E+03	n	2.2E+04	n	5.2E-02	n	2.2E-01	n	3.8E+02	n	2.0E+03	1.6E+01	n	8.2E+01
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Barium Chromate	10294-40-3	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				3.0E-01	I			V		1			Benfluralin	1861-40-1	2.3E+03	n	3.5E+04	n					1.7E+02	n		5.6E+00	n	
				5.0E-02	I					1	0.1		Benomyl	17804-35-2	3.2E+02	n	4.1E+03	n					9.7E+01	n		8.5E-02	n	
				2.0E-01	I					1	0.1		Bensulfuron-methyl	83055-99-6	1.3E+03	n	1.6E+04	n					3.9E+02	n		1.0E-01	n	
				3.0E-02	I					1	0.1		Bentazon	25057-89-0	1.9E+02	n	2.5E+03	n					5.7E+01	n		1.2E-02	n	
				1.0E-01	I			V		1		1.2E+03	Benzaldehyde	100-52-7	7.8E+02	n	1.2E+04	ns					1.9E+02	n		4.3E-02	n	
5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	V		1		1.8E+03	Benzene	71-43-2	1.2E+00	c**	5.1E+00	c**	3.6E-01	c**	1.6E+00	c**	4.6E-01	c**	5.0E+00	2.3E-04	c**	2.6E-03
1.0E-01	X			3.0E-04	X					1	0.1		Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	1.9E+00	n	2.3E+01	c**					6.0E-01	n		1.7E-04	n	
				1.0E-03	P			V		1		1.3E+03	Benzenethiol	108-98-5	7.8E+00	n	1.2E+02	n					1.7E+00	n		1.1E-03	n	
2.3E+02	I	6.7E-02	I	3.0E-03	I				M	1	0.1		Benzidine	92-87-5	5.3E-04	c	1.0E-02	c	1.5E-05	c	1.8E-04	c	1.1E-04	c		2.8E-07	c	
				4.0E+00	I					1	0.1		Benzoic Acid	65-85-0	2.5E+04	n	3.3E+05	nm					7.5E+03	n		1.8E+00	n	
1.3E+01	I							V		1		3.2E+02	Benzotrichloride	98-07-7	5.3E-02	c	2.5E-01	c					3.0E-03	c		6.6E-06	c	
				1.0E-01	P					1	0.1		Benzyl Alcohol	100-51-6	6.3E+02	n	8.2E+03	n					2.0E+02	n		4.8E-02	n	
1.7E-01	I	4.9E-05	C	2.0E-03	P	1.0E-03	P	V		1		1.5E+03	Benzyl Chloride	100-44-7	1.1E+00	c**	4.8E+00	c**	5.7E-02	c**	2.5E-01	c**	8.9E-02	c**		9.8E-05	c**	
		2.4E-03	I	2.0E-03	I	2.0E-05	I			0.007			Beryllium and compounds	7440-41-7	1.6E+01	n	2.3E+02	n	1.2E-03	c**	5.1E-03	c**	2.5E+00	n	4.0E+00	1.9E+00	n	3.2E+00
				9.0E-03	P					1	0.1		Bifenox	42576-02-3	5.7E+01	n	7.4E+02	n					1.0E+01	n		7.6E-02	n	
				1.5E-02	I					1	0.1		Biphenthrin	82657-04-3	9.5E+01	n	1.2E+03	n					3.0E+01	n		1.4E+02	n	
8.0E-03	I			5.0E-01	I	4.0E-04	X	V		1			Biphenyl, 1,1'-	92-52-4	4.7E+00	n	2.0E+01	n	4.2E-02	n	1.8E-01	n	8.3E-02	n		8.7E-04	n	
				4.0E-02	I			V		1		1.0E+03	Bis(2-chloro-1-methylethyl) ether	108-60-1	3.1E+02	n	4.7E+03	ns					7.1E+01	n		2.6E-02	n	

TR=1E-6
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.0E-03	P					1	0.1		Bis(2-chloroethoxy)methane	111-91-1	1.9E+01	n	2.5E+02	n					5.9E+00	n		1.3E-03	n	
1.1E+00	I	3.3E-04	I					V		1		5.1E+03	Bis(2-chloroethyl)ether	111-44-4	2.3E-01	c	1.0E+00	c	8.5E-03	c	3.7E-02	c	1.4E-02	c		3.6E-06	c	
2.2E+02	I	6.2E-02	I					V		1		4.2E+03	Bis(chloromethyl)ether	542-88-1	8.3E-05	c	3.6E-04	c	4.5E-05	c	2.0E-04	c	7.2E-05	c		1.7E-08	c	
				5.0E-02	I					1	0.1		Bisphenol A	80-05-7	3.2E+02	n	4.1E+03	n					7.7E+01	n		5.8E+00	n	
				2.0E-01	I	2.0E-02	H			1			Boron And Borates Only	7440-42-8	1.6E+03	n	2.3E+04	n	2.1E+00	n	8.8E+00	n	4.0E+02	n		1.3E+00	n	
				2.0E+00	P	2.0E-02	P	V		1			Boron Trichloride	10294-34-5	1.6E+04	n	2.3E+05	nm	2.1E+00	n	8.8E+00	n	4.2E+00	n			n	
				4.0E-02	C	1.3E-02	C	V		1			Boron Trifluoride	7637-07-2	3.1E+02	n	4.7E+03	n	1.4E+00	n	5.7E+00	n	2.6E+00	n			n	
7.0E-01	I			4.0E-03	I					1			Bromate	15541-45-4	9.9E-01	c*	4.7E+00	c					1.1E-01	c*	1.0E+01	8.5E-04	c*	7.7E-02
2.0E+00	X	6.0E-04	X					V		1		2.4E+03	Bromo-2-chloroethane, 1-	107-04-0	2.6E-02	c	1.1E-01	c	4.7E-03	c	2.0E-02	c	7.4E-03	c		2.1E-06	c	
				8.0E-03	I	6.0E-02	I	V		1		6.8E+02	Bromobenzene	108-86-1	2.9E+01	n	1.8E+02	n	6.3E+00	n	2.6E+01	n	6.2E+00	n		4.2E-03	n	
						4.0E-02	X	V		1		4.0E+03	Bromochloromethane	74-97-5	1.5E+01	n	6.3E+01	n	4.2E+00	n	1.8E+01	n	8.3E+00	n		2.1E-03	n	
6.2E-02	I	3.7E-05	C	2.0E-02	I			V		1		9.3E+02	Bromodichloromethane	75-27-4	2.9E-01	c	1.3E+00	c	7.6E-02	c	3.3E-01	c	1.3E-01	c	8.0E+01(F)	3.6E-05	c	2.2E-02
7.9E-03	I	1.1E-06	I	2.0E-02	I			V		1		9.2E+02	Bromoform	75-25-2	1.9E+01	c**	8.6E+01	c*	2.6E+00	c	1.1E+01	c	3.3E+00	c*	8.0E+01(F)	8.7E-04	c*	2.1E-02
				1.4E-03	I	5.0E-03	I	V		1		3.6E+03	Bromomethane	74-83-9	6.8E-01	n	3.0E+00	n	5.2E-01	n	2.2E+00	n	7.5E-01	n		1.9E-04	n	
				5.0E-03	H			V		1			Bromophos	2104-96-3	3.9E+01	n	5.8E+02	n					3.5E+00	n		1.5E-02	n	
				2.0E-02	I					1	0.1		Bromoxynil	1689-84-5	1.3E+02	n	1.6E+03	n					3.3E+01	n		2.8E-02	n	
				2.0E-02	I			V		1			Bromoxynil Octanoate	1689-99-2	1.6E+02	n	2.3E+03	n					1.4E+01	n		1.2E-01	n	
3.4E+00	C	3.0E-05	I			2.0E-03	I	V		1		6.7E+02	Butadiene, 1,3-	106-99-0	5.8E-02	c**	2.6E-01	c**	9.4E-02	c**	4.1E-01	c**	1.8E-02	c*		9.9E-06	c*	
				1.0E-01	I			V		1		7.6E+03	Butanol, N-	71-36-3	7.8E+02	n	1.2E+04	ns					2.0E+02	n		4.1E-02	n	
1.9E-03	P			2.0E-01	I					1	0.1		Butyl Benzyl Phthalate	85-68-7	2.9E+02	c**	1.2E+03	c*					1.6E+01	c*		2.4E-01	c*	
				2.0E+00	P	3.0E+01	P	V		1		2.1E+04	Butyl alcohol, sec-	78-92-2	1.3E+04	n	1.5E+05	nms	3.1E+03	n	1.3E+04	n	2.4E+03	n		5.0E-01	n	
				5.0E-02	I			V		1			Butylate	2008-41-5	3.9E+02	n	5.8E+03	n					4.6E+01	n		4.5E-02	n	
2.0E-04	C	5.7E-08	C							1	0.1		Butylated hydroxyanisole	25013-16-5	2.7E+03	c	1.1E+04	c	4.9E+01	c	2.2E+02	c	1.5E+02	c		2.9E-01	c	
3.6E-03	P			3.0E-01	P					1	0.1		Butylated hydroxytoluene	128-37-0	1.5E+02	c*	6.4E+02	c*					3.4E+00	c*		1.0E-01	c*	
				5.0E-02	P			V		1		1.1E+02	Butylbenzene, n-	104-51-8	3.9E+02	ns	5.8E+03	ns					1.0E+02	n		3.2E-01	n	
				1.0E-01	X			V		1		1.5E+02	Butylbenzene, sec-	135-98-8	7.8E+02	ns	1.2E+04	ns					2.0E+02	n		5.9E-01	n	
				1.0E-01	X			V		1		1.8E+02	Butylbenzene, tert-	98-06-6	7.8E+02	ns	1.2E+04	ns					6.9E+01	n		1.6E-01	n	
				2.0E-02	A					1	0.1		Cacodylic Acid	75-60-5	1.3E+02	n	1.6E+03	n					4.0E+01	n		1.1E-02	n	
		1.8E-03	I	1.0E-03	I	1.0E-05	A			0.025	0.001		Cadmium (Diet)	7440-43-9	7.1E+00	n	9.8E+01	n										
		1.8E-03	I	5.0E-04	I	1.0E-05	A			0.05	0.001		Cadmium (Water)	7440-43-9					1.0E-03	n	4.4E-03	n	9.2E-01	n	5.0E+00	6.9E-02	n	3.8E-01
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Calcium Chromate	13765-19-0	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				5.0E-01	I	2.2E-03	C			1	0.1		Caprolactam	105-60-2	3.1E+03	n	4.0E+04	n	2.3E-01	n	9.6E-01	n	9.9E+02	n		2.5E-01	n	
1.5E-01	C	4.3E-05	C	2.0E-03	I					1	0.1		Captafol	2425-06-1	3.6E+00	c**	1.5E+01	c*	6.5E-02	c	2.9E-01	c	4.0E-01	c**		7.1E-04	c**	
2.3E-03	C	6.6E-07	C	1.3E-01	I					1	0.1		Captan	133-06-2	2.4E+02	c**	1.0E+03	c*	4.3E+00	c	1.9E+01	c	3.1E+01	c**		2.2E-02	c**	
				1.0E-01	I					1	0.1		Carbaryl	63-25-2	6.3E+02	n	8.2E+03	n					1.8E+02	n		1.7E-01	n	
				5.0E-03	I					1	0.1		Carbofuran	1563-66-2	3.2E+01	n	4.1E+02	n					9.4E+00	n	4.0E+01	3.7E-03	n	1.6E-02
				1.0E-01	I	7.0E-01	I	V		1		7.4E+02	Carbon Disulfide	75-15-0	7.7E+01	n	3.5E+02	n	7.3E+01	n	3.1E+02	n	8.1E+01	n		2.4E-02	n	
7.0E-02	I	6.0E-06	I	4.0E-03	I	1.0E-01	I	V		1		4.6E+02	Carbon Tetrachloride	56-23-5	6.5E-01	c*	2.9E+00	c*	4.7E-01	c*	2.0E+00	c*	4.6E-01	c*	5.0E+00	1.8E-04	c*	1.9E-03
						1.0E-01	P	V		1		5.9E+03	Carbonyl Sulfide	463-58-1	6.7E+00	n	2.8E+01	n	1.0E+01	n	4.4E+01	n	2.1E+01	n		5.1E-02	n	
				1.0E-02	I					1	0.1		Carbosulfan	55285-14-8	6.3E+01	n	8.2E+02	n					5.1E+00	n		1.2E-01	n	
				1.0E-01	I					1	0.1		Carboxin	5234-68-4	6.3E+02	n	8.2E+03	n					1.9E+02	n		1.0E-01	n	
						9.0E-04	I			1			Ceric oxide	1306-38-3	1.3E+05	nm	5.4E+05	nm	9.4E-02	n	3.9E-01	n						
				1.0E-01	I			V		1			Chloral Hydrate	302-17-0	7.8E+02	n	1.2E+04	n					2.0E+02	n		4.0E-02	n	
				1.5E-02	I					1	0.1		Chloramben	133-90-4	9.5E+01	n	1.2E+03	n					2.9E+01	n		7.0E-03	n	
4.0E-01	H									1	0.1		Chloranil	118-75-2	1.3E+00	c	5.7E+00	c					1.8E-01	c		1.5E-04	c	
3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	V		1	0.04		Chlordane	12789-03-6	1.7E+00	c**	7.5E+00	c**	2.8E-02	c**	1.2E-01	c**	4.5E-02	c**	2.0E+00	3.0E-03	c**	1.4E-01
1.0E+01	I	4.6E-03	C	3.0E-04	I					1	0.1		Chlordecone (Kepone)	143-50-0	5.4E-02	c*	2.3E-01	c	6.1E-04	c	2.7E-03	c	3.5E-03	c*		1.2E-04	c*	
				7.0E-04	A					1	0.1		Chlorfenvinphos	470-90-6	4.4E+00	n	5.7E+01	n					1.1E+00	n		3.1E-03	n	
				2.0E-02	I					1	0.1		Chlorimuron, Ethyl-	90982-32-4	1.3E+02	n	1.6E+03	n					3.9E+01	n		1.3E-02	n	
				1.0E-01	I	1.5E-04	A	V		1		2.8E+03	Chlorine	7782-50-5	1.8E-02	n	7.8E-02	n	1.5E-02	n	6.4E-02	n	3.0E-02	n		1.4E-05	n	
				3.0E-02	I	2.0E-04	I	V		1			Chlorine Dioxide	10049-04-4	2.3E+02	n	3.4E+03	n	2.1E-02	n	8.8E-02	n	4.2E-02	n			n	
				3.0E-02	I					1			Chlorite (Sodium Salt)	7758-19-2	2.3E+02	n	3.5E+03	n					6.0E+01	n	1.0E+03		n	
						5.0E+01	I	V		1		1.2E+03	Chloro-1,1-difluoroethane, 1-	75-68-3	5.4E+03	ns	2.3E+04	ns	5.2E+03	n	2.2E+04	n	1.0E+04	n		5.2E+00	n	
		3.0E-04	I	2.0E-02	H	2.0E-02	I	V		1		7.9E+02	Chloro-1,3-butadiene, 2-	126-99-8	1.0E-02	c	4.4E-02	c	9.4E-03	c	4.1E-02	c	1.9E-02	c		9.8E-06	c	
4.6E-01	H									1	0.1		Chloro-2-methylaniline HCl, 4-	3165-93-3	1.2E+00	c	5.0E+00	c					1.7E-01	c		1.5E-04	c	
1.0E-01	P	7.7E-05	C	3.0E-03	X					1	0.1		Chloro-2-methylaniline, 4-	95-69-2	5.4E+00	c**	2.3E+01	c*	3.6E-02	c	1.6E-01	c	7.0E-01	c**		4.0E-04	c**	
2.7E-01	X							V		1		1.2E+04	Chloroacetaldehyde, 2-	107-20-0	2.6E+00	c	1.2E+01	c					2.9E-01	c		5.8E-05	c	
										1	0.1		Chloroacetic Acid	79-11-8											6.0E+01		1.2E-02
						3.0E-05	I			1	0.1		Chloroacetophenone, 2-	532-27-4	4.3E+03	n	1.8E+04	n	3.1E-03	n	1.3E-02	n						
2.0E-01	P			4.0E-03	I					1	0.1		Chloroaniline, p-	106-47-8	2.7E+00	c**	1.1E+01	c*					3.7E-01	c*		1.6E-04	c*	
				2.0E-02	I	5.0E-02	P	V		1		7.6E+02	Chlorobenzene	108-90-7	2.8E+01	n	1.3E+02	n	5.2E+00	n	2.2E+01	n	7.8E+00	n	1.0E+02	5.3E-03	n	6.8E-02
1.1E-01	C	3.1E-05	C	2.0E-02	I					1	0.1		Chlorobenzilate	510-15-6	4.9E+00	c*	2.1E+01	c*	9.1E-02	c	4.0E-01	c	3.1E-01	c*		1.0E-03	c*	
				3.0E-02	X					1	0.1		Chlorobenzoic Acid, p-	74-11-3	1.9E+02	n	2.5E+03	n					5.1E+01	n		1.3E-02	n	
				3.0E-03	P	3.0E-01	P	V		1		2.9E+02	Chlorobenzotrifluoride, 4-	98-56-6	2.1E+01	n	2.5E+02	n	3.1E+01	n	1.3E+02	n	3.5E+00	n		1.2E-02	n	
				4.0E-02	P			V		1		7.3E+02	Chlorobutane, 1-	109-69-3	3.1E+02	n	4.7E+03	ns					6.4E+01	n		2.6E-02	n	

TR=1E-06
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information																Contaminant		Screening Levels											Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
						5.0E+01	I	V		1		1.7E+03	Chlorodifluoromethane	75-45-6	4.9E+03	ns	2.1E+04	ns	5.2E+03	n	2.2E+04	n	1.0E+04	n		4.3E+00	n	
				2.0E-02	P			V		1		1.1E+05	Chloroethanol, 2-	107-07-3	1.6E+02	n	2.3E+03	n					4.0E+01	n		8.1E-03	n	
3.1E-02	C	2.3E-05	I	1.0E-02	I	9.8E-02	A	V		1		2.5E+03	Chloroform	67-66-3	3.2E-01	c*	1.4E+00	c*	1.2E-01	c*	5.3E-01	c*	2.2E-01	c*	8.0E+01(F)	6.1E-05	c*	2.2E-02
						9.0E-02	I	V		1		1.3E+03	Chloromethane	74-87-3	1.1E+01	n	4.6E+01	n	9.4E+00	n	3.9E+01	n	1.9E+01	n		4.9E-03	n	
2.4E+00	C	6.9E-04	C					V		1		9.3E+03	Chloromethyl Methyl Ether	107-30-2	2.0E-02	c	8.9E-02	c	4.1E-03	c	1.8E-02	c	6.5E-03	c		1.4E-06	c	
3.0E-01	P			3.0E-03	P	1.0E-05	X			1	0.1		Chloronitrobenzene, o-	88-73-3	1.8E+00	c*	7.7E+00	c*	1.0E-03	n	4.4E-03	n	2.4E-01	c*		2.2E-04	c*	
6.3E-03	P			1.0E-03	P	6.0E-04	P			1	0.1		Chloronitrobenzene, p-	100-00-5	6.3E+00	n	8.2E+01	n	6.3E-02	n	2.6E-01	n	1.8E+00	n		1.7E-03	n	
				5.0E-03	I			V		1		2.2E+04	Chlorophenol, 2-	95-57-8	3.9E+01	n	5.8E+02	n					9.1E+00	n		7.4E-03	n	
						4.0E-04	C	V		1		6.2E+02	Chloropicrin	76-06-2	2.0E-01	n	8.2E-01	n	4.2E-02	n	1.8E-01	n	8.3E-02	n		2.5E-05	n	
3.1E-03	C	8.9E-07	C	1.5E-02	I					1	0.1		Chlorothalonil	1897-45-6	9.5E+01	n	7.4E+02	c**	3.2E+00	c	1.4E+01	c	2.2E+01	c**		5.0E-02	c**	
				2.0E-02	I			V		1		9.1E+02	Chlorotoluene, o-	95-49-8	1.6E+02	n	2.3E+03	ns					2.4E+01	n		2.3E-02	n	
				2.0E-02	X			V		1		2.5E+02	Chlorotoluene, p-	106-43-4	1.6E+02	n	2.3E+03	ns					2.5E+01	n		2.4E-02	n	
2.4E+02	C	6.9E-02	C							1	0.1		Chlorozotocin	54749-90-5	2.3E-03	c	9.6E-03	c	4.1E-05	c	1.8E-04	c	3.2E-04	c		7.1E-08	c	
				2.0E-01	I					1	0.1		Chlorpropham	101-21-3	1.3E+03	n	1.6E+04	n					2.8E+02	n		2.6E-01	n	
				1.0E-03	A					1	0.1		Chlorpyrifos	2921-88-2	6.3E+00	n	8.2E+01	n					8.4E-01	n		1.2E-02	n	
				1.0E-02	H					1	0.1		Chlorpyrifos Methyl	5598-13-0	6.3E+01	n	8.2E+02	n					1.2E+01	n		5.4E-02	n	
				5.0E-02	I					1	0.1		Chlorsulfuron	64902-72-3	3.2E+02	n	4.1E+03	n					9.9E+01	n		8.3E-02	n	
				1.0E-02	I					1	0.1		Chlorthal-dimethyl	1861-32-1	6.3E+01	n	8.2E+02	n					1.2E+01	n		1.5E-02	n	
				8.0E-04	H					1	0.1		Chlorthiophos	60238-56-4	5.1E+00	n	6.6E+01	n					2.8E-01	n		7.3E-03	n	
				1.5E+00	I					0.013			Chromium(III), Insoluble Salts	16065-83-1	1.2E+04	n	1.8E+05	nm					2.2E+03	n		4.0E+06	n	
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	0.025			Chromium(VI)	18540-29-9	3.0E-01	c*	6.3E+00	c*	1.2E-05	c	1.5E-04	c	3.5E-02	c		6.7E-04	c	
										0.013			Chromium, Total	7440-47-3											1.0E+02			1.8E+05
				1.3E-02	I					1	0.1		Clofentezine	74115-24-5	8.2E+01	n	1.1E+03	n					2.3E+01	n		1.4E+00	n	
		9.0E-03	P	3.0E-04	P	6.0E-06	P			1			Cobalt	7440-48-4	2.3E+00	n	3.5E+01	n	3.1E-04	c**	1.4E-03	c**	6.0E-01	n		2.7E-02	n	
		6.2E-04	I					V	M	1			Coke Oven Emissions	8007-45-2					1.6E-03	c	2.0E-02	c						
				4.0E-02	H					1			Copper	7440-50-8	3.1E+02	n	4.7E+03	n					8.0E+01	n	1.3E+03	2.8E+00	n	4.6E+01
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, m-	108-39-4	3.2E+02	n	4.1E+03	n	6.3E+01	n	2.6E+02	n	9.3E+01	n		7.4E-02	n	
				5.0E-02	I	6.0E-01	C			1	0.1		Cresol, o-	95-48-7	3.2E+02	n	4.1E+03	n	6.3E+01	n	2.6E+02	n	9.3E+01	n		7.5E-02	n	
				1.0E-01	A	6.0E-01	C			1	0.1		Cresol, p-	106-44-5	6.3E+02	n	8.2E+03	n	6.3E+01	n	2.6E+02	n	1.9E+02	n		1.5E-01	n	
				1.0E-01	A					1	0.1		Cresol, p-chloro-m-	59-50-7	6.3E+02	n	8.2E+03	n					1.4E+02	n		1.7E-01	n	
				1.0E-01	A	6.0E-01	C			1	0.1		Cresols	1319-77-3	6.3E+02	n	8.2E+03	n	6.3E+01	n	2.6E+02	n	1.5E+02	n		1.3E-01	n	
1.9E+00	H			1.0E-03	P			V		1		1.7E+04	Crotonaldehyde, trans-	123-73-9	3.7E-01	c*	1.7E+00	c*					4.0E-02	c*		8.2E-06	c*	
				1.0E-01	I	4.0E-01	I	V		1		2.7E+02	Cumene	98-82-8	1.9E+02	n	9.9E+02	ns	4.2E+01	n	1.8E+02	n	4.5E+01	n		7.4E-02	n	
2.2E-01	C	6.3E-05	C							1	0.1		Cupferron	135-20-6	2.5E+00	c	1.0E+01	c	4.5E-02	c	1.9E-01	c	3.5E-01	c		6.1E-04	c	
8.4E-01	H			2.0E-03	H					1	0.1		Cyanazine	21725-46-2	6.5E-01	c*	2.7E+00	c*					8.8E-02	c*		4.1E-05	c*	
													Cyanides															
				1.0E-03	I					1			~Calcium Cyanide	592-01-8	7.8E+00	n	1.2E+02	n					2.0E+00	n			n	
				5.0E-03	I					1			~Copper Cyanide	544-92-3	3.9E+01	n	5.8E+02	n					1.0E+01	n			n	
				6.0E-04	I	8.0E-04	S	V		1		9.7E+05	~Cyanide (CN-)	57-12-5	2.7E-01	n	1.2E+00	n	8.3E-02	n	3.5E-01	n	1.5E-01	n	2.0E+02	1.5E-03	n	2.0E+00
				1.0E-03	I			V		1			~Cyanogen	460-19-5	7.8E+00	n	1.2E+02	n					2.0E+00	n			n	
				9.0E-02	I			V		1			~Cyanogen Bromide	506-68-3	7.0E+02	n	1.1E+04	n					1.8E+02	n			n	
				5.0E-02	I			V		1			~Cyanogen Chloride	506-77-4	3.9E+02	n	5.8E+03	n					1.0E+02	n			n	
				6.0E-04	I	8.0E-04	I	V		1		1.0E+07	~Hydrogen Cyanide	74-90-8	2.3E+00	n	1.5E+01	n	8.3E-02	n	3.5E-01	n	1.5E-01	n		1.5E-03	n	
				2.0E-03	I					1			~Potassium Cyanide	151-50-8	1.6E+01	n	2.3E+02	n					4.0E+00	n			n	
				5.0E-03	I					0.04			~Potassium Silver Cyanide	506-61-6	3.9E+01	n	5.8E+02	n					8.2E+00	n			n	
				1.0E-01	I					0.04			~Silver Cyanide	506-64-9	7.8E+02	n	1.2E+04	n					1.8E+02	n			n	
				1.0E-03	I					1			~Sodium Cyanide	143-33-9	7.8E+00	n	1.2E+02	n					2.0E+00	n	2.0E+02		n	
				2.0E-04	P					1			~Thiocyanates	NA	1.6E+00	n	2.3E+01	n					4.0E-01	n			n	
				2.0E-04	X			V		1			~Thiocyanic Acid	463-56-9	1.6E+00	n	2.3E+01	n					4.0E-01	n			n	
				5.0E-02	I					1			~Zinc Cyanide	557-21-1	3.9E+02	n	5.8E+03	n					1.0E+02	n			n	
						6.0E+00	I	V		1		1.2E+02	Cyclohexane	110-82-7	6.5E+02	ns	2.7E+03	ns	6.3E+02	n	2.6E+03	n	1.3E+03	n		1.3E+00	n	
2.3E-02	H									1	0.1		Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	2.4E+01	c	1.0E+02	c					2.4E+00	c		1.4E-02	c	
				5.0E+00	I	7.0E-01	P	V		1		5.1E+03	Cyclohexanone	108-94-1	2.8E+03	n	1.3E+04	ns	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.4E-02	n	
				5.0E-03	P	1.0E+00	X	V		1		2.8E+02	Cyclohexene	110-83-8	3.1E+01	n	3.1E+02	ns	1.0E+02	n	4.4E+02	n	7.0E+00	n		4.6E-03	n	
				2.0E-01	I			V		1		2.9E+05	Cyclohexylamine	108-91-8	1.6E+03	n	2.3E+04	n					3.8E+02	n		1.0E-01	n	
				2.5E-02	I					1	0.1		Cyfluthrin	68359-37-5	1.6E+02	n	2.1E+03	n					1.2E+01	n		3.1E+00	n	
				5.0E-03	I					1	0.1		Cyhalothrin	68085-85-8	3.2E+01	n	4.1E+02	n					1.0E+01	n		6.8E+00	n	
				1.0E-02	I					1	0.1		Cypermethrin	52315-07-8	6.3E+01	n	8.2E+02	n					2.0E+01	n		3.2E+00	n	
				7.5E-03	I					1	0.1		Cyromazine	66215-27-8	4.7E+01	n	6.2E+02	n					1.5E+01	n		3.8E-03	n	
2.4E-01	I	6.9E-05	C							1	0.1		DDD	72-54-8	2.3E+00	c	9.6E+00	c	4.1E-02	c	1.8E-01	c	3.2E-02	c		7.5E-03	c	
3.4E-01	I	9.7E-05	C					V		1			DDE, p,p'-	72-55-9	2.0E+00	c	9.3E+00	c	2.9E-02	c	1.3E-01	c	4.6E-02	c		1.1E-02	c	
3.4E-01	I	9.7E-05	I	5.0E-04	I					1	0.03		DDT	50-29-3	1.9E+00	c**	8.5E+00	c**	2.9E-02	c	1.3E-01	c	2.3E-01	c**		7.7E-02	c**	
				3.0E-02	I					1	0.1		Dalapon	75-99-0	1.9E+02	n	2.5E+03	n					6.0E+01	n	2.0E+02	1.2E-02	n	4.1E-02
1.8E-02	C	5.1E-06	C	1.5E-01	I					1	0.1		Daminozide	1596-84-5	3.0E+01	c*	1.3E+02	c*	5.5E-01	c	2.4E+00	c	4.3E+00	c*		9.5E-04	c*	
7.0E-04	I			7.0E-03	I					1	0.1		Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	4.4E+01	n	5.7E+02	n					1.4E+01	n		7.8E+00	n	

TR=1E-06
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				4.0E-05	I					1	0.1		Demeton	8065-48-3	2.5E-01	n	3.3E+00	n					4.2E-02	n			n	
1.2E-03	I			6.0E-01	I					1	0.1		Di(2-ethylhexyl)adipate	103-23-1	4.5E+02	c**	1.9E+03	c*					6.5E+01	c*	4.0E+02	4.7E+00	c*	2.9E+01
6.1E-02	H									1	0.1		Diallate	2303-16-4	8.9E+00	c	3.8E+01	c					5.4E-01	c		8.0E-04	c	
				7.0E-04	A					1	0.1		Diazinon	333-41-5	4.4E+00	n	5.7E+01	n					1.0E+00	n		6.5E-03	n	
				1.0E-02	X			V		1			Dibenzothiophene	132-65-0	7.8E+01	n	1.2E+03	n					6.5E+00	n		1.2E-01	n	
8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	V	M	1		9.8E+02	Dibromo-3-chloropropane, 1,2-	96-12-8	5.3E-03	c*	6.4E-02	c*	1.7E-04	c	2.0E-03	c*	3.3E-04	c	2.0E-01	1.4E-07	c	8.6E-05
				4.0E-04	X			V		1		1.6E+02	Dibromobenzene, 1,3-	108-36-1	3.1E+00	n	4.7E+01	n					5.3E-01	n		5.1E-04	n	
				1.0E-02	I			V		1			Dibromobenzene, 1,4-	106-37-6	7.8E+01	n	1.2E+03	n					1.3E+01	n		1.2E-02	n	
8.4E-02	I			2.0E-02	I			V		1		8.0E+02	Dibromochloromethane	124-48-1	8.3E+00	c*	3.9E+01	c*					8.7E-01	c*	8.0E+01(F)	2.3E-04	c*	2.1E-02
2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	V		1		1.3E+03	Dibromoethane, 1,2-	106-93-4	3.6E-02	c	1.6E-01	c	4.7E-03	c	2.0E-02	c	7.5E-03	c	5.0E-02	2.1E-06	c	1.4E-05
						4.0E-03	X	V		1		2.8E+03	Dibromomethane (Methylene Bromide)	74-95-3	2.4E+00	n	9.9E+00	n	4.2E-01	n	1.8E+00	n	8.3E-01	n		2.1E-04	n	
				3.0E-04	P					1	0.1		Dibutyltin Compounds	NA	1.9E+00	n	2.5E+01	n					6.0E-01	n			n	
				3.0E-02	I					1	0.1		Dicamba	1918-00-9	1.9E+02	n	2.5E+03	n					5.7E+01	n		1.5E-02	n	
		4.2E-03	P					V		1		5.5E+02	Dichloro-2-butene, 1,4-	764-41-0	2.1E-03	c	9.4E-03	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.6E-07	c	
		4.2E-03	P					V		1		5.2E+02	Dichloro-2-butene, cis-1,4-	1476-11-5	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
		4.2E-03	P					V		1		7.6E+02	Dichloro-2-butene, trans-1,4-	110-57-6	7.4E-03	c	3.2E-02	c	6.7E-04	c	2.9E-03	c	1.3E-03	c		6.2E-07	c	
5.0E-02	I			4.0E-03	I					1	0.1		Dichloroacetic Acid	79-43-6	1.1E+01	c**	4.6E+01	c**					1.5E+00	c**	6.0E+01	3.1E-04	c**	1.2E-02
				9.0E-02	I	2.0E-01	H	V		1		3.8E+02	Dichlorobenzene, 1,2-	95-50-1	1.8E+02	n	9.3E+02	ns	2.1E+01	n	8.8E+01	n	3.0E+01	n	6.0E+02	3.0E-02	n	5.8E-01
5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	V		1			Dichlorobenzene, 1,4-	106-46-7	2.6E+00	c	1.1E+01	c	2.6E-01	c	1.1E+00	c	4.8E-01	c	7.5E+01	4.6E-04	c	7.2E-02
4.5E-01	I	3.4E-04	C							1	0.1		Dichlorobenzidine, 3,3'-	91-94-1	1.2E+00	c	5.1E+00	c	8.3E-03	c	3.6E-02	c	1.3E-01	c		8.2E-04	c	
				9.0E-03	X					1	0.1		Dichlorobenzophenone, 4,4'-	90-98-2	5.7E+01	n	7.4E+02	n					7.8E+00	n		4.7E-02	n	
				2.0E-01	I	1.0E-01	X	V		1		8.5E+02	Dichlorodifluoromethane	75-71-8	8.7E+00	n	3.7E+01	n	1.0E+01	n	4.4E+01	n	2.0E+01	n		3.0E-02	n	
5.7E-03	C	1.6E-06	C	2.0E-01	P			V		1		1.7E+03	Dichloroethane, 1,1-	75-34-3	3.6E+00	c	1.6E+01	c	1.8E+00	c	7.7E+00	c	2.8E+00	c		7.8E-04	c	
9.1E-02	I	2.6E-05	I	6.0E-03	X	7.0E-03	P	V		1		3.0E+03	Dichloroethane, 1,2-	107-06-2	4.6E-01	c**	2.0E+00	c**	1.1E-01	c**	4.7E-01	c**	1.7E-01	c**	5.0E+00	4.8E-05	c**	1.4E-03
				5.0E-02	I	2.0E-01	I	V		1		1.2E+03	Dichloroethylene, 1,1-	75-35-4	2.3E+01	n	1.0E+02	n	2.1E+01	n	8.8E+01	n	2.8E+01	n	7.0E+00	1.0E-02	n	2.5E-03
				2.0E-03	I			V		1		2.4E+03	Dichloroethylene, 1,2-cis-	156-59-2	1.6E+01	n	2.3E+02	n					3.6E+00	n	7.0E+01	1.1E-03	n	2.1E-02
				2.0E-02	I			V		1		1.9E+03	Dichloroethylene, 1,2-trans-	156-60-5	1.6E+02	n	2.3E+03	ns					3.6E+01	n	1.0E+02	1.1E-02	n	3.1E-02
				3.0E-03	I					1	0.1		Dichlorophenol, 2,4-	120-83-2	1.9E+01	n	2.5E+02	n					4.6E+00	n		5.4E-03	n	
				1.0E-02	I					1	0.05		Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	7.0E+01	n	9.6E+02	n					1.7E+01	n	7.0E+01	4.5E-03	n	1.8E-02
				8.0E-03	I					1	0.1		Dichlorophenoxy)butyric Acid, 4-(2,4-	94-82-6	5.1E+01	n	6.6E+02	n					1.2E+01	n		1.1E-02	n	
3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	V		1		1.4E+03	Dichloropropane, 1,2-	78-87-5	1.0E+00	c**	4.4E+00	c**	2.8E-01	c**	1.2E+00	c**	4.4E-01	c**	5.0E+00	1.5E-04	c**	1.7E-03
				2.0E-02	P			V		1		1.5E+03	Dichloropropane, 1,3-	142-28-9	1.6E+02	n	2.3E+03	ns					3.7E+01	n		1.3E-02	n	
				3.0E-03	I					1	0.1		Dichloropropanol, 2,3-	616-23-9	1.9E+01	n	2.5E+02	n					5.9E+00	n		1.3E-03	n	
1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	V		1		1.6E+03	Dichloropropene, 1,3-	542-75-6	1.8E+00	c**	8.2E+00	c**	7.0E-01	c**	3.1E+00	c**	4.7E-01	c**		1.7E-04	c**	
2.9E-01	I	8.3E-05	C	5.0E-04	I	5.0E-04	I			1	0.1		Dichlorvos	62-73-7	1.9E+00	c**	7.9E+00	c**	3.4E-02	c**	1.5E-01	c**	2.6E-01	c**		8.1E-05	c**	
				1.0E-04	I					1	0.1		Dicrotophos	141-66-2	6.3E-01	n	8.2E+00	n					2.0E-01	n		4.7E-05	n	
				8.0E-02	P	3.0E-04	X	V		1		2.6E+02	Dicyclopentadiene	77-73-6	1.3E-01	n	5.4E-01	n	3.1E-02	n	1.3E-01	n	6.3E-02	n		2.2E-04	n	
1.6E+01	I	4.6E-03	I	5.0E-05	I					1	0.1		Dieldrin	60-57-1	3.4E-02	c**	1.4E-01	c*	6.1E-04	c	2.7E-03	c	1.8E-03	c*		7.1E-05	c*	
		3.0E-04	C			5.0E-03	I			1	0.1		Diesel Engine Exhaust	NA					9.4E-03	c*	4.1E-02	c*						
				2.0E-03	P	2.0E-04	P			1	0.1		Diethanolamine	111-42-2	1.3E+01	n	1.6E+02	n	2.1E-02	n	8.8E-02	n	4.0E+00	n		8.1E-04	n	
				3.0E-02	P	1.0E-04	P			1	0.1		Diethylene Glycol Monobutyl Ether	112-34-5	1.9E+02	n	2.4E+03	n	1.0E-02	n	4.4E-02	n	6.0E+01	n		1.3E-02	n	
				6.0E-02	P	3.0E-04	P			1	0.1		Diethylene Glycol Monoethyl Ether	111-90-0	3.8E+02	n	4.8E+03	n	3.1E-02	n	1.3E-01	n	1.2E+02	n		2.4E-02	n	
				1.0E-03	P			V		1		1.1E+05	Diethylformamide	617-84-5	7.8E+00	n	1.2E+02	n					2.0E+00	n		4.1E-04	n	
3.5E+02	C	1.0E-01	C							1	0.1		Diethylstilbestrol	56-53-1	1.6E-03	c	6.6E-03	c	2.8E-05	c	1.2E-04	c	5.1E-05	c		2.8E-05	c	
				8.0E-02	I					1	0.1		Difenzoquat	43222-48-6	5.1E+02	n	6.6E+03	n					1.6E+02	n			n	
				2.0E-02	I					1	0.1		Diflubenzuron	35367-38-5	1.3E+02	n	1.6E+03	n					2.9E+01	n		3.3E-02	n	
						4.0E+01	I	V		1		1.4E+03	Difluoroethane, 1,1-	75-37-6	4.8E+03	ns	2.0E+04	ns	4.2E+03	n	1.8E+04	n	8.3E+03	n		2.8E+00	n	
4.4E-02	C	1.3E-05	C					V		1			Dihydrosafrole	94-58-6	9.9E+00	c	4.5E+01	c	2.2E-01	c	9.4E-01	c	3.0E-01	c		1.9E-04	c	
						7.0E-01	P	V		1		2.3E+03	Diisopropyl Ether	108-20-3	2.2E+02	n	9.4E+02	n	7.3E+01	n	3.1E+02	n	1.5E+02	n		3.7E-02	n	
				8.0E-02	I			V		1		5.3E+02	Diisopropyl Methylphosphonate	1445-75-6	6.3E+02	ns	9.3E+03	ns					1.6E+02	n		4.5E-02	n	
				2.0E-02	I					1	0.1		Dimethipin	55290-64-7	1.3E+02	n	1.6E+03	n					4.0E+01	n		8.8E-03	n	
				2.0E-04	I					1	0.1		Dimethoate	60-51-5	1.3E+00	n	1.6E+01	n					4.0E-01	n		9.0E-05	n	
1.6E+00	P									1	0.1		Dimethoxybenzidine, 3,3'-	119-90-4	3.4E-01	c	1.4E+00	c					4.7E-02	c		5.8E-05	c	
1.7E-03	P			6.0E-02	P					1	0.1		Dimethyl methylphosphonate	756-79-6	3.2E+02	c**	1.4E+03	c**					4.6E+01	c**		9.6E-03	c**	
4.6E+00	C	1.3E-03	C							1	0.1		Dimethylamino azobenzene [p-]	60-11-7	1.2E-01	c	5.0E-01	c	2.2E-03	c	9.4E-03	c	5.0E-03	c		2.1E-05	c	
5.8E-01	H									1	0.1		Dimethylaniline HCl, 2,4-	21436-96-4	9.4E-01	c	4.0E+00	c					1.3E-01	c		1.2E-04	c	
2.0E-01	P			2.0E-03	X					1	0.1		Dimethylaniline, 2,4-	95-68-1	2.7E+00	c**	1.1E+01	c*					3.7E-01	c*		2.1E-04	c*	
				2.0E-03	I			V		1		8.3E+02	Dimethylaniline, N,N-	121-69-7	1.6E+01	n	2.3E+02	n					3.5E+00	n		1.3E-03	n	
1.1E+01	P									1	0.1		Dimethylbenzidine, 3,3'-	119-93-7	4.9E-02	c	2.1E-01	c					6.5E-03	c		4.3E-05	c	
				1.0E-01	P	3.0E-02	I	V		1		1.1E+05	Dimethylformamide	68-12-2	2.6E+02	n	1.5E+03	n	3.1E+00	n	1.3E+01	n	6.1E+00	n		1.2E-03	n	
				1.0E-04	X	2.0E-06	X	V		1		1.7E+05	Dimethylhydrazine, 1,1-	57-14-7	5.7E-03	n	2.4E-02	n	2.1E-04	n	8.8E-04	n	4.2E-04	n		9.3E-08	n	
5.5E+02	C	1.6E-01	C					V		1		1.9E+05	Dimethylhydrazine, 1,2-	540-73-8	8.8E-04	c	4.1E-03	c	1.8E-05	c	7.7E-05	c	2.8E-05	c		6.5E-09	c	
				2.0E-02	I					1	0.1		Dimethylphenol, 2,4-	105-67-9	1.3E+02	n	1.6E+03	n					3.6E+01	n		4.2E-02	n	
				6.0E-04	I					1	0.1		Dimethylphenol, 2,6-	576-26-1	3.8E+00	n	4.9E+01	n					1.1E+00	n		1.3E-03	n	
				1.0E-03	I					1	0.1		Dimethylphenol, 3,4-	95-65-8	6.3E+00	n	8.2E+01	n					1.8E+00	n		2.1E-03	n	

TR=1E-06 HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
4.5E-02	C	1.3E-05	C					V		1		1.3E+03	Dimethylvinylchloride	513-37-1	2.0E-01	c	8.9E-01	c	2.2E-01	c	9.4E-01	c	3.3E-01	c		2.4E-04	c	
				8.0E-05	X					1	0.1		Dinitro-o-cresol, 4,6-	534-52-1	5.1E-01	n	6.6E+00	n					1.5E-01	n		2.6E-04	n	
				2.0E-03	I					1	0.1		Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1.3E+01	n	1.6E+02	n					2.3E+00	n		7.7E-02	n	
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,2-	528-29-0	6.3E-01	n	8.2E+00	n					1.9E-01	n		1.8E-04	n	
				1.0E-04	I					1	0.1		Dinitrobenzene, 1,3-	99-65-0	6.3E-01	n	8.2E+00	n					2.0E-01	n		1.8E-04	n	
				1.0E-04	P					1	0.1		Dinitrobenzene, 1,4-	100-25-4	6.3E-01	n	8.2E+00	n					2.0E-01	n		1.8E-04	n	
				2.0E-03	I					1	0.1		Dinitrophenol, 2,4-	51-28-5	1.3E+01	n	1.6E+02	n					3.9E+00	n		4.4E-03	n	
6.8E-01	I									1	0.1		Dinitrotoluene Mixture, 2,4/2,6-	NA	8.0E-01	c	3.4E+00	c					1.1E-01	c		1.5E-04	c	
3.1E-01	C	8.9E-05	C	2.0E-03	I					1	0.102		Dinitrotoluene, 2,4-	121-14-2	1.7E+00	c**	7.4E+00	c*	3.2E-02	c	1.4E-01	c	2.4E-01	c*		3.2E-04	c*	
1.5E+00	P			3.0E-04	X					1	0.099		Dinitrotoluene, 2,6-	606-20-2	3.6E-01	c**	1.5E+00	c*					4.9E-02	c*		6.7E-05	c*	
				2.0E-03	S					1	0.006		Dinitrotoluene, 2-Amino-4,6-	35572-78-2	1.5E+01	n	2.3E+02	n					3.9E+00	n		3.0E-03	n	
				2.0E-03	S					1	0.009		Dinitrotoluene, 4-Amino-2,6-	19406-51-0	1.5E+01	n	2.3E+02	n					3.9E+00	n		3.0E-03	n	
4.5E-01	X			9.0E-04	X					1	0.1		Dinitrotoluene, Technical grade	25321-14-6	1.2E+00	c**	5.1E+00	c*					1.0E-01	c*		1.4E-04	c*	
				1.0E-03	I					1	0.1		Dinoseb	88-85-7	6.3E+00	n	8.2E+01	n					1.5E+00	n	7.0E+00	1.3E-02	n	6.2E-02
1.0E-01	I	5.0E-06	I	3.0E-02	I	3.0E-02	I	V		1		1.2E+05	Dioxane, 1,4-	123-91-1	5.3E+00	c*	2.4E+01	c*	5.6E-01	c**	2.5E+00	c**	4.6E-01	c*		9.4E-05	c*	
													Dioxins															
6.2E+03	I	1.3E+00	I							1	0.03		~Hexachlorodibenzo-p-dioxin, Mixture	NA	1.0E-04	c	4.7E-04	c	2.2E-06	c	9.4E-06	c	1.3E-05	c		1.7E-05	c	
1.3E+05	C	3.8E+01	C	7.0E-10	I	4.0E-08	C	V		1	0.03		~TCDD, 2,3,7,8-	1746-01-6	4.8E-06	c**	2.2E-05	c**	7.4E-08	c*	3.2E-07	c*	1.2E-07	c*	3.0E-05	5.9E-08	c*	1.5E-05
				3.0E-02	I					1	0.1		Diphenamid	957-51-7	1.9E+02	n	2.5E+03	n					5.3E+01	n		5.2E-01	n	
				8.0E-04	X					1	0.1		Diphenyl Sulfone	127-63-9	5.1E+00	n	6.6E+01	n					1.5E+00	n		3.6E-03	n	
				2.5E-02	I					1	0.1		Diphenylamine	122-39-4	1.6E+02	n	2.1E+03	n					3.1E+01	n		5.8E-02	n	
8.0E-01	I	2.2E-04	I							1	0.1		Diphenylhydrazine, 1,2-	122-66-7	6.8E-01	c	2.9E+00	c	1.3E-02	c	5.6E-02	c	7.8E-02	c		2.5E-04	c	
				2.2E-03	I					1	0.1		Diquat	85-00-7	1.4E+01	n	1.8E+02	n					4.4E+00	n	2.0E+01	8.3E-02	n	3.7E-01
7.1E+00	C	1.4E-01	C							1	0.1		Direct Black 38	1937-37-7	7.6E-02	c	3.2E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		5.3E+00	c	
7.4E+00	C	1.4E-01	C							1	0.1		Direct Blue 6	2602-46-2	7.3E-02	c	3.1E-01	c	2.0E-05	c	8.8E-05	c	1.1E-02	c		1.7E+01	c	
6.7E+00	C	1.4E-01	C							1	0.1		Direct Brown 95	16071-86-6	8.1E-02	c	3.4E-01	c	2.0E-05	c	8.8E-05	c	1.2E-02	c			c	
				4.0E-05	I					1	0.1		Disulfoton	298-04-4	2.5E-01	n	3.3E+00	n					5.0E-02	n		9.4E-05	n	
				1.0E-02	I			V		1			Dithiane, 1,4-	505-29-3	7.8E+01	n	1.2E+03	n					2.0E+01	n		9.7E-03	n	
				2.0E-03	I					1	0.1		Diuron	330-54-1	1.3E+01	n	1.6E+02	n					3.6E+00	n		1.5E-03	n	
				4.0E-03	I					1	0.1		Dodine	2439-10-3	2.5E+01	n	3.3E+02	n					8.0E+00	n		4.1E-02	n	
				2.5E-02	I			V		1			EPTC	759-94-4	2.0E+02	n	2.9E+03	n					3.8E+01	n		2.0E-02	n	
				6.0E-03	I			V		1			Endosulfan	115-29-7	4.7E+01	n	7.0E+02	n					1.0E+01	n		1.4E-01	n	
				2.0E-02	I					1	0.1		Endothall	145-73-3	1.3E+02	n	1.6E+03	n					3.8E+01	n	1.0E+02	9.1E-03	n	2.4E-02
				3.0E-04	I					1	0.1		Endrin	72-20-8	1.9E+00	n	2.5E+01	n					2.3E-01	n	2.0E+00	9.2E-03	n	8.1E-02
9.9E-03	I	1.2E-06	I	6.0E-03	P	1.0E-03	I	V		1		1.1E+04	Epichlorohydrin	106-89-8	1.9E+00	n	8.2E+00	n	1.0E-01	n	4.4E-01	n	2.0E-01	n		4.5E-05	n	
						2.0E-02	I	V		1		1.5E+04	Epoxybutane, 1,2-	106-88-7	1.6E+01	n	6.7E+01	n	2.1E+00	n	8.8E+00	n	4.2E+00	n		9.2E-04	n	
				4.0E-02	P					1	0.1		Ethanol, 2-(2-methoxyethoxy)-	111-77-3	2.5E+02	n	3.3E+03	n					8.0E+01	n		1.6E-02	n	
				5.0E-03	I					1	0.1		Ethephon	16672-87-0	3.2E+01	n	4.1E+02	n					1.0E+01	n		2.1E-03	n	
				5.0E-04	I					1	0.1		Ethion	563-12-2	3.2E+00	n	4.1E+01	n					4.3E-01	n		8.5E-04	n	
				1.0E-01	P	6.0E-02	P	V		1		2.4E+04	Ethoxyethanol Acetate, 2-	111-15-9	2.6E+02	n	1.4E+03	n	6.3E+00	n	2.6E+01	n	1.2E+01	n		2.5E-03	n	
				9.0E-02	P	2.0E-01	I	V		1		1.1E+05	Ethoxyethanol, 2-	110-80-5	5.2E+02	n	4.7E+03	n	2.1E+01	n	8.8E+01	n	3.4E+01	n		6.8E-03	n	
				9.0E-01	I	7.0E-02	P	V		1		1.1E+04	Ethyl Acetate	141-78-6	6.2E+01	n	2.6E+02	n	7.3E+00	n	3.1E+01	n	1.4E+01	n		3.1E-03	n	
				5.0E-03	P	8.0E-03	P	V		1		2.5E+03	Ethyl Acrylate	140-88-5	4.7E+00	n	2.1E+01	n	8.3E-01	n	3.5E+00	n	1.4E+00	n		3.2E-04	n	
						1.0E+01	I	V		1		2.1E+03	Ethyl Chloride (Chloroethane)	75-00-3	1.4E+03	n	5.7E+03	ns	1.0E+03	n	4.4E+03	n	2.1E+03	n		5.9E-01	n	
				2.0E-01	I			V		1		1.0E+04	Ethyl Ether	60-29-7	1.6E+03	n	2.3E+04	ns					3.9E+02	n		8.8E-02	n	
						3.0E-01	P	V		1		1.1E+03	Ethyl Methacrylate	97-63-2	1.8E+02	n	7.6E+02	n	3.1E+01	n	1.3E+02	n	6.3E+01	n		1.5E-02	n	
				1.0E-05	I					1	0.1		Ethyl-p-nitrophenyl Phosphonate	2104-64-5	6.3E-02	n	8.2E-01	n					8.9E-03	n		2.8E-04	n	
1.1E-02	C	2.5E-06	C	1.0E-01	I	1.0E+00	I	V		1		4.8E+02	Ethylbenzene	100-41-4	5.8E+00	c*	2.5E+01	c*	1.1E+00	c*	4.9E+00	c*	1.5E+00	c*	7.0E+02	1.7E-03	c*	7.8E-01
				7.0E-02	P					1	0.1		Ethylene Cyanohydrin	109-78-4	4.4E+02	n	5.7E+03	n					1.4E+02	n		2.8E-02	n	
				9.0E-02	P			V		1		1.9E+05	Ethylene Diamine	107-15-3	7.0E+02	n	1.1E+04	n					1.8E+02	n		4.1E-02	n	
				2.0E+00	I	4.0E-01	C			1	0.1		Ethylene Glycol	107-21-1	1.3E+04	n	1.6E+05	nm	4.2E+01	n	1.8E+02	n	4.0E+03	n		8.1E-01	n	
				1.0E-01	I	1.6E+00	I			1	0.1		Ethylene Glycol Monobutyl Ether	111-76-2	6.3E+02	n	8.2E+03	n	1.7E+02	n	7.0E+02	n	2.0E+02	n		4.1E-02	n	
3.1E-01	C	8.8E-05	C			3.0E-02	C	V		1		1.2E+05	Ethylene Oxide	75-21-8	1.8E-01	c	7.9E-01	c	3.2E-02	c*	1.4E-01	c*	5.1E-02	c		1.1E-05	c	
4.5E-02	C	1.3E-05	C	8.0E-05	I					1	0.1		Ethylene Thiourea	96-45-7	5.1E-01	n	6.6E+00	n	2.2E-01	c	9.4E-01	c	1.6E-01	n		3.6E-05	n	
6.5E+01	C	1.9E-02	C					V		1		1.5E+05	Ethyleneimine	151-56-4	2.7E-03	c	1.2E-02	c	1.5E-04	c	6.5E-04	c	2.4E-04	c		5.2E-08	c	
				3.0E+00	I					1	0.1		Ethylphthalyl Ethyl Glycolate	84-72-0	1.9E+04	n	2.5E+05	nm					5.8E+03	n		1.3E+01	n	
				2.5E-04	I					1	0.1		Fenamiphos	22224-92-6	1.6E+00	n	2.1E+01	n					4.4E-01	n		4.3E-04	n	
				2.5E-02	I					1	0.1		Fenpropathrin	39515-41-8	1.6E+02	n	2.1E+03	n					6.4E+00	n		2.9E-01	n	
				2.5E-02	I					1	0.1		Fenvalerate	51630-58-1	1.6E+02	n	2.1E+03	n					5.0E+01	n		3.2E+01	n	
				1.3E-02	I					1	0.1		Fluometuron	2164-17-2	8.2E+01	n	1.1E+03	n					2.4E+01	n		1.9E-02	n	
				4.0E-02	C	1.3E-02	C			1			Fluoride	16984-48-8	3.1E+02	n	4.7E+03	n	1.4E+00	n	5.7E+00	n	8.0E+01	n		1.2E+01	n	
				6.0E-02	I	1.3E-02	C			1			Fluorine (Soluble Fluoride)	7782-41-4	4.7E+02	n	7.0E+03	n	1.4E+00	n	5.7E+00	n	1.2E+02	n	4.0E+03	1.8E+01	n	6.0E+02
				8.0E-02	I					1	0.1		Fluridone	59756-60-4	5.1E+02	n	6.6E+03	n					1.4E+02	n		1.6E+01	n	
				2.0E-02	I					1	0.1		Flurprimidol	56425-91-3	1.3E+02	n	1.6E+03	n					3.4E+01	n		1.6E-01	n	
				7.0E-04	I					1	0.1		Flusilazole	85509-19-9	4.4E+00	n	5.7E+01	n					1.1E+00	n		1.8E-01	n	

TR=1E-06
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				6.0E-02	I					1	0.1		Flutolanil	66332-96-5	3.8E+02	n	4.9E+03	n					9.5E+01	n		5.0E-01	n	
				1.0E-02	I					1	0.1		Fluvalinate	69409-94-5	6.3E+01	n	8.2E+02	n					2.0E+01	n		2.9E+01	n	
3.5E-03	I			1.0E-01	I					1	0.1		Folpet	133-07-3	1.6E+02	c**	6.6E+02	c*					2.0E+01	c**		4.7E-03	c**	
1.9E-01	I									1	0.1		Fomesafen	72178-02-0	2.9E+00	c	1.2E+01	c					3.9E-01	c		1.3E-03	c	
				2.0E-03	I					1	0.1		Fonofos	944-22-9	1.3E+01	n	1.6E+02	n					2.4E+00	n		4.7E-03	n	
		1.3E-05	I	2.0E-01	I	9.8E-03	A	V		1		4.2E+04	Formaldehyde	50-00-0	1.7E+01	c**	7.3E+01	c**	2.2E-01	c**	9.4E-01	c**	4.3E-01	c**		8.7E-05	c**	
				9.0E-01	P	3.0E-04	X	V		1		1.1E+05	Formic Acid	64-18-6	2.9E+00	n	1.2E+01	n	3.1E-02	n	1.3E-01	n	6.3E-02	n		1.3E-05	n	
				3.0E+00	I					1	0.1		Fosetyl-AL	39148-24-8	1.9E+04	n	2.5E+05	nm					6.0E+03	n		7.9E+01	n	
													Furans															
				1.0E-03	X			V		1	0.03		~Dibenzofuran	132-64-9	7.3E+00	n	1.0E+02	n					7.9E-01	n		1.5E-02	n	
				1.0E-03	I			V		1	0.03	6.2E+03	~Furan	110-00-9	7.3E+00	n	1.0E+02	n					1.9E+00	n		7.3E-04	n	
				9.0E-01	I	2.0E+00	I	V		1	0.03	1.7E+05	~Tetrahydrofuran	109-99-9	1.8E+03	n	9.6E+03	n	2.1E+02	n	8.8E+02	n	3.4E+02	n		7.5E-02	n	
3.8E+00	H									1	0.1		Furazolidone	67-45-8	1.4E-01	c	6.0E-01	c					2.0E-02	c		3.9E-05	c	
				3.0E-03	I	5.0E-02	H	V		1		1.0E+04	Furfural	98-01-1	2.1E+01	n	2.6E+02	n	5.2E+00	n	2.2E+01	n	3.8E+00	n		8.1E-04	n	
1.5E+00	C	4.3E-04	C							1	0.1		Furium	531-82-8	3.6E-01	c	1.5E+00	c	6.5E-03	c	2.9E-02	c	5.1E-02	c		6.8E-05	c	
3.0E-02	I	8.6E-06	C							1	0.1		Furmecyclox	60568-05-0	1.8E+01	c	7.7E+01	c	3.3E-01	c	1.4E+00	c	1.1E+00	c		1.2E-03	c	
				4.0E-04	I					1	0.1		Glufosinate, Ammonium	77182-82-2	2.5E+00	n	3.3E+01	n					8.0E-01	n		1.8E-04	n	
						8.0E-05	C			1	0.1		Glutaraldehyde	111-30-8	1.1E+04	n	4.8E+04	n	8.3E-03	n	3.5E-02	n						
				4.0E-04	I	1.0E-03	H	V		1		1.1E+05	Glycidyl	765-34-4	2.3E+00	n	2.1E+01	n	1.0E-01	n	4.4E-01	n	1.7E-01	n		3.3E-05	n	
				1.0E-01	I					1	0.1		Glyphosate	1071-83-6	6.3E+02	n	8.2E+03	n					2.0E+02	n	7.0E+02	8.8E-01	n	3.1E+00
				1.0E-02	X			V		1			Guanidine	113-00-8	7.8E+01	n	1.2E+03	n					2.0E+01	n		4.5E-03	n	
				2.0E-02	P					1	0.1		Guanidine Chloride	50-01-1	1.3E+02	n	1.6E+03	n					4.0E+01	n			n	
				5.0E-05	I					1	0.1		Haloxyfop, Methyl	69806-40-2	3.2E-01	n	4.1E+00	n					7.6E-02	n		8.4E-04	n	
4.5E+00	I	1.3E-03	I	5.0E-04	I			V		1			Heptachlor	76-44-8	1.3E-01	c*	6.3E-01	c*	2.2E-03	c	9.4E-03	c	1.4E-03	c*	4.0E-01	1.2E-04	c*	3.3E-02
9.1E+00	I	2.6E-03	I	1.3E-05	I			V		1			Heptachlor Epoxide	1024-57-3	7.0E-02	c**	3.3E-01	c**	1.1E-03	c	4.7E-03	c	1.4E-03	c**	2.0E-01	2.8E-05	c**	4.1E-03
				2.0E-03	I			V		1			Hexabromobenzene	87-82-1	1.6E+01	n	2.3E+02	n					4.0E+00	n		2.3E-02	n	
				2.0E-04	I					1	0.1		Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	1.3E+00	n	1.6E+01	n					4.0E-01	n			n	
1.6E+00	I	4.6E-04	I	8.0E-04	I			V		1			Hexachlorobenzene	118-74-1	2.1E-01	c*	9.6E-01	c*	6.1E-03	c	2.7E-02	c	9.8E-03	c	1.0E+00	1.2E-04	c	1.3E-02
7.8E-02	I	2.2E-05	I	1.0E-03	P			V		1		1.7E+01	Hexachlorobutadiene	87-68-3	1.2E+00	c**	5.3E+00	c*	1.3E-01	c	5.6E-01	c	1.4E-01	c**		2.7E-04	c**	
6.3E+00	I	1.8E-03	I	8.0E-03	A					1	0.1		Hexachlorocyclohexane, Alpha-	319-84-6	8.6E-02	c	3.6E-01	c	1.6E-03	c	6.8E-03	c	7.2E-03	c		4.2E-05	c	
1.8E+00	I	5.3E-04	I							1	0.1		Hexachlorocyclohexane, Beta-	319-85-7	3.0E-01	c	1.3E+00	c	5.3E-03	c	2.3E-02	c	2.5E-02	c		1.5E-04	c	
1.1E+00	C	3.1E-04	C	3.0E-04	I					1	0.04		Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	5.7E-01	c**	2.5E+00	c*	9.1E-03	c	4.0E-02	c	4.2E-02	c**	2.0E-01	2.4E-04	c**	1.2E-03
1.8E+00	I	5.1E-04	I							1	0.1		Hexachlorocyclohexane, Technical	608-73-1	3.0E-01	c	1.3E+00	c	5.5E-03	c	2.4E-02	c	2.5E-02	c		1.5E-04	c	
				6.0E-03	I	2.0E-04	I	V		1		1.6E+01	Hexachlorocyclopentadiene	77-47-4	1.8E-01	n	7.5E-01	n	2.1E-02	n	8.8E-02	n	4.1E-02	n	5.0E+01	1.3E-04	n	1.6E-01
4.0E-02	I	1.1E-05	C	7.0E-04	I	3.0E-02	I	V		1			Hexachloroethane	67-72-1	1.8E+00	c**	8.0E+00	c**	2.6E-01	c*	1.1E+00	c*	3.3E-01	c**		2.0E-04	c**	
				3.0E-04	I					1	0.1		Hexachlorophene	70-30-4	1.9E+00	n	2.5E+01	n					6.0E-01	n		8.0E-01	n	
1.1E-01	I			3.0E-03	I					1	0.015		Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	6.1E+00	c**	2.8E+01	c*					7.0E-01	c**		2.7E-04	c**	
						1.0E-05	I	V		1		3.4E+03	Hexamethylene Diisocyanate, 1,6-	822-06-0	3.1E-01	n	1.3E+00	n	1.0E-03	n	4.4E-03	n	2.1E-03	n		2.1E-05	n	
				4.0E-04	P					1	0.1		Hexamethylphosphoramide	680-31-9	2.5E+00	n	3.3E+01	n					8.0E-01	n		1.8E-04	n	
						7.0E-01	I	V		1		1.4E+02	Hexane, N-	110-54-3	6.1E+01	n	2.5E+02	ns	7.3E+01	n	3.1E+02	n	1.5E+02	n		1.0E+00	n	
				2.0E+00	P					1	0.1		Hexanedioic Acid	124-04-9	1.3E+04	n	1.6E+05	nm					4.0E+03	n		9.9E-01	n	
				5.0E-03	I	3.0E-02	I	V		1		3.3E+03	Hexanone, 2-	591-78-6	2.0E+01	n	1.3E+02	n	3.1E+00	n	1.3E+01	n	3.8E+00	n		8.8E-04	n	
				3.3E-02	I					1	0.1		Hexazinone	51235-04-2	2.1E+02	n	2.7E+03	n					6.4E+01	n		3.0E-02	n	
				2.5E-02	I					1	0.1		Hexythiazox	78587-05-0	1.6E+02	n	2.1E+03	n					1.1E+01	n		5.0E-02	n	
				3.0E-04	I					1	0.1		Hydramethylnon	67485-29-4	1.9E+00	n	2.5E+01	n					5.9E-01	n		2.1E+02	n	
3.0E+00	I	4.9E-03	I			3.0E-05	P	V		1			Hydrazine	302-01-2	2.3E-01	c	1.1E+00	c	5.7E-04	c**	2.5E-03	c**	1.1E-03	c**			c**	
3.0E+00	I	4.9E-03	I							1			Hydrazine Sulfate	10034-93-2	2.3E-01	c	1.1E+00	c	5.7E-04	c	2.5E-03	c	2.6E-02	c			c	
						2.0E-02	I	V		1			Hydrogen Chloride	7647-01-0	2.8E+06	nm	1.2E+07	nm	2.1E+00	n	8.8E+00	n	4.2E+00	n			n	
				4.0E-02	C	1.4E-02	C	V		1			Hydrogen Fluoride	7664-39-3	3.1E+02	n	4.7E+03	n	1.5E+00	n	6.1E+00	n	2.8E+00	n			n	
						2.0E-03	I	V		1			Hydrogen Sulfide	7783-06-4	2.8E+05	nm	1.2E+06	nm	2.1E-01	n	8.8E-01	n	4.2E-01	n			n	
6.0E-02	P			4.0E-02	P					1	0.1		Hydroquinone	123-31-9	9.0E+00	c*	3.8E+01	c*					1.3E+00	c*		8.7E-04	c*	
				1.3E-02	I					1	0.1		Imazalil	35554-44-0	8.2E+01	n	1.1E+03	n					1.9E+01	n		3.2E-01	n	
				2.5E-01	I					1	0.1		Imazaquin	81335-37-7	1.6E+03	n	2.1E+04	n					4.9E+02	n		2.4E+00	n	
				2.5E-01	I					1	0.1		Imazethapyr	81335-77-5	1.6E+03	n	2.1E+04	n					4.7E+02	n		4.1E-01	n	
				1.0E-02	A					1			Iodine	7553-56-2	7.8E+01	n	1.2E+03	n					2.0E+01	n		1.2E+00	n	
				4.0E-02	I					1	0.1		Iprodione	36734-19-7	2.5E+02	n	3.3E+03	n					7.4E+01	n		2.2E-02	n	
				7.0E-01	P					1			Iron	7439-89-6	5.5E+03	n	8.2E+04	n					1.4E+03	n		3.5E+01	n	
				3.0E-01	I			V		1		1.0E+04	Isobutyl Alcohol	78-83-1	2.3E+03	n	3.5E+04	ns					5.9E+02	n		1.2E-01	n	
9.5E-04	I			2.0E-01	I	2.0E+00	C			1	0.1		Isophorone	78-59-1	5.7E+02	c**	2.4E+03	c**	2.1E+02	n	8.8E+02	n	7.8E+01	c**		2.6E-02	c**	
				1.5E-02	I			V		1			Isopropalin	33820-53-0	1.2E+02	n	1.8E+03	n					4.0E+00	n		9.2E-02	n	
				2.0E+00	P	2.0E-01	P	V		1		1.1E+05	Isopropanol	67-63-0	5.6E+02	n	2.4E+03	n	2.1E+01	n	8.8E+01	n	4.1E+01	n		8.4E-03	n	
				1.0E-01	I					1	0.1		Isopropyl Methyl Phosphonic Acid	1832-54-8	6.3E+02	n	8.2E+03	n					2.0E+02	n		4.3E-02	n	
				5.0E-02	I					1	0.1		Isoxaben	82558-50-7	3.2E+02	n	4.1E+03	n					7.3E+01	n		2.0E-01	n	
						3.0E-01	A	V		1			JP-7	NA	4.3E+07	nm	1.8E+08	nm	3.1E+01	n	1.3E+02	n	6.3E+01	n			n	
				2.0E-03	I					1	0.1		Lactofen	77501-63-4	1.3E+01	n	1.6E+02	n					2.5E+00	n		1.2E-01	n	

DRAFT HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
													Lead Compounds															
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			~Lead Chromate	7758-97-6	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
8.5E-03	C	1.2E-05	C							1			~Lead Phosphate	7446-27-7	8.2E+01	c	3.8E+02	c	2.3E-01	c	1.0E+00	c	9.1E+00	c			c	
2.8E-01	C	8.0E-05	C							1	0.1		~Lead acetate	301-04-2	1.9E+00	c	8.2E+00	c	3.5E-02	c	1.5E-01	c	2.8E-01	c			c	
										1			~Lead and Compounds	7439-92-1	4.0E+02	L	8.0E+02	L	1.5E-01	L			1.5E+01	L	1.5E+01		L	1.4E+01
8.5E-03	C	1.2E-05	C							1	0.1		~Lead subacetate	1335-32-6	6.4E+01	c	2.7E+02	c	2.3E-01	c	1.0E+00	c	9.2E+00	c			c	
				1.0E-07	I			V		1		2.4E+00	~Tetraethyl Lead	78-00-2	7.8E-04	n	1.2E-02	n					1.3E-04	n		4.7E-07	n	
				5.0E-06	P			V		1		3.8E+02	Lewisite	541-25-3	3.9E-02	n	5.8E-01	n					9.0E-03	n		3.8E-06	n	
				2.0E-03	I					1	0.1		Linuron	330-55-2	1.3E+01	n	1.6E+02	n					3.3E+00	n		2.9E-03	n	
				2.0E-03	P					1			Lithium	7439-93-2	1.6E+01	n	2.3E+02	n					4.0E+00	n		1.2E+00	n	
				5.0E-04	I					1	0.1		MCPA	94-74-6	3.2E+00	n	4.1E+01	n					7.5E-01	n		2.0E-04	n	
				1.0E-02	I					1	0.1		MCPB	94-81-5	6.3E+01	n	8.2E+02	n					1.5E+01	n		5.8E-03	n	
				1.0E-03	I					1	0.1		MCPP	93-65-2	6.3E+00	n	8.2E+01	n					1.6E+00	n		4.7E-04	n	
				2.0E-02	I					1	0.1		Malathion	121-75-5	1.3E+02	n	1.6E+03	n					3.9E+01	n		1.0E-02	n	
				1.0E-01	I	7.0E-04	C			1	0.1		Maleic Anhydride	108-31-6	6.3E+02	n	8.0E+03	n	7.3E-02	n	3.1E-01	n	1.9E+02	n		3.8E-02	n	
				5.0E-01	I					1	0.1		Maleic Hydrazide	123-33-1	3.2E+03	n	4.1E+04	n					1.0E+03	n		2.1E-01	n	
				1.0E-04	P					1	0.1		Malononitrile	109-77-3	6.3E-01	n	8.2E+00	n					2.0E-01	n		4.1E-05	n	
				3.0E-02	H					1	0.1		Mancozeb	8018-01-7	1.9E+02	n	2.5E+03	n					5.4E+01	n		7.6E-02	n	
				5.0E-03	I					1	0.1		Maneb	12427-38-2	3.2E+01	n	4.1E+02	n					9.8E+00	n		1.4E-02	n	
				1.4E-01	I	5.0E-05	I			1			Manganese (Diet)	7439-96-5														
				2.4E-02	S	5.0E-05	I			0.04			Manganese (Non-diet)	7439-96-5	1.8E+02	n	2.6E+03	n	5.2E-03	n	2.2E-02	n	4.3E+01	n		2.8E+00	n	
				9.0E-05	H					1	0.1		Mephosfolan	950-10-7	5.7E-01	n	7.4E+00	n					1.8E-01	n		2.6E-04	n	
				3.0E-02	I					1	0.1		Mepiquat Chloride	24307-26-4	1.9E+02	n	2.5E+03	n					6.0E+01	n		2.0E-02	n	
													Mercury Compounds															
				3.0E-04	I	3.0E-04	S			0.07			~Mercuric Chloride (and other Mercury salts)	7487-94-7	2.3E+00	n	3.5E+01	n	3.1E-02	n	1.3E-01	n	5.7E-01	n	2.0E+00		n	
						3.0E-04	I	V		1		3.1E+00	~Mercury (elemental)	7439-97-6	1.1E+00	n	4.6E+00	ns	3.1E-02	n	1.3E-01	n	6.3E-02	n	2.0E+00	3.3E-03	n	1.0E-01
				1.0E-04	I					1			~Methyl Mercury	22967-92-6	7.8E-01	n	1.2E+01	n					2.0E-01	n			n	
				8.0E-05	I					1	0.1		~Phenylmercuric Acetate	62-38-4	5.1E-01	n	6.6E+00	n					1.6E-01	n		5.0E-05	n	
				3.0E-05	I			V		1			Merphos	150-50-5	2.3E-01	n	3.5E+00	n					6.0E-02	n		5.9E-03	n	
				3.0E-05	I					1	0.1		Merphos Oxide	78-48-8	1.9E-01	n	2.5E+00	n					8.5E-03	n		4.2E-05	n	
				6.0E-02	I					1	0.1		Metalaxyl	57837-19-1	3.8E+02	n	4.9E+03	n					1.2E+02	n		3.3E-02	n	
				1.0E-04	I	3.0E-02	P	V		1		4.6E+03	Methacrylonitrile	126-98-7	7.5E-01	n	1.0E+01	n	3.1E+00	n	1.3E+01	n	1.9E-01	n		4.3E-05	n	
				5.0E-05	I					1	0.1		Methamidophos	10265-92-6	3.2E-01	n	4.1E+00	n					1.0E-01	n		2.1E-05	n	
				2.0E+00	I	2.0E+01	I	V		1		1.1E+05	Methanol	67-56-1	1.2E+04	n	1.2E+05	nms	2.1E+03	n	8.8E+03	n	2.0E+03	n		4.1E-01	n	
				1.0E-03	I					1	0.1		Methidathion	950-37-8	6.3E+00	n	8.2E+01	n					1.9E+00	n		4.7E-04	n	
				2.5E-02	I					1	0.1		Methomyl	16752-77-5	1.6E+02	n	2.1E+03	n					5.0E+01	n		1.1E-02	n	
4.9E-02	C	1.4E-05	C							1	0.1		Methoxy-5-nitroaniline, 2-	99-59-2	1.1E+01	c	4.7E+01	c	2.0E-01	c	8.8E-01	c	1.5E+00	c		5.3E-04	c	
				5.0E-03	I					1	0.1		Methoxychlor	72-43-5	3.2E+01	n	4.1E+02	n					3.7E+00	n	4.0E+01	2.0E-01	n	2.2E+00
				8.0E-03	P	1.0E-03	P	V		1		1.2E+05	Methoxyethanol Acetate, 2-	110-49-6	1.1E+01	n	5.1E+01	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		4.2E-05	n	
				5.0E-03	P	2.0E-02	I	V		1		1.1E+05	Methoxyethanol, 2-	109-86-4	3.3E+01	n	3.5E+02	n	2.1E+00	n	8.8E+00	n	2.9E+00	n		5.9E-04	n	
				1.0E+00	X			V		1		2.9E+04	Methyl Acetate	79-20-9	7.8E+03	n	1.2E+05	nms					2.0E+03	n		4.1E-01	n	
						2.0E-02	P	V		1		6.8E+03	Methyl Acrylate	96-33-3	1.5E+01	n	6.1E+01	n	2.1E+00	n	8.8E+00	n	4.2E+00	n		8.9E-04	n	
				6.0E-01	I	5.0E+00	I	V		1		2.8E+04	Methyl Ethyl Ketone (2-Butanone)	78-93-3	2.7E+03	n	1.9E+04	n	5.2E+02	n	2.2E+03	n	5.6E+02	n		1.2E-01	n	
		1.0E-03	X	1.0E-03	P	2.0E-05	X	V		1		1.8E+05	Methyl Hydrazine	60-34-4	1.0E-01	n	4.4E-01	n	2.1E-03	n	8.8E-03	n	4.2E-03	n		9.4E-07	n	
						3.0E+00	I	V		1		3.4E+03	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3.3E+03	n	1.4E+04	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		1.4E-01	n	
						1.0E-03	C	V		1		1.0E+04	Methyl Isocyanate	624-83-9	4.6E-01	n	1.9E+00	n	1.0E-01	n	4.4E-01	n	2.1E-01	n		5.9E-05	n	
				1.4E+00	I	7.0E-01	I	V		1		2.4E+03	Methyl Methacrylate	80-62-6	4.4E+02	n	1.9E+03	n	7.3E+01	n	3.1E+02	n	1.4E+02	n		3.0E-02	n	
				2.5E-04	I					1	0.1		Methyl Parathion	298-00-0	1.6E+00	n	2.1E+01	n					4.5E-01	n		7.4E-04	n	
				6.0E-02	X					1	0.1		Methyl Phosphonic Acid	993-13-5	3.8E+02	n	4.9E+03	n					1.2E+02	n		2.4E-02	n	
				6.0E-03	H	4.0E-02	H	V		1		3.9E+02	Methyl Styrene (Mixed Isomers)	25013-15-4	3.2E+01	n	2.6E+02	n	4.2E+00	n	1.8E+01	n	2.3E+00	n		3.8E-03	n	
9.9E-02	C	2.8E-05	C							1	0.1		Methyl methanesulfonate	66-27-3	5.5E+00	c	2.3E+01	c	1.0E-01	c	4.4E-01	c	7.9E-01	c		1.6E-04	c	
1.8E-03	C	2.6E-07	C			3.0E+00	I	V		1		8.9E+03	Methyl tert-Butyl Ether (MTBE)	1634-04-4	4.7E+01	c*	2.1E+02	c*	1.1E+01	c*	4.7E+01	c*	1.4E+01	c*		3.2E-03	c*	
				3.0E-04	X					1	0.1		Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	1.9E+00	n	2.5E+01	n					6.0E-01	n		3.6E-04	n	
9.0E-03	P			2.0E-02	X					1	0.1		Methyl-5-Nitroaniline, 2-	99-55-8	6.0E+01	c**	2.6E+02	c**					8.2E+00	c**		4.6E-03	c**	
8.3E+00	C	2.4E-03	C							1	0.1		Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	6.5E-02	c	2.8E-01	c	1.2E-03	c	5.1E-03	c	9.4E-03	c		3.2E-06	c	
1.3E-01	C	3.7E-05	C							1	0.1		Methylaniline Hydrochloride, 2-	636-21-5	4.2E+00	c	1.8E+01	c	7.6E-02	c	3.3E-01	c	6.0E-01	c		2.6E-04	c	
				1.0E-02	A					1	0.1		Methylarsonic acid	124-58-3	6.3E+01	n	8.2E+02	n					2.0E+01	n			n	
				2.0E-04	X					1	0.1		Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	1.3E+00	n	1.6E+01	n					4.0E-01	n			n	
1.0E-01	X			3.0E-04	X					1	0.1		Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	1.9E+00	n	2.3E+01	c**					6.0E-01	n			n	
2.2E+01	C	6.3E-03	C						M	1	0.1		Methylcholanthrene, 3-	56-49-5	5.5E-03	c	1.0E-01	c	1.6E-04	c	1.9E-03	c	1.1E-03	c		2.2E-03	c	
2.0E-03	I	1.0E-08	I	6.0E-03	I	6.0E-01	I	V	M	1		3.3E+03	Methylene Chloride	75-09-2	3.5E+01	n	3.2E+02	n	6.3E+01	n	2.6E+02	n	1.1E+01	n	5.0E+00	2.7E-03	n	1.3E-03
1.0E-01	P	4.3E-04	C	2.0E-03	P				M	1	0.1		Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	1.2E+00	c*	2.3E+01	c**	2.4E-03	c	2.9E-02	c	1.6E-01	c*		1.8E-03	c*	
4.6E-02	I	1.3E-05	C							1	0.1		Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	1.2E+01	c	5.0E+01	c	2.2E-01	c	9.4E-01	c	4.8E-01	c		2.6E-03	c	
1.6E+00	C	4.6E-04	C			2.0E-02	C			1	0.1		Methylenebisbenzenamine, 4,4'-	101-77-9	3.4E-01	c	1.4E+00	c	6.1E-03	c	2.7E-02	c	4.7E-02	c		2.1E-04	c	
						6.0E-04	I			1	0.1		Methylenediphenyl Diisocyanate	101-68-8	8.5E+04	n	3.6E+05	nm	6.3E-02	n	2.6E-01	n						

TR=1E-06
HQ=0.1

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Toxicity and Chemical-specific Information													Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				7.0E-02	H			V		1		5.0E+02	Methylstyrene, Alpha-	98-83-9	5.5E+02	ns	8.2E+03	ns					7.8E+01	n		1.2E-01	n	
				1.5E-01	I					1	0.1		Metolachlor	51218-45-2	9.5E+02	n	1.2E+04	n					2.7E+02	n		3.2E-01	n	
				2.5E-02	I					1	0.1		Metribuzin	21087-64-9	1.6E+02	n	2.1E+03	n					4.9E+01	n		1.5E-02	n	
				2.5E-01	I					1	0.1		Metsulfuron-methyl	74223-64-6	1.6E+03	n	2.1E+04	n					4.9E+02	n		1.9E-01	n	
				3.0E+00	P			V		1		3.4E-01	Mineral oils	8012-95-1	2.3E+04	ns	3.5E+05	nms					6.0E+03	n		2.4E+02	n	
1.8E+01	C	5.1E-03	C	2.0E-04	I			V		1			Mirex	2385-85-5	3.6E-02	c*	1.7E-01	c	5.5E-04	c	2.4E-03	c	8.8E-04	c		6.3E-04	c	
				2.0E-03	I					1	0.1		Molinate	2212-67-1	1.3E+01	n	1.6E+02	n					3.0E+00	n		1.7E-03	n	
				5.0E-03	I					1			Molybdenum	7439-98-7	3.9E+01	n	5.8E+02	n					1.0E+01	n		2.0E-01	n	
				1.0E-01	I					1			Monochloramine	10599-90-3	7.8E+02	n	1.2E+04	n					2.0E+02	n	4.0E+03		n	
				2.0E-03	P					1	0.1		Monomethylaniline	100-61-8	1.3E+01	n	1.6E+02	n					3.8E+00	n		1.4E-03	n	
				2.5E-02	I					1	0.1		Myclobutanil	88671-89-0	1.6E+02	n	2.1E+03	n					4.5E+01	n		5.6E-01	n	
				3.0E-04	X					1	0.1		N,N'-Diphenyl-1,4-benzenediamine	74-31-7	1.9E+00	n	2.5E+01	n					3.6E-01	n		3.7E-02	n	
				2.0E-03	I			V		1			Naled	300-76-5	1.6E+01	n	2.3E+02	n					4.0E+00	n		1.8E-03	n	
				3.0E-02	X	1.0E-01	P	V		1			Naphtha, High Flash Aromatic (HFAN)	64742-95-6	2.3E+02	n	3.5E+03	n	1.0E+01	n	4.4E+01	n	1.5E+01	n			n	
1.8E+00	C	0.0E+00	C							1	0.1		Naphthylamine, 2-	91-59-8	3.0E-01	c	1.3E+00	c					3.9E-02	c		2.0E-04	c	
				1.0E-01	I					1	0.1		Napropamide	15299-99-7	6.3E+02	n	8.2E+03	n					1.6E+02	n		1.1E+00	n	
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickel Acetate	373-02-4	6.7E+01	n	8.1E+02	n	1.5E-03	n	6.1E-03	n	2.2E+01	n			n	
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickel Carbonate	3333-67-3	6.7E+01	n	8.1E+02	n	1.5E-03	n	6.1E-03	n	2.2E+01	n			n	
		2.6E-04	C	1.1E-02	C	1.4E-05	C	V		1			Nickel Carbonyl	13463-39-3	8.2E+01	n	1.1E+03	n	1.5E-03	n	6.1E-03	n	2.9E-03	n			n	
		2.6E-04	C	1.1E-02	C	1.4E-05	C			0.04			Nickel Hydroxide	12054-48-7	8.2E+01	n	1.1E+03	n	1.5E-03	n	6.1E-03	n	2.0E+01	n			n	
		2.6E-04	C	1.1E-02	C	2.0E-05	C			0.04			Nickel Oxide	1313-99-1	8.4E+01	n	1.2E+03	n	2.1E-03	n	8.8E-03	n	2.0E+01	n			n	
		2.4E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Refinery Dust	NA	8.2E+01	n	1.1E+03	n	1.5E-03	n	6.1E-03	n	2.2E+01	n		3.2E+00	n	
		2.6E-04	C	2.0E-02	I	9.0E-05	A			0.04			Nickel Soluble Salts	7440-02-0	1.5E+02	n	2.2E+03	n	9.4E-03	n	3.9E-02	n	3.9E+01	n		2.6E+00	n	
1.7E+00	C	4.8E-04	I	1.1E-02	C	1.4E-05	C			0.04			Nickel Subsulfide	12035-72-2	4.1E-01	c	1.9E+00	c	1.5E-03	n	6.1E-03	n	4.5E-02	c			c	
		2.6E-04	C	1.1E-02	C	1.4E-05	C			1	0.1		Nickelocene	1271-28-9	6.7E+01	n	8.1E+02	n	1.5E-03	n	6.1E-03	n	2.2E+01	n			n	
				1.6E+00	I					1			Nitrate	14797-55-8	1.3E+04	n	1.9E+05	nm					3.2E+03	n	1.0E+04		n	
										1			Nitrate + Nitrite (as N)	NA											1.0E+04			
				1.0E-01	I					1			Nitrite	14797-65-0	7.8E+02	n	1.2E+04	n					2.0E+02	n	1.0E+03		n	
				1.0E-02	X	5.0E-05	X			1	0.1		Nitroaniline, 2-	88-74-4	6.3E+01	n	8.0E+02	n	5.2E-03	n	2.2E-02	n	1.9E+01	n		8.0E-03	n	
2.0E-02	P			4.0E-03	P	6.0E-03	P			1	0.1		Nitroaniline, 4-	100-01-6	2.5E+01	n	1.1E+02	c**	6.3E-01	n	2.6E+00	n	3.8E+00	c**		1.6E-03	c**	
		4.0E-05	I	2.0E-03	I	9.0E-03	I	V		1		3.1E+03	Nitrobenzene	98-95-3	5.1E+00	c**	2.2E+01	c**	7.0E-02	c*	3.1E-01	c*	1.4E-01	c**		9.2E-05	c**	
				3.0E+03	P					1	0.1		Nitrocellulose	9004-70-0	1.9E+07	nm	2.5E+08	nm					6.0E+06	n		1.3E+03	n	
				7.0E-02	H					1	0.1		Nitrofurantoin	67-20-9	4.4E+02	n	5.7E+03	n					1.4E+02	n		6.1E-02	n	
1.3E+00	C	3.7E-04	C							1	0.1		Nitrofurazone	59-87-0	4.2E-01	c	1.8E+00	c	7.6E-03	c	3.3E-02	c	6.0E-02	c		5.4E-05	c	
1.7E-02	P			1.0E-04	P					1	0.1		Nitroglycerin	55-63-0	6.3E-01	n	8.2E+00	n					2.0E-01	n		8.5E-05	n	
				1.0E-01	I					1	0.1		Nitroguanidine	556-88-7	6.3E+02	n	8.2E+03	n					2.0E+02	n		4.8E-02	n	
		8.8E-06	P			5.0E-03	P	V		1		1.8E+04	Nitromethane	75-52-5	5.4E+00	c**	2.4E+01	c**	3.2E-01	c**	1.4E+00	c**	6.4E-01	c**		1.4E-04	c**	
		2.7E-03	H			2.0E-02	I	V		1		4.9E+03	Nitropropane, 2-	79-46-9	1.4E-02	c	6.0E-02	c	1.0E-03	c	4.5E-03	c	2.1E-03	c		5.4E-07	c	
2.7E+01	C	7.7E-03	C						M	1	0.1		Nitroso-N-ethylurea, N-	759-73-9	4.5E-03	c	8.5E-02	c	1.3E-04	c	1.6E-03	c	9.2E-04	c		2.2E-07	c	
1.2E+02	C	3.4E-02	C						M	1	0.1		Nitroso-N-methylurea, N-	684-93-5	1.0E-03	c	1.9E-02	c	3.0E-05	c	3.6E-04	c	2.1E-04	c		4.6E-08	c	
5.4E+00	I	1.6E-03	I					V		1			Nitroso-di-N-butylamine, N-	924-16-3	9.9E-02	c	4.6E-01	c	1.8E-03	c	7.7E-03	c	2.7E-03	c		5.5E-06	c	
7.0E+00	I	2.0E-03	C							1	0.1		Nitroso-di-N-propylamine, N-	621-64-7	7.8E-02	c	3.3E-01	c	1.4E-03	c	6.1E-03	c	1.1E-02	c		8.1E-06	c	
2.8E+00	I	8.0E-04	C							1	0.1		Nitrosodiethanolamine, N-	1116-54-7	1.9E-01	c	8.2E-01	c	3.5E-03	c	1.5E-02	c	2.8E-02	c		5.6E-06	c	
1.5E+02	I	4.3E-02	I						M	1	0.1		Nitrosodiethylamine, N-	55-18-5	8.1E-04	c	1.5E-02	c	2.4E-05	c	2.9E-04	c	1.7E-04	c		6.1E-08	c	
5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	V	M	1		2.4E+05	Nitrosodimethylamine, N-	62-75-9	2.0E-03	c*	3.4E-02	c*	7.2E-05	c*	8.8E-04	c*	1.1E-04	c*		2.7E-08	c*	
4.9E-03	I	2.6E-06	C							1	0.1		Nitrosodiphenylamine, N-	86-30-6	1.1E+02	c	4.7E+02	c	1.1E+00	c	4.7E+00	c	1.2E+01	c		6.7E-02	c	
2.2E+01	I	6.3E-03	C					V		1		1.1E+05	Nitrosomethylethylamine, N-	10595-95-6	2.0E-02	c	9.1E-02	c	4.5E-04	c	1.9E-03	c	7.1E-04	c		2.0E-07	c	
6.7E+00	C	1.9E-03	C							1	0.1		Nitrosomorpholine [N-]	59-89-2	8.1E-02	c	3.4E-01	c	1.5E-03	c	6.5E-03	c	1.2E-02	c		2.8E-06	c	
9.4E+00	C	2.7E-03	C							1	0.1		Nitrosopiperidine [N-]	100-75-4	5.8E-02	c	2.4E-01	c	1.0E-03	c	4.5E-03	c	8.2E-03	c		4.4E-06	c	
2.1E+00	I	6.1E-04	I							1	0.1		Nitrosopyrrolidine, N-	930-55-2	2.6E-01	c	1.1E+00	c	4.6E-03	c	2.0E-02	c	3.7E-02	c		1.4E-05	c	
				1.0E-04	X					1	0.1		Nitrotoluene, m-	99-08-1	6.3E-01	n	8.2E+00	n					1.7E-01	n		1.6E-04	n	
2.2E-01	P			9.0E-04	P			V		1		1.5E+03	Nitrotoluene, o-	88-72-2	3.2E+00	c**	1.5E+01	c**					3.1E-01	c**		3.0E-04	c**	
1.6E-02	P			4.0E-03	P					1	0.1		Nitrotoluene, p-	99-99-0	2.5E+01	n	1.4E+02	c**					4.3E+00	c**		4.0E-03	c**	
				3.0E-04	X	2.0E-02	P	V		1		6.9E+00	Nonane, n-	111-84-2	1.1E+00	n	7.2E+00	ns	2.1E+00	n	8.8E+00	n	5.3E-01	n		7.5E-03	n	
				4.0E-02	I					1	0.1		Norflurazon	27314-13-2	2.5E+02	n	3.3E+03	n					7.7E+01	n		5.0E-01	n	
				3.0E-03	I					1	0.1		Octabromodiphenyl Ether	32536-52-0	1.9E+01	n	2.5E+02	n					6.0E+00	n		1.2E+00	n	
				5.0E-02	I					1	0.006		Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	3.9E+02	n	5.7E+03	n					1.0E+02	n		1.3E-01	n	
				2.0E-03	H					1	0.1		Octamethylpyrophosphoramide	152-16-9	1.3E+01	n	1.6E+02	n					4.0E+00	n		9.6E-04	n	
				5.0E-02	I					1	0.1		Oryzalin	19044-88-3	3.2E+02	n	4.1E+03	n					8.1E+01	n		1.5E-01	n	
				5.0E-03	I					1	0.1		Oxadiazon	19666-30-9	3.2E+01	n	4.1E+02	n					4.7E+00	n		4.8E-02	n	
				2.5E-02	I					1	0.1		Oxamyl	23135-22-0	1.6E+02	n	2.1E+03	n					5.0E+01	n	2.0E+02	1.1E-02	n	4.4E-02
				3.0E-03	I					1	0.1		Oxyfluorfen	42874-03-3	1.9E+01	n	2.5E+02	n					3.2E+00	n		2.5E-01	n	
				1.3E-02	I					1	0.1		Paclobutrazol	76738-62-0	8.2E+01	n	1.1E+03	n					2.3E+01	n		4.6E-02	n	
				4.5E-03	I					1	0.1		Paraquat Dichloride	1910-42-5	2.8E+01	n	3.7E+02	n					9.0E+00	n		1.2E-01	n	
				6.0E-03	H					1	0.1		Parathion	56-38-2	3.8E+01	n	4.9E+02	n					8.6E+00	n		4.3E-02	n	

TR=1E-0
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information															Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	vol	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				5.0E-02	H			V		1			Pebulate	1114-71-2	3.9E+02	n	5.8E+03	n					5.6E+01	n		4.5E-02	n	
				4.0E-02	I					1	0.1		Pendimethalin	40487-42-1	2.5E+02	n	3.3E+03	n					1.8E+01	n		2.1E-01	n	
				2.0E-03	I			V		1		3.1E-01	Pentabromodiphenyl Ether	32534-81-9	1.6E+01	ns	2.3E+02	ns					4.0E+00	n		1.7E-01	n	
				1.0E-04	I					1	0.1		Pentabromodiphenyl ether, 2,2',4,4',5- (BDE-99)	60348-60-9	6.3E-01	n	8.2E+00	n					2.0E-01	n		8.7E-03	n	
				8.0E-04	I			V		1			Pentachlorobenzene	608-93-5	6.3E+00	n	9.3E+01	n					3.2E-01	n		2.4E-03	n	
9.0E-02	P							V		1		4.6E+02	Pentachloroethane	76-01-7	7.7E+00	c	3.6E+01	c					6.5E-01	c		3.1E-04	c	
2.6E-01	H			3.0E-03	I			V		1			Pentachloronitrobenzene	82-68-8	2.7E+00	c**	1.3E+01	c*					1.2E-01	c*		1.5E-03	c*	
4.0E-01	I	5.1E-06	C	5.0E-03	I					1	0.25		Pentachlorophenol	87-86-5	1.0E+00	c*	4.0E+00	c*	5.5E-01	c	2.4E+00	c	4.1E-02	c*	1.0E+00	4.2E-04	c*	1.0E-02
4.0E-03	X			2.0E-03	P					1	0.1		Pentaerythritol tetranitrate (PETN)	78-11-5	1.3E+01	n	1.6E+02	n					3.9E+00	n		5.8E-03	n	
						1.0E+00	P	V		1		3.9E+02	Pentane, n-	109-66-0	8.1E+01	n	3.4E+02	n	1.0E+02	n	4.4E+02	n	2.1E+02	n		1.0E+00	n	
													Perchlorates															
				7.0E-04	I					1			~Ammonium Perchlorate	7790-98-9	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				7.0E-04	I					1			~Lithium Perchlorate	7791-03-9	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				7.0E-04	I					1			~Perchlorate and Perchlorate Salts	14797-73-0	5.5E+00	n	8.2E+01	n					1.4E+00	n	1.5E+01(F)		n	
				7.0E-04	I					1			~Potassium Perchlorate	7778-74-7	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				7.0E-04	I					1			~Sodium Perchlorate	7601-89-0	5.5E+00	n	8.2E+01	n					1.4E+00	n			n	
				2.0E-02	P			V		1			Perfluorobutane Sulfonate	375-73-5	1.6E+02	n	2.3E+03	n					3.8E+01	n		2.1E-02	n	
				5.0E-02	I					1	0.1		Permethrin	52645-53-1	3.2E+02	n	4.1E+03	n					1.0E+02	n		2.4E+01	n	
2.2E-03	C	6.3E-07	C							1	0.1		Phenacetin	62-44-2	2.5E+02	c	1.0E+03	c	4.5E+00	c	1.9E+01	c	3.4E+01	c		9.7E-03	c	
				2.5E-01	I					1	0.1		Phenmedipham	13684-63-4	1.6E+03	n	2.1E+04	n					4.0E+02	n		2.1E+00	n	
				3.0E-01	I	2.0E-01	C			1	0.1		Phenol	108-95-2	1.9E+03	n	2.5E+04	n	2.1E+01	n	8.8E+01	n	5.8E+02	n		3.3E-01	n	
				5.0E-04	X					1	0.1		Phenothiazine	92-84-2	3.2E+00	n	4.1E+01	n					4.3E-01	n		1.4E-03	n	
				6.0E-03	I					1	0.1		Phenylenediamine, m-	108-45-2	3.8E+01	n	4.9E+02	n					1.2E+01	n		3.2E-03	n	
4.7E-02	H									1	0.1		Phenylenediamine, o-	95-54-5	1.2E+01	c	4.9E+01	c					1.6E+00	c		4.4E-04	c	
				1.9E-01	H					1	0.1		Phenylenediamine, p-	106-50-3	1.2E+03	n	1.6E+04	n					3.8E+02	n		1.0E-01	n	
1.9E-03	H									1	0.1		Phenylphenol, 2-	90-43-7	2.8E+02	c	1.2E+03	c					3.0E+01	c		4.1E-01	c	
				2.0E-04	H					1	0.1		Phorate	298-02-2	1.3E+00	n	1.6E+01	n					3.0E-01	n		3.4E-04	n	
						3.0E-04	I	V		1		1.6E+03	Phosgene	75-44-5	3.1E-02	n	1.3E-01	n	3.1E-02	n	1.3E-01	n						
				2.0E-02	I					1	0.1		Phosmet	732-11-6	1.3E+02	n	1.6E+03	n					3.7E+01	n		8.2E-03	n	
													Phosphates, inorganic															
				4.9E+01	P					1			~Aluminum metaphosphate	13776-88-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Ammonium polyphosphate	68333-79-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Calcium pyrophosphate	7790-76-3	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Diammonium phosphate	7783-28-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Dicalcium phosphate	7757-93-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Dimagnesium phosphate	7782-75-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Dipotassium phosphate	7758-11-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Disodium phosphate	7558-79-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monoaluminum phosphate	13530-50-2	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monoammonium phosphate	7722-76-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monocalcium phosphate	7758-23-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monomagnesium phosphate	7757-86-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monopotassium phosphate	7778-77-0	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Monosodium phosphate	7558-80-7	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Polyphosphoric acid	8017-16-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Potassium tripolyphosphate	13845-36-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium acid pyrophosphate	7758-16-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium aluminum phosphate (acidic)	7785-88-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium aluminum phosphate (anhydrous)	10279-59-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium aluminum phosphate (tetrahydrate)	10305-76-7	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium hexametaphosphate	10124-56-8	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium polyphosphate	68915-31-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium trimetaphosphate	7785-84-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Sodium tripolyphosphate	7758-29-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tetrapotassium phosphate	7320-34-5	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tetrasodium pyrophosphate	7722-88-5	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tricalcium phosphate	7758-87-4	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Trimagnesium phosphate	7757-87-1	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Tripotassium phosphate	7778-53-2	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				4.9E+01	P					1			~Trisodium phosphate	7601-54-9	3.8E+05	nm	5.7E+06	nm					9.7E+04	n			n	
				3.0E-04	I	3.0E-04	I	V		1			Phosphine	7803-51-2	2.3E+00	n	3.5E+01	n	3.1E-02	n	1.3E-01	n	5.7E-02	n			n	
				4.9E+01	P	1.0E-02	I			1			Phosphoric Acid	7664-38-2	3.0E+05	nm	2.9E+06	nm	1.0E+00	n	4.4E+00	n	9.7E+04	n			n	
				2.0E-05	I			V		1			Phosphorus, White	7723-14-0	1.6E-01	n	2.3E+00	n					4.0E-02	n		1.5E-04	n	
													Phthalates															

TR=1E-06
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information													Contaminant		Screening Levels											Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
1.4E-02	I	2.4E-06	C	2.0E-02	I					1	0.1		~Bis(2-ethylhexyl)phthalate	117-81-7	3.9E+01	c**	1.6E+02	c*	1.2E+00	c	5.1E+00	c	5.6E+00	c**	6.0E+00	1.3E+00	c**	1.4E+00
				1.0E+00	I					1	0.1		~Butylphthalyl Butylglycolate	85-70-1	6.3E+03	n	8.2E+04	n					1.3E+03	n		3.1E+01	n	
				1.0E-01	I					1	0.1		~Dibutyl Phthalate	84-74-2	6.3E+02	n	8.2E+03	n					9.0E+01	n		2.3E-01	n	
				8.0E-01	I					1	0.1		~Diethyl Phthalate	84-66-2	5.1E+03	n	6.6E+04	n					1.5E+03	n		6.1E-01	n	
				1.0E-01	I			V		1			~Dimethylterephthalate	120-61-6	7.8E+02	n	1.2E+04	n					1.9E+02	n		4.9E-02	n	
				1.0E-02	P					1	0.1		~Octyl Phthalate, di-N-	117-84-0	6.3E+01	n	8.2E+02	n					2.0E+01	n		5.7E+00	n	
				1.0E+00	H					1	0.1		~Phthalic Acid, P-	100-21-0	6.3E+03	n	8.2E+04	n					1.9E+03	n		6.8E-01	n	
				2.0E+00	I	2.0E-02	C			1	0.1		~Phthalic Anhydride	85-44-9	1.3E+04	n	1.6E+05	nm	2.1E+00	n	8.8E+00	n	3.9E+03	n		8.5E-01	n	
				7.0E-02	I					1	0.1		Picloram	1918-02-1	4.4E+02	n	5.7E+03	n					1.4E+02	n	5.0E+02	3.8E-02	n	1.4E-01
				1.0E-04	X					1	0.1		Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	6.3E-01	n	8.2E+00	n					2.0E-01	n		1.3E-04	n	
				9.0E-04	X					1	0.1		Picric Acid (2,4,6-Trinitrophenol)	88-89-1	5.7E+00	n	7.4E+01	n					1.8E+00	n		8.4E-03	n	
				1.0E-02	I					1	0.1		Pirimiphos, Methyl	29232-93-7	6.3E+01	n	8.2E+02	n					1.2E+01	n		1.2E-02	n	
3.0E+01	C	8.6E-03	C	7.0E-06	H					1	0.1		Polybrominated Biphenyls	59536-65-1	1.8E-02	c**	7.7E-02	c**	3.3E-04	c	1.4E-03	c	2.6E-03	c**			c**	
													Polychlorinated Biphenyls (PCBs)															
7.0E-02	S	2.0E-05	S	7.0E-05	I			V		1	0.14		~Aroclor 1016	12674-11-2	4.1E-01	n	5.1E+00	n	1.4E-01	c	6.1E-01	c	1.4E-01	n		1.3E-02	n	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1221	11104-28-2	2.0E-01	c	8.3E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1232	11141-16-5	1.7E-01	c	7.2E-01	c	4.9E-03	c	2.1E-02	c	4.7E-03	c		8.0E-05	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1242	53469-21-9	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1248	12672-29-6	2.3E-01	c	9.5E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		1.2E-03	c	
2.0E+00	S	5.7E-04	S	2.0E-05	I			V		1	0.14		~Aroclor 1254	11097-69-1	1.2E-01	n	9.7E-01	c**	4.9E-03	c	2.1E-02	c	7.8E-03	c**		2.0E-03	c**	
2.0E+00	S	5.7E-04	S					V		1	0.14		~Aroclor 1260	11096-82-5	2.4E-01	c	9.9E-01	c	4.9E-03	c	2.1E-02	c	7.8E-03	c		5.5E-03	c	
				6.0E-04	X			V		1	0.14		~Aroclor 5460	11126-42-4	3.5E+00	n	4.4E+01	n					1.2E+00	n		2.0E-01	n	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	1.3E-01	c**	5.2E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		2.8E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	1.2E-01	c**	5.2E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.7E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	1.2E-01	c**	5.1E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.7E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	1.2E-01	c**	5.1E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.7E-03	c*	
3.9E+03	E	1.1E+00	E	2.3E-08	E	1.3E-06	E	V		1	0.14		~Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	1.2E-04	c**	5.2E-04	c**	2.5E-06	c*	1.1E-05	c*	4.0E-06	c*		1.7E-06	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2',3',4,4',5- (PCB 123)	65510-44-3	1.2E-01	c**	5.0E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	1.2E-01	c**	5.0E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	1.2E-01	c**	5.0E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
3.9E+00	E	1.1E-03	E	2.3E-05	E	1.3E-03	E	V		1	0.14		~Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	1.2E-01	c**	5.1E-01	c**	2.5E-03	c*	1.1E-02	c*	4.0E-03	c*		1.0E-03	c*	
1.3E+04	E	3.8E+00	E	7.0E-09	E	4.0E-07	E	V		1	0.14		~Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	3.7E-05	c**	1.5E-04	c**	7.4E-07	c*	3.2E-06	c*	1.2E-06	c*		3.0E-07	c*	
2.0E+00	I	5.7E-04	I					V		1	0.14		~Polychlorinated Biphenyls (high risk)	1336-36-3	2.3E-01	c	9.4E-01	c	4.9E-03	c	2.1E-02	c						
4.0E-01	I	1.0E-04	I					V		1	0.14		~Polychlorinated Biphenyls (low risk)	1336-36-3					2.8E-02	c	1.2E-01	c	4.4E-02	c	5.0E-01	6.8E-03	c	7.8E-02
7.0E-02	I	2.0E-05	I					V		1	0.14		~Polychlorinated Biphenyls (lowest risk)	1336-36-3					1.4E-01	c	6.1E-01	c						
1.3E+01	E	3.8E-03	E	7.0E-06	E	4.0E-04	E			1	0.14		~Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	3.8E-02	c**	1.6E-01	c**	7.4E-04	c*	3.2E-03	c*	6.0E-03	c**		9.4E-04	c**	
3.9E+01	E	1.1E-02	E	2.3E-06	E	1.3E-04	E	V		1	0.14		~Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	1.2E-02	c**	4.9E-02	c**	2.5E-04	c*	1.1E-03	c*	4.0E-04	c*		6.2E-05	c*	
						6.0E-04	I			1	0.1		Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	8.5E+04	n	3.6E+05	nm	6.3E-02	n	2.6E-01	n						
													Polynuclear Aromatic Hydrocarbons (PAHs)															
				6.0E-02	I			V		1	0.13		~Acenaphthene	83-32-9	3.6E+02	n	4.5E+03	n					5.3E+01	n		5.5E-01	n	
				3.0E-01	I			V		1	0.13		~Anthracene	120-12-7	1.8E+03	n	2.3E+04	n					1.8E+02	n		5.8E+00	n	
7.3E-01	E	1.1E-04	C					V	M	1	0.13		~Benz[a]anthracene	56-55-3	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	1.2E-02	c		4.2E-03	c	
1.2E+00	C	1.1E-04	C							1	0.13		~Benzo[j]fluoranthene	205-82-3	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	6.5E-02	c		7.8E-02	c	
7.3E+00	I	1.1E-03	C						M	1	0.13		~Benzo[a]pyrene	50-32-8	1.6E-02	c	2.9E-01	c	9.2E-04	c	1.1E-02	c	3.4E-03	c	2.0E-01	4.0E-03	c	2.4E-01
7.3E-01	E	1.1E-04	C						M	1	0.13		~Benzo[b]fluoranthene	205-99-2	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		4.1E-02	c	
7.3E-02	E	1.1E-04	C						M	1	0.13		~Benzo[k]fluoranthene	207-08-9	1.6E+00	c	2.9E+01	c	9.2E-03	c	1.1E-01	c	3.4E-01	c		4.0E-01	c	
				8.0E-02	I			V		1	0.13		~Chloronaphthalene, Beta-	91-58-7	4.8E+02	n	6.0E+03	n					7.5E+01	n		3.9E-01	n	
7.3E-03	E	1.1E-05	C						M	1	0.13		~Chrysene	218-01-9	1.6E+01	c	2.9E+02	c	9.2E-02	c	1.1E+00	c	3.4E+00	c		1.2E+00	c	
7.3E+00	E	1.2E-03	C						M	1	0.13		~Dibenz[a,h]anthracene	53-70-3	1.6E-02	c	2.9E-01	c	8.4E-04	c	1.0E-02	c	3.4E-03	c		1.3E-02	c	
1.2E+01	C	1.1E-03	C							1	0.13		~Dibenzo(a,e)pyrene	192-65-4	4.2E-02	c	1.8E-01	c	2.6E-03	c	1.1E-02	c	6.5E-03	c		8.4E-02	c	
2.5E+02	C	7.1E-02	C						M	1	0.13		~Dimethylbenz(a)anthracene, 7,12-	57-97-6	4.6E-04	c	8.4E-03	c	1.4E-05	c	1.7E-04	c	1.0E-04	c		9.9E-05	c	
				4.0E-02	I					1	0.13		~Fluoranthene	206-44-0	2.4E+02	n	3.0E+03	n					8.0E+01	n		8.9E+00	n	
				4.0E-02	I			V		1	0.13		~Fluorene	86-73-7	2.4E+02	n	3.0E+03	n					2.9E+01	n		5.4E-01	n	
7.3E-01	E	1.1E-04	C						M	1	0.13		~Indeno[1,2,3-cd]pyrene	193-39-5	1.6E-01	c	2.9E+00	c	9.2E-03	c	1.1E-01	c	3.4E-02	c		1.3E-01	c	
2.9E-02	P			7.0E-02	A			V		1	0.13	3.9E+02	~Methylnaphthalene, 1-	90-12-0	1.8E+01	c*	7.3E+01	c*					1.1E+00	c*		6.0E-03	c*	
				4.0E-03	I			V		1	0.13		~Methylnaphthalene, 2-	91-57-6	2.4E+01	n	3.0E+02	n					3.6E+00	n		1.9E-02	n	
		3.4E-05	C	2.0E-02	I	3.0E-03	I	V		1	0.13		~Naphthalene	91-20-3	3.8E+00	c**	1.7E+01	c**	8.3E-02	c**	3.6E-01	c**	1.7E-01	c**		5.4E-04	c**	
1.2E+00	C	1.1E-04	C							1	0.13		~Nitropyrene, 4-	57835-92-4	4.2E-01	c	1.8E+00	c	2.6E-02	c	1.1E-01	c	1.9E-02	c		3.3E-03	c	
				3.0E-02	I			V		1	0.13		~Pyrene	129-00-0	1.8E+02	n	2.3E+03	n					1.2E+01	n		1.3E+00	n	
				2.0E-02	P					1	0.1		Potassium Perfluorobutane Sulfonate	29420-49-3	1.3E+02	n	1.6E+03	n					4.0E+01	n			n	
1.5E-01	I			9.0E-03	I					1	0.1		Prochloraz	67747-09-5	3.6E+00	c*	1.5E+01	c*					3.8E-01	c*		1.9E-03	c*	
				6.0E-03	H			V		1			Profluralin	26399-36-0	4.7E+01	n	7.0E+02	n					2.6E+00	n		1.6E-01	n	
				1.5E-02	I					1	0.1		Prometon	1610-18-0	9.5E+01	n	1.2E+03	n					2.5E+01	n		1.2E-02	n	
				4.0E-03	I					1	0.1		Prometryn	7287-19-6	2.5E+01	n	3.3E+02	n					6.0E+00	n		9.0E-03	n	
				1.3E-02	I					1	0.1		Propachlor	1918-16-7	8.2E+01	n	1.1E+03	n					2.5E+01	n		1.5E-02	n	

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information														Contaminant		Screening Levels										Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	mutagen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				4.0E-03	I					1	0.1		Propanediol, 1,2-	114-26-1	2.5E+01	n	3.3E+02	n					7.8E+00	n		2.5E-03	n	
				5.0E-03	I					1	0.1		Propanil	709-98-8	3.2E+01	n	4.1E+02	n					8.2E+00	n		4.5E-03	n	
				2.0E-02	I					1	0.1		Propargite	2312-35-8	1.3E+02	n	1.6E+03	n					1.6E+01	n		1.2E+00	n	
				2.0E-03	I			V		1		1.1E+05	Propargyl Alcohol	107-19-7	1.6E+01	n	2.3E+02	n					4.0E+00	n		8.1E-04	n	
				2.0E-02	I					1	0.1		Propazine	139-40-2	1.3E+02	n	1.6E+03	n					3.4E+01	n		3.0E-02	n	
				2.0E-02	I					1	0.1		Propham	122-42-9	1.3E+02	n	1.6E+03	n					3.5E+01	n		2.2E-02	n	
				1.3E-02	I					1	0.1		Propiconazole	60207-90-1	8.2E+01	n	1.1E+03	n					2.1E+01	n		6.9E-02	n	
						8.0E-03	I	V		1		3.3E+04	Propionaldehyde	123-38-6	7.5E+00	n	3.1E+01	n	8.3E-01	n	3.5E+00	n	1.7E+00	n		3.4E-04	n	
				1.0E-01	X	1.0E+00	X	V		1		2.6E+02	Propyl benzene	103-65-1	3.8E+02	ns	2.4E+03	ns	1.0E+02	n	4.4E+02	n	6.6E+01	n		1.2E-01	n	
						3.0E+00	C	V		1		3.5E+02	Propylene	115-07-1	2.2E+02	n	9.3E+02	ns	3.1E+02	n	1.3E+03	n	6.3E+02	n		6.0E-01	n	
				2.0E+01	P					1	0.1		Propylene Glycol	57-55-6	1.3E+05	nm	1.6E+06	nm					4.0E+04	n		8.1E+00	n	
						2.7E-04	A			1	0.1		Propylene Glycol Dinitrate	6423-43-4	3.9E+04	n	1.6E+05	nm	2.8E-02	n	1.2E-01	n						
				7.0E-01	H	2.0E+00	I	V		1		1.1E+05	Propylene Glycol Monomethyl Ether	107-98-2	4.1E+03	n	3.7E+04	n	2.1E+02	n	8.8E+02	n	3.2E+02	n		6.5E-02	n	
2.4E-01	I	3.7E-06	I			3.0E-02	I	V		1		7.8E+04	Propylene Oxide	75-56-9	2.1E+00	c*	9.7E+00	c*	7.6E-01	c**	3.3E+00	c**	2.7E-01	c*		5.6E-05	c*	
				7.5E-02	I					1	0.1		Propyzamide	23950-58-5	4.7E+02	n	6.2E+03	n					1.2E+02	n		1.2E-01	n	
				1.0E-03	I			V		1		5.3E+05	Pyridine	110-86-1	7.8E+00	n	1.2E+02	n					2.0E+00	n		6.8E-04	n	
				5.0E-04	I					1	0.1		Quinalphos	13593-03-8	3.2E+00	n	4.1E+01	n					5.1E-01	n		4.3E-03	n	
3.0E+00	I									1	0.1		Quinoline	91-22-5	1.8E-01	c	7.7E-01	c					2.4E-02	c		7.8E-05	c	
				9.0E-03	I					1	0.1		Quizalofop-ethyl	76578-14-8	5.7E+01	n	7.4E+02	n					1.2E+01	n		1.9E-01	n	
						3.0E-02	A			1			Refractory Ceramic Fibers	NA	4.3E+06	nm	1.8E+07	nm	3.1E+00	n	1.3E+01	n						
				3.0E-02	I					1	0.1		Resmethrin	10453-86-8	1.9E+02	n	2.5E+03	n					6.7E+00	n		4.2E+00	n	
				5.0E-02	H			V		1			Ronnel	299-84-3	3.9E+02	n	5.8E+03	n					4.1E+01	n		3.7E-01	n	
				4.0E-03	I					1	0.1		Rotenone	83-79-4	2.5E+01	n	3.3E+02	n					6.1E+00	n		3.2E+00	n	
2.2E-01	C	6.3E-05	C						M	1	0.1		Safrole	94-59-7	5.5E-01	c	1.0E+01	c	1.6E-02	c	1.9E-01	c	9.6E-02	c		5.9E-05	c	
				5.0E-03	I					1			Selenious Acid	7783-00-8	3.9E+01	n	5.8E+02	n					1.0E+01	n			n	
				5.0E-03	I	2.0E-02	C			1			Selenium	7782-49-2	3.9E+01	n	5.8E+02	n	2.1E+00	n	8.8E+00	n	1.0E+01	n	5.0E+01	5.2E-02	n	2.6E-01
				5.0E-03	C	2.0E-02	C			1			Selenium Sulfide	7446-34-6	3.9E+01	n	5.8E+02	n	2.1E+00	n	8.8E+00	n	1.0E+01	n			n	
				9.0E-02	I					1	0.1		Sethoxydim	74051-80-2	5.7E+02	n	7.4E+03	n					1.0E+02	n		9.3E-01	n	
						3.0E-03	C			1			Silica (crystalline, respirable)	7631-86-9	4.3E+05	nm	1.8E+06	nm	3.1E-01	n	1.3E+00	n						
				5.0E-03	I					0.04			Silver	7440-22-4	3.9E+01	n	5.8E+02	n					9.4E+00	n		8.0E-02	n	
1.2E-01	H			5.0E-03	I					1	0.1		Simazine	122-34-9	4.5E+00	c**	1.9E+01	c*					6.1E-01	c*	4.0E+00	3.0E-04	c*	2.0E-03
				1.3E-02	I					1	0.1		Sodium Acifluorfen	62476-59-9	8.2E+01	n	1.1E+03	n					2.6E+01	n		2.1E-01	n	
				4.0E-03	I					1			Sodium Azide	26628-22-8	3.1E+01	n	4.7E+02	n					8.0E+00	n			n	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Sodium Dichromate	10588-01-9	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
2.7E-01	H			3.0E-02	I					1	0.1		Sodium Diethyldithiocarbamate	148-18-5	2.0E+00	c*	8.5E+00	c					2.9E-01	c			c	
				5.0E-02	A	1.3E-02	C			1			Sodium Fluoride	7681-49-4	3.9E+02	n	5.8E+03	n	1.4E+00	n	5.7E+00	n	1.0E+02	n			n	
				2.0E-05	I					1	0.1		Sodium Fluoroacetate	62-74-8	1.3E-01	n	1.6E+00	n					4.0E-02	n		8.1E-06	n	
				1.0E-03	H					1			Sodium Metavanadate	13718-26-8	7.8E+00	n	1.2E+02	n					2.0E+00	n			n	
				8.0E-04	P					1			Sodium Tungstate	13472-45-2	6.3E+00	n	9.3E+01	n					1.6E+00	n			n	
				8.0E-04	P					1			Sodium Tungstate Dihydrate	10213-10-2	6.3E+00	n	9.3E+01	n					1.6E+00	n			n	
2.4E-02	H			3.0E-02	I					1	0.1		Strofos (Tetrachlorovinphos)	961-11-5	2.3E+01	c**	9.6E+01	c*					2.8E+00	c*		8.2E-03	c*	
5.0E-01	C	1.5E-01	C	2.0E-02	C	2.0E-04	C		M	0.025			Strontium Chromate	7789-06-2	3.0E-01	c	6.2E+00	c	6.8E-06	c	8.2E-05	c	4.1E-02	c			c	
				6.0E-01	I					1			Strontium, Stable	7440-24-6	4.7E+03	n	7.0E+04	n					1.2E+03	n		4.2E+01	n	
				3.0E-04	I					1	0.1		Strychnine	57-24-9	1.9E+00	n	2.5E+01	n					5.9E-01	n		6.5E-03	n	
				2.0E-01	I	1.0E+00	I	V		1		8.7E+02	Styrene	100-42-5	6.0E+02	n	3.5E+03	ns	1.0E+02	n	4.4E+02	n	1.2E+02	n	1.0E+02	1.3E-01	n	1.1E-01
				3.0E-03	P					1	0.1		Styrene-Acrylonitrile (SAN) Trimer	NA	1.9E+01	n	2.5E+02	n					4.8E+00	n			n	
				1.0E-03	P	2.0E-03	X			1	0.1		Sulfolane	126-33-0	6.3E+00	n	8.2E+01	n	2.1E-01	n	8.8E-01	n	2.0E+00	n		4.4E-04	n	
				8.0E-04	P					1	0.1		Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	5.1E+00	n	6.6E+01	n					1.1E+00	n		6.5E-03	n	
						1.0E-03	C	V		1			Sulfur Trioxide	7446-11-9	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n	2.1E-01	n			n	
						1.0E-03	C			1			Sulfuric Acid	7664-93-9	1.4E+05	nm	6.0E+05	nm	1.0E-01	n	4.4E-01	n						
2.5E-02	I	7.1E-06	I	5.0E-02	H					1	0.1		Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	2.2E+01	c*	9.2E+01	c*	4.0E-01	c	1.7E+00	c	1.3E+00	c*		1.5E-02	c*	
				3.0E-02	H					1	0.1		TCMTB	21564-17-0	1.9E+02	n	2.5E+03	n					4.8E+01	n		3.3E-01	n	
				7.0E-02	I					1	0.1		Tebuthiuron	34014-18-1	4.4E+02	n	5.7E+03	n					1.4E+02	n		3.9E-02	n	
				2.0E-02	H					1	0.1		Temephos	3383-96-8	1.3E+02	n	1.6E+03	n					4.0E+01	n		7.6E+00	n	
				1.3E-02	I					1	0.1		Terbacil	5902-51-2	8.2E+01	n	1.1E+03	n					2.5E+01	n		7.5E-03	n	
				2.5E-05	H			V		1		3.1E+01	Terbufos	13071-79-9	2.0E-01	n	2.9E+00	n					2.4E-02	n		5.2E-05	n	
				1.0E-03	I					1	0.1		Terbutryn	886-50-0	6.3E+00	n	8.2E+01	n					1.3E+00	n		1.9E-03	n	
				1.0E-04	I					1	0.1		Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	6.3E-01	n	8.2E+00	n					2.0E-01	n		5.3E-03	n	
				3.0E-04	I			V		1			Tetrachlorobenzene, 1,2,4,5-	95-94-3	2.3E+00	n	3.5E+01	n					1.7E-01	n		7.9E-04	n	
2.6E-02	I	7.4E-06	I	3.0E-02	I			V		1		6.8E+02	Tetrachloroethane, 1,1,1,2-	630-20-6	2.0E+00	c	8.8E+00	c	3.8E-01	c	1.7E+00	c	5.7E-01	c*		2.2E-04	c*	
2.0E-01	I	5.8E-05	C	2.0E-02	I			V		1		1.9E+03	Tetrachloroethane, 1,1,2,2-	79-34-5	6.0E-01	c	2.7E+00	c	4.8E-02	c	2.1E-01	c	7.6E-02	c		3.0E-05	c	
2.1E-03	I	2.6E-07	I	6.0E-03	I	4.0E-02	I	V		1		1.7E+02	Tetrachloroethylene	127-18-4	8.1E+00	n	3.9E+01	n	4.2E+00	n	1.8E+01	n	4.1E+00	n	5.0E+00	1.8E-03	n	2.3E-03
				3.0E-02	I					1	0.1		Tetrachlorophenol, 2,3,4,6-	58-90-2	1.9E+02	n	2.5E+03	n					2.4E+01	n		1.5E-01	n	
2.0E+01	H							V		1			Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	3.5E-02	c	1.6E-01	c					1.3E-03	c		4.5E-06	c	
				5.0E-04	I					1	0.1		Tetraethyl Dithiopyrophosphate	3689-24-5	3.2E+00	n	4.1E+01	n					7.1E-01	n		5.2E-04	n	

TR=1E-06
HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels												Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
						8.0E+01	I	V		1		2.1E+03	Tetrafluoroethane, 1,1,1,2-	811-97-2	1.0E+04	ns	4.3E+04	ns	8.3E+03	n	3.5E+04	n	1.7E+04	n		9.3E+00	n	
				2.0E-03	P					1	0.0007		Tetryl (Trinitrophenylmethylnitramine)	479-45-8	1.6E+01	n	2.3E+02	n					3.9E+00	n		3.7E-02	n	
				7.0E-06	X					1			Thallium (I) Nitrate	10102-45-1	5.5E-02	n	8.2E-01	n					1.4E-02	n			n	
				1.0E-05	X					1			Thallium (Soluble Salts)	7440-28-0	7.8E-02	n	1.2E+00	n					2.0E-02	n	2.0E+00	1.4E-03	n	1.4E-01
				6.0E-06	X			V		1			Thallium Acetate	563-68-8	4.7E-02	n	7.0E-01	n					1.2E-02	n			n	
				2.0E-05	X			V		1			Thallium Carbonate	6533-73-9	1.6E-01	n	2.3E+00	n					4.0E-02	n			n	
				6.0E-06	X					1			Thallium Chloride	7791-12-0	4.7E-02	n	7.0E-01	n					1.2E-02	n			n	
				2.0E-05	X					1			Thallium Sulfate	7446-18-6	1.6E-01	n	2.3E+00	n					4.0E-02	n			n	
				1.3E-02	I					1	0.1		Thifensulfuron-methyl	79277-27-3	8.2E+01	n	1.1E+03	n					2.6E+01	n		7.8E-03	n	
				1.0E-02	I					1	0.1		Thiobencarb	28249-77-6	6.3E+01	n	8.2E+02	n					1.6E+01	n		5.5E-02	n	
				7.0E-02	X					1	0.0075		Thiodiglycol	111-48-8	5.4E+02	n	7.9E+03	n					1.4E+02	n		2.8E-02	n	
				3.0E-04	H					1	0.1		Thiofanox	39196-18-4	1.9E+00	n	2.5E+01	n					5.3E-01	n		1.8E-04	n	
				8.0E-02	I					1	0.1		Thiophanate, Methyl	23564-05-8	5.1E+02	n	6.6E+03	n					1.6E+02	n		1.4E-01	n	
				5.0E-03	I					1	0.1		Thiram	137-26-8	3.2E+01	n	4.1E+02	n					9.8E+00	n		1.4E-02	n	
				6.0E-01	H					1			Tin	7440-31-5	4.7E+03	n	7.0E+04	n					1.2E+03	n		3.0E+02	n	
						1.0E-04	A	V		1			Titanium Tetrachloride	7550-45-0	1.4E+04	n	6.0E+04	n	1.0E-02	n	4.4E-02	n	2.1E-02	n			n	
				8.0E-02	I	5.0E+00	I	V		1		8.2E+02	Toluene	108-88-3	4.9E+02	n	4.7E+03	ns	5.2E+02	n	2.2E+03	n	1.1E+02	n	1.0E+03	7.6E-02	n	6.9E-01
1.8E-01	X			2.0E-04	X					1	0.1		Toluene-2,5-diamine	95-70-5	1.3E+00	n	1.3E+01	c**					4.0E-01	n		1.2E-04	n	
3.0E-02	P			4.0E-03	X					1	0.1		Toluidine, p-	106-49-0	1.8E+01	c**	7.7E+01	c**					2.5E+00	c**		1.1E-03	c**	
				3.0E+00	P			V		1		3.4E-01	Total Petroleum Hydrocarbons (Aliphatic High)	NA	2.3E+04	ns	3.5E+05	nms					6.0E+03	n		2.4E+02	n	
						6.0E-01	P	V		1		1.4E+02	Total Petroleum Hydrocarbons (Aliphatic Low)	NA	5.2E+01	n	2.2E+02	ns	6.3E+01	n	2.6E+02	n	1.3E+02	n		8.8E-01	n	
				1.0E-02	X	1.0E-01	P	V		1		6.9E+00	Total Petroleum Hydrocarbons (Aliphatic Medium)	NA	9.6E+00	ns	4.4E+01	ns	1.0E+01	n	4.4E+01	n	1.0E+01	n		1.5E-01	n	
				4.0E-02	P					1	0.1		Total Petroleum Hydrocarbons (Aromatic High)	NA	2.5E+02	n	3.3E+03	n					8.0E+01	n		8.9E+00	n	
				4.0E-03	P	3.0E-02	P	V		1		1.8E+03	Total Petroleum Hydrocarbons (Aromatic Low)	NA	8.2E+00	n	4.2E+01	n	3.1E+00	n	1.3E+01	n	3.3E+00	n		1.7E-03	n	
				4.0E-03	P	3.0E-03	P	V		1			Total Petroleum Hydrocarbons (Aromatic Medium)	NA	1.1E+01	n	6.0E+01	n	3.1E-01	n	1.3E+00	n	5.5E-01	n		2.3E-03	n	
1.1E+00	I	3.2E-04	I							1	0.1		Toxaphene	8001-35-2	4.9E-01	c	2.1E+00	c	8.8E-03	c	3.8E-02	c	7.1E-02	c	3.0E+00	1.1E-02	c	4.6E-01
				7.5E-03	I					1	0.1		Tralomethrin	66841-25-6	4.7E+01	n	6.2E+02	n					1.5E+01	n		5.8E+00	n	
				3.0E-04	A			V		1			Tri-n-butyltin	688-73-3	2.3E+00	n	3.5E+01	n					3.7E-01	n		8.2E-03	n	
				8.0E+01	X					1	0.1		Triacetin	102-76-1	5.1E+05	nm	6.6E+06	nm					1.6E+05	n		4.5E+01	n	
				3.0E-02	I					1	0.1		Triadimefon	43121-43-3	1.9E+02	n	2.5E+03	n					5.5E+01	n		4.4E-02	n	
				1.3E-02	I			V		1			Triallate	2303-17-5	1.0E+02	n	1.5E+03	n					1.2E+01	n		2.6E-02	n	
				1.0E-02	I					1	0.1		Triasulfuron	82097-50-5	6.3E+01	n	8.2E+02	n					2.0E+01	n		2.1E-02	n	
				8.0E-03	I					1	0.1		Tribenuron-methyl	101200-48-0	5.1E+01	n	6.6E+02	n					1.6E+01	n		6.1E-03	n	
				5.0E-03	I			V		1			Tribromobenzene, 1,2,4-	615-54-3	3.9E+01	n	5.8E+02	n					4.5E+00	n		6.4E-03	n	
9.0E-03	P			1.0E-02	P					1	0.1		Tributyl Phosphate	126-73-8	6.0E+01	c**	2.6E+02	c**					5.2E+00	c**		2.5E-02	c**	
				3.0E-04	P					1	0.1		Tributyltin Compounds	NA	1.9E+00	n	2.5E+01	n					6.0E-01	n			n	
				3.0E-04	I					1	0.1		Tributyltin Oxide	56-35-9	1.9E+00	n	2.5E+01	n					5.7E-01	n		2.9E+01	n	
				3.0E+01	I	3.0E+01	H	V		1		9.1E+02	Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	4.0E+03	ns	1.7E+04	ns	3.1E+03	n	1.3E+04	n	5.5E+03	n		1.4E+01	n	
7.0E-02	I			2.0E-02	I					1	0.1		Trichloroacetic Acid	76-03-9	7.8E+00	c*	3.3E+01	c*					1.1E+00	c*	6.0E+01	2.2E-04	c*	1.2E-02
2.9E-02	H									1	0.1		Trichloroaniline HCl, 2,4,6-	33663-50-2	1.9E+01	c	7.9E+01	c					2.7E+00	c		7.4E-03	c	
7.0E-03	X			3.0E-05	X					1	0.1		Trichloroaniline, 2,4,6-	634-93-5	1.9E-01	n	2.5E+00	n					4.0E-02	n		3.6E-04	n	
				8.0E-04	X			V		1			Trichlorobenzene, 1,2,3-	87-61-6	6.3E+00	n	9.3E+01	n					7.0E-01	n		2.1E-03	n	
2.9E-02	P			1.0E-02	I	2.0E-03	P	V		1		4.0E+02	Trichlorobenzene, 1,2,4-	120-82-1	5.8E+00	n	2.6E+01	n	2.1E-01	n	8.8E-01	n	4.0E-01	n	7.0E+01	1.2E-03	n	2.0E-01
				2.0E+00	I	5.0E+00	I	V		1		6.4E+02	Trichloroethane, 1,1,1-	71-55-6	8.1E+02	ns	3.6E+03	ns	5.2E+02	n	2.2E+03	n	8.0E+02	n	2.0E+02	2.8E-01	n	7.0E-02
5.7E-02	I	1.6E-05	I	4.0E-03	I	2.0E-04	X	V		1		2.2E+03	Trichloroethane, 1,1,2-	79-00-5	1.5E-01	n	6.3E-01	n	2.1E-02	n	8.8E-02	n	4.1E-02	n	5.0E+00	1.3E-05	n	1.6E-03
4.6E-02	I	4.1E-06	I	5.0E-04	I	2.0E-03	I	V	M	1		6.9E+02	Trichloroethylene	79-01-6	4.1E-01	n	1.9E+00	n	2.1E-01	n	8.8E-01	n	2.8E-01	n	5.0E+00	1.0E-04	n	1.8E-03
				3.0E-01	I			V		1		1.2E+03	Trichlorofluoromethane	75-69-4	2.3E+03	ns	3.5E+04	ns					5.2E+02	n		3.3E-01	n	
				1.0E-01	I					1	0.1		Trichlorophenol, 2,4,5-	95-95-4	6.3E+02	n	8.2E+03	n					1.2E+02	n		4.4E-01	n	
1.1E-02	I	3.1E-06	I	1.0E-03	P					1	0.1		Trichlorophenol, 2,4,6-	88-06-2	6.3E+00	n	8.2E+01	n	9.1E-01	c	4.0E+00	c	1.2E+00	n		4.5E-03	n	
				1.0E-02	I					1	0.1		Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	6.3E+01	n	8.2E+02	n					1.6E+01	n		6.8E-03	n	
				8.0E-03	I					1	0.1		Trichlorophenoxypropionic acid, -2,4,5	93-72-1	5.1E+01	n	6.6E+02	n					1.1E+01	n	5.0E+01	6.1E-03	n	2.8E-02
				5.0E-03	I			V		1		1.3E+03	Trichloropropane, 1,1,2-	598-77-6	3.9E+01	n	5.8E+02	n					8.8E+00	n		3.5E-03	n	
3.0E+01	I			4.0E-03	I	3.0E-04	I	V	M	1		1.4E+03	Trichloropropane, 1,2,3-	96-18-4	5.1E-03	c*	1.1E-01	c*	3.1E-02	n	1.3E-01	n	7.5E-04	c*		3.2E-07	c*	
				3.0E-03	X	3.0E-04	P	V		1		3.1E+02	Trichloropropene, 1,2,3-	96-19-5	7.3E-02	n	3.1E-01	n	3.1E-02	n	1.3E-01	n	6.2E-02	n		3.1E-05	n	
				2.0E-02	A					1	0.1		Tricresyl Phosphate (TCP)	1330-78-5	1.3E+02	n	1.6E+03	n					1.6E+01	n		1.5E+00	n	
				3.0E-03	I					1	0.1		Tridiphane	58138-08-2	1.9E+01	n	2.5E+02	n					1.8E+00	n		1.3E-02	n	
						7.0E-03	I	V		1		2.8E+04	Triethylamine	121-44-8	1.2E+01	n	4.8E+01	n	7.3E-01	n	3.1E+00	n	1.5E+00	n		4.4E-04	n	
				2.0E+00	P					1	0.1		Triethylene Glycol	112-27-6	1.3E+04	n	1.6E+05	nm					4.0E+03	n		8.8E-01	n	
						2.0E+01	P	V		1		4.8E+03	Trifluoroethane, 1,1,1-	420-46-2	1.5E+03	n	6.2E+03	ns	2.1E+03	n	8.8E+03	n	4.2E+03	n		1.3E+01	n	
7.7E-03	I			7.5E-03	I			V		1			Trifluralin	1582-09-8	5.9E+01	n	4.2E+02	c**					2.6E+00	c**		8.4E-02	c**	
2.0E-02	P			1.0E-02	P					1	0.1		Trimethyl Phosphate	512-56-1	2.7E+01	c**	1.1E+02	c**					3.9E+00	c**		8.6E-04	c**	
						5.0E-03	P	V		1		2.9E+02	Trimethylbenzene, 1,2,3-	526-73-8	4.9E+00	n	2.1E+01	n	5.2E-01	n	2.2E+00	n	1.0E+00	n		1.5E-03	n	
						7.0E-03	P	V		1		2.2E+02	Trimethylbenzene, 1,2,4-	95-63-6	5.8E+00	n	2.4E+01	n	7.3E-01	n	3.1E+00	n	1.5E+00	n		2.1E-03	n	
				1.0E-02	X			V		1		1.8E+02	Trimethylbenzene, 1,3,5-	108-67-8	7.8E+01	n	1.2E+03	ns					1.2E+01	n		1.7E-02	n	
				1.0E-02	X			V		1		3.0E+01	Trimethylpentene, 2,4,4-	25167-70-8	7.8E+01	ns	1.2E+03	ns					6.5E+00	n		2.2E-02	n	

TR=1E-06 HQ=0.1

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; F = See FAQ; J = New Jersey; O = EPA Office of Water; E = see user guide Section 2.3.5; L = see user guide on lead; M = mutagen; S = see user guide Section 5; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; n = noncancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; SSL values are based on DAF=1; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide)

Toxicity and Chemical-specific Information												Contaminant		Screening Levels											Protection of Ground Water SSLs		
SFO (mg/kg-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	volatile	muta-gen	GIABS	ABS	C_{sat} (mg/kg)	Analyte	CAS No.	Resident Soil (mg/kg)	key	Industrial Soil (mg/kg)	key	Resident Air (ug/m^3)	key	Industrial Air (ug/m^3)	key	Tapwater (ug/L)	key	MCL (ug/L)	Risk-based SSL (mg/kg)	key	MCL-based SSL (mg/kg)
				3.0E-02	I					1	0.019		Trinitrobenzene, 1,3,5-	99-35-4	2.2E+02	n	3.2E+03	n					5.9E+01	n		2.1E-01	n	
3.0E-02	I			5.0E-04	I					1	0.032		Trinitrotoluene, 2,4,6-	118-96-7	3.6E+00	n	5.1E+01	n					9.8E-01	n		5.7E-03	n	
				2.0E-02	P					1	0.1		Triphenylphosphine Oxide	791-28-6	1.3E+02	n	1.6E+03	n					3.6E+01	n		1.5E-01	n	
				2.0E-02	A					1	0.1		Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	1.3E+02	n	1.6E+03	n					3.6E+01	n		8.0E-01	n	
				1.0E-02	X					1	0.1		Tris(1-chloro-2-propyl)phosphate	13674-84-5	6.3E+01	n	8.2E+02	n					1.9E+01	n		6.5E-02	n	
2.3E+00	C	6.6E-04	C					V		1		4.7E+02	Tris(2,3-dibromopropyl)phosphate	126-72-7	2.8E-01	c	1.3E+00	c	4.3E-03	c	1.9E-02	c	6.8E-03	c		1.3E-04	c	
2.0E-02	P			7.0E-03	P					1	0.1		Tris(2-chloroethyl)phosphate	115-96-8	2.7E+01	c**	1.1E+02	c**					3.8E+00	c**		3.8E-03	c**	
3.2E-03	P			1.0E-01	P					1	0.1		Tris(2-ethylhexyl)phosphate	78-42-2	1.7E+02	c**	7.2E+02	c*					2.4E+01	c**		1.2E+02	c**	
				8.0E-04	P					1			Tungsten	7440-33-7	6.3E+00	n	9.3E+01	n					1.6E+00	n		2.4E-01	n	
				3.0E-03	I	4.0E-05	A			1			Uranium (Soluble Salts)	NA	2.3E+01	n	3.5E+02	n	4.2E-03	n	1.8E-02	n	6.0E+00	n	3.0E+01	2.7E+00	n	1.4E+01
1.0E+00	C	2.9E-04	C						M	1	0.1		Urethane	51-79-6	1.2E-01	c	2.3E+00	c	3.5E-03	c	4.2E-02	c	2.5E-02	c		5.6E-06	c	
		8.3E-03	P	9.0E-03	I	7.0E-06	P			0.026			Vanadium Pentoxide	1314-62-1	6.6E+01	n	8.4E+02	n	3.4E-04	c**	1.5E-03	c**	1.5E+01	n			n	
				5.0E-03	S	1.0E-04	A			0.026			Vanadium and Compounds	7440-62-2	3.9E+01	n	5.8E+02	n	1.0E-02	n	4.4E-02	n	8.6E+00	n		8.6E+00	n	
				1.0E-03	I			V		1			Vernolate	1929-77-7	7.8E+00	n	1.2E+02	n					1.1E+00	n		8.9E-04	n	
				2.5E-02	I					1	0.1		Vinclozolin	50471-44-8	1.6E+02	n	2.1E+03	n					4.4E+01	n		3.4E-02	n	
				1.0E+00	H	2.0E-01	I	V		1		2.8E+03	Vinyl Acetate	108-05-4	9.1E+01	n	3.8E+02	n	2.1E+01	n	8.8E+01	n	4.1E+01	n		8.7E-03	n	
		3.2E-05	H			3.0E-03	I	V		1		2.5E+03	Vinyl Bromide	593-60-2	1.2E-01	c**	5.2E-01	c**	8.8E-02	c**	3.8E-01	c**	1.8E-01	c**		5.1E-05	c**	
7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	V	M	1		3.9E+03	Vinyl Chloride	75-01-4	5.9E-02	c	1.7E+00	c*	1.7E-01	c*	2.8E+00	c*	1.9E-02	c	2.0E+00	6.5E-06	c	6.9E-04
				3.0E-04	I					1	0.1		Warfarin	81-81-2	1.9E+00	n	2.5E+01	n					5.6E-01	n		5.9E-04	n	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, P-	106-42-3	5.6E+01	n	2.4E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n		1.9E-02	n	
				2.0E-01	S	1.0E-01	S	V		1		3.9E+02	Xylene, m-	108-38-3	5.5E+01	n	2.4E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n		1.9E-02	n	
				2.0E-01	S	1.0E-01	S	V		1		4.3E+02	Xylene, o-	95-47-6	6.5E+01	n	2.8E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n		1.9E-02	n	
				2.0E-01	I	1.0E-01	I	V		1		2.6E+02	Xylenes	1330-20-7	5.8E+01	n	2.5E+02	n	1.0E+01	n	4.4E+01	n	1.9E+01	n	1.0E+04	1.9E-02	n	9.9E+00
				3.0E-04	I					1			Zinc Phosphide	1314-84-7	2.3E+00	n	3.5E+01	n					6.0E-01	n			n	
				3.0E-01	I					1			Zinc and Compounds	7440-66-6	2.3E+03	n	3.5E+04	n					6.0E+02	n		3.7E+01	n	
				5.0E-02	I					1	0.1		Zineb	12122-67-7	3.2E+02	n	4.1E+03	n					9.9E+01	n		2.9E-01	n	
				8.0E-05	X					1			Zirconium	7440-67-7	6.3E-01	n	9.3E+00	n					1.6E-01	n		4.8E-01	n	

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APPENDIX D LABORATORY QUALITY ASSURANCE DOCUMENTATION

ALS Environmental

USA

Statement of Qualifications

RIGHT SOLUTIONS | RIGHT PARTNER

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ALS IS THE GLOBAL BENCHMARK FOR QUALITY AND INTEGRITY

13,000
Experienced and dedicated staff globally

350+
Laboratories and offices across the world

55
Countries covered by the ALS global network

Corporate Profile

As one of the world's largest and most diverse testing services providers, ALS is strategically located around the world to provide accurate and timely services. We operate in more than 350 locations in 55 countries across six continents. Our teams of experts around the world are available to provide specialized business solutions that align with client needs.

ALS Limited's international testing services are focused on delivering superior services through four main divisions and 13 business groups. These include: Minerals (Geochemistry, Metallurgy, Mine Site, Inspection); Life Sciences (Environmental, Food, Animal Health, Consumer Products, and Electronics); Energy (Coal, Oil & Gas); and Industrial (Asset Care, Tribology). Through these groups, we are able to offer a broad range of technical services to our clients – unrivaled in the industry.

ALS is the global benchmark for quality and integrity, and we have built our reputation on these two principles along with client service, innovation, and technical excellence. Our commitment to systemization and standardization allows our people to focus on what is important.

ALS Core Values

- Honesty and Integrity
- Exceeding Client Expectations
- Belief in our Ability
- Hard Work and Continuous Improvement
- Doing it Better
- Celebrating Success
- Safety as a Priority

Life Sciences Division

ALS Life Sciences is comprised of five primary analytical testing areas: Environmental, Food, Electronics, Consumer Products, and Animal Health. With our expansive worldwide footprint, ALS Life Sciences is the leader in global, comprehensive analytical testing services. We are experts in microbiological, physical and chemical testing services. Our industry-leading technical expertise, performance excellence and dedication to customer service make us the most reliable and trusted analytical service in the world.

At ALS Life Sciences, we work closely with you to understand your current analytical testing and service requirements, as well as those of the future. Our philosophy is to provide you with more than just reliable test results. We offer our clients all the advantages that an integrated laboratory network provides: regulatory compliance across six continents, excessive capacity, redundant certifications, and program management flexibility not possible with other laboratories.

SAFETY AS A PRIORITY

"OUR GLOBAL MINIMUM STANDARD ASSISTS IN MANAGING HEALTH, SAFETY, AND ENVIRONMENTAL ISSUES."

ALS is committed to a safe work culture. Our global minimum standard assists in managing health, safety and environmental issues. On a national basis, policy and procedures are designed to comply with the requirements of relevant legislation. ALS employs a team of Health and Safety professionals at both a regional and corporate level to support continual improvement and best practice.

ALS believes that meeting its safety and environmental obligations is essential to its long-term success. ALS imparts its safety and environmental values from the first day the employee commences work with the company and throughout their term as a valued employee.

We do this by:

- Comprehensive safety training upon hire
- Ongoing training, including formal training on core topics and personalized training based on risk assessments
- Integration with our day-to-day operations through our "Safety First" program and quality management system
- Auditing, reporting and review at all levels of the organization

ALS has a core value of "Safety as a Priority". Being an employee of ALS is about putting safety first. This approach is identical for staff working across the globe.

As part of this global approach, the minimum standard is driven by an ethic to deliver a consistently friendly and safe approach to work, regardless of differences in local laws.

The ALS HSE Minimum Standard requires each business to manage risks by adopting the following:

- Ensuring health, safety and environmental resources are available
- Ensuring managers are aware of their responsibilities
- Implementing a plan for managing injuries and site emergencies
- Ensuring contractors work safely
- Ensuring that key safety information is available for all staff to view
- Providing training on key safety risks
- Ensuring that all staff have an opportunity to provide feedback
- Ensuring that work areas are designed and maintained in a safe manner
- Ensuring that all incidents are reported so we can learn from our experiences
- Completing a review of health and safety issues on a regular basis
- Ensuring that a monthly site audit of Safety issues is conducted

Fixed schedules are in place for auditing, reporting and review of the HSE management system by staff, supervisors and management.

THE **LEADER IN** COMPREHENSIVE ANALYTICAL **TESTING SERVICES**

North America Headquarters: 10450 Stancliff Rd, Ste 210 • Houston, Texas 77099 USA • +1 877 793 5656

AIR WATER WASTEWATER SOIL SLUDGE SOLIDS WASTE OIL HAZARDOUS WASTE SOLVENTS SEDIMENTS TISSUES

The World's Largest Environmental Laboratory Network

ALS provides a full range of environmental analytical testing services, specializing in the analysis of air, water (raw, waste, drinking, catchment, recycled, saline, and product), soil, sludge, solids, waste oil, solvents, hazardous waste, sediments and tissues. Analytical laboratory testing services for these matrices includes routine, trace and ultra-trace level organics (volatile and semi volatile, herbicides, pesticides, PCBs and disinfection byproducts), metals and nutrients, inorganic non-metallics, microbiological, biological, toxicological parameters, particle sizing and radionuclides. We have expertise in many specialty testing areas in addition to the routine services.

As the largest and most diverse global environmental laboratory network, ALS has the experience, resources, and expertise needed to ensure we exceed expectations for all your environmental projects.

Benefits of Using ALS Environmental

ALS, through the depth of technical and management expertise, consistently provides high-level service. Our commitment to good science and personal service is backed by a sound quality program. Each laboratory within the ALS network maintains accreditations to satisfy target market demands. To obtain copies of Scopes of Accreditation, visit alsglobal.com, refer to the accrediting bodies, or contact the local ALS laboratory location. When working with ALS, clients can expect:

- Rapid turnaround to keep projects on schedule
- Project mobilization assistance to cover the scope of services required
- Technical resources to help solve problems
- Extensive experience working with a wide range of clients and programs
- Customized EDD formats with direct database uploads
- Interaction with trained professionals and problem solvers
- Regular participation in Proficiency Test evaluations to ensure that the accuracy of results is continuously monitored and improved

EXPERIENCE AND EXPERTISE WITH MANY INDUSTRIES

"ALS HELPED US WITH A NON-STANDARD, TIME-SENSITIVE PROJECT AND DELIVERED! THEY ARE EXPERTS IN THEIR FIELDS, AND CAN DEVELOP AND MODIFY ANALYTICAL PROTOCOLS TO SUIT OUR NEEDS. ALS WENT ABOVE AND BEYOND."

NATIONAL ENGINEERING FIRM

Our staff consists of more than 800 employees, including chemists, biologists, computer scientists, technicians and support personnel. The diverse educational backgrounds and experience of our employees provide ALS the comprehensive skills required by a modern analytical laboratory network. We take pride in our experience and professional dedication and are committed to providing the necessary resources to maintain and further develop our expertise to meet our customers' needs. ALS provides analytical services to many different industries, including:

- Aerospace
- Agriculture
- Automotive
- Chemical
- Commercial/Solid Waste
- Construction
- Electronics
- Environmental & Construction Engineering
- Federal Government Agencies (DoD, EPA, NOAA)
- Forest Products
- Health & Safety
- Industrial
- Manufacturers
- Microelectronics, Semiconductor
- Mining
- Municipalities
- Nutraceutical
- Petrochemical
- Petroleum, Oil, Gas, Coal
- Pharmaceutical
- Ports and Harbors
- Pulp and Paper
- Transportation
- Utilities
- Waste Management
- Water Industries
- Water Treatment

COMPREHENSIVE RANGE OF **CAPABILITIES** AND **SERVICES**

"ALS IS INCREDIBLY HELPFUL WITH TECHNICAL AND BASIC QUESTIONS. I FEEL THEY REALLY GO OUT OF THEIR WAY TO MAKE MY FIELD SAMPLING ACTIVITIES A SUCCESS BY PROVIDING SOUND ADVICE. THEY PROVIDE FAST AND ACCURATE SERVICE."

STATE GOVERNMENT AGENCY

Organic Capabilities

- Air Testing (ambient)
- CAL LUFT, CAL WET
- Chemical Agent Breakdown Products by LC/MS
- Dioxins/Furans
- Endocrine Disruptors
- Ethene, Ethane, Methane
- Explosives by LC/UV and LC/MS/MS
- Formaldehyde
- GC Semi-VOAs-PCBs
- GC Semi-VOAs-Pesticides and Herbicides
- GC Volatiles-BTEX
- GC/MS VOAs, Semi-VOAs, PAHs
- GC/MS/MS Pesticides
- GC/MS/SIM/LVI (various applications)
- GRO/DRO/ORO
- Incremental Sampling
- LC/MS and LC/MS/MS (various applications)
- NDMA
- Nitrocellulose
- Nitroglycerine, PETN
- Nitroguanidine,
- Oxyanions and Perchlorate
- PCB Congeners
- Petroleum Biomarkers
- Pharmaceutical and Personal Care Products (PPCP)
- Polybrominated Diphenyl Ethers by GC/MS/LVI/SIM
- Sediment/Tissue Chemistry
- Speciated Hydrocarbons
- TCLP/SPLP Organics
- TPH
- Vapor Intrusion
- White Phosphorus (7580)

Inorganic Capabilities

- Chemical Separations
- Chemistry
- Clean Room Chemistry
- Clean Sampling Equipment
- Elutriations - SET, EET, DRET, etc.
- General Wet
- Hydride Techniques
- ICP/MS Metals
- Low-level Mercury
- Mercury by CV
- Metals Speciation
- Organometallics
- Physical Tests (Grain Size, Atterberg, etc.)
- Sediment/Tissue Chemistry
- Selective Sequential Extractions
- TCLP/SPLP Metals
- Ultra-trace Metals

COMPREHENSIVE RANGE OF **CAPABILITIES** AND **SERVICES**

"ALS IS EASY TO WORK WITH AND ALTHOUGH THEY HAVE THE FULL EXPERIENCE AND SUPPORT OF A GREAT BIG NATIONWIDE LAB, IT'S NICE TO FEEL LIKE YOU ARE DEALING WITH YOUR LOCAL LAB."

ECOTOXICOLOGY COMPANY

Air Quality and Industrial Hygiene

- Air Toxics Methods
- Aldehydes and Amines
- Amines
- Antineoplastic / Chemo Drugs
- Beryllium
- Carboxylic Acids
- Diacetyl/Acetoin
- Diesel Particulates
- Dietary Supplements
- Fixed/Permanent Gases
- Formaldehyde/Aldehydes
- GC/MS Screens
- LEEDs Testing
- Loaner Pumps and Media
- Metals
- Methamphetamine
- NIOSH 0600 Respirable Dust
- NIOSH 0500 Total Dust
- Organics
- Passive Sampling for VOCs
- Pesticides and Herbicides
- PM-10/PM-2.5 (47 mm ptfe)
- Radiochemistry
- Silica
- Siloxanes
- Source & Stack Testing
- TO-9 and M23 for Dioxins/PCBs
- TO-14, 15 , 17
- TSP/PM10 (8x10 filters) on glass fiber/quartz filters
- Wet Chemistry

COMPREHENSIVE RANGE OF **CAPABILITIES** AND **SERVICES**

"I NEEDED ANALYTICS WITH A SHORT DEADLINE MEET. ALS TOOK EXCELLENT AND PROMPT CARE OF MY REQUIREMENTS WITH CHEERFUL AND PROFESSIONAL SERVICE."

FEDERAL GOVERNMENT AGENCY

Asbestos/Microscopy Capabilities

At ALS Environmental, our Microscopy department utilizes PCM, PLM, and TEM to identify fibers (primarily asbestos) in air, bulk, dust, and water samples.

Our wide range of prep methods, instrumentation, and expertise, allow us to customize analyses such as fiber and particle characterization and identification to individual client needs.

- Low Level Radioactively Contaminated Asbestos analysis
- Nanoparticles
- Other Fiber Identification
- Particle Sizing & Identification
- Soil (OH VAP Certified)
- Vermiculite

PCM Analysis
- Airborne Fibers by PCM
- Particle Characterization by PCM
- Airborne Fibers by PCM - Mines and Quarries
- Vitreous Fibers by PCM

PLM Analysis
- Asbestos by PLM
- Asbestos by PLM in soil
- Asbestos Point Count by PLM
- Asbestos in Vermiculite by PLM
- Friable Material by PLM
- Nonfriable Organic Binder by PLM
- Particle Characterization by PLM
- Refractory Ceramic Fibers by PLM

TEM Analysis
- Asbestos in Settled Dust via Ghost Wipe by TEM
- Asbestos in Settled Dust via MicroVac by TEM
- Airborne Asbestos (>0.5 µm) by TEM
- Airborne Asbestos (>5 µm) by TEM
- Asbestos in Friable Bulk by TEM
- Asbestos in Nonfriable Bulk by TEM
- Asbestos in Soil by TEM
- Asbestos in Vermiculite by TEM
- Asbestos in Water by TEM
- Particle Characterization by TEM

COMPREHENSIVE RANGE OF **CAPABILITIES** AND **SERVICES**

"ALS HAS ALWAYS PROVIDED EXCELLENT CUSTOMER SERVICE. THEY GO OUT OF THEIR WAY, AFTER WORKING HOURS, TO SHIP SAMPLE CONTAINERS OVERNIGHT TO MY OFFICE."

NATIONAL ENVIRONMENTAL CONSULTING FIRM

Dietary Supplements

- Fish Oil for High-Resolution Dioxins/PCBs
- Heavy Metals
- Minerals Analysis
- Pesticides Screens
- Vitamin Analysis

Microbiology/Mycology

- Coliforms and E. coli 0157:H7
- Endotoxins/Mycotoxins
- Microbial Identification
- Non-Viable Fungal Spore Analysis
- Viable Fungal and Bacterial Analysis

Radiochemical Capabilities

- Alpha Isotopics
- Alpha Scintillation Methods
- Carbon-14
- Gamma Scans
- Gas Flow Proportional Counting
- Gross Alpha Beta
- Iodine-129
- Iron-55
- Lead-210
- Liquid Scintillation
- Nickel-63
- Plutonium-241
- Radium-226 and Radium-228
- Radon-222
- Strontium-89/90
- Technetium-99
- Tritium

COMPREHENSIVE RANGE OF **CAPABILITIES** AND **SERVICES**

"THE PEOPLE AT ALS ARE ALWAYS VERY FRIENDLY AND ACCOMMODATING. THEY ARE QUICK TO RESPOND, THEY HAVE REASONABLE PRICING, AND QUICK TURNAROUND. ALS IS JUST ALL AROUND A GREAT COMPANY TO DEAL WITH!"

NATIONAL ENGINEERING FIRM

Field Products

Passive Diffusion Bag (PDB) Samplers for the Collection of Groundwater Samples for Volatile Organics Analysis

ALS has been granted a license to manufacture, use and provide the bags by the US Geological Survey (USGS) and The General Electric Company (GE), both co-patent holders on the product (US #5,804,743). The downhole passive water sampler and method of sampling was invented by Don Vroblesky (USGS) and Thomas Hyde (GE).

PDB Samplers are made of low-density polyethylene (LDPE), which acts as a semipermeable membrane. Volatile Organic Compounds (VOCs), excluding certain ketones, ethers and alcohols diffuse readily through the membrane. Equilibrium is established between the VOCs in the bag and those in the groundwater. The PDB Sampler, in the shape of a long cylindrical tube, is filled with analyte-free water. It is available in both field-ready and field-filled versions. It is simple to deploy, eliminates the collection and disposal of purged water and significantly reduces the cost of sampling. Upon retrieval, usually 14 days after deployment, bags are opened to fill vials and returned to the laboratory for analysis.

Rigid Porous Polyethylene Samplers (RPPs) for the Collection of Groundwater Samples for Water Soluble Analyte Analysis

ALS also manufactures another passive sampler based on the design and research of Don Vroblesky of the USGS. The Rigid Porous Polyethylene sampler (RPPs) is made of thin sheets of foam-like porous polyethylene with pore sizes of 6-20 microns. When completely filled with water the pores allow a water-water interface, facilitating the equilibrium of water-soluble analytes in the aquifer adjacent to the well screen with the deionized water of the RPP.

Primary sampling applications for the RPPS are for all water soluble analytes, like inorganic anions and cations, metals, MEE parameters, 1,4-dioxane, MTBE, hexavalent chromium, explosives, perchlorate and dissolved gases. They are also very useful in deep wells where submersible pumps may not function or be economically feasible.

Like the PDB, the RPP is simple to deploy, eliminates the collection and disposal of purged water and significantly reduces the cost of sampling.

A **NETWORK** OF LABORATORIES TO MEET **ALL PROJECT NEEDS**

Cincinnati, Ohio

Facility size: 13,824 sq ft
The Cincinnati laboratory is an Ohio EPA Voluntary Action Program (VAP) accredited laboratory providing environmental and AIHA accredited industrial hygiene analyses of air and other matrices to government and private clientele across the country. This facility also provides asbestos analysis of soils, settled dust and radioactively contaminated samples.

Everett, Washington

Facility size: 6,500 sq ft
The facility in Everett, Washington is designed to analyze air, water, wastewater, soil, sludge, solids, waste oil, solvents, and hazardous waste samples associated with a variety of chemical and toxic contaminants. ALS Everett is accredited by the Washington State Department of Ecology, and routinely participates in EPA and other agency programs.

Fort Collins, Colorado

Facility size: 26,000 sq ft
The laboratory in Fort Collins is a premier radiochemistry and environmental laboratory that has extensive experience serving the Department of Energy (DOE) and Department of Defense (DoD). In addition to a full range of organic and inorganic analyses, they also offer both Alpha and Gamma Spectroscopy, Liquid Scintillation, Gas-Flow Proportional and Alpha Scintillation methods and radiochemical analyses.

Holland, Michigan

Facility size: 18,500 sq ft
The facility in Holland is a NELAP accredited laboratory, offering a comprehensive range of analytical services and providing clients with access to a global network of capabilities. In addition to their analytical services, the laboratory offers sample collection and courier services, with convenient service centers in Chicago, Cleveland, Detroit, and Northwest Indiana.

Houston, Texas

Full-Service Laboratory
Facility size: 49,603 sq ft
The laboratory in Houston is a NELAC accredited laboratory with a comprehensive range of environmental testing and technical support services. The Houston facility is a high-capacity, quick-turnaround laboratory with highly experienced staff. This facility is on the same site as the corporate offices for ALS Environmental in North America.

High-Resolution Laboratory
Facility size: 8,800 sq ft
The Houston High-Resolution laboratory specializes in the analysis of Dioxins, Furans and PCB Congeners by high-resolution gas chromatography/mass spectrometry (HRGC/HRMS). The laboratory performs these analyses on a variety of sample matrices, everything from marine and animal tissue to household dust and food products. Rush services are available upon request.

Jacksonville, Florida

Facility size: 17,637 sq ft
The Jacksonville laboratory has the instrumentation and staffing to handle large projects for various matrices. This is a NELAC accredited facility with project managers averaging more than 15 years of experience in the environmental laboratory field. This laboratory is well versed in product and process testing, as well as the requirements of the pulp and paper industry. They also offer the more routine testing required of many industries and government clients.

A **NETWORK** OF LABORATORIES TO MEET **ALL PROJECT NEEDS**

Kelso, Washington

Facility size: 57,500 sq ft
The network's largest laboratory routinely processes complex projects requiring the analysis of large numbers of samples, difficult matrices, and low levels of detection. The team at this facility specializes in analyses requiring a high degree of technical expertise, such as those that allow the ultra-trace determinations of various constituents. Much of the chemistry performed here is in direct support of risk-based studies where routine environmental procedures are insufficient to meet project objectives.

Middletown, Pennsylvania

Facility size: 23,800 sq ft
The Middletown laboratory is a full-service, NELAC accredited facility with a full range of testing capabilities. With multiple service centers and a full fleet of vehicles, this laboratory can also offer a wide range of field and sampling services. The staff in Middletown handles programs such as RCRA, Superfund, Clean Water, Clean Air and Drinking Water.

Rochester, New York

Facility size: 23,564 sq ft
The facility in Rochester is a full-service environmental laboratory with NELAC certifications in most eastern and southeastern states, as well as approvals from many industry audit programs. In addition to routine analyses required by all regulatory programs in the Eastern US and those under federal auspices, Rochester also performs various specialized tests including those for all 5 fatty acids (MNA monitoring parameters), RSK-175 and air analyses. In addition, the Rochester laboratory also manages all groundwater passive sampling supplies, including Passive Diffusion Bags (PDBs) and Rigid Porous Polyethylene Samplers (RPPs).

Salt Lake City, Utah

Facility size: 28,000 sq ft
The laboratory in Salt Lake City is a premier provider of environmental and extensive industrial hygiene analytical services. This location is accredited by the American Industrial Hygiene Association (AIHA) and NELAC, and has been the primary contract laboratory for the National Institute for Occupational Safety and Health (NIOSH) for over 30 years. Salt Lake provides a full range of capabilities, including specialty analytical services such as mycological, microscopy, dietary supplement testing and the testing of air samples.

Simi Valley, California

Facility size: 22,000 sq ft
The Simi Valley facility is a nationally recognized, 22,000 square foot air testing laboratory specializing in the analysis of ambient and indoor air pollution, stationary source emissions, process gas, and industrial hygiene samples. They are accredited by the American Industrial Hygiene Association (AIHA), as well as NELAC. This laboratory maintains an inventory of over 4,000 pre-cleaned, passivated steel canisters of various sizes, low-volume flow controllers and critical orifice assemblies, analog vacuum gauges, and many other solid sampling media.

Tucson, AZ

Facility size: 9,331 sq ft
The specialty laboratory in Tucson offers a variety of testing services, including micro-elemental testing, fuel testing for power generation, environmental testing of water and soils, analyses of soil and waste-rock for acid generation potential, agronomic analyses, and leaching/attenuation studies for the mining industry.

HIGH-TECH **INSTRUMENTATION** WITH **CAPACITY** FOR LARGE PROJECTS

Instrument quantity at each ALS laboratory:	Cincinnati, OH	Everett, WA	Fort Collins, CO	Holland, MI	Houston, TX	Houston, TX (Hi-Res)	Jacksonville, FL	Kelso, WA	Middletown, PA	Rochester, NY	Salt Lake City, UT	Simi Valley, CA	South Charleston, WV	Tucson, AZ
Instrument														
Metals Testing														
CVAFS / CVAAS	1	1	2	2	3			1	1	1	2		1	
GFAAS / DFAAS								2	0					
Gold Trap Hydra Hg Analyzer				1				1	1	1				
ICPMS		1	1	2	4			3	3	1	2		1	
ICPOES	3		2	1				2	2	3	7		2	1
Thermal Decomposition Gold Trap Hg Analyzer														1
Non-Metallic Inorganics														
Amperometric Analyzer (Available CN-)				1						1				
Auto-Titrators			1	1				1	1	1				
BOD Analyzer									1					
Combustion Analyzers			1	1	1			2	2	1	2			2
Colourimetric Autoanalyzers			1	2	2			3	2		3			
Ion Chromatographs	2	1	2	2	3			4	6	6	4	2	1	1
Organics Testing														
GC-ECD	2	1	4	3	4		3	11	6	2	10	1		
GC-PID					3		1							
Automated Soxhlet Extractors							2	102		4				
Automated TKN Analyzer									1					
Combustion Analyzers														2
GC-ECD/ECD										3		1	2	
GC-ELCD/PID										2				
GC-FID	3	3	3	4	10		4	5	7	7	9	6	2	
GC-FID/ECD	2											3		
GC-FID/FID												2		
GC-FID/TCD	1							1				3		
GC-FID/TCD/TCA												1		
GC-FPD								2			2			
GC-HRMS						4								
GC-NPD				1				1	1					
GC-NPD/FID	1			1								2		
GC-PFPD												1		
GC-PID/FID	1	2	1	1						2				
GC-SCD												3		
GC/MS/MS triple quads								1						
GCMS - Air Analysis / IH	1								2	1	2	8		
GCMS - ECD												1		
GCMS - SVOC	3	2	3	4	5		4	14	7	5	6	5	1	
GCMS - TD (thermal desorption TO-17)												3		

Instrument quantity at each ALS laboratory:	Cincinnati, OH	Everett, WA	Fort Collins, CO	Holland, MI	Houston, TX	Houston, TX (Hi-Res)	Jacksonville, FL	Kelso, WA	Middletown, PA	Rochester, NY	Salt Lake City, UT	Simi Valley, CA	South Charleston, WV	Tucson, AZ
Instrument														
GCMS - VOC	2	2	4	5	8		3	10	8	6	6		1	
GPC			1		1			3	1	1	4			
HPLC - UV	1			1	3			5	2	3	9			
HPLC-UV/Fl	1									1				
Infrared	1													
LC/MS										1	4	1		
LC/MS/MS triple quads								3			3			
Microwave Digestion	1		1				1		2		2			1
Oxygen Analyzer														1
Soxtec - Accelerated Soxhlet				6	4									
TOC			1	2	1			3	2	2			1	1
Radiochemistry Testing														
Alpha Spec			10											
Gamma Spec			16											
Gas Flow Proportional Counter			5											
Liquid Scintillation			4											
Miscellaneous Testing														
Balance (6 place)	1													2
Carbon Analyzer											2			
Conductivity Meter														1
EDXRF														1
Ion Selective Electrode														3
Coulometric Titrator														1
GC/PHID											1			
GC/SCD											2			
PCM											2			
PCM (Fiber count)	1													
pH Meter										4		2		
PLM											2			
PLM (Asbestos testing)	2													
Semi-automated Isoperibolic Calorimeter														1
Semi-automated Thermogravimetric Analyzer														1
TEM (Asbestos testing)	1													
X-Ray Diffraction											1			

QUALITY ASSURANCE PROGRAM BUILT FOR CLIENT NEEDS

"IF I EVER HAVE QUESTIONS ABOUT SAMPLING OR ANALYSIS, I GO DIRECTLY TO ALS ENVIRONMENTAL. THE ALS STAFF IS EXTREMELY KNOWLEDGEABLE AND HELPFUL."

MINING COMPANY

Quality Management System

The ALS Quality Management System (QMS) is structured to include the needs of clients and ALS corporate policies, as well as accreditation, licensing, and certification requirements. Our exemplary QMS focuses on the generation of high-quality data that is delivered on time, and meets client and regulatory requirements. The ALS QMS documented in the Quality Assurance Manual (QAM) is designed to meet federal, state and local regulatory guidelines, as well as all available quality standards. Extensive training and monitoring at all facilities by quality assurance staff ensures effective implementation.

ALS policy:

- Generate scientifically sound and legally defensible data
- Comply with requirements of NELAC and other accrediting bodies
- Provide high quality testing services in compliance with all federal, state and agency regulatory requirements

All analytical methods used at ALS undergo validation prior to their approval for use in the laboratory. The approved methods contain criteria for quality control and performance criteria that provides information on each preparation and analytical stage of analysis. Data generated are compared to data quality objectives.

Scheduled internal audits are performed on all quality management system elements. System audits are qualitative evaluations of all components of the laboratory systems. They determine if the measurement systems are being used appropriately. Such audits typically involve a comparison of the activities given in the QA Manual with those actually scheduled or performed and are conducted by a Quality Assurance Manager at each facility. Audit findings are used by ALS to improve process performance. Accreditation, certification, and licensing bodies also perform audits to ensure conformity to the applicable standards or regulations. In addition, clients may wish to perform audits to verify compliance with their project requirements. Each ALS facility participates in the Performance Testing programs semiannually for each certified area of testing. Proficiency Testing programs are used to monitor testing activities. Results are reported to accreditation bodies when applicable and are used to measure performance while meeting accreditation and license requirements.

QUALITY ASSURANCE PROGRAM BUILT FOR CLIENT NEEDS

"ALS STAFF ARE VERY PATIENT AND RESPONSIVE WITH OUR INITIAL QUESTIONS. WE WILL CERTAINLY USE ALS WHEN WE NEED MORE TESTING. THEY ARE A VERY EFFICIENT TEAM AND HAVE GOOD TURNAROUND TIME."

MEDICAL TECHNOLOGY MANUFACTURER

Accreditations, Recognitions and Licenses

ALS Environmental is committed to utilizing performance testing samples to ensure that all analyses are compliant with industry standards. ALS laboratories are routinely involved with various performance programs over the past several years.

These programs include, but are not limited to:

- American Water Works Association (AWWA)
- American Industrial Hygiene Association (AIHA)
- American Public Health Association (APHA)
- BC Ministry of Environment EDQA
- BC Provincial Health Officer EWQA
- Canadian Association for Laboratory Accreditation Inc. (CALA)
- EPA and OECD Good Laboratory Practices (GLP)
- Health Canada Good Manufacturing Practices
- National Environmental Laboratory Accreditation Program (NELAP)
- Ontario Ministry of the Environment Drinking Water License
- Standards Council of Canada (SCC)
- US Environmental Protection Agency (USEPA)
- US Army Corps of Engineers (USACE)
- US Department of Defense (DoD)
- US Department of Energy Mixed-Analyte Performance Evaluation Program (MAPEP)
- National Oceanic and Atmospheric Administration (NOAA)
- North American Proficiency Testing Program (NAPT)
- National Voluntary Laboratory Accreditation Program (NVLAP)

Quality Commitment

It is important to reiterate that ALS is committed to supporting accreditation programs by active participation in state specific environmental programs and The NELAC Institute (TNI). All feedback and non-conformance issues from clients are documented, tracked, resolved, and used as part of the company's continuous improvement plan. Monitoring of improvements provides clients with assurance that ALS has addressed their concerns and implemented corrective action procedures that meet client expectations.

The ALS management team routinely reviews all activities to ensure the continued suitability of the Quality Management System to meet expectations. The reviews are used to set measurable goals and timelines for future performance and growth. ALS management invites clients to visit the nearest laboratory for a tour and review of management systems.

LIST OF USA STATE ACCREDITATIONS

	Available state programs	Cincinnati, OH	Everett, WA	Fort Collins, CO	Holland, MI	Houston, TX	Houston, Texas (High-Res)	Jacksonville, FL	Kelso, WA	Middletown, PA	Rochester, NY	Salt Lake City, UT	Simi Valley, CA	S. Charleston, WV	Tucson, AZ
Alabama	D	**	**	**	**	**	**	**	**	**	**	**	**	**	
Alaska	D, W, S, U		U	D[1], R, U					U, W, S						
Arizona	D, W, S, A			W, S, R			D, S		D, W[1], S[1]				A		
Arkansas	D, W, S					W, S	Z[1]		Z[1]						
California*	D, W, S			D[1], W, S, R		W, S	D, W, S		D, W, S						
Colorado	D, U	**	**	D[1], R	**	**	**	**	**	**	**	**	**	**	
Connecticut	D, W, S			D[1], W, S, R						D, W, S	D, W, S				
Delaware	D, S	**	**	**	**	**	**	**	**	D, H	H	**	**	**	
Florida*	D, W, S, A, T			W, S, U, R	W[1]		D, A, W, S, T	D, W, S, A[1]	D, W, S, T		W, S	S	A		
Georgia	D	D[1]	**	**	**	**	**	D	D	**	**	**	**	**	
Hawaii	D	**	**	**	**	**	D	**	D	**	**	**	**	**	
Idaho	D	D[1]	**	D[1], R	**	**	**	**	D	**	**	**	**	**	
Illinois*	D, W, S				W, S	S	D, W, S				W, S				
Indiana	D	D[1]	**	**	D	**	**	**	D	**	**	**	**	**	
Iowa	D, W, S, U				W, S							S			
Kansas*	D, W, S	D[1]		D[1], W, S, R		W, S	D, W, S								
Kentucky	D, U	U		D[1], R	U	U		U							
Louisiana*	D, W, S, U, A, T	D[1], W, S, A				W, S	D, W, S, A, T	W, S	W, S, T						
Maine	D, W, S				W[1]		D, W	W[1]	Z	D, W, S	D, W, S		A[1]		
Maryland	D	**	**	D[1], R	**	**	D	**	**	D	**	**	**	**	
Massachusetts	D, W										W				
Michigan	D	D[1]	**	**	D	**	D	**	D	**	**	**	**	**	
Minnesota*	D, W, S, U, A				W, S		S		W, S, U				A		
Mississippi	D	**	**	**	**	**	**	**	**	**	**	**	**	**	
Missouri	D	**	**	D[1], R	**	**	**	**	**	**	**	**	**	**	
Montana	D, U	D[1]	**	**	**	**	**	**	D	**	**	**	**	**	
Nebraska	D	D[1]	**	D, R	**	**	**	**	D	**	**	**	**	**	
Nevada	D, W, S	D[1]		D[1], W, S, U, R			D, W, S		W, S		W[1], S[1]	W, S, U			
New Hampshire*	D, W, S										D, W, S				
New Jersey*	D, W, S, A, T			D[1], W, S, R			W, S, T		W, S, T	D, W, S, A	D[1], W, S		A		
New Mexico	D	D[1]	**	**	**	**	D	**		**	**	**	**	**	
New York*	D, W, S, A	D[1]					D, W, S			D, W, S, A	D, W, S, A		A		
North Carolina	D, W	D[1]				W		W[2]	W[2]		W[2]				
North Dakota	D, W, S			D[1], W, S, U, R	W, S	W, S									
Ohio	D	D[1], W, S, A			W, S										
Oklahoma	D, W, S			S, R		W, S	W, S		W, S			S			
Oregon*	D, W, S, A, T						D, W, S, T		D, W, S, T				A		
Pennsylvania*	D, W, S	D[1]		D[1], W, S, U, R	W, S	W, S	D, W, S	W, S		D, W, S	W, S		**	W[1]	
Rhode Island	D, W										D, W				
South Carolina	D, W, S	D[1]						D, W, S	W[1], S[1]						
South Dakota	D	D[1]	**	**	**	**	**	**	**	**	**	**	**	**	
Tennessee	D, U	D[1]	**	D[1], R	**	**	D	**	**	**	**	**	**	**	
Texas*	D, W, S, A, T			W, S, U, R	W, S	W, S, U	D, W, S	W, S	W, S, T	D		A	A		
Utah*	D, W, S	D[1]		D[1], W, S, U, R			D, W, S					D[1], W, S, U, A	A		
Vermont	D	**	**	**	**	**	**	**	**	**	**	**	**	**	
Virginia*	D, W, S, A, T							D, W, S		D, W, S	D, W, S				
Washington	D, W, S, A	D[1]	W, S, U, A	D[1], W, S, R			D, W, S		D, W, S				A		
West Virginia	D, W, S, A				W, S	W, S	W, S			D, W, S				W, S	
Wisconsin	D, W, S, T								W, S, T						
Wyoming	D	D[1]							D	D					
Dept. of Defense				✓		✓	✓	✓	✓	✓	✓	✓	✓		
Dept. of Energy				✓								A			
AIHA		✓										✓	✓		
USDA Soil Imp. Permit		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
USDA Plant Imp. Permit									✓						
ISO17025		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓		

Revised: August 2013

LEGEND

D = Drinking Water (SDWA)
W = Waste Water (CWA)
S = Solid/Hazardous Waste (RCRA)
U = Underground Storage Tank (UST)
A = Air
Z = Specific Analytes
R = Radio Chemistry
T = Tissue
H = HSCA (Delaware)

1 = Limited scope of accreditation. Contact laboratory for details.
2 = Also certified for some groundwater methods. Contact laboratory for details.
* = NELAP State
** = Able to perform analyses in this state for all parameters that do not fall under specific state certification programs

PERFORMING **EFFICIENTLY** AND **ETHICALLY** AT ALL TIMES

"THE CUSTOMER SERVICE IS ABOVE EXCEPTIONAL, THEY GO OUT OF THEIR WAY TO GET YOU WHAT YOU NEED WHEN YOU NEED IT WITHOUT ANY PROBLEMS. THE BEST AND MOST PROFESSIONAL BUSINESS I WORK WITH!"

ENVIRONMENTAL CONSULTING FIRM

ALS is committed at all times to performing duties in efficient and ethical ways, while meeting and often exceeding standards that govern the operations of the company and complying with the all applicable laws.

Compliance

ALS believes that meeting compliance obligations is a responsibility essential to its long-term success. The company is committed to adhering to all legislation relating to ALS operations.

All ALS employees are responsible for complying with policies and procedures established to ensure that ALS fulfills requisite legislative requirements. Every employee, contractor, or agent of the company is held accountable to conform to the law and act ethically at all times.

Health and Safety

ALS is committed to achieving the highest levels of occupational health and safety performance in all of its laboratories through the reduction of risk of workplace injuries and illness. The company has a comprehensive health and safety program that protects staff, contractors, visitors, property, and the public. Compliance with health and safety legislation, development of safe operating procedures, employee training programs, regular site inspections, and annual audits ensure that employees at every level are responsible and accountable for the company's health and safety performance.

Environment

ALS is committed to minimizing its environmental footprint. To support this goal, each laboratory adheres to relevant legislation in their jurisdiction for waste storage and disposal. Samples and wastes are recycled or disposed in an environmentally responsible manner. Containers and packaging are recycled wherever possible.

Confidentiality

ALS employees understand the importance of confidentiality and have implemented policies that ensure the protection of client information. Employees are required to sign and follow ethics, conflict of interest, and confidentiality policies. These agreements are required to ensure that all employees are aware of the following items:

- Laboratory policy regarding ethics and the standards of integrity that are expected of them
- The notion that they are free from any undue pressures that might affect the quality of their work

Client confidentiality ensures that procedures for sending test results by mail, facsimile, email, or electronically meet client requirements. Requests for records made by a third party must be accompanied by written consent from the client. All employees assure clients that confidentiality is observed at all times when presenting records.

System Integrity

- Secure, virus-free system, including a firewall to protect data
- Back-up of all data
- Redundancy of major equipment and services
- Professionally managed and maintained

DEDICATED MANAGEMENT AND **TECHNICAL** STAFF

"THE CERTIFICATES OF ANALYSIS ARE ALWAYS CLEAR AND PRECISE. THE TIME FRAMES TO GET PRICE QUOTES AND SAMPLES ANALYZED ARE EXCELLENT."

NATIONAL CHEMICAL COMPANY

Management and Professional Staff

ALS employs the most dedicated management and technical staff in the business. A focus on staff retention and career development has always been a priority. This loyalty translates into a technical resource with a very high level of expertise and experience.

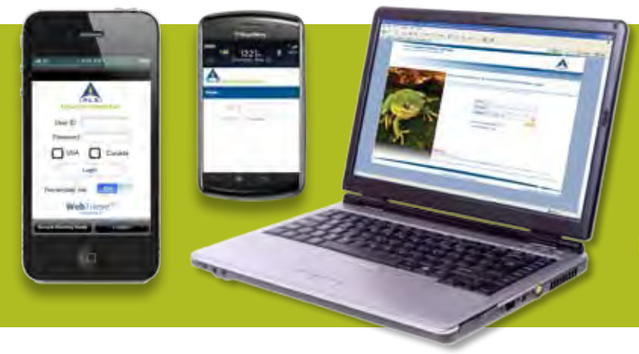
ALS is managed within a regional structure with the autonomy to deliver services that meet local needs. Since the majority of staff, including senior management, are chemists, testing requirements of clients are well known. The resume of key technical professionals are available upon request. Key positions include:

- **Managers** - responsible for resource management and efficient delivery of services
- **Technical Specialists** - responsible for maintaining the leadership at ALS in the analytical testing market. Technical specialists are knowledgeable about emerging technologies, and are often consulted by industry and regulatory bodies to provide expert assistance on a wide range of unique projects
- **Account/Project Managers** - provide the routine interaction between the laboratory and the client as it relates to the analytical project requirements for which ALS is renowned. Each client is assigned a Project/Account Manager that develops an understanding of service requirements
- **Chemists and Technical Staff** - are highly skilled professionals trained in modern analytical procedures
- **Support Staff** – ensure that services are available to provide clients with timely and secure data delivery

What This Means to Our Clients

The depth of technical and management expertise of ALS allows the company to deliver a consistently high level of service to clients. A commitment to having the highest level of technical expertise and knowledge provides the assurance that data are supported by a quality program using only modern instrumentation and procedures. The personal and comprehensive service delivered by ALS professionals translates to peace of mind and successful partnerships.

WEBTRIEVE™ ONLINE DATA ACCESS AND WEBTRIEVE™ MOBILE APPS



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Real-Time Results to Save You Time and Money

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- Multiple levels of access available
- Compare results to guidelines
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- Online request for quotes and bottle orders
- Online communication with ALS

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- ALS contact information
- Sample handling guide
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No iPhone? No problem. Most smart phone users can still access WebTrieve™ Mobile at: **mobile.alsenviro.com.**

Available on the iPhone App Store

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Cincinnati, OH
Cleveland, OH

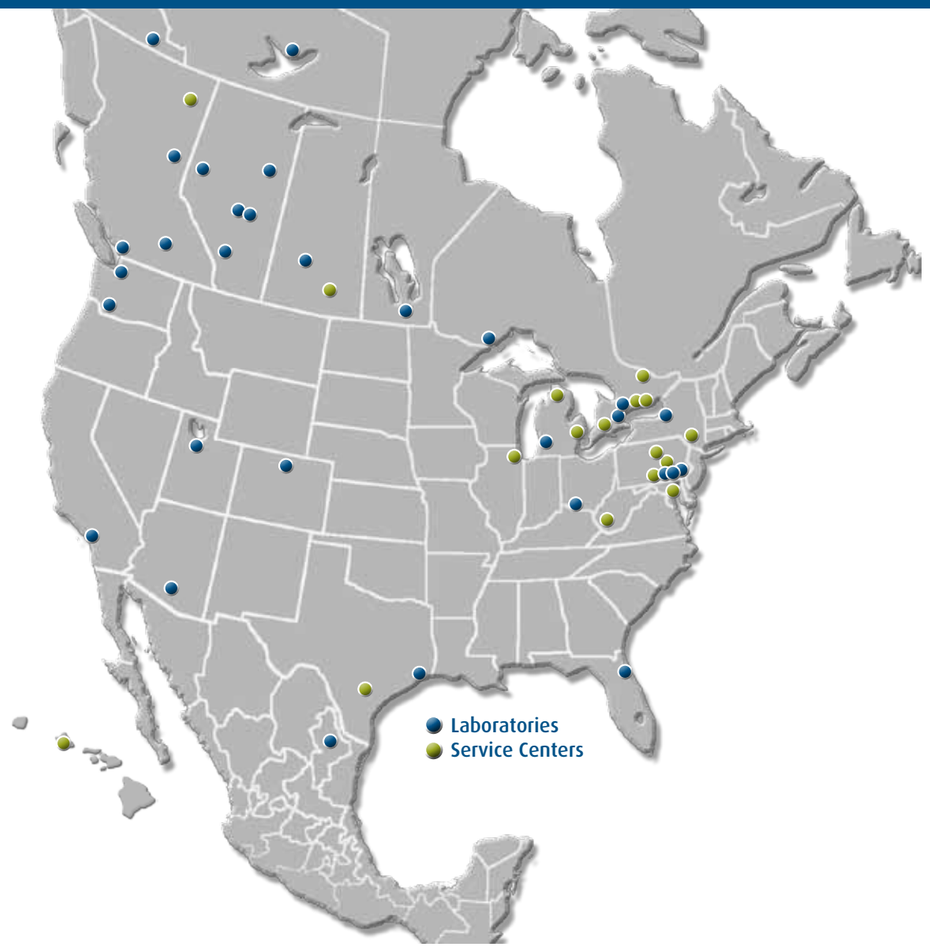
Pennsylvania
Chambersburg, PA
Harrisburg, PA
Middletown, PA
Spring City, PA
Williamsport, PA
York, PA

Texas
Houston, TX
George West, TX

Utah
Salt Lake City, UT

Washington
Everett, WA
Kelso, WA

West Virginia
South Charleston, WV



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EVERETT, WA

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USA Laboratories

Cincinnati, OH	+1 513 733 5336
Everett, WA	+1 425 356 2600
Fort Collins, CO	+1 970 490 1511
Holland, MI	+1 616 399 6070
Houston, TX	+1 281 530 5656
Houston, TX (High-Res)	+1 713 266 1599
Jacksonville, FL	+1 904 739 2277
Kelso, WA	+1 360 577 7222
Middletown, PA	+1 717 944 5541
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USA Service Centers

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Chicago, IL	+1 616 723 7806
Columbia, MD	+1 410 290 8884
George West, TX	+1 361 254 3347
Harrisburg, PA	+1 717 540 3424
Hopewell Junction, NY	+1 845 894 8544
Kapolei, HI	+1 808 682 1564
South Charleston, WV	+1 304 356 3168
Spring City, PA	+1 610 948 4903
Traverse City, MI	+1 231 421 3204
Williamsport, PA	+1 717 648 7000
York, PA	+1 717 505 5280

ALS Environmental

RIGHT SOLUTIONS | RIGHT PARTNER

[For lab use only]

ANALYTICAL REQUEST FORM

1. ☐ **REGULAR Status**

☐ **RUSH Status Requested - ADDITIONAL CHARGE**
RESULTS REQUIRED BY _____
DATE
CONTACT ALS SALT LAKE PRIOR TO SENDING SAMPLES

2. Date _____ Purchase Order No. _____

3. Company Name _____

Address _____

_____

Person to Contact _____

Telephone ( ) _____

Fax Telephone ( ) _____

E-mail Address _____

Billing Address (if different from above)

_____

_____

_____

4. Quote No. _____

ALS Project Manager _____

5. Sample Collection

Sampling Site _____

Industrial Process _____

Date of Collection _____

Time Collected _____

Date of Shipment _____

Chain of Custody No. _____

6. How did you first learn about ALS?

_____

_____

7. REQUEST FOR ANALYSES

Laboratory Use Only	Client Sample Number	Matrix*	Sample Volume	ANALYSES REQUESTED - Use method number if known	Units**

* Specify: Solid sorbent tube, e.g. Charcoal; Filter type; Impinger solution; Bulk sample; Blood; Urine; Tissue; Soil; Water; Other

** 1. µg/sample 2. mg/m^3 3. ppm 4. % 5. µg/m^3 6. _____ (other) Please indicate one or more units in the column entitled Units**

Comments _____

_____

Possible Contamination and/or Chemical Hazards _____

7. Chain of Custody (Optional)

Relinquished by _____ Date/Time _____

Received by _____ Date/Time _____

Relinquished by _____ Date/Time _____

Received by _____ Date/Time _____

960 West LeVoy Drive / Salt Lake City, UT 84123 **800-356-9135 or 801-266-7700 / FAX: 801-268-9992**

ALS Environmental

Canister Chain of Custody

Client:	Project/Job/Task:
Account No:	

Please do not apply adhesive labels directly on Canisters
Manilla tags are provided, attached to Canisters for your convenience, to apply adhesive labels

Canister Serial No.:	Date Cleaned	Initial Vacuum (inches of Hg vacuum)	VFR flow rate (ml/min)	Initials:	Field Vacuum before sampling (inches of Hg vacuum)	Final Vacuum after sampling (Inches of Hg vacuum)	Client Sample Identification	Other Client Information	ALS use only
VFR Serial No.:									

Original Field Sample Chain-of-Custody

Relinquished By: (Signature)	Date/Time	Received By: (Signature)	Reason for Transfer/Storage Location

Return to:
ALS Environmental
960 W. LeVoy Drive
Salt Lake City, UT 84123
800-356-9135

If canisters are kept for longer than the original project scheduled sampling, a $40 per can - per week rental fee will be assessed. If a project is cancelled after ALS has shipped cans, in addition to the cost of the initial shipping, a $40 weekly rental fee will be charged for each unused can until they are returned to ALS.

ALS Environmental

Field Chain-of-Custody Record

Page _____ of _____

Client Name & Address:

Phone:

FAX:

e-mail:

Project No.:

Project Name:

Sampler: *(Signature)*

Matrix Codes:
W) Water B) Bulk
L) Liquid F) Filter
S) Soil G) Wipe
C) Solid M) Media

Preservation Codes:
1) Cool to 4°C
2) HCl to pH<2, 4°C
3) H_2SO_4 to pH<2, 4°C
4) HNO_3 to pH<2, 4°C
5) NaOH to pH>12, 4°C
6) ZnOAc/NaOH to pH>9, 4°C

Field Sample Number	Site ID	Date	Time	Depth	ALS Sample Number	Preservation Code	Sample Matrix Code	Sample for Matrix QC	Analyses Requested								No. of Containers	Remarks

Possible Hazard Identification
☐ Non-Hazard ☐ Skin Irritant ☐ Rad
☐ Flammable ☐ Poison ☐ Unknown

Sample Disposal
☐ Return to Client ☐ Archive for _____ Months
☐ Disposal by Lab
(fees may be assessed if samples are retained longer than 3 months)

Requested Turn Around Time
☐ 2 Days (Rush) ☐ 7 Days (Rush) ☐ 21 Days
☐ 3 Days (Rush) ☐ 14 Days ☐ Other
(Rush = email data by COB on day due. Surcharges assessed.)

Carrier/Airbill #:

Relinquished by: *(Signature)*	Received by: *(Signature)*	Date	Time
Relinquished by: *(Signature)*	Received by: *(Signature)*	Date	Time
Relinquished by: *(Signature)*	Received by: *(Signature)*	Date	Time

Shipped to:

ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
Phone: (800) 356-9135
Phone: (801) 266-7700
FAX: (801) 268-9992

White - Laboratory Copy ***Yellow - Client Copy***

ENERGY LABORATORIES-BILLINGS, MT
QUALITY ASSURANCE MANUAL

Revision May 4, 2015

Energy Laboratories, Inc.
1120 South 27th Street
PO Box 30916
Billings, Montana 59107

Toll Free: (800) 735-4489
Local: (406) 252-6325
Fax: (406) 252-6069
E-Mail: eli@energylab.com

_____
President:

_____
Laboratory Manager

_____
Quality Assurance Officer:

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ELI COMMITMENT

Energy Laboratories, Inc. Strives Toward:

1. Being highly skilled in the field of analytical chemistry.
2. Delivering quality and service with integrity.
3. Encouraging the professional development of our staff.
4. Offering our employees a safe and positive work environment.
5. Being profitable and using resources wisely for a sustainable future.

INTRODUCTION

Energy Laboratories, Inc. provides chemical, industrial hygiene, and environmental analytical services to private industry, agricultural industry, engineering consultants, government agencies, and private individuals. Analytical services include: analysis of waters and soils for inorganic and organic constituents, aquatic toxicity testing, hazardous waste analysis, radiochemistry, industrial hygiene, microbiology, soils and water physical parameters, and petroleum analysis.

Founded in 1952, Energy Laboratories currently incorporates five separate testing laboratories. The corporate headquarters are located in Billings, MT, with branch laboratories located in Casper, WY; Gillette, WY; College Station, TX; and Helena, MT.

ELI, as a coordinated company of five participating branches, has developed a QA program that takes into account the various method types and EPA programs, while also considering sample matrices, to develop a single comprehensive set of QA guidance. We have used scientific approaches, Good Laboratory Practices, EPA Methods and Guidance documents, and accreditation audit guidance to develop our overall QA Program.

The Quality Assurance Program establishes acceptable performance criteria for all routine analytical procedures being performed by laboratory personnel. The Quality Assurance Assessment Program provides a formal system for evaluating the quality of data being generated and reported. The ELI Laboratory Safety Manual & Chemical Hygiene Plan defines the safety and monitoring procedures used by laboratory personnel in laboratory operations. These, in addition to the experience and expertise of our analysts, provide a comprehensive Quality Assurance Program. Energy Laboratories, Inc., in Billings, Montana, is certified under the Safe Drinking Water Act by Region VIII EPA for Wyoming, and the States of Montana, Idaho, Colorado, Nevada, Texas, North Dakota, and South Dakota. ELI-Billings also holds accreditation for Clean Water Act, Safe Drinking Water Act and Resource Conservation Recovery Act (RCRA) parameters through the National Environmental Laboratory Accreditation Program (NELAP), which is supported by the EPA. The NELAP certification is maintained through the state of Florida. Individual State approval for RCRA and CWA (NPDES) is managed through the Federal/State DMRQA program or through reciprocal certifications when required by a specific state. ELI obtains these certifications either through reciprocal recognition of ELI's primary Montana State or NELAP certification. To perform radon testing, ELI is certified

under the National Radon Proficiency Program administered by the National Environmental Health Association. Branch laboratories of ELI are certified in their own state and in additional states. Copies of ELI's certificates for all laboratories are maintained on ELI's website: www.energylab.com.

The ELI Quality Assurance Manual and the ELI Technical Services and Fee Schedule together are used to outline the ELI Quality Assurance/Quality Control Program. This Quality Assurance Manual is appropriate to all departments of Energy Laboratories-Billings. The procedures discussed or referenced in this manual describe our day-to-day laboratory practices and adhere to USEPA Safe Drinking Water Act, and TNI (The NELAC Institute) requirements as well as Good Laboratory Practices (GLPs). Information on the ELI-Billings and all other ELI branch labs applicable accreditations and certifications are maintained on the ELI website at www.energylab.com.The primary NELAC accreditation for the ELI Billings laboratory can be found in Appendix A of this plan. Where possible, ELI uses EPA, AOAC, ASTM, APHA, NIOSH, OSHA, or published analytical methods and follows the procedures with strict adherence to described protocol and recommended QA/QC parameters. The analytical methods approved and in use are described in Standard Operating Procedures, and are available for review at the laboratory. Vital parts of our Quality Assurance Program, Quality Control and Quality Assessment programs are outlined in Chapters One and Two of this manual.

To generate data that will meet project-specific requirements, it is necessary to define the type of decisions that will be made and identify the intended use of the data. Data Quality Objectives (DQOs) are an integrated set of specifications that define data quality requirements and the intended use of the data. Project-specific DQOs will be established as needed for both field and lab operations. Through the DQO process, appropriate reporting limits, extraction/digestion methods, clean-up methods, analytical methods, target analytes, method quality control samples, sample security requirements, quality control acceptance ranges, corrective action procedures, reporting formats and reporting limits can be specified. Professional laboratory project managers are available to assist clients in specifying appropriate laboratory analyses and reporting procedures necessary to meet project requirements.

Client-specific DQOs can be coordinated with the laboratory through our Project Managers via quotations or contracts, or with relevant documentation provided to the laboratory prior to (or at time of) sample receipt. Client-specific requirements are communicated to analysts and final report validators through the laboratory LIMS system. By default, our methods, analytes, and QC parameters are set up to meet the DQOs specified in the referenced method and/or federal/state regulations. ELI encourages clients to provide ELI documentation of any client-specific, regulatory or project monitoring requirements.

Certain types of requests may not be suitable to standardized analytical methods. These custom requests are handled individually with laboratory management and staff scientists. Project-specific methods and reporting packages are available. Attention to documentation of the analytical procedure and use of suitable QC parameters is maintained according to good scientific discipline and Good Laboratory Practice guidelines.

The ELI-Billings laboratory manager, or their designee, will evaluate all new contracts to determine that the laboratory is capable of performing the requested work. This process includes ensuring that the laboratory maintains the required accreditation, equipment and resources. In the event that sample analysis is not performed at our Billings location, clients are notified on the laboratory analytical report if the work is subcontracted to a qualified branch laboratory or an outside laboratory (See Subcontracting Policy – Chapter 6 in this QA Manual).

This Quality Manual and related quality documentation meet requirements of the National Environmental Laboratory Accreditation Program (NELAP), which is an EPA approved accreditation program.

CHAPTER 1 – QUALITY CONTROL PROGRAM

Quality Policy Statement

Energy Laboratories, Inc. is committed to producing laboratory data of known and documented quality that is scientifically valid, meets method specifications, satisfies regulatory requirements, and accomplishes the data quality objectives of the client and project. Management ensures that the laboratory maintains current certifications and is in compliance with accreditations through USEPA, State Agencies, and NELAP. Those method, regulatory, and client requirements (as well as the policies, procedures, and all referenced documents) are incorporated into our Quality Assurance Program; which is outlined within this Quality Assurance Manual. Our Quality Systems are designed to comply with the standards as defined by the most current version of the NELAC accreditation standard and ISO 17025 standards. To ensure compliance with these standards, all laboratory personnel are required to be familiar with quality documentation and implement those policies and procedures in their work. ELI is dedicated to the continual improvement of the management system's effectiveness by providing appropriate corporate resources to set objectives, offering training opportunities, and monitoring the quality performance of our staff. ELI also provides facilities and equipment adequate and appropriate to these objectives.

Quality Assurance Program

The purpose of the Quality Assurance Program is to ensure that the analytical services provided by Energy Laboratories are of high quality, data is within established accuracy and precision limits (required by the referenced method or Standard Operating Procedure), and each analytical result produced meets or exceeds our accreditation requirements. Management ensures that the integrity of the management system is maintained. The Technical Director, or their designee, ensures that changes to the management system are planned, implemented and documented.

Management establishes and maintains data integrity by providing the following to ELI's data integrity system:

1) Data Integrity Training (Including the highest standards of ethical behavior)
2) Periodic review of data integrity procedural documentation
3) Annual review of data integrity procedures with updates as needed
4) Periodic, in-depth monitoring of data integrity
5) Maintenance of signed data integrity documentation for all laboratory employees

All employees are expected to implement and follow the policies contained within the Quality Assurance Program. Internal documents (controlled and associated with the Quality Assurance Program) are listed in Appendix B.

The quality systems in the program consist of the policies and procedures, and all referenced documents, described in this Quality Assurance Manual. The Quality Control Program also functions to maintain the laboratory's compliance with accreditations through USEPA, State Agencies, and NELAP.

The Quality Control Program requires that the following points be met for each applicable analytical method:

- Performance of any analytical method requires that the proper equipment and instrumentation are available. A list of major equipment is listed in Appendix F. The procedure for operation of an analytical instrument is described in the equipment manufacturer's operating manual, and may also be supplemented with a specific Standard Operating Procedure (SOP) for the instrument and/or the method.

- Specific SOPs cover operation of the instrument including the sequence of operations involved in instrument start-up, calibrating, analyzing, and shutting down. Chapter Thirteen of this manual includes recommended preventative maintenance, and/or a list of parameters used to identify other types of maintenance. SOPs outline any special safety precautions for operation of the instrument.

- SOPs of well-detailed EPA, ASTM, NIOSH, APHA, OSHA, or published procedures include, as appropriate, a list of any method-specific items or variances, a list of QC parameters and their recommended method performance ranges, recommended or example analytical sequences, specific or unique safety information, method references, and a signed signature page. SOPs details, and format of method SOPs, follow NELAP requirements. Detailed SOPs may be prepared for those procedures that do not have published methods. Further details of SOP format and information required in method SOPs can be found in the ELI SOP, *Preparation, Numbering, Use, and Revision of Standard Operating Procedures.* Written Standard Operating Procedures referenced within this manual are available at the laboratory for review. (ELI SOPs are considered confidential proprietary information and ELI does not allow copies to be removed).

- For radiochemical analysis performed at ELI's branch labs, each method undergoes Method Validation as outlined in EPA's specific method and/or the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), Chapter 6.

- The required detection level (RDL) for radiochemical analysis of drinking water samples is calculated based on the requirements in 40 CFR 141.25(c), which is a sample specific determination. The equation is specific for each method and noted in the method-specific SOP.

- The initial test method evaluation for chemical analysis involves Method Detection Limit (MDL) studies, (refer to ELI SOP, *Determination of Method Detection Limits (MDL) and Quantitation Limits*), confirmation of the Limit of Detection (LOD) and/or Practical Quantitation Limit (PQL), also known as the Limit of Quantitation (LOQ), an evaluation of method performance (using four or more replicates of quality control samples), evaluation of the selectivity of the method, and any additional method-specific requirements

- ELI demonstrates that laboratory staff is qualified and capable of performing the method. Analysts are assigned duties based on their skills and experience. Training records are

maintained for all analysts. Curricula vitae of supervisory and senior analysts are described in Appendix E.

- It is the responsibility of the analyst to become thoroughly familiar with the methodology and instrument operation before performing the analysis. It is the responsibility of the person providing training to monitor all laboratory results generated for a reasonable time. The amount of time necessary may vary depending on the method and the experience of the analyst. At a minimum, the analyst's performance is to be monitored until the analyst demonstrates the ability to generate results of acceptable accuracy and precision according to the method.

- All analysts are required to demonstrate and maintain a record of proof of competency by routinely analyzing quality control samples appropriate to the analytical procedures they perform. Competency in analyzing these control samples is documented in analysts' training files per NELAP requirements (for more information, see ELI SOP, *Personnel Training and Training Records*). For those analyses where external proficiency testing (PT) samples are not routinely analyzed, competency is documented by including the results of routine analysis of method-specific quality control samples (prepared by laboratory staff) and/or a verifying statement of procedural review by a supervisor or trained analyst.

- Each analytical method is subjected to quality control monitoring. The purpose is to demonstrate that results generated meet acceptable accuracy and precision criteria for the method. Precision and bias are determined for standard and non-standard methods. Precision and bias are determined for standard methods through control charting of data from quality control samples. Precision and bias using non-standard, modified standard or laboratory-developed methods are compared to the criteria established by the client (when requested), the method, or the laboratory.

- Quality control requirements are outlined in the methods and ELI, at a minimum, follows the guidelines specified in the methods used. Additional QC requirements are also added as appropriate. Statistical method performance is periodically evaluated against method requirements using control charts.

- Quality control monitoring to measure accuracy for each method generally requires that five to ten percent of all samples analyzed be fortified (spiked) with a known concentration of target analytes tested by the method. The percent recovery is then calculated. This provides a means for monitoring method accuracy and evaluating sample matrix effects. Where appropriate, surrogates are included in the method to monitor method performance on each individual sample. Blank spike samples replace matrix spike samples for certain methods, or when there is insufficient sample for a matrix spike analysis. Historical, routine batch QC sample performance can be used to estimate the precision and accuracy of the method.

- Quality control monitoring to measure precision for each method requires replicate samples be prepared and analyzed when appropriate. Actual requirements are outlined

in the specific SOP. When replicate samples or matrix spike duplicates are analyzed, relative percent difference is calculated and used to monitor precision of the method. In instances where there are no specific method requirements, it is the policy of this laboratory to analyze five to ten percent of all samples in duplicate. Duplicate test results must be within the control limits established for each analysis type or data is qualified. Acceptance limits generally follow specifications listed in the method. Matrix spike duplicates replace sample duplicates for most methods.

- When not defined in the method, and as appropriate, method blanks and/or instrument blanks are analyzed one in every 20 samples at a minimum. Method blanks are used to verify that contamination from laboratory reagents and glassware is not present in the analytical sample process. Generally, the method blank should be less than the reporting limit, or 10 times less than the concentration amount in the sample, for the analytical parameter being tested, whichever is greater.

- When not defined in the method, and as appropriate, method spikes (blank spikes) are analyzed one in every 20 samples, at a minimum.

- Calibration standards are analyzed and calibration curves are developed for all applicable methods. For additional information on instrument calibration, see Chapter Seven of this QA manual.

- The initial calibration is continuously monitored by analyzing a continuing calibration standard every 10 to 20 samples, or within a specified time frequency, and at the end of each analytical sequence; depending on the method and instrumentation. Results must be within an established range as described by the method SOP. Initial calibrations are verified against a standard from a second source.

- Proficiency testing samples and further quality control check samples may be required for various methods. Refer to Chapter Two of this QA manual for further details.

Estimation of Uncertainty

The estimation of uncertainty consists of the sum of the uncertainties of the individual steps or processes of an analytical procedure. The variability of the sampling plan, sample heterogeneity, extraction procedure, instrument calibration, instrument drift, systematic bias, and many other factors all contribute to the uncertainty of a measurement or result.

ELI estimates uncertainty utilizing Confidence Intervals defined as ±2σ (95%) and ±3σ (99%) where σ is the standard deviation of the recovery of quality control samples. The confidence intervals calculated from these QC samples are based on the spike level concentrations for each method. Uncertainty at low concentrations may be one to three times the quantitation limit. Real world samples, depending on matrix interferences, may have a greater amount of uncertainty associated. Due to limitations in assessing the uncertainty for each matrix type, the confidence intervals calculated from method QC samples provides an estimate of uncertainty.

Energy Laboratories, Inc. uses the procedures outlined in ELI SOP, *Control Chart Generation and Maintenance*, for the purpose of evaluating estimation of uncertainty for chemical analyses and uses the determination of uncertainty on a sample-specific basis for all radiochemistry measurements. These estimates of uncertainty have formulas documented in the individual SOP.

Maintenance of Performance Records

All quality control monitoring is recorded and documented. Quality control data is recorded in laboratory notebooks, electronic summary files, and/or analysis sheets. Generally, review of QC data and trends is managed within the Laboratory LIMS system. QC data management and control chart generation, maintenance, and usage are described in ELI SOP, *Control Chart Generation and Maintenance*. It is the responsibility of the analyst to see that all results are recorded in a timely manner.

All quality control data is filed and available for inspection and assessment by analysts, supervisors, management, and quality control personnel.

Method Quality Control Specifications

Summaries of Quality Assurance/Quality Control specifications for a selected subset of procedures offered by ELI are outlined in Appendix C. These types of tables are available upon request for our clients to use in the preparation of Quality Assurance Project Plans (QAPPs). Exact details of method QC can be found in the applicable method SOPs.

CHAPTER 2 – QUALITY ASSESSMENT PROGRAM

The function of the Quality Assessment Program is to provide formal evaluation of the quality of data being generated and reported by the laboratory. External and internal quality control measures are used in this assessment. These measures include proficiency testing samples, laboratory quality control check samples, and routine internal and external audits on methodology and documentation procedures.

Proficiency Testing (PT) Samples

PT samples are supplied by an outside entity and contain known amounts of constituents. The laboratory does not have access to known values of the samples. Only the PT provider has knowledge of constituent levels prior to the formal publishing of the test results.

PT samples are received on a routine basis, with results sent to the providing entity for evaluation. Proficiency Testing (PT) samples for USEPA, NELAP and various State certifications are Water Pollution Study samples (WP or DMRQA), Water Supply Study samples (WS), and LPTP Soil PT samples provided by either Resource Technology Corporation (RTC) and/or Environmental Resource Associates (ERA); both being NELAP approved PT providers. Routine participation in LPTP, WS and WP PT sample studies is used to maintain certifications for Safe Drinking Water Act (SDWA), Clean Water Act (CWA), National Pollutant Discharge Elimination System (NPDES), Discharge Monitoring Report Quality Assurance (DMRQA), permit monitoring analyses, Resource Conservation and Recovery Act (RCRA) analyses, as well as other states and projects requiring method accredited parameter analyses. The samples are analyzed in the same manner as any routine sample in the laboratory. Acceptable results are those that fall within a defined range as determined by the vendor/EPA/ NELAP; based on multi-laboratory study results. The provider sends results to USEPA and other certifying agencies as requested by ELI-Billings. PT study results are posted on the ELI website www.energylab.com.

A copy of the certificate for our primary certifications to perform drinking water analyses issued by the State of Montana and the NELAP certificate from Florida Department of Health are included in Appendix A. The Montana certification includes a list of parameters/methods for which drinking water certification has been granted. The NELAP certificate also includes RCRA methods used for hazardous waste characterizations and CWA parameters/methods which are used for NPDES monitoring permits. ELI also participates in the Federal/State DMRQA programs for clients which require/request this with their NPDES permits. Reciprocal accreditation in other states is based on either of these, or both, depending on specific state certification requirements/parameters. A list of current certifications is maintained on the ELI website at www.energylab.com.

Proficiency testing samples for Radon Proficiency testing certification are from the National Environmental Health Association (NEHA), an EPA approved commercial Radon testing certification association. Our own radon sampling canisters are submitted to NEHA for known levels of radon exposure. Acceptable results are those that fall within a defined range based on multi-laboratory study results.

Blind Quality Control Check Samples are samples submitted as regular lab samples and are processed through the system in the same manner as any other sample. The analysts do not know the true values of these samples when performing the analyses. Method performance reports are returned to the analysts. Clients occasionally submit these types of samples for their QAPP.

Inter-Laboratory comparison samples are samples containing known/unknown quantities of analytes that are split and analyzed by more than one laboratory.

Quality Control Check Samples

Quality Control Check Samples are performance evaluation samples used for routine method performance monitoring. As appropriate, analytical procedures include the analysis of a quality control sample with every sample batch analyzed. The materials are obtained from a commercial source when available, or they may be prepared in-house. Acceptable results are within a defined range based on certified ranges, or against statistically determined control limits, method-defined criteria or client defined Data Quality Objectives. Routinely used methods not subjected to PT sample monitoring are evaluated with Quality Control Check Samples, as appropriate.

QC samples are processed through the system in the same manner as any other sample, except the analyst is aware of the source, concentration, and acceptance ranges of target analytes and calculates analyte recoveries to evaluate method performance in real time.

Quality Assurance Audits

Quality Assurance Audits consist of internal and external laboratory inspections designed to monitor adherence to Quality Systems and quality control requirements. These audits check general laboratory operations, overall Quality Systems, adherence to QA program requirements, sample tracking procedures, sample holding times, storage requirements, adherence to procedures during analysis, calculations, completion of required quality control samples within the group surrounding the sample, and proper record-keeping.

Internal quality control audits are conducted or coordinated by the Quality Assurance Officer of the laboratory. See ELI SOP, *Internal Quality Assurance Audits*, for further information. ELI conducts internal inspections on a regular basis to monitor adherence to quality control requirements. Results of formal audits are given to management with possible recommendations for corrective action in the event any discrepancies are found. As necessary, a follow-up review is conducted to determine that identified problems have been addressed. Annually, the overall quality systems of the laboratory are reviewed and a summary report is prepared.

Per NELAP/ISO 17025-2005 requirements, the management of the laboratory will conduct an annual review of the Quality System, including policies, procedures and environmental testing activities. This is done to ensure the continuing suitability and effectiveness of the QA systems,

as well as provide the opportunity to introduce necessary changes or improvements. The review shall take into account, at a minimum, the following:

- The suitability of policies and procedures
- Reports from managerial and supervisory personnel
- The outcome of recent internal audits
- Corrective and preventative actions
- Assessments by external bodies
- The results of inter-laboratory comparisons or proficiency tests
- Changes in the volume and type of work
- Client feedback
- Complaints
- Recommendations for improvement
- Other relevant factors, such as quality control activities, resources and staff training

The findings from management reviews and the corrective actions that arise from these findings shall be recorded. The management shall ensure that any corrective actions are carried out within an appropriate, pre-determined time frame.

ELI also conducts Peer Audits as part of an internal auditing program established within the company. This process utilizes analysts and supervisors from other branch laboratories to evaluate a designated ELI branch. The Peer Audits serve to not only address conformance issues, but also provide ELI with a tool to continuously improve process and consistency throughout the company. The goals of the Peer Audits are to:

- Encourage relationships between analysts
- Transfer technical knowledge between peers
- Establish consistency of analytical process/method between branch laboratories
- Identify the depth of analysts' knowledge at each position by observing what analysts are doing at the bench
- Determine training needs of personnel
- Document process/method and verify that issues are being corrected when found
- Work with, and in support of, QA department efforts

Depending on the size of the laboratory, a large number of methods and processes are examined during a Peer Audit. Results from these audits are provided to the branch management, as well as Corporate Management. Corrective Action Plans of a Peer Audit are initiated with the assistance of the Corporate Quality Assurance Officer for resolution of any findings.

ELI welcomes external Quality Assurance Audits, by qualified outside auditors, for review and comment on the overall QA program. To maintain certifications, accrediting authorities from the State of Montana, USEPA, and NELAP conduct periodic comprehensive external audits. External audits to meet Quality Assurance Project Plans (QAPPs), as applicable to environmental remediation projects, or for major industries, are conducted as requested. For more information, see ELI SOP, *External Quality Assurance Audits*.

CHAPTER 3 – LABORATORY FACILITIES

The facility for Energy Laboratories, Inc. – Billings, MT consists of multiple buildings with over 35,000 square feet of total space; these buildings are located in Billings at 1120 South 27th Street, Billings MT 59101.

The phone number for Billings Energy Laboratories, Inc. is (406) 252-6325, the fax number is 406-252-6069, the toll free number is 800-735-4489, and the email address is eli@energylab.com.

Laboratory space includes adequate bench top and floor space to accommodate periods of peak work load. Working space includes sufficient bench top area for processing samples; storage space for reagents, chemicals, glassware, bench and portable equipment items; floor space for stationary equipment; and adequate associated area for cleaning glassware. Laboratory departments are organized and the facilities are designed for specific laboratory operations in order to protect the safety of analysts and to minimize potential sources of contamination between and within department areas (for more information, see ELI SOP, *Facility Description, Access, and Security*).

The laboratory is appropriately ventilated and illuminated, and is not subject to excessive temperature changes. Specific laboratory areas are temperature and humidity controlled as required. Ample cabinets, drawers and shelves are available for storage and protection of glassware. Exhaust fume hoods are available as needed for use during preparation, extraction, and analysis of samples. Employee exposure monitoring is conducted to provide a safe working environment.

To maintain security, all visitors must enter their name on the ELI sign-in log at the front desk and wear a visitor's badge.

The laboratory has provisions for the disposal of chemical and microbiological wastes. These provisions are described in Standard Operating Procedures as well as outlined in the Laboratory Safety Manual & Chemical Hygiene Plan along with other safety and health guidelines. For more information, see ELI SOP, *General Laboratory Waste Disposal*.

CHAPTER 4 – PERSONNEL REQUIREMENTS AND LABORATORY ORGANIZATION

Relationship between Management, Technical Operations, Support Services and the Quality System

Laboratory Organization

The corporate organization of the five ELI laboratories located in Montana (2), Wyoming (2), and Texas is provided in Appendix D. The Billings laboratory is the center for all corporate functions. Each laboratory is managed and operated individually under the supervision of a Laboratory Manager. Branch laboratories have fiscal and QA/QC responsibilities to Corporate, as well as general operating policies and goals. Quality Assurance Manuals are prepared individually for each branch and follow the QA/QC program outlined in the ELI-Billings QA manual.

The ELI-Billings Organizational Chart is also included in Appendix D with curricula vitae of key ELI-Billings laboratory personnel maintained in Appendix E of this manual.

Quality Assurance receives direct support from senior management. Branch Quality Assurance Officer reports directly to the Corporate Quality Assurance Officer as well as the Laboratory Manager. Quality Assurance Officers provide independent oversight of Quality Systems within the overall Energy Laboratories structure. When Quality Assurance Officers fill more than one role within the organization, they operate independently of direct environmental data generation while fulfilling quality assurance responsibilities. Quality Assurance Officers facilitate development of and maintain the branch Quality Assurance Manual, provide assistance to personnel on quality assurance / quality control issues, maintain a quality assurance training program, and review quality documentation including SOPs.

Management ensures the development and implementation of programs and policies to continuously improve the effectiveness of ELI's QA Program and Management Systems. Management performs an annual review of the laboratory's Quality System (policies, procedures, work instructions) to assure their continuing suitability and effectiveness (See ELI SOP: *Management Reviews*, for detailed procedures). As appropriate, management identifies and implements any necessary changes or improvements. Corrective and preventive actions are detailed in a Corrective Action Report and filed with the QA Department. (Refer to ELI SOP: *Nonconformance Procedures and Corrective/Preventive Action Reports,* for detailed procedures.) In addition, management performs meetings with supervisory and key staff members throughout the year. Supervisors and QA personnel provide input on their specific areas of responsibility and evaluate the following:

1) Client-Related Items
2) Internal and External Audit Reports
3) Proficiency Testing Results
4) Review of Performance by Department

5) Corrective and Preventive Actions
6) Personnel Training Needs
7) Quality System Policies and Procedures
8) Resources including Personnel, Equipment and Facilities

Laboratory Management Review findings are compiled into a summary report. The report includes deficiencies identified and areas for improvement. The QA department ensures items from the Management Review are tracked, including actions that must be addressed, assignment of parties responsible for the actions to be taken, and recommendations on improvements to the Quality System. The Technical Director, Laboratory Manager, Quality Assurance Officer or designee, shall assign specific persons to address management review findings and establish deadlines for their completion. The Technical Director, Laboratory Manager, Quality Assurance Officer or designee, reviews and approves all QA documents issued to personnel in the laboratory as part of the management system. The Technical Director, or designee, has overall responsibility for the technical operations of the laboratory. Any procedural deviations to SOPs that are client or project-specific must receive approval either from the Technical Director, Laboratory Manager, or Quality Assurance Officer. Work is stopped when identification of any of the following is made: unapproved departures from the management system, unauthorized deviations from the procedures for performing tests and/or calibrations, and data quality or data integrity issues. The Technical Director, Laboratory Manager, QA Officer, or designee, is responsible for providing authorization for the work to resume once the identified issue has been addressed.

Personnel Requirements

ELI maintains experienced staff and management. Below is a summary of the primary roles, responsibilities and qualifications for the designated positions. Laboratory experience can be substituted for academic requirements. At ELI's smaller laboratory operations, the technical director may serve multiple roles. Detailed job descriptions are maintained by the Human Resources department. Specific titles of employees are at the discretion of the Laboratory Manager.

Laboratory Manager

The Laboratory Manager is required to have education equivalent to a Bachelor of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is required.

The Laboratory Manager is responsible for all operations, client management, analysis scheduling, equipment acquisition, as well as compliance with all employment, safety, environmental and NELAP/ISO 17025 regulations. The Laboratory Manager may delegate daily activities of these work aspects to appropriate personnel. The Laboratory Manager reports directly to the Corporate Director of Operations. All Laboratory Managers have both technical and management responsibilities.

Quality Assurance Officer

The Quality Assurance Officer is required to have an education or experience equivalent to a Bachelor's of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is preferred.

The Quality Assurance is responsible for quality systems development, implementation, and management. The Quality Assurance Officer is also responsible for maintaining and improving compliance with all applicable state and federal regulations as well as maintaining compliance with NELAP/ISO 17025 regulations regarding Quality Systems. The Quality Assurance Officer or his/her designee manages the laboratory's certification programs to meet government regulatory requirements. The QA program is implemented in cooperation with all levels of management and staff. Quality Assurance Officers report directly to the Corporate Quality Assurance Officer. The Laboratory Manager will direct daily laboratory-specific QA/QC requirements.

Technical Director

The Technical Director is required to have a Bachelor of Science degree in Chemistry or a related science. Five years of relevant laboratory experience is required.

The Technical Director is responsible for ensuring compliance with all laboratory policies and that the analyses conducted under their supervision are compliant with all state, EPA, and NELAC/ISO17025 standards. The Technical Director reports directly to the Laboratory Manager.

The Technical Director may serve multiple roles. Laboratory Managers serve as one of the branch Technical Directors.

Laboratory Supervisor

A Laboratory Supervisor is required to have education equivalent to a Bachelor of Science degree in Chemistry or related science. Two years of relevant laboratory experience is required.

ELI's Laboratory Supervisors are responsible for the day-to-day operation of the laboratories: scheduling testing, assigning work, and completing the technical review of laboratory data. Supervisors are responsible for ensuring compliance with all laboratory policies and ensure that the analyses conducted under their supervision are compliant with all state, EPA, and NELAC/ISO17025 standards. They report directly to the Laboratory Manager.

Analysts

Analysts are required to have an education equivalent to a Bachelor of Science degree in Chemistry (or related science), or a High School diploma with experience as an analyst in training. New analysts require a minimum of six months of on-the-job training, under direct

supervision of a qualified analyst, in the measurements being considered for certification. After the initial training period, and on a continuing basis thereafter, the analyst must demonstrate acceptable skills through the successful participation in the analysis of applicable performance evaluation and quality control samples.

Analysts perform the following duties: Preparation of samples and reagents, analysis and preliminary data input, as well as various other tests. Analysts are responsible for complying with all laboratory policies and procedures.

Laboratory Technicians

Laboratory Technicians are required to have a High School Diploma or equivalent. Laboratory Technicians work under the supervision of the primary analyst performing general laboratory tests.

Under the supervision of a primary analyst, Laboratory Technicians perform the following duties: preparation of samples and reagents, analysis, and preliminary data input, as well as various other tests.

Laboratory Technicians are responsible for complying with all laboratory policies and procedures.

Approved Signatories

Signatures for policies are based on appropriate individuals, roles and responsibilities as determined by the policy being reviewed and approved. A list of significant signatories is included below. Additional signatures may be required for specific procedures.

- Laboratory Manager
- Technical Director
- Quality Assurance Officer
- Corporate Officer- Board of Directors

A master list including signatures and initials for all employees is maintained for reference and signature verification.

CHAPTER 5 – SAMPLING PROCEDURES

Private individuals or companies, who are responsible for using proper collection procedures, collect most of the samples processed in this laboratory. Members of the staff are acquainted with proper sample collection and handling procedures and advise those who need help in this area. Instructions and forms for initiating Chain-of-Custody are available from ELI. Laboratory procedures for logging in samples for analysis and maintaining Chain-of-Custody are described in ELI SOP, *Sample Receipt, Login, and Labeling*.

When the laboratory has been assigned the responsibility of sample collection, there is strict adherence to correct sampling protocols, initiation of chain-of-custody, sampling documentation, complete sample identification, and prompt transfer of sample(s) to the laboratory. Procedures are described in ELI SOP, *Field Sampling*.

This laboratory provides proper sample containers and preservatives as specified for the procedure. Certified sample bottles may be ordered upon request. Sample containers, preservatives, coolers for shipping, re-sealable plastic bags for ice containment, trip blanks for monitoring contamination during shipping, temperature blanks for accurately monitoring sample receiving temperatures, Chain-of-Custody forms, Chain-of-Custody seals, sample bottle labels, instructions for sampling, sample labeling, sample preservation, and sample packaging/shipping are provided upon request. Sample container type, sample volume, preservation requirements, and maximum holding times, are detailed for each analyte/method in the ELI Technical Services and Fee Schedule. See the ELI website, www.energylab.com for the current pricing.

Energy Laboratories maintains a strict Sample Acceptance Policy. The client is immediately notified (as appropriate) upon sample receipt if there is any doubt concerning the sample's suitability for testing, including but not limited to, when:

- Samples are out of temperature compliance;
- Samples are received in unacceptable containers;
- Samples have not been properly preserved*;
- Samples have labels or chain-of-custody procedures that are incomplete;
- Samples cannot be analyzed within method recommended holding time; or
- The custody seal has been broken.

Notification of sample receipt condition is available through the final report, Energy Source, Email, telephone and/or voice.

Samples not collected or documented properly can be rejected for any regulatory-based analysis with re-sampling recommended. If re-sampling is not possible, or the client cannot be contacted, the sample may be analyzed, and if analyzed, the sample will be clearly qualified in the data package.

The laboratory will preserve samples at the time of sample login if samples are unpreserved and preservation is required by the methodology. Aqueous samples for volatile analysis are checked

for preservation at the time of analysis. Samples for microbiological analysis are collected in pre-sterilized 120 mL plastic bottles containing sodium thiosulfate.

Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at collection. Refer to ELI Technical Services and Fee Schedule for detailed information on sample preservation requirements per applicable method and regulatory requirements.

The laboratory initiates a sample condition report titled Workorder Receipt Checklist at the time of sample receipt. The sample condition report contains Chain-of-Custody procedures, sample preservation status, carrier used for sample shipment, sample receipt temperature, and provides general comments concerning sample condition. The sample condition report is provided with the analytical data report package. For more information, see ELI SOP, *Sample Receipt, Login, and Labeling*.

When any sample is shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements as described in the ELI Technical Services and Fee Schedule, the Office of Hazardous Materials, Material Transportation Bureau, and Department of Transportation has determined the Federal Hazardous Materials Regulations do not apply to the following:

A) Hydrochloric Acid - (HCl) in water solutions of 0.04 % by weight or less (pH of 1.96 or greater).
B) Nitric Acid - (HNO_3) in water solutions of 0.15 % by weight or less (pH of 1.62 or greater).
C) Sulfuric Acid - (H_2SO_4) in water solutions of 0.35% by weight or less (pH of 1.15 or greater).
D) Sodium Hydroxide - (NaOH) in water solutions of 0.080% by weight or less (pH of 12.30 or less).

For regulatory compliance monitoring, it is required that all samples be analyzed within the prescribed holding times. Holding times are the maximum times allowed between sampling and analysis for results to still be considered valid. Samples should be delivered to the laboratory as soon as possible following collection to assure that holding times can be met. Samples are analyzed as soon as possible after sample receipt. When maximum holding times cannot be met, re-sampling is requested. If samples are analyzed out of hold, data is appropriately qualified.

To ensure that drinking water analysis for radiochemistry is met, the requirements for sample handling, preservation, and instrumentation for radiochemical analysis are included in ELI SOP: "*Sample Receipt, Log-In and Labeling*". (For additional information, refer to "Manual for the Certification of Laboratories Analyzing Drinking Water", Table VI-2: Sample Handling, Preservation, and Instrumentation, EPA 5th Edition, January 2005).

CHAPTER 6 – SAMPLE HANDLING

The ELI laboratory utilizes a sample tracking policy that includes client-initiated chain of custody. Upon receipt, the security of the samples is maintained by the implementation of the laboratory access and security policies. See ELI SOP, *Facility Description, Access and Security*.

Sample Receipt

All samples arriving at the laboratory are logged in the Laboratory Information Management System (LIMS). Each sample container is given a unique laboratory sample number. The sample receipt checklist evaluates Chain-of-Custody procedures, sample preservation status, carrier used for sample shipment, sample temperature, and provides general comments concerning sample condition. The completed checklist is provided with the analytical report package. Chain-of-Custody forms are checked for pertinent information. If necessary information has been omitted, the collector is notified, if possible, and the missing information is requested.

Samples requiring preservation are checked to determine if the client performed preservation. If requested, ELI staff will preserve or filter samples as appropriate. Samples that degrade quickly or cannot be opened (such as aqueous samples for volatiles) are not preserved at the time of sample login. If samples are improperly preserved, or the maximum holding times are exceeded upon arrival at the laboratory, the client is notified and re-sampling is requested.

Samples are stored per method specifications, or as method/parameter storage requirements are updated per later EPA guidance in Federal Regulations posted in 40CFR (Method Update Rules).

During sample login, all sample information such as sample description, client name and address, analyses requested, special requirements, etc. are entered into the computer database of the Laboratory Information Management System (LIMS). Requested analysis parameters and special requirements are communicated to the analysts via their LIMS work lists. Project-specific requirements are maintained in the LIMS for any samples received from a special project. This process ensures that individual requirements are maintained.

Chain-of-Custody

Evidence level internal chain-of-custody (COC) procedures are available on a project-specific basis. For these procedures, internal COC sample custody is maintained down to the individual analyst level. When transferring the possession of the samples, the transferee must sign and record the date and time on the chain-of-custody record. Every person who takes custody must fill in the appropriate section of the chain-of-custody record. When received by ELI, sample identification information on the sample containers is compared to the custody report form. The sample is inspected and information regarding the condition of the sample and seal (if used) is recorded on a report form; the method of shipping is also documented on the report form. A

copy of the report form is kept with the sample data file and a copy is sent to the client with the analysis report. Internal chain-of-custody forms are used to document the progress of the sample through the laboratory. ELI's routine COC policy is maintained at the laboratory level through our laboratory access and security policies. See ELI SOP, *Facility Description, Access, and Security*.

Sample Tracking

Samples are tracked through the analytical process by the LIMS. Completed analyses, which have been approved by the appropriate reviewer as valid data, are reported in the LIMS. When all analyses are complete, the data is reviewed as a whole to ensure results pass data quality checks. The completed report is signed by an approved signatory. The signed report is sent to the client via requested delivery format. Generation of the invoice automatically completes the work order in the LIMS and removes the samples from the status report. For more information, see ELI SOP, *Document and Record Management, Control and Archiving*.

Sample Disposal

It is preferred that remaining hazardous sample material be returned to the originator (client) for disposal. When this is not possible or reasonable, ELI will dispose of remaining hazardous sample materials with a waste disposal surcharge added to the cost of the analysis.

The disposal of laboratory wastes will be performed in accordance with local, state, and federal regulations which apply to such activities. Each method SOP addresses waste minimization and management specific to the method procedure. See ELI SOP, *General Laboratory Waste Disposal,* for more information.

Subcontracting Policy

The ELI Billings laboratory utilizes the expanded branch laboratory capability and expertise to provide comprehensive analytical services. This occurs when the laboratory is requested to perform an analysis outside of the laboratory's capabilities (If sample overload is experienced; if equipment is out of service; or when the laboratory is not accredited for the particular analysis). Upon completion of the analyses, the branch laboratories report the sample results, and their quality control package, to the primary laboratory. The results are reviewed before being reported.

Branch laboratories are certified to perform drinking water analysis in their state and in neighboring states. Samples are forwarded to our branch laboratories only if the laboratory is certified in the state from which the sample originated. Individual branch laboratory Quality Assurance Programs are consistent with the Corporate Quality Assurance Program and are monitored through internal laboratory audits.

To support Energy Laboratories, Inc. Billings analytical services, ELI branch laboratories (which maintain specific instrumentation for specialized analysis) are utilized to provide complete analytical services. Refer to Appendix A for the certificates detailing routine analyses performed

by the Billings branch. All branch laboratory certificates are also available on the Energy Laboratories website at www.energylab.com.

ELI Billings routinely subcontracts the following parameters/methods to branch laboratories:

Total Organic Halogens (TOX) by SW-846 9020
Total Arsenic CVAA by ASTM 3114
Low level EDB and DBCP by EPA 504
Carbamates by EPA 531.1
Glyphosate by EPA 547
Diquat by EPA 549.2
Total Organic Carbon (TOC/DOC) by A5310 C or A5310B, and SW-846 9060
Oil & Grease by SW-846 1664A
All Radiochemistry except Radon in air

In the event that ELI is dependent on the service of an outside laboratory for analyses not available through our facility or our branch laboratories, the client is notified t that their samples are subcontracted to an outside laboratory. The outside laboratory reports the results to ELI and these results become part of the final report. Any external or internal subcontracted analyses that require accredited analyses will be performed by a laboratory accredited for those parameters in the State from which the sample originated. All final reports indicate where the analyses were performed.

CHAPTER 7 – INSTRUMENT OPERATION AND CALIBRATION

Laboratory instruments and equipment are operated and calibrated according to the manufacturer's instructions and according to the requirements of the method being used. Exact calibration procedures are outlined in the appropriate SOP. For most instruments, a calibration curve composed of three to five standards covering the concentration range of the samples is prepared. The acceptance criteria for the calibration curves are listed in the individual methods. Unless otherwise specified in the method, at least one of the standards is at or below the practical quantitation limit (PQL) of the method. Routine PQLs for each method are given in the ELI Technical Services and Fee Schedule. Calibration standards are routinely compared to second source calibration standards to verify accuracy. These second source standard results must fall within an established range, as described by the SOP, to be accepted. Whenever possible, the laboratory uses calibration standards prepared from certified stock standards. Initial instrument calibration curves are verified and routinely monitored by analyzing a continuing calibration standard every 10 to 20 samples (or within a specified time frequency) and at the end of every analytical sequence, depending on the analysis method and instrumentation. When applicable to the method, high-level samples, which produce an analytical response outside the calibrated range of the instrument, are diluted (or reduced in mass) and re-analyzed until a response within the calibrated range is obtained and/or the result is appropriately qualified.

System cleanliness is verified through the analysis of reagent/instrument blanks prior to analysis, between highly contaminated samples, and at regular intervals during the analysis.

Use of measuring equipment and reagents (glassware, water, chemical reagents, and industrial gases) conform to Good Laboratory Practice guidelines. Good Laboratory Practices (GLPs) are laboratory guidelines which were established by the Food and Drug Administration and published in the Federal Register (21 CFR, part 58). The GLP guidelines were adopted by the Environmental Protection Agency. SOPs are developed in accordance with GLP and NELAP guidelines. Laboratory volumetric glassware conforms to National Institute of Standards and Technology (NIST), American Society for Testing and Materials (ASTM) Class A or B standards. All mechanical pipettes are calibrated at least quarterly. Laboratory balances are serviced annually and calibrated by certified technicians. Calibration checks of balances are performed each day of use, using ASTM Class 1 or 2 weights. Laboratory thermometers are calibrated annually against a NIST traceable thermometer and routinely checked for accuracy. Laboratory drying ovens, incubators, freezers, refrigerators, and water bath temperatures are monitored and recorded each working day, or at frequencies as described in the specific SOP. Laboratory pure water is generated by commercial water purification systems and is monitored and documented each working day in accordance with specifications needed for applicable methods. The routine analysis of laboratory blanks is used to verify laboratory water quality and the suitability of sampling containers. Chemical reagents and gases meet or exceed purity requirements for their intended uses. Laboratory stock and working standards are derived from ISO 17025 and/or 9001 (or equivalent-certified) commercially available primary standards whenever possible. Standard preparation notebooks document the reagent/standard type, source, purity, content, concentrations, preparation date, and analyst. All calibration standards

are documented in each daily analytical sequence such that they are uniquely identified and traceable to stock standards and their source.

Standard Operating Procedures (SOPs) detail the sequence of operations involved in instrument start-up, calibration, analysis, shut-down, and routine maintenance. Suggestions for corrective action are included with the SOPs and parameters are identified which dictate certain types of maintenance. Instrument and method detection limit studies are performed at the method required frequency or whenever there is a significant change in instrumentation. Method Detection Limits are determined according to EPA guidelines found in 40 CFR, part 136, Appendix B for general chemistry and 40 CFR 141.25 (c) for radiochemistry (except for the few methods that are not amenable to MDLs). Refer to ELI's Technical Services and Fee Schedule for practical quantitation limits (method reporting limits). Acceptable instrument response/performance criteria are based upon the manufacturer or the analytical method specifications. SOPs exist for all major pieces of analytical equipment/methods.

Instrument logbooks are used to document instrument maintenance and repairs. Instruments that are no longer being utilized are documented in the applicable instrument logbook as "out-of-service" with the date the instrument was taken out of use noted. All out-of-service instruments are labeled with an out-of-service tag that identifies the effective date the instrument was taken out of use.

Laboratory analysts record and document all instrumental runs in Laboratory Instrument Logbooks or computer files. Instrument Logbooks and/or dated computer files record instrument performance data, analytical sequences, instrument maintenance, calibration standards data, and any other additional information pertinent to operation of the instrument.

CHAPTER 8 – RECORDS AND REPORTING

Document Management

Energy Laboratories Inc. QA manages three types of documents: 1) controlled, 2) approved, and 3) obsolete.

A CONTROLLED document is one that is uniquely identified, issued, tracked, and kept current as part of the Quality System. Controlled documents may be internal documents or external documents. A list of ELI's controlled documents is listed in Appendix B. All ELI controlled documents are written and reviewed by personnel technically competent to perform that procedure and approved for use by the Laboratory Manager as well as the Quality Assurance Officer.

APPROVED documents have been reviewed, signed and dated by the technical reviewer, the Quality Assurance Officer and the Laboratory Manager.

OBSOLETE documents are documents that have been superseded by more recent versions. Obsolete documents are retained for legal use or historical knowledge preservation. Old or archived SOPs are available for review using the laboratory's electronic document system. ELI's OBSOLETE document records are maintained for at least ten years.

Documents are reviewed on an annual basis to ensure their contents are suitable and in compliance with the current quality systems requirements, and accurately describe current operations. SOPs include a Record of Review/Revision page, which details revisions or reviews. The Branch Quality Assurance Officer/Officer maintains a master list of controlled documents (which include title, author, and date of issue).

Procedures for identification, collection, access, filing, storage, and disposal of records are found in ELI SOP, *Document and Record Management Control and Archiving*.

Laboratory Notebooks

Several different types of Laboratory Notebooks are maintained at the ELI Laboratory. These include, but are not limited to, the following:

Method/Parameter Notebooks
Project Notebooks
Instrument/Equipment Use and Maintenance Notebooks
Standard Preparation Logbooks
Balance Calibration Logbooks
Pipet Calibration Logbooks
General Logbooks

The general purpose of maintaining each of these Laboratory Notebooks is to record the details that may be important in repeating a procedure, interpreting data, or documenting certain

operations. Entries in the notebook may include data such as standard and sample weights, pH measurements, instrument operating parameters, preparation of calibration curves, analytical run sequences, calculations, recording of instrument operating parameters, sample condition, etc. The analyst's notebook is particularly important in documenting analyses that deviate in any way from routine or standard practices. It can also be an important training record. All pertinent data is to be recorded directly in the notebook. Some notebooks or data records are maintained in electronic format (LIMS, spreadsheets, or databases). Electronic data records are duplicated using hardcopy and/or alternate electronic backup techniques.

It is the responsibility of each analyst to maintain a laboratory notebook according to Good Laboratory Practices (GLP) Guidelines. All physical laboratory notebooks are assigned a unique logbook control number and are assigned to an analyst and/or supervisor. These notebooks remain the responsibility of the ELI staff member's supervisor to whom they are assigned until they are formally transferred to another staff member, until they are completely filled and returned to the ELI QA Department for archiving, or until the staff member resigns and returns them as a part of the check-out process. ELI staff members, other than the individual to whom the laboratory notebook is issued to, may make entries in the notebook as long as those entries are consistent with the intended use of the notebook and such entries are initialed and dated. Procedures for use and maintenance of laboratory notebooks are detailed in ELI SOP, *Laboratory Notebooks*.

Records

The laboratory maintains records of all chemical analyses, including all quality control records, for a minimum of ten years. In the event that Energy Laboratories, Inc., or any individual laboratory transfers ownership or goes out of business, the records will be transferred to the new owners. If a branch laboratory is closed, records will be maintained by Energy Laboratories Corporate office in Billings, Montana. Energy Laboratories, Inc. reserves the right to offer the records to the clients in the event of complete closure. Details are described in ELI SOP, *Document and Record Management, Control and Archiving*.

Data Reduction

Data reduction refers to the process of converting raw data to reportable units. The reporting units used and analytical methods performed are described in the ELI Technical Services and Fee Schedule.

Wherever possible, the instrument is calibrated to read out directly in the units reported. In this case, the value is recorded directly into a laboratory notebook, logbook, bench sheet, or electronic file and presented for review.

In cases such as titration, gravimetric measurements, or other techniques that require calculation prior to reporting, raw data is recorded in the appropriate laboratory notebook or electronic file, or on the appropriate laboratory form. The calculations specified in the methods are used to determine the reported value. That value is also entered into the laboratory

notebook or bench sheet. Most calculations are automated to reduce the chance of arithmetic or transcription errors.

Wherever possible, electronic data results are transmitted throughout the laboratory via the LIMS computer network. This process is intended to minimize manual data transcriptions within the laboratory. Additional advantages include the opportunity for rapid comprehensive data validation by supervisors, and more rapid data reporting.

Validation

Data validation includes the procedures used to ensure that the reported values are consistent with the raw data, calculated values, sample type, sample history, and other analysis parameters requested.

The data recorded is validated with several review steps. The analyst who submits the analytical results checks all the values reported for omissions and accuracy. Elements of this review also evaluate all instrument and method QC results. Automated data management programs are designed with an interactive step allowing data review by the analyst. Results to be reported are approved by the analyst.

The report is reviewed for the suitability of the data according to project and method performance specifications. Analytical results for each requested parameter may be evaluated against other requested parameters, project specifications, other samples within the set, historical files associated with the project/client, and/or any other information provided with the sample.

The reports are generated, proofread, and reviewed by designated reporting staff.

Laboratory managers, project managers, supervisors, QA managers or their designees, may also examine the data included in the final report.

Internal and external laboratory audits review selected sets of data to ensure that the analytical results are correct and accurate, analytical methods are appropriate, documentation and record keeping procedures are complete, and that there is compliance to the overall objectives of the Quality Assurance Program. Data integrity is being monitored on an on-going basis. See ELI SOP: *Assessment of Data Integrity*, for details.

All controlled automated programs used to process and report data are initially verified using manually calculated results. Whenever a modification is performed to a program, re-verification of overall software function is performed.

One step of the Quality Control process involves data outlier detection; data that falls outside of established limits. If an outlier is observed, corrective action is taken as appropriate, to investigate and/or correct the cause. Actions to correct these causes may include, but are not limited to, inspection of the instrumentation, checking calibrations, checking sample numbers or dilutions, re-analyzing samples or calibrations.

Reporting

One copy of the report is distributed to the client, via requested delivery format, after the report is validated and signed. A standardized report format is used unless otherwise specified. Client-specified report formats are available upon request. Results can be sent via physical media, email, EDD, website FTP and/or FAX when requested by the client. Energy Laboratories, Inc. offers its clients access to electronic records through our Energy Source Portal.

Various levels of data reporting are available. All analytical results, regardless of the level of reporting used, have record keeping procedures which allow an appropriate "data validation package" to be produced. Note that a comprehensive "data validation package" is most easily generated at the time of sample analysis. Example data packages are available upon request.

Safe Drinking Water Act (SDWA) compliance monitoring samples for microbiological and chemistry samples that exceed the SDWA maximum contaminant level (MCL) may require notification to the appropriate state agencies. Generally, notification to the client, and to the state, of any SDWA MCL exceedance must be within 24 hours of completion of analysis/review, or by noon the next business day. If requested by the client, additional copies of the report will be sent to a specified address or person.

The final copy of a completed report is maintained in an electronic format. An electronic copy of this file is available upon request. Energy Source is a client resource of ELI that provides secure online access for clients to view their data and documents. Clients are able to access their electronic files through ELI's secure website at https://energysource.energylab.com/. For more information, see ELI SOP, *Document and Record Management, Control and Archiving*.

In addition to traditional ink signatures, Energy Laboratories has approved the use of electronic signatures within our company-produced PDF documents. These signatures comply with Title 15 of the US Code Section 101 regarding legal requirements of a digital signature.

Electronic signatures verify that the document has not changed after it was produced. Upon opening the document, notifications automatically display to inform the recipient of the validity of the sender's electronic signature and all included certificates. Should any changes be detected, an alert message is automatically displayed, noting that the signatures cannot be validated due to changes made to the document. Detailed instruction on how to view/validate ELI's electronic signatures is available.

CHAPTER 9 – GENERAL LABORATORY PRACTICES

Chemicals and Reagents

When available and appropriate, chemicals used in the laboratory are analytical reagent grade (AR) chemicals purchased from reliable suppliers. Reagents are prepared, standardized, and made fresh as mandated by the method, their stability, and according to Good Laboratory Practices. Procedures for purchasing of materials may be found in ELI SOP, *Property Procurement, Inventory, and Control*.

Normalized standards are checked regularly against independently prepared reference materials.

All standards and reagents are dated when received, opened, or prepared, and each is labeled with an expiration date when applicable. Standards and reagents are checked for discoloration or signs of degradation and are discarded if these are observed.

Certified primary standards are obtained from ISO accredited commercial sources when available. Standards used for calibration are verified against second source standards. Secondary and working standards are accurately prepared with volumetric flasks, or other calibrated glassware, from primary standards and stored in appropriate containers.

ELI has determined 5 years to be a reasonable expiration date for stable salts where the manufacturer does not supply such information. Titrants, standards, and other solutions used for analytical purposes are frequently standardized upon preparation with certified or traceable standards. Method SOPs specify if standardization is necessary. The date and analyst's initials must be recorded on the container whenever re-standardized and these records are maintained in a laboratory notebook or in the LIMS.

Individual SOPs may also provide additional details for reagent requirements.

Reagent Interference

To determine the extent of reagent interference, method blanks are analyzed prior to sample analysis whenever appropriate.

If any interference cannot be eliminated, the magnitude of the interference is considered when calculating the concentration of the specific constituent in the sample, but only when permitted within the applicable method.

If reagents, materials, or solvents contain substances that interfere with a particular determination, they are replaced.

Individual method SOPs may also provide additional requirements for handling reagent interferences.

Glassware Preparation

All glassware used for inorganic and radiochemical analysis is washed in warm detergent solution and thoroughly rinsed in tap water. Glassware is then rinsed well three times with laboratory-purified water. This cleaning procedure is sufficient for many analytical needs, but individual SOPs detail additional procedures when necessary. Glassware washing procedures for inorganic analysis are described in ELI SOP, *Cleaning of Glassware Used in Inorganic Analyte Sample Preparation and Analysis*.

All glassware used for organic analysis is washed in warm synthetic detergent solution and thoroughly rinsed in tap water. The glassware is then rinsed well with laboratory-purified water, followed by rinses with acetone to remove any residual organics. Prior to use, the glassware is rinsed three times with the organic solvent to be used with the glassware. Glassware washing procedures for cleaning glassware for organic analysis are described in ELI SOP, *Cleaning of Glassware Used in Volatile and Semivolatile Analyte Sample Preparation and Analysis*.

All glassware used for microbiological analysis is washed in warm detergent solution. The detergent must be proven to contain no bacteriostatic or inhibiting substances. The glassware is rinsed thoroughly with laboratory-purified water. Specific details are described in SOPs.

Disposable, glassware/plasticware is preferred for many procedures in the laboratory. The cleanliness and suitability of disposable glassware/plasticware is continuously evaluated for each test with the routine analysis of method blanks.

All volumetric glassware used in precise measurements of volume is Class A or laboratory calibrated.

Laboratory Pure Water

Laboratory-purified water is used in the laboratory for dilution, preparation of reagent solutions and final rinsing of glassware. For organic analysis, organic-free water is prepared and used. Energy Laboratories, Inc. uses water purification systems that are designed to produce deionized water that meets the requirements of the methods. Use and maintenance of laboratory reagent water systems are described in ELI SOP, *Use and Maintenance of the Milli-Q Water System*.

Water quality is monitored for acceptability in the procedure in which it is used. Specific details are listed in the appropriate SOPs.

Employee Training

All new ELI employees and contract personnel are given an initial general orientation and tour of the laboratory facilities. Personnel are shown the locations of safety equipment such as safety showers, eye wash fountains, fire extinguishers, and first aid supplies. Personal protective equipment such as lab coats, disposable gloves, and safety glasses (if applicable) are issued at this time.

Safety considerations are a vital part of the training process. All hazards associated with the performance of a procedure or with the operation of an instrument are to be understood by the trainee before training can be considered complete. General laboratory safety procedures are a part of the new and current employee training. Specific safety procedures are outlined in SOPs and in instrument Operator's Manuals. Training in use of protective clothing, eye protection, ventilation, and general safety are provided to each employee. Each employee is required to read and sign the *Laboratory Safety Manual & Chemical Hygiene Plan*.

All new and existing employees must demonstrate capability prior to performing an analytical procedure independently (see Chapter One). Method performance on Quality Control Samples is used to document employee training and work quality. Employees are required to read the Quality Assurance Manual and all appropriate SOPs. Employees are required to sign a Quality Assurance Manual Acknowledgement form which states that they have read, understood, and will comply with the requirements of the Quality Assurance Manual. Employees also are required to sign, for all applicable SOPs, a Record of Acknowledgement Form that states they have read, understood, and agree to abide by the SOP. In the case of method SOPs, the employees sign a Record of Acknowledgement form that states they have read, understood, and agree to abide by the SOP using the latest method technology.

Employees also receive training on general laboratory policies including ethics and conflict of interest. All employees are required to read, understand and comply with the Corporate Compliance & Ethics Manual. Data integrity training is provided for all employees initially upon hire and annually thereafter. In addition to the *Corporate Compliance & Ethics Manual*, the ELI Quality Assurance department maintains a *Laboratory Ethics & Data Integrity Manual*, which supplements the corporate manual and provides specific training on data integrity. All employees are required to read, understand and comply with the ELI *Laboratory Ethics & Data Integrity Manual*. An annual Ethics training course is given to all laboratory employees. Attendance is required and is recorded with a signature attendance sheet or other form of documentation that demonstrates all staff have participated and understand their obligations related to data integrity and ethics policies. For details pertaining to ethics training and additional ethical procedures and policies refer to ELI SOP, *Personnel Training and Training Records*.

ELI encourages attendance at courses, workshops and other forms of continuing education available from on-site seminars, private institutions, local schools, and State and Federal regulatory agencies. Staff and department meetings are held routinely to communicate company policies and procedures. All training on procedures and policies is documented, per NELAP guidelines, in employee training files. For more information see ELI SOP, *Personnel Training and Training Records*.

Data Integrity

In order to provide for the integrity of ELI and client data, the laboratory has multiple controls on the network, LIMS and applications used. These controls limit access to and the ability to change data as well as provide for redundancy in case of loss.

These include but are not limited to:

- Users connecting to ELI computer systems are authenticated through a user name and password combination.
- Passwords are required to be changed on a regular basis.
- Permissions within ELI applications are role based with different roles having various levels of access and control. Users (analysts, supervisors, and managers) are assigned to these roles.
- In the LIMS, analytical data locks after a period of time and cannot be modified without special handling.
- Certain information has been identified for additional tracking and logging. Changes to this information is not only tracked in an audit log but also reported to select personnel.
- Information on ELI servers including the ELI LIMS system is backed up and recoverable.

Standard Operating Procedures

Laboratory operations and procedures are documented in Standard Operating Procedures (SOPs). SOPs provide information on the consistent and safe operation of the laboratory. For analytical methods, SOPs provide information on the details of the analysis that is not specified in a published analytical method. For routine procedures other than analytical methods, SOPs define the steps required in accomplishing a given task. All SOPs are reviewed and updated periodically to reflect any changes in laboratory operations. Method SOPs follow NELAP requirements. For more information on generation and distribution of SOPs, see ELI SOP, *Preparation, Numbering, Use, and Revision of Standard Operating Procedures*.

Client Confidentiality

Each employee has the responsibility to maintain confidentiality in all matters pertaining to our clients, samples submitted, and Energy Laboratories, Inc. Information obtained during employment with this laboratory, regarding the specific business of this laboratory, or its clients shall at no time be revealed to any outside sources without permission from the owner of the data.

Sample submittal, analysis and the report contents are considered confidential information of the client. When requested to provide results (either in person, via telephone or email), the employees shall verify that the requestor is either the person associated with the project, on the COC, or on a list provided by the client who are authorized to receive data. If a person who is not associated with the project personnel (or is not on the approved list), the base client will be contacted to inquire about authorization to release data. These contacts are documented and associated with the work order in the LIMS system to provide archival proof of authorization to release data. If the client does not authorize a release of data, the requestor will be contacted and told of this decision.

Client confidentially is maintained electronically through the use of password-protected logins on all laboratory computer systems. Additionally, the laboratory maintains network security such as anti-virus programs and firewalls that prevent any unauthorized outside access. All copies of the original report are stored on the laboratory's document archival system, which is also protected from unauthorized use by the network security systems. Raw data, reports, and LIMS records are kept in a secure location of the laboratory or off-site. All client confidential paper waste, including printouts, is shredded.

CHAPTER 10 – QUALITY CONTROL MONITORING

Routine Monitoring

Temperatures of incubators, water baths, refrigerators, and ovens are checked and recorded according to a prescribed schedule using a continuous monitoring system.

Conductivity of the laboratory-purified water is continuously monitored using an automated monitoring system and as method blanks in routine analytical runs.

Reagents are dated and initialed at the time of receipt. Expirations dates are assigned as a fundamental component of their receipt and/or preparation. Reagents are not used after manufacturer's expiration date is exceeded.

Balances are checked daily, or as required, against ASTM Class 1 or 2 NIST traceable weights and are calibrated and serviced by certified technicians annually.

SOPs are reviewed periodically for accuracy.

Laboratory Notebooks are reviewed periodically for correctness and accuracy by supervisors.

Proficiency Testing (PT) Samples are analyzed as required (See Chapter Two of this QA Manual).

Quality Control Check Samples are analyzed with each analytical batch.

Internal and external audits are performed as specified or requested (See Chapter Two of this QA Manual for additional discussion).

Additional monitoring requirements may also be specified in individual SOPs.

The Laboratory maintains an active fraud protection program that is implemented through the laboratory ethics policy. Additionally, the potential of fraud is monitored through analyst supervision, management supervision, regular internal audits, PT study participation, and an active quality assurance program.

Instruments/Methods

Calibration is performed as outlined in Chapter Seven of this QA Manual.

Generally, and depending on method requirements, the standard curve is verified with a known second source reference sample. The reference sample results must fall within the appropriate target range for the calibration to be accepted.

In most cases, the calibration stability is checked by analyzing a continuing calibration standard every 10 to 20 samples, depending on the analysis and instrumentation. The verification

standard results must fall within an established range as described by the SOP.

All laboratory instruments are subjected to preventive maintenance schedules. Preventive maintenance schedules are specified in instrument maintenance logbooks.

As appropriate, instrument and/or method detection limits are determined annually, or more frequently if changes in instrument performance are noted or per method requirements. Procedures for the determination of instrument detection and method detection limits are described in ELI SOP, *Determination of Method Detection Limits (MDL) and Quantitation Limits*.

Precision and accuracy requirements for each method are specified in the SOPs. General guidelines are given below.

- Each analytical batch will contain QC samples to measure the accuracy of the method. Each QC sample result is monitored to be within QC specifications of the method. Results of blank spiked sample analysis must be within the established control limits. Quality Control Limits are specified in the SOPs and meet recommended QC limits as described in the referenced method.

- Each analytical batch will contain QC samples to measure the precision of the method. (See Chapter One for discussion on duplicate sample analysis.) Criteria for duplicate sample acceptance are found in the SOP and are generally taken from the referenced method.

- Each analytical batch will contain QC samples to measure the performance of the method on the sample matrix. These are typically identified as a matrix spike analysis and may be performed in duplicate to assess method precision. Typically the sample is fortified with a known amount of target analyte and spike recoveries are calculated. Results outside of method QC guidance are flagged. Quality control limits and appropriate corrective actions steps are specified in the method SOP.

- Several methods are considered to be concurrent methods in that they are either nearly identical or are identical to a method with a different citation. Even if two methodologies are identical in procedure, slight differences in the QC requirements might be the only difference between the two methodologies. These types of methods may also be considered "concurrent" if the procedures are identical and the more stringent of the two method criteria are used. During data reduction and reporting, the referenced method specifications and criteria will always take priority.

As appropriate, the performance trends of QC sample results are evaluated with Quality Control Charts. Suitability of existing QC limits is evaluated and possibly adjusted, but not to exceed method specification.

CHAPTER 11 – CORRECTIVE ACTION

When the quality control checks indicate that an analysis is not within the established control limits, corrective action is needed. This section gives general guidelines for corrective action. Corrective actions for each method or instrument are detailed in individual SOPs. Records are maintained of non-conformances requiring corrective action to show that the root cause(s) was investigated, and includes the results of the investigation. The QA Manager/Officer will monitor implementation and documentation of the corrective action to assure that the corrective actions were effective.

Method QC samples that fail to fall within QC control limits may be analyzed again to verify if a problem exists. However, matrix spike or matrix spike duplicate QC samples are not required to be re-analyzed if the performance can be attributed to matrix effects; data results are then reported and flagged.

If the repeat analysis is not within control limits, the particular instrument or procedure is checked according to the specific protocols outlined in the method or according to the instrument manufacturer's guidelines. Once results are within control limits, analysis of all samples that were analyzed while the procedure was out of control are repeated, i.e., all analyses are repeated back to the previous acceptable control sample. In the case of radiochemical analysis, the term “analyze again” means to recount the final sample on the same (or different) detector.

If the analyst is unable to achieve acceptable results after following the corrective action guidelines detailed in the SOP, a supervisor is consulted. If necessary, the appropriate service personnel are contacted if the problem is determined to be due to instrument error, and cannot be resolved. It is also possible that the result is due to statistical variation of the results based on the tolerable error rate that has been determined for the analysis (usually 0.05). In certain cases, where control limits are exceeded, it is possible that problems cannot be corrected to satisfy QC criteria. This could be due to problems such as matrix interference, instrument problems, lack of sufficient sample, missed holding times, high blank contamination, etc. If all possible solutions available to correct the problem are examined and the sample results are still considered valid, qualifying comments are attached to the sample report describing the non-compliance and probable cause.

In the case of a single radiochemistry detector being returned to service, this refers only to the samples counted on that detector. For example, an individual gas proportional counter instrument may have up to 16 detectors; if only one does not pass the QC check the others are still valid and sample analyses performed on the others do not need to be repeated.

In the event that a QC audit or other informational review shows an analysis report to be incorrect, incomplete, or adversely compromised, a revised report and explanation is submitted to the client within ten business days unless otherwise communicated to the client with another time period. The report will clearly be identified as a revised report. As appropriate, an explanation submitted to the client should give a detailed review of the problem and document any unapproved deviations from the regulations, standard operating procedures, or project-

specific scope of work that may have caused it. The explanation to the client may include, but not be limited to, the following components:

1) What actions have been taken regarding the affected data set(s),
2) Identification of the cause, and
3) Corrective action(s) taken to prevent future occurrence.

In the event that a QC check fails, the analyst will follow the procedures outlined in the QA/QC summary of the SOP.

Quality Control Checks for each method or instrument may vary. Energy Laboratories Inc. follows the QC checks set by each governing method. Due to the wide variations between methods, specifics are listed within each SOP for the given method. Please reference the SOP for specific QC checks for the given method. The QC checks may include: ICV, MB, CCV, CCB, LCS, LCSD, LOD, MS, MSD or others specific to that method.

The following table lists the typical actions to be taken upon discovery of a QC sample failure. The purpose of this table is not to supersede the actions stipulated in the method SOP or the Method criteria.

QA Indicator	Frequency	Acceptance Criteria	Corrective Action For Failure	Comments
ICV	At the beginning of the sequence, immediately after the ICAL.	Usually ± 10%. Method Dependent. Some methods have more stringent criteria.	**Option 1** – Re-analyze the ICV. **Option 2** – Stop analysis and re-calibrate the instrument.	-Evaluates calibration accuracy and method performance. Must be prepared from Second source standard. Know and follow any method specifications regarding the ICV.
CCV	At the beginning of sequence, and every ten samples. Must have a closing CCV at the end of the sequence.	Typically ± 10% recovery. Very method dependent. See SOP & Method.	**Option 1** – Immediately re-analyze CCV upon failure. **Option 2** –Invalidate all samples not bracketed by passing CCVs, recalibrate, and re-analyze all invalidated samples.	-Evaluates instrument drift throughout analytical sequence. Typically uses midpoint calibration standard. Know and follow any method specifications regarding the CCV.
CCB	Every ten samples	CCB<PQL	**Option 1** – Stop analysis, invalidate all samples not bracketed by passing CCBs. Re-calibrate and re-analyze samples.	-Evaluates baseline drift, contamination in the analytical system, and analyte carryover. – Know and follow any method specifications regarding the CCB.

QA Indicator	Frequency	Acceptance Criteria	Corrective Action For Failure	Comments
LCS	One per sample batch of 20, or less if tighter criteria specified in the published method.	Typically ± 10% recovery. Very method dependent.	**Option 1** – Re-analyze LCS for recovery. **Option 2** – Stop analysis, recalibrate, re-extract and/or re-analyze all samples.	- Evaluates overall method accuracy/bias for the Preparatory Batch. Know and follow any method specifications regarding the LCS.
MS	One per sample batch of 20, or less if tighter criteria specified in the published method	Typically ± 30% recovery. Very method dependent.	**Option 1** - Report Spike as analyzed. LCS/LFB must be passing. Flag sample for possible matrix effects. **Option 2** –Re-analyze MS/MSD, only if there was an error making the MS, for either recovery or RPD failure.	-Evaluates effect of matrix on method performance. Know and follow any method specifications regarding the MS.
MSD	One per sample batch of 20, or less if tighter criteria specified in the published method.	Typically ± 30% Recovery. Very method dependent. 10-30% RPD –Check method for exact specifications.	Same as for MS.	-MSD also evaluates method precision. Know and follow any method specifications regarding the MSD.
MBLK	One per sample batch of 20, or less if tighter criteria specified in the published method.	MBLK< PQL	**Option 1** – Re-analyze the entire analysis. All organic analyses with blank detections must be re-analyzed. **Option 2** – Flag data on report as having compound in blank.	-Evaluates overall method including possible contamination in reagents and glassware utilized in preparatory batch. Know and follow any method specifications regarding the MBLK.
DUP	One per sample batch of 20, or less if tighter criteria specified in the published method. (The DUP can be satisfied by a MS/MSD).	10-30% RPD –Check method for exact specifications.	**Option 1** – Re-analyze sample. **Option 2** – Flag analysis as having a failing DUP RPD for reporting.	Evaluates method precision. MSD duplicate analyses preferred on some methods.

*Deviation from the method or SOP shall be documented in laboratory records.

Procedure for Dealing with Complaints

DEFINITIONS

Complaint: For the purposes of this procedure, a complaint comes from a client, a user of our data, or employee. The complaint might cover issues about the quality of our data, sample turnaround time, method used, pricing, or other expectations.

Client: The client is a person or company that ordered and paid for the services.

Procedure: The staff person receiving the complaint exercises judgment in deciding the severity and disposition of every complaint. The judgment must be used to decide whom, if anyone, is alerted to the complaint and what actions are appropriate. The complaint issued should be handled with a high degree of discretion and tact by the supervisor or manager involved. The individual handling the complaint is instructed to follow ELI's guidelines provided in this section on how to handle the complaint. This involves listening to the client and getting adequate information so the complaint can be investigated and resolved. The appropriate laboratory staff is notified and a solution to the problem, as well as a timeline for action, is given.

After the complaint is investigated or resolved, as necessary, the client is made aware of the results and determination is made as to what further actions are needed. Complaints and investigations may result in the need to submit a revised report or invoice. Complaints that are straightforward and can be resolved using the resources available to the person handling the complaint should be resolved there. These include such things as minor revisions of reports or invoices. If other decisions need to be made, the appropriate person should be contacted.

It may be appropriate to initiate or prepare a non-compliance report. This report should be completed with the intention of informing the affected staff about the problem so that everyone can learn from it, it can be used as a training tool, change our procedures and improve our service. A procedure to document non-compliance reports is documented in ELI SOP, *Nonconformance Procedures and Corrective/Preventive Action Reports.*

If an employee or former employee sees an issue, they are encouraged to report concerns regarding Quality Systems, unethical behavior, and/or financial mismanagement. This issue should initially be brought to the attention of their supervisor. The supervisor will take appropriate action to resolve the concern. If the employee is uncomfortable with approaching their supervisor or feels that the issue was not properly dealt with, they may approach higher levels of management with their issue.

Energy Laboratories, Inc., has also implemented a program to facilitate confidential reporting to upper management. This tool allows employees to report situations or behaviors that they consider to be unethical, immoral, or improper. It also allows the reporting of suggestions or comments. The program has been implemented at ELI so that anyone reporting a situation can be assured that there will not be retaliation for reporting. It is meant to encourage parties to communicate with upper management when there appears to be no alternative for resolving the

types of issues already described. . Access to the program is available on the ELI internal website.

Penalty for Improper, Unethical or Illegal Actions

Energy Laboratories, Inc. employees are expected to work in an ethical, proper, and legal manner. They are expected to perform laboratory analyses according to the cited method(s) and in conjunction with the SOP and the Quality Assurance Plan. Employees are expected and required to report any violations of this policy. All employees are mandated to participate in an ethics-training program as part of their orientation upon hire.

Improper, unethical, or illegal actions by an employee will be addressed on a case-by-case basis as determined by the seriousness of the offense. Corrective actions may include disciplinary action up to and including discharge.

CHAPTER 12 – MANAGEMENT OF CHANGE

Management of change is the process used to review and manage proposed changes to materials, technology, equipment, procedures, personnel and facility operations. These changes may be permanent or temporary depending on circumstances. Change is managed, communicated, and documented as appropriate to the level of change, by the Laboratory Manager and the Supervisors of each department. Significant revisions to controlled documents may require employees to sign a record of acknowledgement.

- New Equipment Validation – Documented in the Instrument Maintenance Module. Supporting studies are documented in the LIMS.
- Implementation of new test methods and method updates – Documented in the method SOP and Instrument Maintenance Module. Supporting studies are documented in the LIMS.
- The QA Manual and SOPs – Documented in the Record of Revision and stored in the Document Control Software.
- Work order changes are documented in the work order report and stored in the LIMS or Document Control Software.
- LIMS changes - documented in a version control repository.
- Personnel changes - documented in employee training records or personnel records.

CHAPTER 13 – MAJOR EQUIPMENT AND METHODS

A summarized listing of major instrumentation utilized in the laboratory is included in Appendix F. See attached NELAP certificate in Appendix A for a complete list of accredited methods and analytes that ELI performs to support SDWA, RCRA and CWA regulated methods. Refer to the ELI Technical Services and Fee Schedule, located on the ELI website at www.energylab.com, for a list of all methods and analyte parameters that Energy Laboratories, Inc. as a company performs for comprehensive services.

CHAPTER 14 – PREVENTIVE MAINTENANCE

Preventive maintenance is performed on laboratory equipment according to the manufacturer's guidelines and our operational experience. Repairs and maintenance are accomplished in-house by experienced laboratory personnel whenever possible. Other than consumable equipment items, an inventory of spare parts is not maintained. Spare parts are available from outside vendors on an as needed basis. (To ensure method capability, some methods have more than one instrument available). An example of maintenance performed follows:

Instrument	**Maintenance**	**Frequency – Note that Daily is based on use.**
Balances	Check with Class 1 weights	Daily
	Independent Service	Annually
Pipettes	Check volume	Quarterly/Daily
IC	Change Bed supports	Weekly
	Change Guard Column	As Needed
	Change Analytical Column	As Needed
	Calibrate	After maintenance or as needed
	Clean Stator Plate	Annually
	Change tubing	As needed
	Calibrate Conductivity Cell	Every 6 months
	Backup Data	Monthly
ICP-Atomic Emission	Check Pump Tubing	Daily
	Check Coolant Levels	Monthly
	Lubricate Autosampler	As needed
	Air Filter	Quarterly
	Optics Servicing	As needed
ICP-Mass Spectrometry	Check Pump Tubing	Daily
	Check Coolant Levels	Monthly
	Check Electron Multiplier	Daily
	Lubricate Autosampler	As needed
	Air Filter	Quarterly
Gas Chromatograph	Change Septum	As needed
	Check Injection Liner	Daily
	Clean Detector	As needed
	Change Gas Cylinders	At 200 psi
	Change Column	As needed
Auto Analyzers		
	Check For Leaks	Daily
	Change Tubing	When wear is visible
	Lubricate Pumps	Annually
	Lubricate Sampler	Annually
Man-tech Auto-titrator	Visually inspect all probes/ stirrer/ thermometer and fill probes	Daily/As needed
	Flush pH probe/ Fluoride probe	Every 15 days
	Calibrate sample dosing pump	Quarterly
	Replace Tubing	Annually/ As needed
	Clean out titration vessel and rinse station	Quarterly/ As needed
	Clean buret	Quarterly
	Calibrate buret	Monthly

Instrument	**Maintenance**	**Frequency – Note that Daily is based on use.**
	Replace pH/ Fluoride probe	As needed
	Replace Tubing	As needed
	Change Lip seals gland washers on dosing pump	As needed
Man-tech Auto-titrator	Visually inspect all probes/ stirrer/ thermometer and fill probes	Daily/As needed
Metrohm-automated pH, conductivity, ion electrode analyzer	Visually inspect all probes/ stirrer/ thermometer and fill probes	Daily/As needed
	Flush pH probe/ change storage solution	Monthly/ As needed
	Replace Tubing	As needed
	Calibrate buret	Monthly
	Replace pH probe	As needed
Mass Spectrometers	Monitor Vacuum Pressures	Daily
	Monitor Background Levels	Daily
	Monitor Electron Multiplier	Daily
	Change Pump Oil	As Needed
Microbiology	Monitor Room Temperature	Twice daily
	Monitor Incubator Temperature	Twice daily
	Autoclave Maintenance	Annually
	Monitor Water Bath Temperature	Twice daily
Reagent Water Systems	Change/Check Cartridges	Quarterly, or as needed
Compressed Gases	Change Gas Cylinders	At 50 psi, monitor daily
Liquid Chromatograph	Flush System	Daily
	Change Filters	As needed
	Replace Seals	As needed
Continuous Monitoring System	Check Temperatures	Daily, calibrated annually

CHAPTER 15 - REFERENCES

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ASTM D 7282-06 Standard Practices for Set-up, Calibration, and Quality Control of Instruments Used for Radioactive Measurements.

Handbook for Analytical Quality Control in Water and Wastewater Laboratories, Environmental Protection Agency. EPA 600/4-79-019

ELI Technical Services and Fee Schedule, Current Revision, Energy Laboratories, Inc.

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Manual for the Certification of Laboratories Analyzing Drinking Water, Supplement to 5th Ed., EPA 815-F-08-006, June 2008.

Methods for Chemical Analysis of Water and Wastes Environmental Protection Agency, 600/4-79-020.

Methods for the Determination of Metals in Environmental Samples – Supplement I, EPA/600/R-94-111, May 1994.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93-100, August 1993.

Methods for the Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, December 1998.

Methods for the Determination of Organic Compounds in Drinking Water – Supplement I, EPA/600/4-90/020, July 1990.

Methods for the Determination of Organic Compounds in Drinking Water – Supplement II, EPA/600/R-92/129, August 1992.

NELAC Chapter 5: Quality System Standard, 2003 or most current version approved by Florida and Texas NELAC Accreditation program.

NELAP, National Environmental Laboratory Accreditation Program http://www.nelac-institute.org/newnelap.php

Standard Methods for the Examination of Water and Wastewater; 20th, 21st and -22nd Editions, APHA.

Technical Notes on Drinking Water Methods, EPA/600/R-94/173, October 1994.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846), Environmental Protection Agency. http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm

TNI Standard, Volume 1 (EL-V1-2009), The NELAP Institute.

CHAPTER 16 – GLOSSARY OF TERMS

Accuracy - The degree of agreement between an observed value and an accepted reference value.

Analyst - The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Sample - Any solution or media introduced into an instrument on which an analysis is performed, excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blank.

Audit or Assessment- A systematic evaluation to determine the conformance to quantitative specifications of some operational function or activity.

Batch - Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to twenty environmental samples of the same matrix, meeting the criteria above. An analytical batch is composed of prepared environmental samples, extracts, digestates, or concentrates, which are analyzed together as a group.

Blank (BLK) - A sample of clean water that accompanies the samples through different aspects of sampling and/or sample preparation. It is used to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value. There are various types of blanks: equipment blank, field blank, instrument blank, method blank, and reagent blank.

Blank Spike - See Laboratory Fortified Blank.

Blind QC Check Samples - Samples whose analyte concentrations are not known to the analyst. That the sample is a QC check sample may or may not be known to the analyst.

Calibration - The set of operations that establish, under specified conditions, the relationship between values indicated by the measuring instrument and the corresponding known value of the property being measured.

Calibration Blank - A volume of reagent water fortified with the same matrix as the calibration standards, but without the analytes, internal standards, or surrogate analytes.

Calibration Check Standard - See Check Standard.

Calibration Curve – The graphical relationship between the known values and the instrument responses for a series of calibration standards.

Calibration Standard - A solution of known concentration used in the calibration of an analytical instrument.

Chain of Custody Form- A record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses.

Check Standard - A material of known composition that is analyzed concurrently with test samples to evaluate a measurement process.

Clean Water Act - Public Law PL 92-500. Found at 40 CFR 100-140 and 400-470. The act regulates the discharge of pollutants into surface waters.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) - The enabling legislation (42 USC 9601 - 9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 USC 9601 et seq.), to eliminate the health and environmental threats posed by hazardous waste sites.

Continuing Calibration Blank (CCB) – See Check Standard.

Continuing Calibration Standard - See Check Standard.

Continuing Calibration Verification (CCV) - See Check Standard.

Control Limits - A range within which specified measurement results must fall to be compliant.

Control Standard - See Check Standard.

Corrective Action (CA) - An action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Data Quality Objectives (DQO) - An integrated set of specifications that define data quality requirements and the intended use of the data.

Demonstration of Capability (DOC) - A procedure to establish the ability of the analyst to generate data of acceptable quality.

Detectability – For radiochemical analysis, detectability as a Lower Limit Detection (LLD) or Minimum Detection Concentration (MDC), is assessed based on the requirements of 40 CFR 141.25(c) and is a sample-specific determination. The equation is specific for each method and noted in the method SOP.

Detection Limit - See Practical Quantitation Limit and Method Detection Limit. Reporting of detection in radiochemistry is based on specific formulas identified in individual procedures.

Single activity point standards are used for efficiency calibration. When required, multiple energy emitters are used for energy calibration.

Document Control - The act of ensuring that documents and revisions are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate (DUP) - A second aliquot of a sample that is treated the same as the original sample to determine the precision of the method.

Duplicate Sample - See Duplicate.

Fortified Sample - See Matrix Spike.

Holding Times (Maximum Allowable Holding Times) - The maximum time that samples may be held prior to analysis and still be considered valid or not compromised.

Initial Calibration Verification (ICV) - A sample of known concentration, from a source other than that of the calibration standards, analyzed following calibration to demonstrate validity of the calibration.

Instrument Blank - See Calibration Blank.

Internal Standard – A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.

Laboratory Control Sample (LCS) – A sample with a known concentration prepared and/or analyzed as a measure of accuracy for the method.

Laboratory Fortified Blank (LFB) – An aliquot of reagent water to which known quantities of specific compounds are added and which is analyzed as a measure of method recovery.

Laboratory Inter-comparison Sample - A performance evaluation sample analyzed by numerous laboratories. Acceptance criteria are often based statistically on the analysis results.

Limit of Detection (LOD) - For chemical analysis, the LOD is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and may be laboratory-dependent.

Limit of Quantitation (LOQ) – For chemical analysis, the LOQ is an estimate of the minimum amount of a substance that can be reported with a specified degree of confidence. An LOQ is an evaluation of precision and bias.

LIMS - Laboratory Information Management System.

Matrix – The substrate of a test sample.

Matrix Spike - (MS) – An aliquot of a sample to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the effect of the matrix on the methods recovery efficiency.

Matrix Spike Duplicate (MSD) – A second aliquot of a sample to which known quantities of specific compounds are added, and which is carried through the entire analytical process to determine the effect of the matrix on the method's recovery efficiency and the precision of the method.

Maximum Contaminant Level (MCL) – Regulatory action levels for a contaminant of concern.

Method Blank (MBLK)- A clean sample processed simultaneously with, and under the same conditions as, samples being tested for an analyte of interest through all steps of the analytical procedure.

Method Detection Limit (MDL) - A measure of the limit of detection for an analytical method determined according to the procedure given in 40 CFR Part 136 Appendix B.

Method Validation - The confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled (NELAC 2003) (MARLAP 2004 for radiochemical methods).

NELAC - National Environmental Laboratory Accreditation Conference.

NELAP - National Environmental Laboratory Accreditation Program.

NPDES - National Pollutant Discharge Elimination System- A discharge permit system authorized under the Clean Water Act.

Performance Evaluation (PE) Sample - A sample with a composition unknown to the analyst that is provided to test whether the analyst/laboratory can produce analytical results within specified limits.

Practical Quantitation Limit (PQL) – The lowest concentration or amount of the target analyte that can be identified, measured and reported with confidence that the analyte concentration is not a false positive value.

Precision - The degree to which a set of observations or measurements of the same property conform to themselves.

Preservation - Refrigeration and/or reagents added at the time of sample collection to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing (PT) Sample - A sample with a composition unknown to the analyst which is provided to test whether the analyst/laboratory can produce analytical results within specified limits.

Quality Assurance – An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance Project Plan (QAPP) - A formal document describing the detailed quality control procedures pertaining to a specific project. For environmental clean-up projects, this is typically produced by an engineering firm with references to include a laboratory's Quality Assurance Manual.

Quality Control – The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Control Sample – A sample used to assess the performance of all, or a portion, of the measurement system.

Replicate - See Duplicate.

Reporting Limit (RL) –. The lowest level of concentration reported for an analyte.

Resource Conservation and Recovery Act (RCRA) - The enabling legislation under 42 USC 321 et seq. (1976) that gives EPA the authority to control hazardous waste.

Safe Drinking Water Act (SDWA) - The enabling legislation, 42 USC 300f et seq. (1974), which requires the USEPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample (SAMP) - A portion of material to be analyzed.

Spiked Sample – See Matrix Spike.

Standardization - See Calibration.

Standard Operating Procedure (SOP) - A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

TNI – The NELAC Institute

Traceability – The property of a result of a measurement whereby it can be related to appropriate standards.

Trip Blank - One type of Field Blank. An aliquot of analyte-free water or solvent transported to the field in a sealed container and returned to the laboratory with the sample containers.

Acronyms and Abbreviations

AA	-	Accrediting Authority
AB	-	Accrediting Body
ANSI	-	American National Standards Institute
AOAC	-	The Scientific Association Dedicated to Analytical Excellence
APHA	-	American Public Health Association
ASQC	-	American Society for Quality Control
ASTM	-	American Society for Testing and Materials
Bq	-	Becquerel
BLK	-	Blank
Bg	-	Background
°C	-	Degrees Celsius
Cal	-	Calibration
CAS	-	Chemical Abstract Service
CCB	-	Continuing Calibration Blank
CCV	-	Continuing Calibration Verification
COC	-	Chain of Custody
DOC	-	Demonstration of Capability
DO	-	Dissolved Oxygen
DQO	-	Data Quality Objectives
DMRQA	-	NPDES Discharge Monitoring Report Quality Assurance
DUP	-	Duplicate
ELI	-	Energy Laboratories, Inc.
EPA	-	Environmental Protection Agency
FDA	-	Food and Drug Administration
g/L	-	Grams per Liter
GC	-	Gas Chromatography
GC-MS	-	Gas Chromatography-Mass Spectrometry
ICP-AES	-	Inductively Coupled Plasma Atomic Emission Spectrophotometry
ICP-MS	-	Inductively Coupled Plasma-Mass Spectrometry
ICV	-	Initial Calibration Verification
ISO	-	International Organization for Standardization
LCS	-	Laboratory Control Sample
LFB	-	Laboratory Fortified Blank
LIMS	-	Laboratory Information Management System
LLD	-	Low Limit Detection
LOD	-	Limit of Detection
LOQ	-	Limit of Quantitation
MDC	-	Minimum Detection Concentration
MDL	-	Method Detection Limit
MBLK	-	Method Blank
MS/MSD	-	Matrix Spike/Matrix Spike Duplicate
NEHA	-	National Environmental Health Association
NELAC	-	National Environmental Laboratory Accreditation Conference
NELAP	-	National Environmental Laboratory Accreditation Program
NIOSH	-	National Institute for Occupational Safety and Health
NIST	-	National Institute of Standards and Technology
NPDES	-	National Pollutant Discharge Elimination System
OSHA	-	Occupational Safety and Health Administration

pCi/L	-	Picocuries per Liter
PT	-	Proficiency Testing
QA/QC	-	Quality Assurance / Quality Control
QS	-	Quality Systems
QAM	-	Quality Assurance Manual
RDL	-	Required Detection Level
RCRA	-	Resource Conservation and Recovery Act
RL	-	Reporting Limit
RPD	-	Relative Percent Difference
RSD	-	Relative Standard Deviation
SOP	-	Standard Operating Procedure
SPK	-	Spike
Std	-	Standard
SVOC	-	Semi-Volatile Organic Compound
TNI	-	The NELAC Institute
ug/L	-	Micrograms Per Liter
UV/VIS	-	Ultraviolet/Visible Spectroscopy
VOC	-	Volatile Organic Compound
WET	-	Whole Effluent Toxicity

APPENDIX A

Laboratory Certifications

The following are included in this Appendix:

- Montana State Drinking Water Certificate

MT State Drinking Water Certificate

- NELAP Accreditation Certificate
- NELAP Accredited Analyte List

Nelap Certification and List

Certifications and performance evaluation studies are available at www.energylab.com website and include:

- North Dakota State Certification
- South Dakota State Certification
- Wyoming State Certification (EPA Region VIII)
- Idaho State Certification
- Colorado State Certification
- Nevada State Certification
- Recent EPA WS and WP/DMRQA Study Results
- Recent NELAC Water/Soil Study Results

APPENDIX B

Quality Systems Controlled Documents

APPENDIX C

Quality Assurance / Quality Control Specifications

APPENDIX D

Organizational Charts

Corporate Organizational Chart
Billings Branch Lab Organizational Chart

APPENDIX E

Curricula Vitae of Key Laboratory Personnel

APPENDIX F

Equipment and Methods List

ENERGY LABORATORIES
Trust our People. Trust our Data.

Chain of Custody & Analytical Request Record

www.energylab.com

Account Information *(Billing information)*

Company/Name		
Contact		
Phone		
Mailing Address		
City, State, Zip		
Email		
Receive Invoice ☐Hard Copy ☐Email	Receive Report ☐Hard Copy ☐Email	
Purchase Order	Quote	Bottle Order

Report Information *(if different than Account Information)*

Company/Name
Contact
Phone
Mailing Address
City, State, Zip
Email
Receive Report ☐Hard Copy ☐Email
Special Report/Formats: ☐ LEVEL IV ☐ NELAC ☐ EDD/EDT *(contact laboratory)* ☐ Other_____

Comments

Project Information

Project Name, PWSID, Permit, etc.	
Sampler Name	Sampler Phone
Sample Origin State	EPA/State Compliance ☐ Yes ☐ No

MINING CLIENTS, please indicate sample type.
*If ore has been processed or refined, call before sending.
☐ Byproduct 11 (e)2 material ☐ Unprocessed ore (NOT ground or refined)*

Matrix Codes

A - Air
W- Water
S - Soils/ Solids
V - Vegetation
B - Bioassay
O - Other
DW - Drinking Water

All turnaround times are standard unless marked as RUSH.

Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling – See Instructions Page

Sample Identification *(Name, Location, Interval, etc.)*	Collection Date	Collection Time	Number of Containers	Matrix *(See Codes Above)*	Analysis Requested									See Attached	RUSH TAT	ELI LAB ID *Laboratory Use Only*
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	**Received by Laboratory (print)**	**Date/Time**	**Signature**

LABORATORY USE ONLY

Shipped By	Cooler ID(s)	Custody Seals	Intact	Receipt Temp	Temp Blank	On Ice	Payment Type	Amount	Receipt Number *(cash/check only)*
		Y N C B	Y N	°C	Y N	Y N	CC Cash Check_____	$	

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

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ASBESTOS TESTING LABORATORIES

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Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

List of Accreditations

Accreditation Source	Certificate/Lab Number
American Industrial Hygiene Association Laboratory Accreditation Programs (AIHA-LAP, LLC)	AIHA Lab # 100188 Certificate # 444
American Industrial Hygiene Association (AIHA-LAP, LLC) Proficiency Analytical Testing Programsfor Metals and Asbestos	AIHA-PAT # 100188
American Industrial Hygiene Association (AIHA-LAP, LLC) Environmental Lead AIHA Proficiency Analytical Testing Programs (ELPAT) Proficiency Dust/Wipe, Soil, Paint Chip, and Air	AIHA ELPAT # 100188-Lead Paint, Soil, Dust Wipe AIHA ELPAT # 100188-Lead Air
American Industrial Hygiene Association (AIHA-LAP, LLC) Asbestos Analyst Registry Program	Various Laboratory Analysts
Colorado Department of Public Health and Environment, Air Pollution Control Division	Registration No. AL-18632
Connecticut Department of Public Health Environmental Health Services Division, Asbestos Air and Bulk Certification	PH-0760
European Union International Measurement Evaluation Programme	IMEP-31
State of Hawaii Department of Health	L-13-002
State of Louisiana Department of Environmental Quality Louisiana Environmental Laboratory Accreditation Program (LELAP)	Agency Interest No. 30717
The State of Maine, Department of Environmental Protection Asbestos Analytical Laboratory (Air: PCM, TEM) (Bulk: PLM)	LA-004, LB-005
The Commonwealth of Massachusetts, Department of Labor and Industry, Asbestos Testing Program	AA000092
National Voluntary Laboratory Accreditation Program (NVLAP) through NIST for Bulk Asbestos Fiber Analysis by PLM and Airborne Asbestos Fiber Analysis by TEM	NVLAP # 101165-0
National Lead Laboratory Accreditation Program (NLLAP)	AIHA Lab # 100188
New Jersey Department of Environmental Protection-Asbestos and Metals in Drinking Water	03863
New York State Department of Health, Environmental Laboratory Approval Program (ELAP)- PCM, PLM, TEM, NOB, and AAS-Lead	ELAP # 11021
The State of Ohio, Department of Health Environmental Lead Analytical Laboratory	E10017
Ohio State EPA: Asbestos Analysis in Drinking Water Voluntary Action Program (VAP)	Ohio Asbestos in Drinking Water Certified Laboratory # CL104
Pennsylvania Department of Environmental Protection	68-03378
Perry Johnson Laboratory (PJLA) Consumer Product Testing for Lead in materials	# 64683
The City of Philadelphia, Analytical Testing Laboratory Certification	License # 101
Rhode Island Department of Health Analysis of Potable Water, Non-Potable Water, and Lead Asbestos Program Certification for the analysis of PLM, PCM, TEM	LAO00305 AAL-113
The State of Texas, Department of Health Asbestos Laboratory (TEM, PLM, and PCM)	License # 300151
US Environmental Protection Agency	NJ00554
The Commonwealth of Virginia, Department of Professional and Occupational Regulation - Asbestos Analytical Laboratory License	3333-000045
The State of West Virginia, Bureau of Public Health Asbestos Air and Bulk Sample Analytical Laboratory	LT000388

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Chain of Custody

– Environmental Lead –

Contact Information

Client Company: _____ **Project Number:** _____
Office Address: _____ **Project Name:** _____
City, State, Zip: _____ **Primary Contact:** _____
Fax Number: _____ **Office Phone:** _____
Email Address: _____ **Cell Phone:** _____

iATL is accredited by the National Lead Laboratory Accreditation Program (NLLAP) to perform analytical testing of environmental samples for lead (Pb). The accreditation is through AIHA-LAP, LLC and several other nationally recognized state programs.

Matrix/Method:

- ☐ Paint by AAS: ASTM D3335-85a, 2009
- ☐ Wipe/Dust by AAS: SW 846: 3050B: 700B, 2010
- ☐ Air by AAS: NIOSH 7082, 1994
- ☐ Soil by AAS: EPA SW 846 (Soil)
- ☐ Water by AAS-GF: ASTM D3559-03D, US EPA 200.9
- ☐ Other Metals (Cd, Zn, Cr) by AAS
- ☐ Toxicity Characteristic Leaching Procedure (TCLP) by AAS: US EPA 1311
- ☐ Other _____

Special Instructions:

_____

_____

Turnaround Time

Preliminary Results Requested Date: _____ ☐ Verbal ☐ Email ☐ Fax
Specific date / time

☐ 10 Day ☐ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization): _____ Date: _____ Time: _____
Received (Name / iATL): _____ Date: _____ Time: _____
Sample Login (Name / iATL): _____ Date: _____ Time: _____
Analysis(Name(s) / iATL): _____ Date: _____ Time: _____
QA/QC Review (Name / iATL): _____ Date: _____ Time: _____
Archived / Released: _____QA/QC InterLAB Use: _____ Date: _____ Time: _____

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Sample Log

–Environmental Lead –

Client:_____ Project:_____

Sampling Date/Time: _____

Client Sample #	iATL #	Location/ Description	Flow Rate	Start End	Sampling time (min)	Area (ft2) Volume (L)	Results ( )

** = Insufficient Sample Provided to Perform QC Reanalysis (<200mg)*
*** = Insufficient Sample Provided to Analyze (<50mg) ***= Matrix / Substrate Interference Possible*
FB = Method Requires the submittal of blank(s). ML = Multi Layered Sample. May result in inconsistent results.
These **preliminary results** are issued by iATL to expedite procedures by clients based upon the above data. iATL assumes that all of the sampling methods and data upon which these results are based, has been accurately supplied by the client. These results may not have been reviewed by the Laboratory Director. Final Certificate of Analysis will follow these preliminary results. The signed COA is to be considered the official results. All EPA, HUD, and NJDEP conditions apply.

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Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company: _____ **Project Number:** _____
Office Address: _____ **Project Name:** _____
City, State, Zip: _____ **Primary Contact:** _____
Fax Number: _____ **Office Phone:** _____
Email Address: _____ **Cell Phone:** _____

PLM Instructions:

- ☐ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

☐ PLM: Point Counting
- ☐ PC: via ELAP 198.1
- ☐ PC: 400 Points
- ☐ PC: 800 Points *
- ☐ PC: 1600 Points *

☐ PLM: Instructions for Multi-Layered Samples
- ☐ Analyze and Report All Separable Layers per EPA 600
- ☐ Report Composite for Drywall Systems per NESHAP
- ☐ Report All Layers and Composite Where Applicable
- ☐ Only Analyze and Report Specifically Noted Layer

☐ PLM: Analyze Until Positive (Positive Stop)
- ☐ AUP: by Homogenous Area as Noted
- ☐ AUP: by Material Type as Noted

☐ PLM: NOB via 198.6
- ☐ PLM: Friable via EPA 600 2.3
- ☐ If <1% by PLM, to TEM via 198.4 *
- ☐ If <1% by PLM, Hold for Instructions

☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
- ☐ Soil or Vermiculite Analysis*
- ☐ CARB 435

Special Instructions: _____

_____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ ☐ Verbal ☐ Email ☐ Fax
Specific date / time

☐ 10 Day ☐ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization): _____ Date: _____ Time: _____
Received (Name / iATL): _____ Date: _____ Time: _____
Sample Login (Name / iATL): _____ Date: _____ Time: _____
Analysis(Name(s) / iATL): _____ Date: _____ Time: _____
QA/QC Review (Name / iATL): _____ Date: _____ Time: _____
Archived / Released: _____QA/QC InterLAB Use: _____ Date: _____Time: _____

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Sample Log

–Bulk Asbestos –

Client:_____ Project:_____

Sampling Date/Time:_____

Bulk Asbestos Sample Log			
Client Sample #	**iATL #**	**Location/Description**	**Notes**

APPENDIX E STANDARD OPERATING PROCEDURES

Index of SOPs Included:

- SOP-3 (Surface Water Sampling)
- SOP-5 (Field Measurement of Electric or Specific Conductance)
- SOP-6 (Field Measurement of pH)
- SOP-7 (Field Measurement of Water Temperature)
- SOP-8 (Field Measurement of Dissolved Oxygen)
- SOP-9 (Sample Packaging and Shipping)
- SOP-10 (Field Forms)
- SOP-11 (Equipment Decontamination)
- SOP-12 (Sample Documentation)
- SOP-16 (Monitoring Well Construction)
- SOP-17 (Monitoring Well Development)
- SOP-18 (Groundwater Sampling)
- SOP-20 (Field Measurement of Ground Water Level)
- SOP-22 (Soil Sample Collection)
- SOP-23 (X-Ray Fluorescence Spectrometer Use and Calibration)
- SOP-24 (Soil Sample Preparation and Preservation)
- SOP-27 (Field Measurement of Volatile Organic Compounds Headspace)
- SOP-51 (Low-Flow Groundwater Sampling)
- SOP for Asbestos Inspections
- SOP for Final Air Clearance Sampling

SOP-03

STANDARD OPERATING PROCEDURE

SURFACE WATER SAMPLING

EQUAL DISCHARGE INTEGRATED SAMPLING

1. Visually check DH-48 or D-74 sediment sampler for damage. Replace or repair parts as necessary.

2. Decontaminate all parts of the sampler including nozzle, body, gasket, sample collection bottle, and handle using the procedure outlined in SOP-11.

3. Following streamflow measurement, and utilizing the same tag line or surveyor's tape stretched across the stream, divide the stream into an appropriate number of sections of equal discharge based on stream gaging results. At the mid point of each equi-discharge section, lower the sampler into the stream with one continuous motion making sure the sample handle is vertical. Lower the sediment sampler to the streambed at a rate based on the rating curve for the nozzle size used and the velocity of the stream. The sample bottle should be just under half full upon encountering the streambed. Raise the sampler at a rate similar to the descent rate. Low velocity streams are slow to fill the sample bottle; repeat the procedure until sampler is nearly full. The sample bottle should not be completely full upon removal from the stream. Pour contents of sample bottle into a churn splitter or into an appropriately sized compositing container.

4. Repeat procedure for the other equal discharge sections identified, composite collected samples.

5. Mix composite sample, fill out bottle labeling information, and fill the appropriate sample bottle.

6. Fill out appropriate field form documenting sample location, time, and other pertinent information prior to leaving sampling site.

GRAB SAMPLING

1. Decontaminate sampling container in accordance with SOP-11.

2. Locate sampling point if feasible at the interval in the stream which exhibits the largest volume of flow and/or highest velocity. More than one interval may be sampled.

3. Submerge sample container at sampling point such that mouth of container is under water surface 2 to 3 inches, if possible. If sampling inorganics, allow container to fill partially; rinse container by shaking and discharge this water away from sample site. Repeat this procedure three times. Do not rinse sample bottles for organics analysis.

4. Collect sample and transfer into compositing container. Transfer water from compositing container into pre-labeled sampling bottles.

5. Fill out appropriate field form(s) documenting sample location, time, and other pertinent information prior to leaving sampling site.

SURFACE SAMPLING

1. This sampling procedure is to be used when sampling for organic constituents that float on top of water (e.g. oil and grease).

2. Decontaminate sampling container in accordance with SOP-11. The sampling container should be a wide mouth jar.

3. Submerge the sampling container in such a manner that leaves the mouth of the container half-way out of the water. Wait for container to fill.

4. Transfer directly into sampling bottles.

5. Fill out appropriate field form(s) documenting sampling location, time and other pertinent information prior to leaving the sampling site.

SOP-05

STANDARD OPERATING PROCEDURE

FIELD MEASUREMENT OF ELECTRIC OR SPECIFIC CONDUCTANCE (EC/SC)

INSTRUMENT CALIBRATION (for non-temperature compensating meters)

At the beginning each day of making measurements, determine the cell constant for the meter in the field or lab.

1. Turn on machine and check red line and zero point on meter. Adjust as necessary. If unable to reach red line, or zero point, replace D cell batteries.

2. Plug probe into jack, and rinse probe with deionized water.

3. Measure conductivity and temperature of two KCl solution standards which best bracket the expected EC/SC of the sample.

4. Calculate EC/SC using the following chart to adjust conductivity measurement for temperature correction.

TEMPERATURE CORRECTION TABLE

TEMP °C	FACTOR	TEMP °C	FACTOR	TEMP °C	FACTOR
-1	1.89	8	1.46	17	1.18
0	1.84	9	1.42	18	1.15
1	1.79	10	1.38	19	1.13
2	1.74	11	1.35	20	1.10
3	1.68	12	1.32	21	1.08
4	1.63	13	1.29	22	1.06
5	1.58	14	1.26	232	1.04
6	1.54	15	1.23	24	1.02
7	1.50	16	1.20	25	1.00

5. Use the following procedure to calculate cell factor:

SC of Standard_____(a)

Temperature of Standard _____

Instrument Reading_____

Temperature Correction Factor (from above table)

Temp.Corrected SC_____(b)

Cell Correction Factor _____
[divide (a)/(b)]

6. The cell factor is calculated for each standard and then averaging the values from the two standards. The cell correction factor is the ratio of the actual conductivity of the standard KCl solution(a) to the computed conductivity(b). Use the averaged value of the two standards to adjust the measured field conductivity for each sample taken during the day.

FIELD PROCEDURE

1. Turn on machine and check red line and zero point on meter. Adjust as necessary. If unable to reach red line, or zero point, replace D cell batteries.

2. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.

3. Place approximately 150 ml. of sample in decontaminated glass beaker.

4. Rinse probe with deionized water and place conductivity probe in sample water.

5. Immerse conductivity probe in sample so that vent hole is submerged. Move probe around in sample to displace any air bubbles. The probe should not be touching the sides of the beaker. Turn instrument to appropriate scale for sample being analyzed. Multiply reading by the correct multiplier from the dial and record to the nearest ten micromhos/centimeter. Measure sample temperature to nearest 0.5^{o}C from conductivity meter.

6. Record temperature and conductivity reading on the sample field form. Compute the adjusted specific conductivity using the following procedure:

   Water Temp. _____ Observed SC (a) _____

   Temperature Correction (from table) (b) _____
   Cell Correction Factor (from above) (c) _____
   Adjusted Sample SC [multiply (a)(b)(c)] _____

7. Remove probe from sample and rinse probe with DI water. Store probe in deionized water to protect coating.

MAINTENANCE

1. Store meter in its case during transport. Store probe immersed in deionized water (a poly bottle with rubber stopper works well).

2. Check batteries before taking meter into the field. Carry spare batteries and screwdriver.

3. Inspect conductivity electrodes regularly for cracks or other damage.

4. If platinum black has flaked off, a sharp end point cannot be achieved or readings are erratic. Return probe to factory so it can be replatinized.

SOP-06

STANDARD OPERATING PROCEDURE

FIELD MEASUREMENT OF pH

INSTRUMENT CALIBRATION

1. Calibrate pH meter before leaving for the field and each day in the field when pH will be measured. Calibrate using following procedure:

   - Rinse pH electrode and temperature probe with distilled water.
   - Immerse electrode and temperature probe in bottle of commercial calibration solution of pH buffer 7.0. Calibrate meter to within 0.1 standard unit (s.u.).
   - Remove electrode and temperature probe from solution, rinse with distilled water.
   - Immerse electrode and temperature probe in second pH calibration buffer having a pH of 3 units higher or lower than the first, bracketing the expected range of natural sample pH.
   - The pH meter should be recalibrated during the field day, especially when air temperatures are changing by 5 or more degrees. To recalibrate pH meter, measure pH of the 7.0 buffer solutions. If the measured value differs from expected value by more than 0.1 units, recalibrate meter using according to meter instructions.

FIELD PROCEDURES

1. Rinse decontaminated glass beaker with approximately 50 milliliters of sample water three times.
2. Rinse pH electrode with deionized water.
3. Check meter using 7.0 pH buffer. Re-calibrate meter, if not within 0.1 pH units.
4. Fill beaker with sample water.
5. Immerse electrode and temperature probe in sample, agitate probes to provide thorough mixing. Continue to agitate until reading has stabilized. Read pH to nearest 0.1 s.u.
6. Record the sample pH. Note any problems such as erratic readings.
7. Rinse probe with DI water and store according to manufacturer's directions.

MAINTENANCE

1. Store meter in its case with electrode immersed in a KCl or pH 7.0 buffer solution.
2. If meter is not used often, inspect bi-weekly to make sure electrode is immersed in one of the solutions described above.
3. Check batteries each time meter is used. Carry a spare battery pack and a screwdriver into the field in the pH meter case.
4. It is wise to keep an additional pH electrode available in case of probe malfunction or breakage. Usually probes are replaced as their sensitivity becomes weakened. If stabilized readings take an unusually long time to reach, or the meter cannot be calibrated.

SOP-07

STANDARD OPERATING PROCEDURE

FIELD MEASUREMENT OF WATER TEMPERATURE

1. Carry two NBS-calibrated thermometers inside cases, into the field.

2. Check thermometer for cracks or gaps in the solution. Do not use thermometers if either cracks or gaps are visible. (Some gaps can be closed by submersing tip in a beaker of boiling water, or placing thermometer in a freezer).

3. When possible, measure temperature of surface water at midstream submersing the thermometer for approximately one minute or until temperature stabilizes. Temperatures should be collected from moving water, avoiding still pools which may be warmer than actual conditions.

4. When in situ temperature measurements are not possible, draw sample of at least 200 mL into a decontaminated beaker or sample bottle as soon after sampling as possible.

5. Place thermometer in sample. Do not allow thermometer bulb to touch sides of beaker. Allow to equilibrate (about 1 minute).

6. Record temperature to nearest 0.5^{o}C in field log book or on field data sheet.

7. Rinse thermometer with deionized water.

8. On a quarterly basis, check field thermometers against a NBS-certified laboratory thermometer. Agreement should be within 0.5^{o}C.

STANDARD OPERATING PROCEDURE

FIELD MEASUREMENT OF DISSOLVED OXYGEN

1. Inspect dissolved oxygen (DO) meter for damage. The probe end should be examined to be sure the membrane is intact. Repair as necessary according to manufacturer's instructions.

2. Rinse probe and cable with Deionized water.

3. Prepare probe and DO meter in accordance with instrument manufacturer's operating procedures (in meter box). Make certain probe contains sufficient electrolyte and the oxygen sensor membrane is in good repair.

4. Calibrate probe and meter using the fresh water - air calibration method. Correct calibration value for temperature and altitude; adjust meter accordingly.

5. When possible place probe directly into the stream, or water to be measured. If not possible, place probe into beaker filled with sample. Manually raise and lower probe through sample about 1 foot/second. Allow sufficient time for probe to stabilize to sample temperature and dissolved oxygen concentration.

6. Read dissolved oxygen value. Record appropriate data on field forms.

SOP-09

STANDARD OPERATING PROCEDURE

SAMPLE PACKAGING AND SHIPPING

All environmental samples collected should be packaged and shipped using the following procedures:

PACKAGING

1. Label all sample containers with indelible ink (on the side, not on the cap or lid). Place labeled sample bottles in a high quality cooler containing an adequate amount of ice and/or frozen blue ice (appropriate for the season), making sure the cooler drain plug is taped shut.

2. Place the samples in an upright position and wrap the samples with absorbent, cushioning material for stability during transport. Samples should not be loose; the cooler should be able to withstand rough handling during shipment without sample breakage.

3. Fill out the appropriate shipping forms, and place the paperwork in a ziploc bag and tape it to the inside lid of the shipping container. Shipping forms usually include: 1) a chain-of-custody form, documenting the samples included in the shipment; 2) an analysis request form, specifying the laboratory analyses for each sample. If more than one cooler is used per chain of custody, put a photocopy in the other coolers and mark them as a copy.

4. Close and seal the cooler using fiberglass strapping tape.

5. Secure the shipping label with address, phone number, and return address clearly visible.

SHIPPING HAZARDOUS MATERIALS/WASTE

Hazardous materials need to be shipped using procedures specified under Federal Law. Samples need to be shipped in ziploc bags or paint cans filled with vermiculite, depending on the level of hazard. Special package labeling may be needed. Consult the project manager for specific shipping procedures.

SOP-10

STANDARD OPERATING PROCEDURE

FIELD FORMS

All pertinent field investigations and sampling information shall be recorded on a field form during each day of the field effort and at each sample site. The field crew leader shall be responsible for ensuring that sufficient detail is recorded on the field forms. No general rules can specify the extent of information that must be entered on the field form. However, field forms shall contain sufficient information so that someone can reconstruct all field activity without relying on the memory of the field crew. All entries shall be made in indelible ink, weather conditions permitting. Each day's or site's entries will be initialed and dated by the author.

At a minimum, entries on the field sheet or in field notebook shall include:

- Date and time of starting work and weather conditions.
- Names of field crew leader and team members
- Project name and type
- Description of site conditions and any unusual circumstances.
- Location of sample site, including map reference, if relevant
- Equipment ID numbers
- Details of actual work effort, particularly any deviations from the field work plan or standard operating procedures
- Field observations
- Any field measurements made (e.g., pH)

For sampling efforts, specific details for each sample should be recorded using Tetra Tech standardized field forms. Surface water and groundwater field forms contain fill-in-the-blank type information in order that all pertinent information shall be recorded. In addition to the items listed above, the following information is recorded on field forms during sampling efforts:

- Time and date samples were collected
- Number and type (natural, duplicate, QA/QC) of samples collected
- Analysis requested
- Sampling method, particularly deviations from standard operating procedures

Strict custody procedures shall be maintained with the field forms. Field forms shall remain with the field team at all times, while being used in the field. Upon completion of the field effort, photocopies of the original field forms will be made and used as working documents; original field forms shall be filed in an appropriately secure manner.

SOP-11

STANDARD OPERATING PROCEDURE

EQUIPMENT DECONTAMINATION

The purpose of this section is to describe general decontamination procedures for field equipment in contact with mine/mill tailings, soil, or water. During field sampling activities, sampling equipment will become contaminated after it is used. Sampling equipment must be decontaminated between sample collection points if it is not disposable. Field personnel must wear disposable latex or vinyl gloves while decontaminating equipment at the project site. Change gloves between every sample. Every precaution must be taken by personnel to prevent contaminating themselves with the wash water and rinse water used in the decontamination process.

Table A-1 lists equipment and liquids necessary to decontaminate field equipment.

The following should be done in order to complete thorough decontamination:

1. Set up the decontamination zone upwind from the sampling area to reduce the chances of windborne contamination.

2. Visually inspect sampling equipment for contamination; use stiff brush to remove visible material.

3. The general decontamination sequence for field equipment includes: wash with Liquinox or an equivalent degreasing detergent; deionized water rinse; 10% dilute nitric acid rinse (if sampling for metals); deionized water rinse; rinse with sample water three times.

4. Rinse equipment with methanol in place of the nitric rinse if sampling for organic contamination. Follow with a deionized water rinse.

5. Decontaminated equipment that is to be used for sampling organics should be wrapped in aluminum foil if not used immediately.

6. Clean the outside of sample container after filling sample container.

Alternatively, field equipment can be decontaminated by steam cleaning, rinsing with 10% dilute nitric acid, and rinsing with deionized water.

All disposable items (e.g., paper towels, latex gloves) should be deposited into a garbage bag and disposed of in a proper manner. Contaminated wash water does not have to be collected, under most circumstances.

If vehicles used during sampling become contaminated, wash both inside and outside as necessary.

TABLE A-1. EQUIPMENT LIST FOR DECONTAMINATION

5-gallon plastic tubs	Liquinox (soap)
5-gallon plastic water-container	Hard bristle brushes
5-gallon carboy DI water	Garbage bags
1-gallon cube of 10% HNO_3	Latex gloves
1-gallon container or spray bottle of 10% Methanol or pesticide grade acetone for organics	Squeeze bottles
	Paper Towels

SOP-12

STANDARD OPERATING PROCEDURE

SAMPLE DOCUMENTATION

Sample documentation is an important step to ensure the laboratory, project manager, and field personnel are informed on the status of field samples. Depending on the specifics required for each project, a number of forms will need to be filled out. Most sample documentation forms are preprinted carbonless triplicates, enabling copies to be filed or mailed from labs or offices. The forms will be completed by field personnel, who have custody of the samples. The office copy will be kept in the project file and subsequent copies sent to the laboratory, or other designated parties. The responsibility for the completion of these forms will be with each field crew leader. It is important the field crew leader is certain field personnel are familiar with the completion process for filling out forms, and the expected information is included.

Potential documents to be completed clearly in ink for each sample generated include:

- Field Form
- Chain-of-Custody
- Custody Seal

If working on Superfund activities, the following additional forms will also be prepared:

- EPA Sample Tags
- SAS Packing Lists
- Sample Identification Matrix Forms
- Organic Traffic Report (if applicable)
- Inorganic Traffic Report (if applicable)

STANDARD OPERATING PROCEDURE

MONITORING WELL CONSTRUCTION

1. Arrive on-site with properly sized drilling equipment and materials for site conditions. All drilling equipment and materials should be properly decontaminated prior to its arrival on-site. Decontamination usually includes steam - or hot water-cleaning methods.

2. Drilling muds or drilling solutions of any kind are not to be used during drilling activities in conjunction with monitoring well construction. Acceptable drilling techniques include air-rotary, cable tool, or hollow-stem auger. If unconsolidated material is encountered, it may be necessary to drive steel casing during drilling to maintain borehole integrity. It is suggested threaded steel casing be used in lieu of welding joints together to minimize this source of potential well contamination. Hydraulic jacks or the drill rig can be used to pull back the steel casing following emplacement of plastic casing.

3. A detailed lithologic log shall be completed during drilling activities. Water bearing characteristics of the formations should also be denoted on the log. In addition, details of monitoring well construction should also be described on the well log including total depth, perforated interval, sizes and types of construction materials, etc.

4. Seven- or ten-inch outside diameter hollow-stem augers can used in drilling shallow exploration drill holes in many situations. Care is taken to avoid contamination due to oil and grease from the drill rig and split spoon sampler. Appropriate decontamination of the drill rig between drill holes is performed. Soil and sediment samples are collected using a standard 1.4 inch inside diameter split spoon sampler and a 140 pound drive hammer. The number of blows necessary to obtain an 18 inch length of sample is recorded on the exploration log. Appropriate decontamination of the split spoon sampler is accomplished between samples.

   Either a single- or multi-completion monitoring well can be constructed in a single borehole where hollow-stem auger drilling is not used. Backfill with chemically-inert silica sand to above the perforated interval and emplace a bentonite plug above the sand. Install factory-screened and blank PVC (or stainless steel or PTFE for organics) well casing into the borehole. Where appropriate, begin pulling temporary steel casing out of borehole. Emplace silica frac sand above and below any perforated sections in the borehole; install bentonite plugs above and below sand pack around perforated sections. Backfill remaining well annulus with a bentonite slurry or with grout to the surface. Monitoring well development is presented in SOP-17.

5. Place locking well protector over PVC casing(s) after outer steel casing has been removed from the borehole if necessary. Place bentonite plug below bottom of well protector; grout well protector in place and lock with high quality lock.

6. Many states now require certification and licensing for monitoring well drillers. Be sure you know the State's regulations before arriving on-site, especially if drilling outside your own State.

7. Safety equipment required on-site of the drill rig is mandatory. Personal protective equipment includes (at a minimum): hard hat, safety glasses, steel toed boots, gloves, first aid kit, and site safety plan - with routes to hospitals known by all personnel on-site.

STANDARD OPERATING PROCEDURE

MONITORING WELL DEVELOPMENT

1. Visually inspect all well development equipment for damage - repair as necessary.

2. Decontaminate all stingers, air hoses, surge blocks by scrubbing with brush and Liquinox solution, rinsing with dilute nitric acid solution, and rinsing with deionized water. If sampling for organics, replace the nitric acid rinse with 10% methanol as per SOP 11.

3. If using compressed air method for well development, make certain compressor utilized does not produce air laden with hydraulic fluid for lubricating purposes. This may affect the integrity of the monitoring well for producing viable water quality data.

4. Develop well by using surging techniques (surge block or bailer) followed by well evacuation. Repeat this procedure until evacuated water is visibly clean and essentially sand-free. In most cases, evacuated water can be disposed of on-site.

5. If specified in the project workplan, during evacuation process, collect water samples for field determinations of temperature, specific conductivity, and pH. Continue developing well until field parameters stabilize to within $\pm$5% on three consecutive measurements.

6. Report field observations and volume of water removed on standard form.

SOP-18

STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLING

EQUIPMENT:

five gallon bucket graduated in gallons	pH meter/thermometer (optional)
coolers and ice	specific conductance meter (optional)
sample bottles	bailer(s)
preservatives	bailer rope or teflon reel
filter apparatus	field sampling forms
decontamination equipment & fluids	indelible marker
water level probe	stop watch
purge pump(s)	generator
discharge hose	fuel

All sampling equipment shall be inspected for damage, and repaired if necessary, prior to arriving on-site.

GENERAL PROCEDURE - PURGING

Purging must be performed on all wells prior to sample collection. If required by the project workplan, the stability of pH, specific conductivity, and temperature will be evaluated. A minimum of three volumes of groundwater in the well casing shall be withdrawn prior to sample collection. The volume of water present in each well shall be computed using the length of water column, monitoring well inside diameter, and casing diameter. The total volume of water in the well (gallons) can be approximated using the following formula (depth and water level measurements in feet; borehole diameter in inches):

$$\textbf{(1/25)(Total Depth - Measured Water Level)(Casing Diameter)}^2 \textbf{ = gallons}$$

Several general methods are used for well purging. Well purging may be achieved using bailers, bladder pumps and submersible pumps. The specific pumping method shall be chosen based on depth to groundwater, diameter of well, existing well configuration and contaminant(s) of concern. Specific conductance, pH, temperature, and purge volume values will be entered on the Field Sampling Forms. If sampling for hydrocarbon compounds, wells shall be checked for the presence of free product prior to purging and sampling.

If specified by the project workplan, field parameters will be measured periodically during well purging. The well is ready for sampling when either or both of the following conditions are met: 1) measured field parameters stabilize at plus or minus five percent of the reading, over three successive readings or, 2) three to five casing volumes have been evacuated from the well.

If the recovery of a low-yield well exceeds two hours after purging, the sample shall be extracted as soon as sufficient volume is available in the well for a sample to be extracted. At no time will a monitoring well be pumped dry if the recharge rate causes formation water to cascade down the well casing causing an accelerated loss of volatiles and change in pH.

COLLECTING WATER QUALITY SAMPLES

1. Generally, wells shall be sampled from the least contaminated to the most contaminated, if known. Open well and measure water level (SOP-20).

2. Decontaminate sampling equipment using the following procedure: scrub with brush and Liquinox solution; rinse with 10% dilute nitric acid (if sampling for metals); rinse with methanol, if sampling for organic compounds; rinse three times with deionized water. Use disposal latex or vinyl gloves throughout decontamination and sampling procedure and new gloves for each sampling point.

3. Sampling Monitoring Wells

   a. To collect a water quality sample, use a new disposable polypropylene, decontaminated stainless steel, or teflon bailer and a spool of polypropylene rope or equivalent bailer cord (teflon-coated stainless steel cable). Tie a bowline knot through the bailer loop to secure.

   b. Slowly lower bailer or other sample collection device to the bottom of the well and remove an additional 5 feet of rope from the spool. Secure end of rope to steel well casing or wrist.

   c. Purge well by bailing or pumping, collecting evacuated water in a graduated 5 gallon bucket to measure the total volume discharged.

   d. Collect a sufficient quantity of water using the bailer or pump into a decontaminated one gallon sample container to fill all sample bottles.

4. Sampling Domestic Wells

   a. Turn-on household fixture (preferably an outside faucet without a hose connected) that is on the well-side of any household water conditioning device.

   b. Using the above equation, calculate the volume of water to be evacuated. Measure the discharge rate from the faucet in a graduated 5 gallon bucket, or other suitable container, to compute the rate of discharge. Calculate the time needed to evacuate the predicted volume from the well. Record all measurements and calculations on field forms.

   c. Samples should be collected directly from hydrant or faucet and prior to entry of the water through any water conditioning devices. Do not collect samples through rubber hoses.

5. If specified by the project work plan, measure pH and specific conductance (SOP-05 and SOP-06). Continue monitoring field parameters (pH and specific conductance) periodically during purging process. The well is ready for sampling when either or both of the following conditions are met: 1) the purged volume is equal to three to five casing volumes and/or, 2) measured field parameters are within plus or minus five percent ($\pm$ 5%) over three successive readings.

6. If sampling for dissolved metals, field filter sample according to SOP-04.

7. Label each sample container with project number, sample location, well owner, date, military time, sampler's initials, preservative, and analysis required. For inorganics samples, rinse sample containers, without preservatives, three times with sample water before final collection. Do not rinse containers for organics analysis.

8. Pour the sample into the appropriate sample containers and and any needed preservatives in accordance with SOP-42. Also see ("Handbook for Sampling and Sample Preservation of Water and

Wastewater", EPA-600/4-82-029; "Guidelines Establishing Test Procedures for the Analyses of Pollutants Under the Clean Water Act", 40 CFR 136; and "Test Methods for Evaluating Solid Wastes," EPA SW-846). A few common sample preservatives are listed below:

Dissolved Metals	Add 3-4 ml. Nitric Acid to 500 ml. sample
Nutrients	Refrigerate to 4□C; Add 3-4 ml. Sulfuric Acid to 500 ml.sample
Common Ions	Refrigerate to 4□C
Hydrocarbon VOA	Refrigerate to 4□C; Add 3-4 drops HCl*
Diesel Range Organics	Refrigerate to 4□C; Add 80 drops (4ml) HCl
Fluorescent Tracer Dye	Refrigerate to 4□C; Prevent exposure to light

For additional bottling and sample preservation information, consult Tetra Tech laboratory.

9. For volatile analyses add preservative to sample vial and fill vials at the rate of 100 milliliters per minute (24 seconds for 40 milliliter vial); form positive meniscus over vial brim and cap. After capping, invert vial, gently tap and look for air bubbles. If bubbles are present, un-cap vial, add more water and repeat procedure.

10. If required by the project workplan, perform field parameter tests including pH, SC, Eh, and temperature on water sampled from the well. Record field measurements on field forms.

11. Complete the necessary shipping and handling paperwork, and record all pertinent information on Field Sampling Form in accordance with SOP-10.

SOP-20

STANDARD OPERATING PROCEDURE

FIELD MEASUREMENT OF GROUND WATER LEVEL

1. Calibrate well probe to a steel tape prior to and following each data gathering episode. Note any corrections to well probe measurements on field forms.

2. Check well probe prior to leaving for field for defects by placing probe in water and testing buzzer and light. Repair as necessary. Make certain the well probe, a tape measure calibrated to tenths of feet and extra batteries are in the carrying case.

3. Measure all wells (monitoring and domestic) from the top of the well casing in the north quadrant or from a designated measuring point, as appropriate. Measure and record distance from measuring point to ground level. Make sure measuring point is labeled on well, so future measurements can be made from the same location.

4. Obtain a depth to water from measuring point to the nearest hundredth of a foot. Record data on appropriate field forms.

5. Decontaminate well probe between each measurement by rinsing with deionized water. Additional decontamination, such as liquinox scrubbing, may be required for certain wells; consult the project work plan.

SOP-22

STANDARD OPERATING PROCEDURE

SOIL SAMPLE COLLECTION

This SOP describes the field equipment and sampling methods for surface and subsurface sampling of soil material. Methods explained in this SOP may be different from those identified in the project specific Sampling and Analysis Plan (SAP) and the project specific SAP should be referenced for additions or deletions to the methods noted below. All sampling equipment should be cleaned before arriving on site.

FIELD EQUIPMENT

- Sharp shooter and clean-out shovel
- Stainless steel mixing bowl and sampling trowel
- Dilute (10%) hydrochloric acid
- Hand lens (10) power
- Steel tape (10 foot)
- pH and electrical conductivity meters (if required)
- Munsel color book (if required)
- No. 10 sampling screen
- Field forms and field book
- Bucket augers

SURFACE SAMPLING

Surface soil/tailings samples are collected from the surface to a depth of one inch unless otherwise specified in the project specific SAP. Sufficient sample will be collected for the analysis that will be performed but generally this will be on the order of one gallon. Soil samples will be collected in either wide mouth glass jars or resealable polyethylene bags (ziploc or equivalent).

Samples should be described according to the procedures outlined in the Unified Soil Classification System (USCS; method ASTM D2487) or the Soil Conservation Service (SCS) classification system. Soil texture should be classified by either the USCS or U.S. Department of Agriculture (USDA) classification. Descriptions shall be recorded in field books or on standard morphological description logs as provided in the SAP.

Samples should be collected from an area of approximately six square feet by digging up the top inch with the sampling trowel and placed in the mixing bowl. The sample should be screened with the 10 mesh sieve if coarse fragments are to be excluded from the sample. If a sod or duff layer is present, this layer should be pealed back to the top of the mineral soil.

The sample placed in the mixing bowl shall be well mixed and then a portion of the sample placed in the sample container. To select a sample from the mixing bowl, quarter the sample in the bowl and place an equal volume of soil from each quarter in the sample container. When sampling soil for organics, the samples should not be mixed.

All equipment used in the sampling of surface soils will be decontaminated using the procedures in SOP-11. All necessary paperwork will be filled out in accordance with SOP-12.

SUBSURFACE SAMPLING

Subsurface sampling will be completed using a bucket auger, split spoon sampler, or hand dug or backhoe excavated pits. Sampling procedures for each type of equipment is described below. Sample collection, homogenation, and transfer to sampling containers should follow the same procedures as outlined for collection of surface samples.

Bucket Auger

1. Arrive on-site equipped with stainless steel auger rod and several sizes of stainless steel bucket augers (e.g. 2-inch, 4-inch, 6-inch, etc.).

2. Bucket auger holes can be drilled as one size or in a telescoping manner if contamination between sample intervals is a concern. If a single sized, advance the bucket auger to the desired sampling interval depth and empty the contents of the auger in a stainless steel mixing bowl. For the telescoping method, advance the largest auger to an approximate depth of three feet, collecting specified depth increment samples as the auger is advanced. Install temporary decontaminated PVC casing with a diameter slightly smaller than the borehole to keep the hole open and reduce possible cross-contamination between depth intervals. Using the next size smaller bucket auger, repeat the process.
3. Select sample intervals for packaging for laboratory analysis in accordance with procedures described in the SAP.

4. Fill out appropriate paper work and bottle labels as necessary prior to leaving site.

5. Decontaminate all equipment between sample locations.

Split Spoon Sampler

1. Arrive on-site equipped with at least two standard 1.4 inch inside diameter split spoon samplers. If geotechnical information is desired, a 140 pound drive hammer is required.

2. Install sampler into borehole and advance to the desired depth with the 140 pound drop hammer or equivalent means. Record number of blow counts to complete sampling over each 18-inch interval, as necessary. Retrieve sampler and place on work table. Using the other sampler, repeat this sequence.

3. Record lithology and percent recovery from cores retrieved from split spoon sampler.

4. Based upon the project work plan or sampling and analysis plan, composite like core intervals by mixing in stainless steel bowl in a similar manner as described for surface sampling. When sampling for organics, the sample should not be mixed.

5. Decontaminate sampling equipment between each interval sampled if required by the SAP. Decontaminate sampling equipment between sampling sites.

Backhoe or Hand Dug Excavations

1. Locate the site to be sampled and insure that equipment can safely access the site. Minimize off road travel to prevent off site damage to surrounding vegetation.

2. Orient excavation to maximize use of the angle of the sun to illuminate the pit for photographs. Place excavated material a sufficient distance from the excavation.

3. Excavate to the prescribed depth. If the pit exceeds five feet in depth, OSHA construction standards for shoring or sloping must be observed to prevent accidental burials. Sampling personnel should enter the

pit with care during and after excavation.

4. Soil profile descriptions shall be made from a hand cleaned surface along the pit wall. Complete profile descriptions and take photographs before pit is sampled.

5. Soil samples shall be collected from depth intervals specified in the SAP. When a depth interval is sampled, an equal volume of soil should be collected from the entire interval exposed on the pit wall. Soil samples will be collected with the stainless steel trowel and mixing bowl according to methods described for surface soil sampling. When sampling for organics, the sample should not be mixed.

6. After sampling is completed, the pit should be backfilled with excavated material in the reverse order that it was excavated so that topsoil material is returned to the top of the pit. When backfilling is complete the area should be cleaned-up to its original condition.

7. Decontaminate sampling equipment between sampling sites. Excavation equipment should be cleaned between sites with water (where possible) or with a shovel to remove accumulated dirt and mud.

STANDARD OPERATING PROCEDURE

X-RAY FLUORESCENCE SPECTROMETER (XRF) USE AND CALIBRATION

The chemical characterization of soil samples in the field will be determined by the field portable X-ray fluorescence (XRF) Spectrometer ATX-100 instrument manufactured by Aurora Tech, Inc, Salt Lake City, Utah. The instrument uses low level self-contained and shielded radioactive sources that produce spectral peaks whose position (energy level) is specific to an individual element and whose peak height or area which is indicative of the concentration of that element within the area exposed to the source. Two sources will be used, cadmium-109 (15 millicuries) and Iron-55 (100 millicuries) emplaced by the manufacturer. These sources allow semiquantitative determination of the copper, zinc, arsenic, iron, manganese and lead concentrations. Additional elements that will be monitored include chromium, barium, cobalt, nickel, selenium, and molybdenum.

The detection limit for each parameter is a function of source strength, geometry/particle size, counting time, and the concentration of other elements. Since the source strength and instrument geometry are constants, the detection limit is dependent on geometry/particle size, counting time, and concentration. It has been demonstrated that 80 mesh particle size dominantly composed of a siliceous or calcareous skeletal matrix will give analytical results within 20 percent. The larger the particle size, the larger the error. A rock made up of fine-grained minerals, however, will essentially have the same precision and accuracy as a finely ground sample.

Soil samples will be screened and all particles greater than 2 mm (No. 10 sieve) will be removed.

The counting time also affects the detection limit. In general, the longer the counting time, the lower the detection limit, and certainly the higher the precision and accuracy. The instrument has controllable time units of 10, 30, 100, 300, and manual control seconds. The 30 second counting time will likely be the standard for this test. The time may change for either or both sources depending on the actual sample matrix encountered in the field.

The primary operator will receive one day's training on the proper use of the instrument particularly for health and safety purposes. The manufacturer's statement on radiation safety is also attached. Each operator will have a gamma film badge service (monthly) and will have the dates and times used logged in the record book specifically kept for this purpose.

Calibration of the unit will be provided by the following method.

The XRF will be calibrated before being taken in the field by developing response curves of index values verses actual concentrations of metals in soils. Numerous samples have been analyzed through the CLP program for metals content and splits of these samples are archived in Helena. These splits will be used to develop the response curves so that the index values that are generated in the field can be converted into concentrations. These concentrations will then be used to help direct the soil sampling program for laboratory samples. The XRF will also be calibrated using the internal standards as recommended by the manufacturer. This internal calibration will be performed, each day of use, in the morning, at noon and at the end of the day. Time, temperature and calibration data will be noted during each calibration in the field logbook.

Data for Cu, Zn, Fe, Mn, Pb, As, and Ni will be recorded in the field logbook or on standard forms.

To obtain the best quantitative XRF results, a uniform volume of soil material of generally the same particle size will be used. The sample should be prepared in the following manner: (1) Disaggregate and

homogenize field moist sample, foreign objects such as rocks, twigs, roots, etc.; (2) Dry sample preferably overnight in an over set at approximately 105°C; (3) Cool sample to room temperature; (4) Sieve sample through a 2 mm nonmetallic sieve; (5) homogenize sieved sample; and, (6) Place sample in a 2-inch petri dish.

The soil material will be well packed in the petri dish and the top surface should be uniformly smoothed to the level of the petri dish edges. The head of the XRF should then be placed over the petri dish.

If soil is sticking to the XRF, place a piece of Saran Wrap over the petri dish. If any dust sticks to the head of the XRF, clean it with a fine-bristle paint brush.

SOP-24

STANDARD OPERATING PROCEDURE

SOIL SAMPLE PREPARATION AND PRESERVATION

This SOP applies to EPA Superfund Projects.

The Document Control Officer (DCO) will direct all packaging and shipping procedures in the field. Each of the three field scientists will be responsible for a specific task to ensure consistency.

Procedure

1. All soil sampling, decontamination, QA/QC samples, sample splits, and pH and SC measurement should be completed for each sample.

2. Upon filling a soil sample container, a field scientist will place a completed EPA custody seal over the top of the container. The custody seal serves two purposes. It secures custody of the sample and it secures the lid of the container.

3. An EPA sample tag is completed by a field scientist, and is taped securely to the sample container.

4. The soil samples will then be placed into a cooler labeled "SOIL SAMPLES", with the site identification and date also written on the cooler top. Since soil samples will be in glass ICHEM jars, they will be packed with vermiculite to prevent breakage. The cooler will be packed full, so there is no empty space for the contents to move about.

5. When the cooler is full, or when the sample collection is complete, the correct Chain-of-Custody, Inorganic Traffic Report (ITR) and Special Analytical Service (SAS) packing list can be completed at a later date. A prenumbered airbill will be assigned to that cooler.

6. The DCO will double check the forms to assure those samples mentioned on the COC, ITR and SAS are all present and accounted for in the cooler. He/she will document this on the ITR, SAS Packing List and Sample ID Matrix.

7. The cooler will be clearly marked "FRAGILE/THIS SIDE UP" on all four sides and the top as appropriate.

8. The DCO will then place the proper COC, and SAS, SIDM, and Packing Lists in a ziplock bag, taped to the inside roof of the cooler.

9. The DCO or field scientist will then close the cooler and affix the airbill to the top of the cooler.

10. The DCO or field scientist will then seal the cooler and place the appropriate custody seals (one in front and one in back), signed and dated, on the cooler.

11. The field scientist will then place fiberglass tape over the custody seals and around the cooler, making sure everything is secure.

12. The cooler will be labeled as to type of samples and date of sampling, with a large felt-type pen. A label should also be placed on top of the cooler so the laboratory will return the cooler to you.

13. The cooler(s) will then be transported to a secure storage facility, where they can be kept under custody until they are shipped.

STANDARD OPERATING PROCEDURE

FIELD MEASUREMENT OF VOLATILE ORGANIC COMPOUNDS HEADSPACE

INSTRUMENT CALIBRATION

1. Calibrate meter before leaving for the field and each day in the field when headspace will be measured. Record results of calibration in the field book for project in which the instrument is being used. Calibrate using one of the following procedures:

   A. MiniRAE 2000
      - Assemble instrument and turn on.
      - Fill Tedlar bag half full of isobutylene using regulator.
      - Press and hold “mode” button and follow instructions for “span cal” as they appear on the screen.
      - Check calibration gas cylinder for concentration. Normally is 100 ppm.
      - When prompted to “Apply gas now”, allow instrument too naturally “suck” calibration gas from Tedlar bag (do not force gas into instrument).

FIELD PROCEDURES

1. Place sample material in a Ziplock bag and seal. Mix contents in bag to break up soil clumps and homologize. Alternatively, place sample to be tested in clean canning type jar. Cover the sample tightly using aluminum foil and the outer ring of the jar lid. Be sure to mark container with sample location (boring/test pit # and depth).

2. Allow sample to come to room temperature (approximately 70 - 80° F) by placing in warm location not in direct sunlight. This can be accomplished by placing the container under the heater vent of the vehicle in winter or in a closed vehicle in summer.

3. Insert probe through foil or small opening in the Ziploc bag. Probe should be placed in contained such that soil particles are not ingested into analyzer. Record maximum reading.

   NOTE: Consistency in results is enhanced by using approximately equal portions of material, similar jar or bag sizes and similar test temperatures. Moisture content may also affect readings using some instruments.

MAINTENANCE

1. Disassemble and store meters in their case.

2. Charge batteries after each use as described in user's manual.

3. Occasional routine maintenance may be necessary ie. cleaning or replacing filters. Any maintenance you feel unqualified to perform should be handled by an authorized service representative.

STANDARD OPERATING PROCEDURE

LOW – FLOW GROUNDWATER SAMPLING

EQUIPMENT:

Five gallon bucket to record gallons removed	Flow-Cell and Meter
Cooler and Ice	Low-Flow Tubing/reel, pump (may be bladder or electric submersible pump)
Sample bottles	
Preservative	Field forms
Decontamination equipment and fluids	Indelible marker
Stop watch	500 ml poly bottle marked off
Calibration fluids for SC, pH 4-7 or 10	50 mL increments to measure
ORP – Zobel solution or Quinhydrone	ML/cycle of discharge

Make sure the equipment is ready to take out in the field and meter or water analyzer is charged.

STARTUP (using the FC-5000 Micropurge/Flow Cell).

1. Connect meter to Sonde Cable.
2. Press “ON” key (O/I symbol) on meter. After startup screens, the Home Screen will appear, showing (in numeric month/date/year/hour/minutes/second format) and the Internal Battery Voltage (IBV) and SC, DO, ORP, pH and Temp.
3. Full battery charge is 8.2 volts (IBV) and should last 12 to 16 hours of continuous operations. When the (IBV) Internal Battery Volts has dropped to 6.5 volts the meter will automatically turn off and it will not turn back on until it is charged. (Charging nightly is recommended.) To charge internal battery in meter, connect 110 volt AC or 12 Volt DC charger cable to meter, press the power “on” O/I key. The meter must be “on to charge”. Allow approximately 3½ hours for a full charge cycle from drained battery condition. Display will provide the exact charge status, including Estimated Time of Charge (ETCC) in HHMMSS format. The charger must be removed when the 3½ hours has been reached (the meter will beep) or the meter will start to discharge the battery as if it were taking parameters.
   - CALIBRATION USING THE FC-5000 MICROPURGING SYSTEM. (Every instrument will calibrate differently, so follow instructions step by step.)
   - All calibration except conductivity “0” are preformed with Sonde storage (up threaded or to the Sonde, with sensors pointing upward using the calibration Sonde holder, cable end of Sonde down. Discharge the storage water from cup. Watch for the probes when installing cup or flow-cell because they are very fragile (Don’t bump probes.)

pH CALIBRATION

pH calibration requires a pH 7 standard first, then second, slope buffer that is near the values of the samples to be metered (i.e.: 4 or 10).

1. Rinse sensors by pouring the 7 standard into the storage cup. You don’t need to fill the cup, pour enough in the cup to rinse , then fill cup with buffer solution. DO sensors must be submerged.
2. Turn on the meter.
3. Allow readings to stabilize.

4. Press
   - Setup/Cal The 4 buttons at the top of the key pad that correspond with the 4 boxes at the bottom of the screen.
   - Calibrate
   - Sonde
   - Arrow key and select pH
   - Select which is the bottom right button at the top of the key pad
   - Using the arrow keys, pick out the numbers 7.00
   - Done (The top right button).Go back three times to restore Home screen. The reading must remain stable
   - Rinse the cup with water for 6 seconds
   - Rinse sensors using the slope buffers, discard and fill the cup with slope buffer
   - Setup/Cal
   - Calibrate
   - Sonde
   - Arrow to pH again.
   - Select (bottom right button)
   - Done (upper right button)
   - Go back three times to home screen (top left button)

CONDUCTIVITY (2 point calibration) "0" first then standard.

1. Rinse the sensors with D.I. water.
2. Remove storage cup and dry the conductivity probe with a Q-tip or soft cloth. Press:
   - Setup/Cal
   - Calibrate
   - Sonde
   - Arrow to "SpCond:ms/cm" or "SpCond:s/cm"
   - Select
   - Arrow to "0"
   - Done button (the top right)
   - Go back three times to restore Home Screen
   - Rinse cup out with D.I. water
   - Fill cup just over the top of the probes
   - Setup/cal
   - Calibrate
   - Sonde
   - Arrow to "spCond:ms/cm" or "SpCond:s/cm" then select
   - Arrow to the numbers that are the standard.

- Done (upper right button)
- Go back three times to restore the home screen.

DISSOLVED OXYGEN

Dissolved oxygen (DO) uses 100% saturation in air at 100% humidity.

1. Prior to calibration DO, shut off the circulators
   - Setup/Cal
   - Setup
   - Sonde
   - Arrow – circulator on/off
   - Select
   - Turn circulator off “0”
   - Done
   - Press any key
   - Go back 3 times to the home screen
2. Fill the storage cup with D.I. water to just below the O-ring and the membrane at the top of the DO probe.
3. Use a Kim Wipe or Q-Tip and carefully remove the water droplets from the DO membrane.
4. Cover the storage cup loosely with the lid, and allow units to equilibrate until readings are stable, which should take a few minutes.
5. To perform calibration, press:
   - Setup/Cal
   - Calibrate
   - Sonde
   - Arrow to “DO%:sat”
   - Select
   - Arrow to enter the local barometric pressure (mmHg, corrected for altitude) if known, or select 760. See chart for elevation and the correct barometric pressure (see attached sheet).
   - Done
   - Go back 3 times to the home screen
6. Turn the circulator back on by:
   - Setup/Cal
   - Setup
   - Sonde
   - Arrow to select “1” to turn on the circulator
   - Select
   - Done
   - Press any key

- Go back 3 times to the home screen.

See the Fc-5000 quick guide for graphing/storing files/down loading files to a PC etc

TURBIDITY.

Use a meter not going through Flow-Cell to meet EPA standards.

ORP (see attached sheet for values using Zobel or Quintydrone).

Using Zobel solution or Quinhydrone for a 2 point calibration for ORP and mixing of Quinhydrone.

- Setup/cal
- Calibrate
- Sonde
- Arrow to ORP
- Select
- Arrow to the value of the standard
- Done (see the attached sheets for the values of the standards)
- Go back 3 times to the home screen. (Use field sheet) (SOP-10) (See attachment). Now you are ready to start to take parameters. First rinse probes with DI water, then remove cup and put the caps back on the cup and store.
- You can have the analyzer take the values for you or you can write them down every 3 to 5 minutes depending on mL/cycle. The parameters need to stabilize to the following limits:
    - Turbidity (10% for value greater than 1 NTU)
    - DO (10%
    - Specific conductivity (3%)
    - PH (± 0.1 units)
    - ORP/Eh (± 10 millivolts)

    (We use ± 10% on all parameters.)

PURGING AND GROUNDWATER SAMPLING PROCEDURES

Groundwater samples will be collected using a low-flow sampling system in general accordance with U.S. EPA Standard Operating Procedure No. GW-0001. Low-flow methods can use either a bladder pump or an electric submersible pump to purge and sample the wells while minimizing aeration and subsequent volatilization of solvent constituents. The bladder pump method includes use of an air compressor, controller and stainless steel bladder pump equipped with disposable down-well tubing to bring the water to the surface. The electric bladder pump includes use of a controller (with battery), stainless steel submersible pump with disposal down-well tubing to bring the water to the surface.

1. Generally, wells shall be sampled from the least contaminated to more contaminated, if known.

2. Measure static water level prior to placing the pump in the well or collecting any samples and prior to starting the pump.

3. All non-disposable down-hole equipment will be decontaminated prior to sampling and between wells by washing with liquinox® detergent and tap water solution, followed with 10% volumetric methanol and distilled water solution, followed with a 10% volumetric nitric acid and distilled water solution (if sampling for metals), and finally distilled water rinses. Distilled water may be purified through a distilling process or a reverse osmosis (RO) process. The RO process is preferred if sampling for metal contaminates.

4. The bladder pump intake will be lowered to a specific sampling depth that is selected for each well. Pump placement is dependent upon many variables such as the specific characteristics of the contaminate(s) targeted for sample analysis, contaminate(s) source and subsurface lithology to name a few. Review the site specific SAP for clarification of specific sampling protocols. The sampling depth should meet the following criteria;

    - Pump intake **must** be in the screened interval of the well casing;
    - The pump should be placed to a depth that will ensure sufficient head is maintained for bladder recharge and DTW measurements;
    - Pump intake should be placed at a depth consistent with previous monitoring activities;
    - Pump should never be lowered to the bottom of the well; maintain 1-2 feet above well bottom minimum.

5. Turn on the pump adjust the flow rate to minimize water level drawdown in the well (less than 0.3'). If the minimal drawdown that can be achieved exceeds 0.3' but remains stable, continue to purge. Measure or record pumping rate and collect water in a 5 gallon bucket to measure the total volume removed.

6. Field parameters including pH, specific conductivity (SC), temperature, dissolved oxygen (DO), and oxidation-reduction potential (ORP) will be measured during the purge process and at the time of sample collection using a YSI 556 multi-meter and flow-through cell. These parameters are used in the field to assess chemical stability prior to sampling.

7. Stabilization is considered to be achieved when three consecutive readings, taken three to five minutes, apart are within a predetermined range as outlined below (summary of EPA's field parameter stabilization requirements).

EPA SOP GW-0001 Requirements for Field Parameter Stabilization		
Parameter	**Stabilization Unit**	**Field Parameters Stabilization Requirements**
Turbidity*	Percent	Three consecutive readings within 10
Dissolved Oxygen	Percent	Three consecutive readings within 10
Specific Conductance	Percent	Three consecutive readings within 3
Temperature	Percent	Three consecutive readings +/- 3 units

pH	pH units	Three consecutive readings +/- 0.1 units
Oxidation Reduction Potential	millivolts	Three consecutive readings within 10 units

* = within 10 percent for values greater that 1 NTU

8. Field measurement data and notes will be recorded on groundwater sampling field forms. Record all field parameters, start time, flow rate, pump depth, water levels, time of parameters, water levels and the total volume removed from wells.

9. If field parameters have not stabilized with 90 minutes indicate such on the groundwater sampling field forms, and collect groundwater samples.

STANDARD OPERATING PROCEDURE
FOR
ASBESTOS INSPECTIONS

Tetra Tech

Revised:
November 29, 2012

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APPENDIX A: AHERA Regulations (CD Only)

APPENDIX B: NESHAP Regulations (CD Only)

APPENDIX C: Random Number Diagrams

APPENDIX D: Asbestos Inspection Checklist Sheet

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APPENDIX F: Building Information Sheet

APPENDIX G: Suspect ACBM Room by Room Summary Sheet

APPENDIX H: Chain of Custody Record

APPENDIX I: Suspect Material List

INTRODUCTION

In order to insure that each U.S. Environmental Protection Agency (EPA) and/or State certified asbestos inspector working for Tetra Tech is conducting the inspection of asbestos using current standards under the Asbestos Hazard Emergency Response Act (AHERA) Asbestos-Containing Materials in Schools (40 CFR 763), National Emission Standard for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) and/or State regulations, this Standard Operating Procedure (SOP) for asbestos inspections has been developed. It is intended as a guide for new inspectors as well a reminder for experienced inspectors. It is assumed that anyone performing asbestos inspections has successfully completed an EPA and/or State Asbestos Inspector Course.

Please take time to read through this SOP to be sure that you are conducting asbestos inspections according to AHERA, NESHAPS and/or State regulations. The AHERA regulation is included in Appendix A and the NESHAPS regulation is included in Appendix B. State regulations are not included in this SOP, as each State regulation may very from State to State. Each analyst should have received a copy of the above referenced regulations in their inspector course, which were provided during the Initial Asbestos Inspector training course they attended.

1.0. Equipment

1.1. Ladder to access areas.

1.2. Flashlight to aid in visibility.

1.3. Air tight sampling containers (film canisters, centrifuge tubes, zip lock baggies).

1.4. Spray mister bottle with water to spray the area to be sampled.

1.5. Plastic drop cloth to spread beneath the area to be sampled.

1.6. Knife, linoleum cutter, cork borer, or other tool appropriate for extracting samples.

1.7. Caulking gun and compound for filling holes once a sample has been extracted.

1.8. Spray acrylic or adhesive to encapsulate sample extractions.

1.9. Duct tape for repairing thermal system insulation jackets.

1.10. Cloth (premoistened) for cleaning up debris and tools.

1.11. Vacuum cleaner equipped with high efficiency particulate air (HEPA) filters.

1.12. Indelible ink pen for labeling sample containers.

1.13. Camera for photographic documentation.

1.14. Disposable protective clothing, gloves and bootees.

1.15. Personal respirator, either a negative pressure full or half mask with HEPA cartridges.

1.16 Safety glass's for eye protection

2.0 Planning Phase

Prior to commencing building inspection activities the following tasks should be performed.

2.1. Contact management of the facility to inform them as to what will take place during the inspection.

2.2. Determine the hours of operation for the facility.

2.3. Develop a project schedule agreeable to the building owner including arrival time at the site and time of initial meeting with building personnel.

2.4 Review existing as-built drawings, if available to become familiar with the facility as to the mechanical system layout, and materials used in construction. Develop scaled drawings from as-built drawings, if provided by the building owner, for use in the inspection.

2.5 Review any previous asbestos inspections that may have been conducted in the past.

3.0 Inspection Phase

Inspections should be performed using the currently recognized standard protocol developed for schools under AHERA. General guidelines for conducting the inspection are as follows:

3.1. Conduct on-site informational meetings with facility personnel to inform them of what will transpire during the inspection. Discuss bulk sampling protocol with maintenance personnel and determine sampling locations that will be acceptable to the owner.

3.2. Perform an initial walk through of the building accompanies by a maintenance person if possible.

3.3. Observe the building layout and whether the building was built in phases or all at once.

3.4 Observe where the divisions are between construction phases.

3.5. Locate all mechanical areas.

3.6. Document location of and access to all pipe chases, pipe tunnels, crawl spaces, attics, and roof(s).

3.7. Walk completely around the outside of the building.

3.8 Fill out asbestos inspection checklist sheet (Appendix D).

3.9 Fill out building information sheet (Appendix F).

3.10 Fill out homogeneous area summary sheet (Appendix E).

3.11 Fill out room by room sheets (Appendix G).

3.12 Prepare a building diagram.

4.0 Number of Samples

Nine samples per homogeneous sampling area are recommended. With nine samples, the likelihood of detecting asbestos when it is present is very high. Cost or other constraints, may limit the number of samples that can be collected. If nine samples cannot be collected, use the following table to determine the minimum number as required by AHERA Rules.

Friable Surfacing Material

The number of samples collected from friable surfacing material was determined based on the following protocol developed under AHERA.

1,000 square feet or less	Three bulk samples
1,000 to 5,000 square feet	Five bulk samples
Over 5,000 square feet	Seven bulk samples

Thermal System Insulation

Thermal system insulation was sampled in a randomly distributed manner, with at least three bulk samples collected from each homogeneous material. At least one bulk sample was collected from each homogeneous material of patched thermal system insulation that was not assumed to be ACBM.

Bulk samples were also collected from each insulated mechanical system where cement or plaster was used on fittings, such as tees, elbows, or valves. The number of samples was sufficient to determine whether the material was asbestos containing. Generally, three samples were collected from each homogenous area.

Bulk samples were not collected from any homogeneous material where the inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-asbestos containing building material.

Miscellaneous Material

Bulk samples were also collected from each miscellaneous material. The number of samples was sufficient to determine whether the material was asbestos containing. Generally, three samples were collected from each homogenous area.

Non-friable suspected ACBM

The number of samples collected from non-friable suspect ACBM was sufficient to determine whether the material was asbestos containing. Generally, three samples were collected from each homogenous area.

5.0 Selection of Samples

Sample locations are selected so that they are representative of the sample area. When nine samples are collected, they are distributed evenly throughout the sampling area. If fewer than nine samples are collected, a random sampling scheme is used to determine their location. Choosing sample locations according to personal judgment produces samples which may not be representative and can lead to a wrong decision about the presence or absence of asbestos. The sampling scheme described here avoids this problem and controls the frequency of mistakes.

5.1 Divide the sampling area into nine equally sized sub areas. This is done by dividing the length and breadth of the sampling area into three equal lengths and drawing a grid over the diagram (see Appendix C). This can be done carefully by eye. Exact measurements are not needed.

If the sampling area does not easily fit into a rectangular shape, parts of the grid might not be in the sampling area. This is not a problem in most cases. If, however, a large part of the grid falls outside the sampling area, it is advisable to divide the sampling area into two or more separate sampling areas, each of which is approximately rectangular, and select sample locations by applying the sampling scheme to each sampling area. If three samples are going to be collected, take them from the sub areas marked 1,2,3,4, and 5, and so on.

For each sampling area, use a new diagram. If you have more than 18 sampling areas, start again at the top of the random number diagram (sample area #1) to determine sampling locations for sampling area 19.

6.0 Identification of Samples

Assign a unique sample ID number to each sample location. This ID number will be on the sampling container when it goes to the certified laboratory for analysis. Record the ID number and the sample location on the sample area diagrams and also on room by room summary sheets. This must be done carefully so that there is no uncertainty about the location and identity of each sample collected. Make sure that no two samples have the same ID number. Non-sequential numbers are used to prevent the laboratories from knowing which samples come from the same sample areas or the same buildings. On the other hand, non-sequential ID numbers make organizing the analytical results by homogeneous area much more difficult. Suspect material sheet is provided in Appendix E.

7.0 Collecting Samples

7.1 Personal protective equipment should be utilized. Since inhalation of asbestos fibers during hundreds of asbestos inspections and sampling projects may pose a serious health hazard, the use of personal protective equipment by building inspectors is crucial during the sampling process. As a minimum level of protection, inspectors should wear a respirator, either a negative pressure full or half mask with HEPA cartridges. Disposable clothing should be worn during sampling if the sampling operation is likely to dislodge pieces of suspect material or if the environment is extremely dusty. Inspectors should have plastic bags, twisters, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials should be stored pending survey results. If laboratory reports establish the presence of asbestos-containing materials, these waste materials should be disposed of as asbestos containing waste.

7.2 If possible, collect samples after hours or when the building is not in use.

7.3 Spread the plastic drop cloth and set up other equipment.

7.4 Put on protective equipment.

7.5 Label containers with its ID, sample location, and type of material sampled on a sample data form. Always place the label on the container itself. If using ridged containers always place the ID on the container, not on the lid, as lids can be inadvertently switched by a laboratory when handling numerous sample containers.

7.6 Mark the location of the sample on the sampling diagram and record the sample identification number on the plan diagram as well.

7.7 Moisten area where sample is to be extracted (spray the immediate area with water).

7.8 Extract sample using a clean knife to cut out or scrape off a small piece of the material. Be sure to penetrate all layers of material. Be careful not to disturb adjacent material.

7.9 Place sample in a container and tightly seal it.

7.10 Wipe the exterior of the container with a wet wipe to remove any material which may have adhered to it during sampling.

7.11 Clean your tools with wet wipes and wet mop or vacuum area with a HEPA vacuum to clean all debris.

7.12 Fill hole with calking compound on highly friable material and/or spray with an encapsulant (to minimize subsequent fiber release) or for appearance.

7.13 Repeat the above steps at each sample location. Place sample containers in plastic bags.

7.14 Discard protective clothing, wet wipes and rags, filter cartridges, and drop cloth in a labeled plastic bag.

8.0 Sample Handling

8.1. After placing a sample in a container according to the procedures outlined earlier, enter the ID number on the Chain-of-Custody Sheet. A sample Chain-of-Custody Sheet is located in Appendix J.

8.2. Upon receipt of samples from the inspector, the laboratory should check and sign the Chain-of-Custody Sheet(s), copy same and return original(s) to the inspector. It is important that this, or a similar arrangement for sample accountability be agreed upon by the laboratory prior to sending samples for analysis.

8.3. Each individual or laboratory engaged in asbestos identification shall participate in the Proficiency Analytical Testing Program, the Asbestos Analyst Registry or equivalent.

8.4 Polarized light microscopy (PLM) is the EPA-approved method for analyzing bulk materials for asbestos. This method of analysis is relatively inexpensive. PLM utilizes a light microscope equipped with polarizing filters. The identification of asbestos fiber bundles is determined by the visual properties displayed when the sample is treated with various dispersion staining liquids. Identification is substantiated by the actual structure of the fiber and the effect of polarized light on the filter, all of which is viewed by the trained technician. The limit of detection of asbestos by PLM is about 1% by area. Samples containing lower levels of asbestos are not reliable detected by this technique.

9.0 Quality Assurance

After inspection is completed perform a field quality assurance program as indicated by the following tasks.

9.1 Review all inspection forms for completeness. (Remember a physical street address is required by AHERA).

9.2 Walk through building one last time to verify that you have identified all the suspect homogeneous areas.

9.3 Review Chain-of-Custody document for completeness and verify the number of samples and sample numbers for the suspect materials collected during the inspection.

APPENDIX A
AHERA Regulations

AHERA REGULATIONS

https://www.gpo.gov/fdsys/pkg/USCODE-2009-title15/html/USCODE-2009-title15-chap53-subchapII.htm

APPENDIX B
NESHAP Regulations

NESHAP REGULATIONS

https://www.ecfr.gov/cgi-bin/text-idx?SID=d1cb7551b7d66a7b8955d3fa83ae2c14&mc=true&node=sp40.9.61.m&rgn=div6

APPENDIX C
Random Number Diagrams

TETRA TECH

RANDOM NUMBER DIAGRAM

Name of Facility_____Project Number_____

	9	8	1		5	8	1		8	5	2
1	2	7	6	7	4	3	6	13	3	6	9
	5	3	4		2	7	9		7	1	4

	8	7	1		5	7	1		4	1	6
2	3	9	5	8	6	3	4	14	3	9	7
	4	2	6		2	8	9		8	5	2

	4	1	7		3	6	4		3	5	6
3	2	6	9	9	9	2	7	15	9	2	8
	8	5	3		5	8	1		7	4	1

	6	1	8		5	7	3		4	8	3
4	5	9	3	10	8	1	6	16	2	5	9
	2	7	4		2	9	4		7	1	6

	6	4	3		5	1	6		8	2	7
5	1	5	8	11	3	4	9	17	4	5	3
	9	2	7		7	8	2		1	9	6

	7	4	3		7	1	9		2	5	9
6	6	1	5	12	2	4	5	18	6	1	8
	2	9	8		6	8	3		4	7	3

APPENDIX D
Inspection Checklist Sheet

ASBESTOS INSPECTION CHECKLIST

Project Name:_____Project Number:_____

Technician: Date:

Planning Phase	
Contact site contact informing them of your arrival time.	
Contact Name:	
Contact Number:	
Review existing inspections and drawings of facility.	
Key Location:	
Inspection Phase	
Conduct on-site informational meeting and discuss sampling protocol/ Fill Out JSA	
Perform initial walk through of building.	
Identify different phases of construction.	
Locate mechanical areas	
Walk exterior of building.	
Complete Field Drawing	
Fill out building information sheet.	
Fill out homogeneous area summary sheet.	
Review homogeneous area list generated and develop sampling strategy.	
Collect samples and fill out chain-of-custody.	
Note sample location on drawings.	
Patch sample holes and clean surrounding area of sample debris.	
Photograph homogeneous areas using identifier in photo.	
Check out with Facility Staff/ Return Key	
Post Field Work Phase	
Ship Samples – Verify Samples, TAT, and Lab.	
Photo Copy COC.	
Place Field Materials in File Location.	
Download Photos.	
Discuss Project with Project Manager.	

APPENDIX E
Homogeneous Area Summery Sheet

TETRA TECH

HOMOGENEOUS AREA ASSESSMENT REPORT

Client:	**Date:**
Building: **Inspected by:**	**Project No.:** **Sheet of**

Homogeneous Area Number:		
Homogeneous Area Description and Location		
Quantity of ACBM: (LF or SF)		
Reason for Classification:		
AHERA Classification		Damaged or significantly damaged TSI ACM
		Damaged friable surfacing ACM
		Significantly damaged friable surfacing ACM
		Damaged or significantly friable miscellaneous ACM
		ACBM with potential for damage
		ACBM with potential for significant damage
		Remaining friable ACBM or friable suspected ACBM
		Not Applicable (non-friable material)
Material Status		Encapsulated
		Enclosed
		Removed
		Neither
		New
Material Condition	Type of damage or significant damage:	
	Severity of damage:	
	Extent of damage:	
Accessibility		High (Uncontrolled access by public or building occupants)
		Moderate (Controlled assess by building staff)
		Low (Rarely accessed by building staff)
Potential for Disturbance		High (May be contracted during maintenance or repair)
		Moderate (May be contacted during maintenance or repair)
		Low (Out of reach or behind building system)
Known or suspected causes of damage or significant damage		
Preventive Measures		
Sample Numbers		

APPENDIX F
Building Information Sheet

TETRA TECH

BUILDING INFORMATION SHEET

Project Name:_____ Project No.:_____
Building Name/Number:_____ Date:_____
Building Address:_____ Inspected by:_____
City/State:_____
Site of Contact:_____ Site Phone No.:_____

General Building Information	
Original construction date (year)	Number of floors
Renovation or building additions (year)	Number of basement levels
Building size (square feet)	Number of attic or penthouse levels
General Building Exterior Information	**General Building Interior Information**
Siding material	Wall material
Roof type and material	Floor material
Window Glazing Y N	Ceiling material
Foundation Coating: Y N	Base cove material
	Building insulation
HVAC System **Location:**	
Heating System □ Boiler Units □ Other □ Forced Air Furnaces Comments:	**Fuel Type** □ Natural Gas □ Oil □ Electric □ Other □ Steam Comments:
Mechanical Piping Route □ Above Ceilings □ Floor Slab □ Crawl Spaces □ Wall Chases/ Pipe Chases □ Pipe Tunnels □ Other Comments:	

Comments:_____

_____

_____

APPENDIX G
Suspect ACBM Room by Room Sheet

TETRA TECH

SUSPECT ACBM
ROOM SUMMARY

Project Name:_____ Date:_____
Building:_____ Project No.:_____
Building Address:_____ Sheet: _____ of___
Building Floor/Area:_____ Inspected by:_____

	HA Number	Asbestos Present (Yes or No)	Quantity (SF, LF or EA)	Friable (Yes or No)	AHERA Category (1 thru 7)	Comments
Room No.:	**Use:**			**Room Size:**		**Ceiling Height:**
Floors						
Walls						
Ceiling						
Base						
TSI						
Miscellaneous						
Room No.:	**Use:**			**Room Size:**		**Ceiling Height:**
Floors						
Walls						
Ceiling						
Base						
TSI						
Miscellaneous						
Room No.:	**Use:**			**Room Size:**		**Ceiling Height:**
Floors						
Walls						
Ceiling						
Base						
TSI						
Miscellaneous						

HAZARD RANKING	ACBM CONDITION	ACBM DISTURBANCE POTENTIAL
7	Significant Damage	Any
6	Damaged	Potential for Significant Damage
5	Damaged	Potential for Damage
4	Damaged	Low
3	Good	Potential for Significant Damage
2	Good	Potential for Damage
1	Good	Low

APPENDIX H
Chain-of-Custody Sheet

COC #_____

Date:_____

CHAIN OF CUSTODY
BULK ASBESTOS SAMPLE LOG

Tetra Tech
Client

_____
Contact Name

_____
Project or Site Name

Contact Email

_____
Project Number

☐ PLM EPA 600/R-93/116

☐ TEM Bulk

_____
Sampler Name (Print)

☐ Positive Stop

_____
Sampler Signature

Turnaround Time

Preliminary Results By:_____

10 Day	5 Day	3 Day	2 Day	1 Day	12 Hour	6 Hour
☐	☐	☐	☐	☐	☐	☐

SAMPLE NUMBER	LAB NUMBER	SAMPLE DESCRIPTION AND LOCATION	NOTES

Date	Time	Relinquished by	# Samples	Date	Time	Received by
Date	Time	Relinquished by	# Samples	Date	Time	Received by

Sheet_____of _____

P.O. Box 30615, Billings, MT 59107
618 South 25th Street, Billings, MT 59101
Tel 406.248.9161 Fax 406.248.9282

APPENDIX I
Suspect Material List

SUSPECT MATERIALS LIST

TSI

T1	BOILER JACKETING
T2	PIPE JOINT INSULATION
T3	STRAIGHT PIPE INSULATION
T4	HVAC CONNECTOR MATERIAL
T5	TANK INSULATION
T6	BOILER INSULATION
T7	BOILER INSULATION BOILER BREECHING
T8	DUCT INSULATION
T9	PATCHING MATERIAL
T10	FLUE INSULATION/METALBESTOS
T11	DUCT WRAP
T12	VERMICULITE INSULATION
T13	ASBESTOS PAPER/ BOARD

MISCELLANEOUS MATERIALS

M1	ROOF MATERIAL
M2	ROOF FLASHING
M3	WALLBOARD/TAPING/JOINT COMPOUND
M4	TRANSITE
M5	CEILING PANELS
M6	CEILING TILES
M7	ROOF PENETRATION COMPOUND
M8	CAULKING
M9	FIRE DOORS
M10	SINK UNDERCOATING
M11	ELECTRICAL WIRE INS
M12	WALL BASE
M13	BRICK/ MORTAR
M14	PIPE PENETRATION COMPOUND
M15	LAB COUNTER TOPS
M16	CERAMIC TILE/ GROUT
M17	SOFT CONCRETE
M18	CONCRETE
M19	FIRE HOSE
M20	FELT PAPER/ MOISTURE BARRIER
M21	STAGE FIRE CURTAIN
M22	CMU BLOCK/ MORTAR
M23	CHALKBOARD
M24	GLASS WINDOW BLOCK GROUT
M25	DUCT SEAM MASTIC
M26	CORKBOARD MASTIC
M27	KILN BRICK INSULATION
M28	WALL PANELS
M29	WINDOW GLAZING

SURFACING MATERIAL

S1	PLASTER
S2	STUCCO
S3	WALLBOARD TEXTURE
S4	POPCORN CEILING
S5	FIREPROOFING
S6	WALL COATING

FLOOR COVERING

F1	SHEET VINYL
F2	12" X 12" TILE
F3	9" X 9" TILE
F4	FLOORING FELT
F5	STAIR TREAD COVERING
F6	MASTICS AND ADHESIVES

HAZARD RANKING

HAZARD RANKING	ACBM CONDITION	ACBM DISTURBANCE POTENTIAL
7	SIGNIFICANT DAMAGE	ANY
6	DAMAGED	POTENTIAL FOR SIGNIFICANT DAMAGE
5	DAMAGED	POTENTIAL FOR DAMAGE
4	DAMAGED	LOW
3	GOOD	POTENTIAL FOR SIGNIFICANT DAMAGE
2	GOOD	POTENTIAL FOR DAMAGE
1	GOOD	LOW

STANDARD OPERATING PROCEDURE
FOR
ASBESTOS FINAL AIR CLEARANCE SAMPLING

Tetra Tech

Revised:
December 5, 2011

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APPENDIX E: Chain of Custody Record

APPENDIX F: NIOSH 7400 Method (Extracted to Appendix C of Rainbow Hotel SAP)

INTRODUCTION

In order to ensure that each U.S. Environmental Protection Agency (EPA) and/or State certified asbestos Contractor/Supervisor working for Tetra Tech is conducting the final air clearance and final visual inspection of asbestos abatement projects using current standards under the Asbestos Hazard Emergency Response Act (AHERA) Asbestos-Containing Materials in Schools (40 CFR 763), National Emission Standard for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) and/or State regulations, this Standard Operating Procedure (SOP) for asbestos clearance has been developed. It is intended as a guide for new air monitoring technicians as well a reminder for experienced field staff. It is assumed that anyone performing asbestos clearance has successfully completed an EPA and/or State Asbestos Contractor/ Supervisor Course (40 Hour).

Please take time to read through this SOP to be sure that you are conducting asbestos clearances according to AHERA, NESHAPS and/or State regulations. The AHERA regulation is included in Appendix A and the NESHAPS regulation is included in Appendix B. Please note that the Montana State Regulations (Administrative Rules of Montana) are included in this SOP, however; State regulations may vary from State to State. Each analyst should have received a copy of the above referenced regulations in their Contractor/ Supervisor course, which were provided during the Initial Asbestos Contractor/ Supervisor training course they attended.

1.0. Equipment

1.1. High Volume Pumps – Thomas Heavy-Duty Diaphragm Pumps (5 per Containment)

1.2. Primary Calibration Device – Bios DryCal or Bios Defender

1.3. 25-mm, three-piece cassette with ca. 50-mm electrically conductive extension cowl and cellulose ester filter, 0.45- to 1.2-µm pore size, and backup pad

1.4. IAQ Pump Stands (5 per Containment)

1.5. High-Speed Leaf Blower

1.6. Electric Fans

1.7. Extension Cords and Power Strip

1.8. Duct tape

1.9. Air Sample Calibration Sheet

1.10. Final Visual Inspection Checklist

1.11. Indelible ink pen for labeling Cassettes and Completing Paperwork

1.13. Camera for photographic documentation.

1.14. Disposable protective clothing (i.e. Tyvek Suit with hood and boot covers), gloves, and bootees.

1.15. Personal respirator, either a negative pressure full or half mask with HEPA cartridges.

1.16 Safety glass's for eye protection

2.0 Planning Phase

Prior to commencing final air clearance and final visual inspection activities the following tasks should be performed.

2.1. Contact management of the facility to inform them what will take place during the clearance process.

2.2. Determine the time of completion of abatement operations for the facility.

2.3. Develop a project schedule agreeable to the building owner including arrival time at the site and time of initial meeting with building personnel.

2.4 Review existing asbestos inspection report, if available to become familiar with the facility as to the materials anticipated to be abated. Develop scaled drawings from as-built drawings, if provided by the building owner, for use in the air clearance.

3.0 Final Visual Inspection Phase

Final Visual Inspections should be performed using the currently recognized standard protocol as detailed by the State agency (if applicable). General guidelines for conducting the inspection are as follows:

3.1. Personal protective equipment should be utilized. Since inhalation of asbestos fibers during hundreds of asbestos clearances and air sampling projects may pose a serious health hazard, the use of personal protective equipment by air monitoring personal is crucial during the sampling process. Use of PPE is also required by OSHA regulations when entering a Regulated Area. As a minimum level of protection, personnel should wear a respirator. Unless otherwise specified, either a negative pressure full or half mask with HEPA cartridges should be sufficient. Disposable clothing (as detailed above) is also required. Air monitoring personnel should have plastic bags, duct tape, and labels with them to handle the disposal of cartridges, protective clothing, wet cloths, and debris. These waste materials can often be left onsite with the abatement company for disposal. Personnel should also sign-in on the sign-in sheet prior to entry into the regulated area.

3.2. Perform an initial walk through of the abatement area, accompanied by the Competent Person for the removal area (if present).

3.3. Observe the entire asbestos project area to verify that the asbestos project contractor has removed all visible asbestos-containing waste, dust, and debris from the work area;

3.4 Require any necessary re-cleaning by the asbestos project contractor and conduct subsequent visual inspections that verify that the asbestos project contractor has removed all ACM identified in the asbestos project permit and related asbestos-containing waste, dust, and debris from the work area; and

3.5. Complete a signed, written affidavit (Final Visual Inspection Checklist, Appendix D) verifying that the asbestos project contractor has removed all ACM identified in the asbestos project permit and related asbestos-containing waste, dust, and debris;

3.6. Prepare a diagram of the abatement area, identifying general features within the containment or removal area.

4.0 Number of Samples

Verify the appropriate number of samples required for clearance of regulated areas based on local, state, or federal regulations. For most locations, 5 filed samples and one field blank per removal area are considered sufficient.

5.0 Collection of Samples

Sample locations are selected so that they are representative of the sample area. The sampling scheme described here avoids this problem and controls the frequency of mistakes.

5.1 Ensure final clearance air sampling and testing are not performed until after the final visual inspection has been completed in accordance with the above referenced procedures.

5.2 Once the work area has passed the final visual inspection, sweep an air stream from a high-speed blower or equivalent air-blowing device across all surfaces in the work area for a time adequate to disturb air in all areas of the work area prior to beginning final air clearance sampling;

5.3 Ensure the air is continually agitated, creating maximum air disturbance in all potentially occupied areas, i.e., continually running fans, during the collection of final air clearance samples. Agitating the air in the work area prior to final air clearance sampling is not required for unoccupied areas such as crawl spaces; and

5.4 Immediately after agitating the air in the work area, begin collecting at least five final clearance air samples in the work area;

5.5 For an asbestos project with more than a single isolated work area within a large space contained by four walls and a ceiling, the owner or operator of a renovation or demolition activity shall ensure the isolated work areas are sampled by taking at least one air sample within each isolated work area. If more than five isolated work areas are used in a space contained by four walls and a ceiling, at least five aggressive air samples must be collected. The first four air samples must be gathered from those isolated work areas where the greatest potential for asbestos exposure exists; the fifth sample must be taken in the last isolated work area in which the asbestos project occurred;

5.6 For asbestos projects employing glovebags, the owner or operator of the renovation or demolition activity shall have at least one aggressive air sample collected in the immediate area of each glovebag, with at least five air samples collected for each space contained by four walls and a ceiling. If more than five glovebags are used in a space contained by four walls and a ceiling, at least five air samples are required for that space. The five samples

must be gathered from areas where the greatest potential for asbestos exposure exists;

5.7 The asbestos project may not be cleared until after the final visual inspection and after the results of all required air clearance samples demonstrate that asbestos concentrations do not exceed the applicable concentration. For most projects these concentrations are as follows:

(a) less than or equal to 0.01 fibers per cubic centimeter of air for each of five samples collected within the work area, if analyzed by PCM. The PCM analysis must be conducted using the NIOSH 7400 or NIOSH 7402 method; or

(b) less than or equal to the average concentration of 70 structures per square millimeter for five samples collected within the work area, if analyzed by transmission electron microscopy (TEM). The TEM analysis must be conducted using EPA's interim TEM analytical methods provided in 40 CFR 763, subpart E, appendix A.

5.8 Persons conducting a final visual inspection and final air clearance sampling and testing shall record:

(i) the names of the asbestos project contractor/supervisor and the person or persons conducting final visual inspection and final air clearance sampling;
(ii) the name and address of the facility site and location of the asbestos project;
(iii) the number of the asbestos project permit issued by the department;
(iv) the date of final visual inspection and final air clearance sampling;
(v) whether the work area was aggressed;
(vi) the number of samples collected;
(vii) the type of samples (i.e., PCM or TEM);
(viii) a statement of whether final visual inspection and final air clearance sampling has documented the completion of the asbestos project;

5.9 The final visual inspection and air clearance sampling report must include the signatures of the project contractor/supervisor and final air clearance sampling person attesting to the completion of the asbestos project; and

5.10 The results of the final visual inspection and final air clearance sampling and testing must be maintained by the asbestos project contractor and by the person who performed the sampling.

5.11 For asbestos projects with final air clearance sampling, the person conducting final air clearance sampling shall:

(a) Collect five samples of air, with each sampling at least 1,199 liters of air, by using an air sampling pump capable of drawing a volume that is equal to or greater than 1,199 liters of air through each of the five millimeter filters, at a rate equal to or greater than one liter and less

than ten liters per minute for TEM samples and equal to or greater than one liter and less than 16 liters per minute for PCM samples;

(b) Ensure that the flow rate for each air sampling pump is calibrated at the beginning and end of the sampling period; and

(c) Ensure air sampling cassettes are placed four to six feet above the floor at a 45 degree angle down. The cassettes must be uniformly distributed throughout the work area. At least one cassette must be located in each room. If the asbestos project was conducted in more than five rooms, a representative sample of rooms must be selected. Each cassette must be subject to normal air circulation, avoiding room corners, walls, ceilings, obstructed locations, and sites near windows, doors, or vents.

5.12 Document pertinent sample collection data on the Air Sample Field Calibration Sheet (Appendix C). At a minimum, the following data should be included:

a. Sample collection ID (see section 7.0)

b. Sample collection location

c. Sample pump number or ID

d. Sample collection start and stop times

e. Sample pre-calibration flow rates, post-calibration flow rates, and total sample flow rate averages

f. Sample volume (calculated following sample collection).

5.13 An asbestos project is considered complete when the final visual inspection documents no residual visible ACM, dust, or debris is present, and the results of clearance air sampling meet the requirements specified in 5.7, or required by relevant local, state, or project requirements.

5.14 Approximate sample collection locations should also be recorded on field drawings for further documentation purposes.

6.0 Sample Analysis

6.1 Air samples may be analyzed only by laboratories accredited by the American Industrial Hygiene Association (AIHA) or laboratories that participate in the AIHA proficiency analytical testing (PAT) program and that have received a "proficient" rating for asbestos PCM samples. For sampling and sample analysis, a quality assurance program must be implemented as described in

the NIOSH 7400 method or another quality assurance program accepted in writing by the department. PAT results must be submitted to the department upon request.

6.2 PCM analyses may be conducted only by a person certified in the NIOSH 582 or 582E sample collection and analytical method and who participates in a round robin quality assurance/quality control program for PCM analysts or another industry accepted certification or quality assurance/quality control program.

6.3 TEM sample analyses must be conducted by a laboratory accredited by the National Voluntary Laboratory Accreditation Program or a laboratory accredited by an industry accepted equivalent accreditation program.

7.0 Identification of Samples

Assign a unique sample ID number to each sample. This ID number will be on the sampling cassette when it goes to the certified laboratory (or analytical technician) for analysis. Sample cassettes should be labeled prior to sample collection to prevent potential confusion. Record the ID number and the sample location on the sample area diagrams and also on field calibration sheets. Make sure that no two samples have the same ID number. Typical sample ID's consist of a unique letter and number combination. The letters utilized should represent a unique location associated with the abatement project, with the number referencing the date and the individual sample number. For example MR-1211-1, would reference the first sample (1) collected from the containment within the Mechanical Room (MR), on December 11th (1211). While this formula is not required to be strictly followed, the sample ID should reflect pertinent information about the site.

8.0 Sample Handling

8.1. After collection of the samples, replace end caps. Double check to verify that the sample cassettes have been properly labeled, and place into a re-sealable bag. If submitting to a laboratory, enter the ID number on the Chain-of-Custody Sheet. A sample Chain-of-Custody (COC) Sheet is located in Appendix E.

8.2. Upon receipt of samples from the air monitoring personnel, the laboratory should check and sign the Chain-of-Custody Sheet(s), copy same and return original(s) to the sender. It is important that this (or a similar arrangement for sample accountability) be agreed upon by the laboratory prior to sending samples for analysis.

8.3 If samples are to be analyzed by individuals other than a laboratory, the filling out of a COC is not required. Preparations will need to be made by the analytical technician for mounting and reading slides in accordance with the NIOSH 7400 method.

8.4 Personnel engaging in field analysis of PCM samples must be accredited in accordance with Section 6.2 listed above.

8.5 Samples should be analyzed in accordance with NIOSH Method 7400 for the analysis of asbestos fibers by the PCM Method. Equipment necessary for sample analysis will include:

a. Tape, shrink- or adhesive-.
b. Slides, glass, frosted-end, pre-cleaned, 25- × 75-mm.
c. Cover slips, 22- × 22-mm, No. 1½, unless otherwise specified by microscope manufacturer.
d. Lacquer or nail polish.
e. Knife, #10 surgical steel, curved blade.
f. Tweezers.
g. Acetone flash vaporization system for clearing filters on glass slides
h. Micropipettes or syringes, 5-µL and 100- to 500-µL.
i. Microscope, positive phase (dark) contrast, with green or blue filter, adjustable field iris, 8 to 10× eyepiece, and 40 to 45× phase objective (total magnification ca. 400×); numerical aperture = 0.65 to 0.75.
j. Graticule, Walton-Beckett type with 100-µm diameter circular field (area = 0.00785 mm^2) at the specimen plane (Type G-22). Available from Optometrics USA, P.O. Box 699, Ayer, MA 01432 [phone (508)-772-1700], and McCrone Accessories and Components, 850 Pasquinelli Drive, Westmont, IL 60559 [phone (312) 887-7100].NOTE: The graticule is custom-made for each microscope. (see APPENDIX A for the custom-ordering procedure).
k. HSE/NPL phase contrast test slide, Mark II. Available from Optometrics USA.
l. Telescope, ocular phase-ring centering.
m. Stage micrometer (0.01-mm divisions)

9.0 Quality Assurance

After air monitoring is completed, perform a field quality assurance program as indicated by the following tasks.

9.1 Submit at least one field blank (or 10% of the total samples, whichever is greater) for each set of samples. Handle field blanks in a manner representative of actual handling of associated samples in the set. Open field blank cassettes at the same time as other cassettes just prior to sampling. Store top covers and cassettes in a clean area (e.g., a closed bag or box) with the top covers from the sampling cassettes during the sampling period.

9.2 Review all field forms for completeness.

9.3 Review Chain-of-Custody document for completeness and verify the number of samples and sample numbers for the samples collected during the inspection (if applicable).

APPENDIX A
NESHAP Regulations
(Included on CD Only)

NESHAP

https://www.ecfr.gov/cgi-bin/text-idx?SID=d1cb7551b7d66a7b8955d3fa83ae2c14&mc=true&node=sp40.9.61.m&rgn=div6

APPENDIX B
Administrative Rules of Montana
(Included on CD Only)

ADMINISTRATIVE RULES OF MT

http://www.mtrules.org/gateway/ChapterHome.asp?Chapter=17%2E74

APPENDIX C
Air Sample Calibration Sheet

AIR SAMPLE COLLECTION

Project Name:	Date:	Project No.:	
Building:	Calibration Instrument:	S/N:	Exp Date:
Area:	Tetra Tech Technician:		
Material/Method:	Checked By:		

Sample ID	Sample Description And Location	Pump ID	Start Time	Stop Time	Total Minutes	Pre Calibration			Pre Average Flow	Post Calibration			Post Average Flow	Volume (liters)
						Test 1	Test 2	Test 3		Test 1	Test 2	Test 3		

TETRA TECH

APPENDIX D
Final Visual Inspection Sheet

TETRA TECH

FINAL CLEARANCE VISUAL INSPECTION

Project:	Project No.:
Building:	Address:
Removal Area:	Date:
Contractor:	Project Permit No.:
ACM Removed:	

Residual Dust On:	Yes	No	Not Applicable
Floors			
Walls			
Ledges			
Stationary Items			
Pipes			
Hangars			
Conduits			
Light Fixtures			
Ductwork			
Equipment			

HEPA machine(s) running			
Containment dry			
Only critical barriers present			
Decontamination unit attached and functional			

Aggressed: ___Yes ___No

Visual Inspection: ___Pass ___Fail

Remarks: _____

_____

_____

Technician: _____ _____
Printed Name/Accreditation No./Exp. Date Signature

Asbestos C/S: _____ _____
Printed Name/Accreditation No./Exp. Date Signature

APPENDIX E
Chain of Custody

COC #_____

Date:_____

CHAIN OF CUSTODY
BULK ASBESTOS SAMPLE LOG

Tetra Tech
Client

_____
Contact Name

_____
Project or Site Name

Contact Email

_____
Project Number

☐ PLM EPA 600/R-93/116

☐ TEM Bulk

_____
Sampler Name (Print)

☐ Positive Stop

_____
Sampler Signature

Turnaround Time

Preliminary Results By:_____

10 Day	5 Day	3 Day	2 Day	1 Day	12 Hour	6 Hour
☐	☐	☐	☐	☐	☐	☐

SAMPLE NUMBER	LAB NUMBER	SAMPLE DESCRIPTION AND LOCATION	NOTES

Date	Time	Relinquished by	# Samples	Date	Time	Received by
Date	Time	Relinquished by	# Samples	Date	Time	Received by

Sheet_____of _____

P.O. Box 30615, Billings, MT 59107
618 South 25th Street, Billings, MT 59101
Tel 406.248.9161 Fax 406.248.9282

APPENDIX F
NIOSH 7400 Method
(Located in Appendix C of Rainbow Hotel SAP)

NIOSH 7400 METHOD

https://www.cdc.gov/niosh/docs/2003-154/pdfs/7400.pdf

APPENDIX F DATA VALIDATION CHECKLIST

TETRA TECH

DATA VALIDATION REPORT

1.0 INTRODUCTION

GENERAL PROJECT INFORMATION			
Project Name:		**Date Validated:**	
Tetra Tech Project Number:		**Data Validated By:**	
Sample Start and End Dates:		**Laboratory Name:**	
Sample Matrix:		**Laboratory Workorder#:**	
Analytical Parameters:			
Name & Date of Approved SAP, QAPP, Work Plan, Etc.			

2.0 LABORATORY METHODS & SAMPLE HANDLING

Validation Criteria Used:

X USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. Dated August 2014.

X USEPA Contract Laboratory Program National Functional Guidelines for Superfund Inorganic Methods Data Review. Dated August 2014.

X List SAP/QAPP

3.0 LIST OF SAMPLES VALIDATED IN THIS REPORT

Field Sample ID#	Laboratory Sample ID#	Sample Type *(Natural, Duplicate, Field Blank, Etc.)*
		Natural Natural Natural Natural

Field Sample ID#	Laboratory Sample ID#	Sample Type *(Natural, Duplicate, Field Blank, Etc.)*
		Natural Field Duplicate Rinsate Blank Field Blank

4.0 DATA QUALIFIERS

Data Evaluation Qualifiers	
Data Qualifier	**Qualifier Description** *(as per USEPA 2008 CLP Guidelines)*
U	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract Required Quantitation Limit (CRQL) for sample and method. The U-qualifier does not necessarily indicate a quality control problem.
J	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is considered estimated and may be inaccurate or imprecise.
R	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

Laboratory Data Qualifiers	
Laboratory Qualifier	**Qualifier Description in Laboratory Report**
J	Estimated value. The analyte was present but less than the reporting limit.
S	Spike recovery outside of advisory limits.

5.0 LABORATORY NARRATIVE, CHAIN-OF-CUSTODY, & SAMPLE RECEIPT

Was a laboratory narrative provided and were there any non-conformance issues with the analytical data?

Were sample Chain-of-Custody (CoC) forms complete? *Describe.*

Were the requested analytical methods in compliance with project requirements (i.e., QAPP, SAP, etc.)?

Were samples received in good condition within method specified requirements? *Explain any exceptions and how sample conditions may affect the results.*

6.0 LABORATORY COMPLIANCE WITH PROJECT REQUIREMENTS

Were samples analyzed within method specified or technical holding times? *Explain any exceptions and how this may affect the results.*

Do the laboratory reports include all constituents requested to be analyzed on the COC or under the QAPP, SAP, or other applicable document? *Explain.*

Were reported units appropriate for the associated sample matrix/matrices and method(s) of analyses? *Explain.*

Were detection limits reported by the laboratory in accordance with the project requirements**?** *Discuss.*

LABORATORY REPORTING LIMITS				
Analytical Parameter	**Method Detection Limit (mg/kg)**	**Contract Required Quantitation Limit (CRQL)**	**IML05.4 CRQL** *(see below)*	**Sample(s) Where CRQL Not Met**

Results qualified by the laboratory based on the laboratory reporting limit.

RESULTS QUALIFIED BY LABORATORY DUE TO CONCENTRATION DETECTED BETWEEN MDL & CRQL				
Analyte	**Natural Sample ID#**	**Laboratory ID#**	**Laboratory Result (mg/kg)**	**Qualifier**

7.0 LABORATORY QA/QC REVIEW

The following sections review laboratory QA/QC and lists any samples that require qualification due to laboratory QC outside control limits.

7.1 CONTINUING CALIBRATION VERIFICATION (CCV) STANDARD

Was there indication from the laboratory that the initial or CCV results were within acceptable limits? *Explain.*

pH:

Metals:

7.2 LABORATORY CONTROL SAMPLE (LCS)

Was the reference material used for the laboratory control standard (LCSs) the correct matrix and concentration? *Explain and include a discussion on how this affects the data.*

Was the total number of LCSs analyzed equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

Were LCSs prepared the same way as the associated samples? *Explain and include a discussion of how this affects the data.*

Were LCS/LCSD percent recoveries and LCS/LCSD RPDs within laboratory QC limits? *Explain and include discussion on how this affects the data.*

7.3 LABORATORY BLANK SAMPLES

Was the total number of method blank samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

Were laboratory blank samples free of analyte contamination? *Explain.*

METHOD BLANK RESULTS					
Analyte	Method Blank #	MDL (mg/kg)	CRQL (mg/kg)	Blank Result Above MDL (mg/kg)	10x Blank Result (mg/kg)

RESULTS QUALIFIED DUE TO METHOD BLANK DETECTIONS				
Analyte	Natural Sample ID#	Laboratory ID#	Laboratory Result (mg/kg)	Qualifier

7.4 MATRIX SPIKE / MATRIX SPIKE DUPLICATES

What project samples were used to prepare the MS and MSD samples?

Was the total number of MS samples prepared equal to at least 5% (1 in 20) of the total number of samples, or analyzed as required by the method? *Explain.*

Were MS percent recoveries and all MS/MSD relative percent differences (RPDs) within data validation or laboratory QC limits? *Explain and include a discussion on how this affects the data.*

MS/MSD RESULTS				
Analyte	Laboratory Sample ID#	%R or RPD	Control Limits %R / RPD	Laboratory Qualifier

PDS – Post digestions pike/distillation spike

.

7.5 LABORATORY DUPLICATES

Were laboratory duplicate RPD values within laboratory-specified limits**?** *Explain and include discussion of how this affects the data.*

7.6 SURROGATES

Were surrogate recoveries within laboratory QC limits? *Explain and include discussion on how this affects the data.*

8.0 FIELD QA/QC

8.1 TRIP AND FIELD BLANKS

Were the number of equipment, trip, or field blanks collected equal to at least 10% of the total number of samples, or as required by the project requirements, QAPP, or SAP**?** *Explain and include how this affects the data.*

LIST OF TRIP AND FIELD BLANKS				
QC Sample ID#	**Blank Type**	**Corresponding Laboratory Workorder #**	**Corresponding Matrix**	**Date of Corresponding Samples**

Were the trip blank, field blank, and/or equipment blank samples free of analyte contamination? *Explain and include discussion of how this affects the data.*

The following equation was used to convert the metals aqueous rinsate and field blank results to mg/kg for comparison with metal soil analytical results.

$$Blank\ Result\ in \frac{mg}{kg} = Blank\ Result\ in \frac{mg}{L} \times \frac{Sample\ Extract\ Volume\ mL}{Sample\ Weight\ g} \times \frac{1\ L}{1000\ mL} \times \frac{1000\ g}{1\ kg}$$

Analyte	Sample Blank #	MDL (mg/L)	Blank Result Above MDL in mg/L	Converted Blank Result in mg/kg	10x Blank Result mg/kg

8.2 FIELD DUPLICATES

Were the field duplicates collected as required by the project requirements, QAPP or SAP? Include a table of duplicate samples. *Explain and include discussion of how this affects the data.*

Were field duplicate RPD values within data validation QC limits? *Explain and include discuss of how this affects the data.*

DUPLICATE RPD RESULTS			
Analyte	Natural Sample Result	Duplicate Result	RPD (0-50%)

DUPLICATE RPD RESULTS			
Analyte	Natural Sample Result	Duplicate Result	RPD (0-50%)

DUPLICATE RPD RESULTS			
Analyte	08-400-18-24 Natural Sample Result	Dup-4 Duplicate Result	% RPD (0-50%)

9.0 OTHER

Did DEQ collect split samples? If so, explain how those results compare to the natural sample.

Other comments or observations.

10.0 SUMMARY OF QUALIFIED DATA

QUALIFICATION SUMMARY				
Analyte	Natural Sample ID#	Laboratory ID#	Laboratory Result (mg/kg)	Qualifier
Results Qualified due to Method Blank Detections				

11.0 ACCEPTABILITY AND USABILITY OF THE DATA

Precision

The data are considered precise as all MS/MSD and duplicate results were within control limits.

Accuracy

The data are considered accurate as no data required qualification to due sample handling, preservation or preparation; analytical techniques; laboratory blanks; MS/MSD results; or LCS.

Representativeness

The data are considered representative as the sample locations were selected for a specific purpose to meet the DQOs specified in the SAP. The samples are representative of other samples collected, handled, and preserved in the same manner under similar conditions, and analyzed using the same techniques and methods.

Completeness

The data are considered 100% complete as the data was collected per the SAP and all data are considered useable.

Comparability

The sample data are comparable to other sample data collected with similar field methods, quality assurance/quality control measures, and the same analytical methods.

ATTACHMENT B

Supplementary Information

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SPECIFIC MANAGEMENT RECOMMENDATIONS ROUNDUP COMMUNITY CENTER SCHOOL BUILDING – Room Numbering Series 100				
HOM. MATERIAL NUMBER	DESCRIPTION	AHERA CATEGORY	REMOVAL PRIORITY	RECOMMENDED RESPONSE ACTION
1F3.1	9" by 9" Mottled tan floor tile/black mastic	N/A	7	Operations and Maintenance
1F3.2	9" by 9" Red with white flecks floor tile/black mastic	N/A	7	Operations and Maintenance
1F3.3	9" by 9" Tan with black flecks floor tile/black mastic	N/A	7	Operations and Maintenance
1F3.4	9" by 9" Gray with white flecks floor tile/black mastic	N/A	7	Operations and Maintenance
1T3.1	Straight run "AirCell" pipe insulation – boiler room	1	1	Removal
1T3.2	Straight run "AirCell" pipe insulation – crawlspace	1	1	Removal

SPECIFIC MANAGEMENT RECOMMENDATIONS ROUNDUP ORIGINAL (1908) ELEMENTARY SCHOOL BUILDING – Room Numbering Series 200				
HOM. MATERIAL NUMBER	DESCRIPTION	AHERA CATEGORY	REMOVAL PRIORITY	RECOMMENDED RESPONSE ACTION
2M4.1	Chalkboards (Assumed)	N/A	7	Operations and Maintenance
2M16.1	Asbestos contaminated soil in crawlspace (Assumed)	1	1	Removal
2T3.1	Straight run "AirCell" pipe insulation (Assumed)	1	1	Removal

SPECIFIC MANAGEMENT RECOMMENDATIONS ROUNDUP ELEMENTARY SCHOOL BUILDING (1962 ADDITION) – Room Numbering Series 300				
HOM. MATERIAL NUMBER	DESCRIPTION	AHERA CATEGORY	REMOVAL PRIORITY	RECOMMENDED RESPONSE ACTION
3F1.1	Vinyl sheet flooring, tan pebbled pattern	N/A*	7	Operations and Maintenance
3F1.2	Vinyl sheet flooring, green pebbled pattern	N/A	7	Operations and Maintenance
3F3.1thru 3F3.6	9" by 9" Floor tile (assorted colors)/Mastic	N/A	7	Operations and Maintenance

SPECIFIC MANAGEMENT RECOMMENDATIONS ROUNDUP ELEMENTARY SCHOOL BUILDING (1962 ADDITION) – Room Numbering Series 300				
HOM. MATERIAL NUMBER	DESCRIPTION	AHERA CATEGORY	REMOVAL PRIORITY	RECOMMENDED RESPONSE ACTION
3T1.1	Boiler door rope gasket	7	7	Operations and Maintenance
3T2.1	Heating line mudded fittings	7	1	Removal
3T4.1	HVAC Vibration joint cloth (Assumed)	N/A	7	Operations and Maintenance

SPECIFIC MANAGEMENT RECOMMENDATIONS ROUNDUP JR./SR. HIGH SCHOOL (ORIGINAL 1958) BUILDING – Room Numbering Series 400				
HOM. MATERIAL NUMBER	DESCRIPTION	AHERA CATEGORY	REMOVAL PRIORITY	RECOMMENDED RESPONSE ACTION
4F3.1 thru 4F3.6	9" by 9" Floor file and black mastic, Multiple colors with colored spots	N/A	7	Operations and Maintenance
4M4.1	Chalkboards (Assumed)	N/A	7	Operations and Maintenance
4S1.1	Spray-on ceiling texture	1	1	Removal
4T3.1	Straight run "AirCell" pipe insulation (Assumed)	1	1	Removal
4T4.1	HVAC Vibration Joint Cloth (Assumed)	N/A	7	Operations and Maintenance

SPECIFIC MANAGEMENT RECOMMENDATIONS ROUNDUP JR./SR. HIGH SCHOOL (1975 EXPAMSION) BUILDING – Room Numbering Series 500				
HOM. MATERIAL NUMBER	DESCRIPTION	AHERA CATEGORY	REMOVAL PRIORITY	RECOMMENDED RESPONSE ACTION
5M4.1	Transite Chalkboards, Range hood, and Firewall (in welding room) (All Assumed)	N/A	7	Operations and Maintenance

*Note: AHERA hazards ranks are only applies to friable materials. All materials with N/A in the AHERA Category column are non-friable.

SECTION 5: REMOVAL COST ESTIMATE

Removal Cost Estimate

Room:	Description:	Quantity:	Unit:	Total Cost:
112A	Straight Pipe Insulation	600	LF	$6,000.00
115	9" x 9" Floor Tile	104	SF	$260.00
117	9" x 9" Floor Tile	50	SF	$125.00
121	9" x 9" Floor Tile	35	SF	$87.50
121	9" x 9" Floor Tile	35	SF	$87.50
124	9" x 9" Floor Tile	455	SF	$1,137.50
124	9" x 9" Floor Tile	455	SF	$1,137.50
125	9" x 9" Floor Tile	65	SF	$162.50
125	9" x 9" Floor Tile	65	SF	$162.50
126	9" x 9" Floor Tile	112	SF	$280.00
127	9" x 9" Floor Tile	30	SF	$75.00
127	9" x 9" Floor Tile	30	SF	$75.00
128	9" x 9" Floor Tile	30	SF	$75.00
129	Linoleum	240	SF	$1,440.00
140	Straight Pipe Insulation	1	LF	$100.00
206	Transite	96	SF	$240.00
207	Transite	96	SF	$240.00
210	Transite	96	SF	$240.00
218	Transite	96	SF	$240.00
220	Transite	96	SF	$240.00
221	Transite	16	SF	$40.00
244	Straight Pipe Insulation	300	LF	$3,000.00
244	Straight Pipe Insulation	150	CF	$1,500.00
306A	Linoleum	20	SF	$120.00
309	Pipe Joint Insulation	5	EA	$100.00
310	Linoleum	128	SF	$768.00
312	9" x 9" Floor Tile	875	SF	$2,187.50
312	9" x 9" Floor Tile	875	SF	$2,187.50
313	9" x 9" Floor Tile	360	SF	$900.00
313A	9" x 9" Floor Tile	20	SF	$50.00
313A	HVAC Connector Material	4	SF	$100.00
313A	Pipe Joint Insulation	10	EA	$200.00
314	9" x 9" Floor Tile	80	SF	$200.00
317	9" x 9" Floor Tile	24	SF	$60.00
318	9" x 9" Floor Tile	320	SF	$800.00
319	9" x 9" Floor Tile	720	SF	$1,800.00
320	Gasket Materials	6	LF	$300.00

Removal Cost Estimate

Room:	Description:	Quantity:	Unit:	Total Cost:
321	Pipe Joint Insulation	15	EA	$300.00
401	9" x 9" Floor Tile	2240	SF	$5,600.00
401	9" x 9" Floor Tile	560	SF	$1,400.00
401	Ceilings and Beams	1240	SF	$7,440.00
401A	9" x 9" Floor Tile	50	SF	$125.00
402	9" x 9" Floor Tile	180	SF	$450.00
402	9" x 9" Floor Tile	540	SF	$1,350.00
402	Ceilings and Beams	320	SF	$1,920.00
403	9" x 9" Floor Tile	672	SF	$1,680.00
404	9" x 9" Floor Tile	504	SF	$1,260.00
405	9" x 9" Floor Tile	144	SF	$360.00
406	9" x 9" Floor Tile	156	SF	$390.00
407	9" x 9" Floor Tile	504	SF	$1,260.00
407	Transite	96	SF	$240.00
408	9" x 9" Floor Tile	532	SF	$1,330.00
408	Transite	128	SF	$320.00
409	9" x 9" Floor Tile	532	SF	$1,330.00
409	Transite	128	SF	$320.00
410	9" x 9" Floor Tile	616	SF	$1,540.00
412	9" x 9" Floor Tile	532	SF	$1,330.00
413	9" x 9" Floor Tile	532	SF	$1,330.00
413	Transite	160	SF	$400.00
414	9" x 9" Floor Tile	644	SF	$1,610.00
415	9" x 9" Floor Tile	420	SF	$1,050.00
415	Transite	160	SF	$400.00
416	9" x 9" Floor Tile	644	SF	$1,610.00
417	9" x 9" Floor Tile	1092	SF	$2,730.00
419	9" x 9" Floor Tile	188	SF	$470.00
419A	9" x 9" Floor Tile	20	SF	$50.00
419B	9" x 9" Floor Tile	40	SF	$100.00
421	9" x 9" Floor Tile	400	SF	$1,000.00
422	9" x 9" Floor Tile	230	SF	$575.00
423	9" x 9" Floor Tile	20	SF	$50.00
425	9" x 9" Floor Tile	154	SF	$385.00
427	9" x 9" Floor Tile	20	SF	$50.00
429	9" x 9" Floor Tile	620	SF	$1,550.00
429	Transite	160	SF	$400.00
430	9" x 9" Floor Tile	620	SF	$1,560.00

TABLE 1
Summary of Confirmed Asbestos-Containing Materials and Recommended Response Actions

Material Description	Material Number and Additional Comments	Lab Results *	Recommended Response Actions ‡
Linoleum	1F1.2 Vinyl sheet flooring, beige pebbled pattern	35% Chrysotile	O&M
9" x 9" Floor Tile	1F3.1 Vinyl floor tile, 9" by 9" tan mottled pattern/black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	1F3.2 Vinyl floor tile, 9" by 9" red with white flecks/black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	1F3.4 Vinyl floor tile, 9" by 9" gray with white flecks/black mastic	3% Chrysotile	O&M
Straight Pipe Insulation	1T3.1 Straight run "AirCell" pipe insulation	35% Chrysotile	Removal
Straight Pipe Insulation	2M16.1 Asbestos contaminated soil	Assumed ACM	Removal
Transite	2M4.1 Chalkboards	Assumed ACM	O&M
Straight Pipe Insulation	2T3.1 Straight run "AirCell" pipe insulation	35% Chrysotile	Removal
Linoleum	3F1.1 Vinyl sheet flooring, tan pebbled pattern	25% Chrysotile	O&M
Linoleum	3F1.2 Vinyl sheet flooring, light green pebbled	35% Chrysotile	O&M
9" x 9" Floor Tile	3F3.1 Vinyl floor tile, 9" by 9" beige with tan streaks, black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	3F3.2 Vinyl floor tile, 9" by 9" turquoise with brown streaks, black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	3F3.3 Vinyl floor tile, 9" by 9" beige with brown spots, black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	3F3.4 Vinyl floor tile, 9" by 9" beige with tan streaks, black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	3F3.5 Vinyl floor tile, 9" by 9" white with black spots, black mastic	4% Chrysotile	O&M
9" x 9" Floor Tile	3F3.6 Vinyl floor tile, 9" by 9" beige with blue spots, black mastic	2% Chrysotile	O&M
Gasket Materials	3T1.1 Boiler door rope gasket	20% Chrysotile	O&M
Pipe Joint Insulation	3T2.1 Heating lines mudded joint fittings	10% Chrysotile	Removal
HVAC Connector Material	3T4.1 HVAC Vibration joint cloth	Assumed ACM	O&M
9" x 9" Floor Tile	4F3.1 Vinyl floor tile, 9" by 9" lt. Brn. with multicolored spots, black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	4F3.2 Vinyl floor tile, 9" by 9" red with multicolored spots, blk mastic	2% Chrysotile	O&M
9" x 9" Floor Tile	4F3.3 Vinyl floor tile, 9" by 9" pink with multicolored spots, blk mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	4F3.4 Vinyl floor tile, 9" by 9" pink with multicolored spots, black mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	4F3.5 Vinyl floor tile, 9" by 9" dark brn with multicolored spots, blk mastic	3% Chrysotile	O&M
9" x 9" Floor Tile	4F3.6 Vinyl floor tile, 9" by 9" yellow with multicolored spots, black mastic	3% Chrysotile	O&M
Transite	4M4.1 Chalkboards	Assumed ACM	O&M

Northern Industrial Hygiene, Inc.

NORTHERN INDUSTRIAL HYGIENE, INC.
TECHNICIAN DAILY PROJECT LOG

CLIENT NAME Roundup School District	CONTRACTOR Safetech	NIH PROJECT NUMBER 999-438
PROJECT LOCATION Roundup Elementary School	CONTRACTORS SUPERVISOR Brian Ike	PROJECT DAY 1
WORK AREA Crawl Space and Tunnel	NO. OF CONTRACTORS WORKERS None	DATES 08/03/05
TECHNICIAN 1: Gabe Zeiler	**TECHNICIAN'S INFORMATION** ARRIVE ON SITE: 9:00 AM ARRIVE ON SITE: 2:40 PM	LEAVE SITE: 1:45 PM LEAVE SITE: 4:20 PM
__BACKGROUND __PERSONAL __EXCURSION	**AIR QUALITY SAMPLING** __INSIDE CONTAINMENT __OUTSIDE CONTAINMENT 10 CLEARANCE	__HEPA EXHAUST __TEM __FIELD BLANK

DAILY DIARY OF ACTIVITIES

TIME OF DAY	
9:00 AM	Northern Industrial Hygiene (NIH) tech arrives on site and meets with Brian Ike of Safetech.
9:10 AM	NIH tech and contractor don personal protective equipment (PPE) and enter crawl space containment to conduct the final clearance visual inspection.
12:18 PM	Final clearance visual inspection passes. Contractor starts encapsulating the containment while NIH tech goes to the tunnel containment to do the final clearance visual clearance on it.
12:21 PM	NIH tech dons PPE and starts the final clearance visual inspection on the tunnel containment.
12:55 PM	Visual passes and NIH tech starts setting up pumps and pre-calibrating them. NIH tech now puts on cassettes and starts sampling. NIH tech exits the containment.
1:40 PM	NIH tech goes to the crawl space containment and starts setting up sampling pumps and pre-calibrating them. NIH tech now puts on cassettes and starts sampling in the crawl space.
1:45 PM	NIH tech leaves site and goes to lunch.
2:40 PM	NIH tech back on site and fills out paperwork while pumps are running.
3:35 PM	NIH tech goes to the tunnel containment and dons PPE and enters containment. NIH tech post-calibrates pumps and pulls the cassettes. NIH tech now wet wipes sampling equipment and removes from the containment.
3:53 PM	NIH tech goes to crawl space containment and post-calibrates the sampling pumps and pulls the cassettes. Sampling equipment is now wet wiped and removed from the containment. NIH tech packs up all equipment and hauls to the truck.

NORTHERN INDUSTRIAL HYGIENE, INC. TECHNICIAN DAILY PROJECT LOG		
CLIENT NAME Roundup School District	CONTRACTOR Safetech	NIH PROJECT NUMBER 999-438
PROJECT LOCATION Roundup Elementary School	CONTRACTORS SUPERVISOR Brian Ike	PROJECT DAY 1
WORK AREA Crawl Space and Tunnel	NO. OF CONTRACTORS WORKERS None	DATES 08/03/05
TECHNICIAN 1: Gabe Zeiler	**TECHNICIAN'S INFORMATION** ARRIVE ON SITE: 9:00 AM ARRIVE ON SITE: 2:40 AM	LEAVE SITE: 1:45 PM LEAVE SITE: 4:20 PM
__BACKGROUND __PERSONAL __EXCURSION	**AIR QUALITY SAMPLING** __INSIDE CONTAINMENT __OUTSIDE CONTAINMENT __CLEARANCE	__HEPA EXHAUST __TEM __FIELD BLANK

DAILY DIARY OF ACTIVITIES

TIME OF DAY	
4:20 PM	NIH tech leaves site and travels back to Billings, MT.
5:20 PM	NIH tech packages the TEM Air Sample cassettes with the chain of custody and deliveries to Horizon Air for delivery to LAB/COR of Seattle, Washington for AHERA sampling analysis. NIH tech requests a six-hour tour around.
	8/04/05
1:30 PM	LAB/COR telephones NIH tech with the results of the tunnel containment. The average of the 5 samples is below the ARERA clearance level of (70 smm^2) for asbestos.
3:30 PM	LAB/COR telephones NIH tech with the results of the crawl space containment. The average of the 5 samples is below the AHERA clearance level of (70 smm^2) for asbestos. NIH tech telephones Sam Shirley of Safetech with the results. Safetech says they will tear down the containments on Friday afternoon or Monday morning.

FINAL CLEARANCE VISUAL INSPECTION

PROJECT:	Removal of Pipe Insulation, Mudded Fittings and Soil From Crawl Space	DATE:	8/3/2005
BUILDING:	Roundup Elementary School	TIME:	12:30 PM
LOCATION:	Roundup, Montana	PROJECT NO.:	999-438

VISUAL CHECKLIST:

RESIDUAL DUST ON:	YES	NO / NA
FLOOR		X
WALLS		X
LEDGES		X
PIPES		X
HANGERS		X
CONDUITS		X
CABLES		X
LIGHT FIXTURES		X
DUCTWORK		X
EQUIPMENT		X

RESULTS OF VISUAL INSPECTION PASS X FAIL ____

REMARKS:

All asbestos mudded fittings and straight pipe runs were successfully removed from the containment as described in the specifications. Also all asbestos debris was removed from the soil.

NORTHERN INDUSTRIAL HYGIENE, INC.
Billings, Montana
Helena, Montana
Burien, Washington

HYGIENIST Gabe Zeiler
Gabe Zeiler

FINAL CLEARANCE VISUAL INSPECTION

PROJECT: Removal of Pipe Mudded Fittings in Tunnel
BUILDING: Roundup Elementary School
LOCATION: Roundup, Montana

DATE: 8/3/2005
TIME: 12:45 PM
PROJECT NO.: 999-438

VISUAL CHECKLIST:

RESIDUAL DUST ON:	YES	NO / NA
FLOOR		X
WALLS		X
LEDGES		X
PIPES		X
HANGERS		X
CONDUITS		X
CABLES		X
LIGHT FIXTURES		X
DUCTWORK		X
EQUIPMENT		X

RESULTS OF VISUAL INSPECTION PASS X FAIL ____

REMARKS:

All asbestos mudded fittings were successfully removed from the the containment as described in the specifications.

NORTHERN INDUSTRIAL HYGIENE, INC.
Billings, Montana
Helena, Montana
Burien, Washington

HYGIENIST Gabe Zeiler
Gabe Zeiler

Roundup School District
Three Year AHERA Reinspection

Name of School: **Elementary School (Old)**
LEA Designated Person: **Chad Sealey**
Date: **August 17, 2016**

1. Reinspection and Reassessment of Friable ACM:

There was no friable asbestos containing material in the building at the time of the reinspection.

2. Reinspection and Reassessment of Nonfriable and Assumed ACM:

Material Description	Material Location	Change in Condition	Comments
Slate (Transite) Chalkboards 2M4.1	Throughout the building	The material was not in the building at the time of the reinspecion	
Vinyl Sheet Flooring – tan pebbled pattern 3F1.1	Little Bathroom connected to the Special Education Room	None	The material is in good condition and is classified as a 5.
Vinyl Sheet Flooring – green pebbled pattern 3F1.2	Girl's Restroom	None	The material is in good condition and is classified as a 5.
9" Vinyl Floor Tile and Mastic– beige with tan 3F3.2	Closet and Halls 4	None	The material is showing general wear and tear but is nonfriable. It is rated as a 5.
9" Vinyl Floor Tile and Mastic – turquoise with brown 3F3.2	Multi-purpose Room 3	None	The material is nonfriable and is rated as a 5.
9" Vinyl Floor Tile and Mastic – beige with brown 3F3.3	Multi-purpose room and Halls 2	None	The material is nonfriable and is classified as a 5.
9" Vinyl Floor	Halls	None	There is some breakage

Tile and Mastic – brown with black 3F3.4	7		leading into the Sandstone Building but the material is nonfriable and listed as a 5.
9" Vinyl Floor Tile and Mastic – white with black 3F3.5	Kitchen 8	None	The material is nonfriable and listed as a 5.
9" Vinyl Floor Tile and Mastic – Beige with Blue 3F3.6	Throughout the building – under carpet UNKNOWN	None	The material is under carpet and is rated as a 5.
Boiler Door Rope Gasket 3T1.1	Boiler Room – Boiler Door	None Removed	The material is intact and is rated as a 5.
Heating Line Mudded Fittings 3T2.1	Throughout	None	The material has been covered in places with duct tape. The material is rated a 5.
HVAC Vibration Joint Collars	Off of the Multi-purpose room	None	The material is in good condition and ranked as a 5.

3. Newly Friable Homogenous Areas

The reinspection did not reveal any newly friable homogenous areas.

4. Collection and Analysis of Bulk Samples

The collection and analysis of bulk samples was not needed at the time of the reinspection.

5. Recommended Response Action for Nonfriable ACM

A. Floor Tile and Mastic

This material could be a potential hazard if it is made friable by grinding, sanding, cutting, or improper removal. This material should be maintained in good condition under the guidelines set forth in the Operation and Maintenance (O&M) program.

B. Mudded Joints and Fittings

Project: CENTRAL SCHOOL - ROUNDUP, MT - MUSIC Building

Date: 10/20/16

TDD:

Inspector: BM, MC

Sample ID	Material	Location	Estimated Extent	Notes
example CSC-B4-material-#				
~~CSC-CT01~~				
CSC-B4-CT01-001	Drop Ceiling Tile	music, dance, Hall 1	2086 Ft²	2x4 panels
CSC-B4-FT01-002	Floor TILE	music, dance, Bathroom	12x12 gray patterned	
CSC-B4-BG01-03	Molding/Glue	Music, Dance, Hall 1, BATH	–	molding/mastic
CSC-B4-DW01-04	Drywall	" " " "	>3000	music rm
05				Dance rm
06				Hallway 1
07				BATHROOM 1
08				music rm
CSC-B4-DW02-09	Drywall	Central Connector Rm	<1000	DW, JC, TAPE
10				
11				
CSC-B4-LN01-12	LINOLEUM	Janitor Rm	40 ft²	Peeling up
CSC-B4-DW03-13	Drywall		<1000	
-14				
-15				
CSC-B4-PL01-16	PLASTER	Dance Rm ABOVE DROP CEILING		
-17				
-18				
CSC-B4-FT02-19	Floor Tile	Cooler	12x12 tile	Tan w/ RED + BRN Flake
CSC-B4-DW04-20	Drywall	Hallway 2 ~~Above~~		
-21				
-22				
CSC-B4-PL02-23	PLASTER	Hallway 2		
-24		Storage 1		
-25		Storage 2		
CSC-B4-VI-26	Vermiculite	Hallway 2 - walls ARE FILLED AROUND		coolers
CSC-B4-DI01-27	Door INSULATION	Cooler Door		BEAD/ROPE style INSULATION
CSC-B4-DI02-28	" "	"		INSULATION INSIDE DOOR

Project: Central School - Roundup, MT

Date: 10/20/16

TDD:

Inspector: BM, MC

Sample ID	Material	Location	Estimated Extent	Notes
CSC-B4-WP01-29	wallpaper	Cooler		
CSC-B4-DC01-30	door caulk	Cooler		
CSC-B4-WC01-31	window caulk	Hallway 2		
CSC-B4-DW05-32	drywall	Storage 2		DW, JC, TAPE
-33		Storage 2		
-34		Storage 1		
CSC-B4-PL03-35	Plaster	Basement		
-36				
37				
CSC-B4-RM01-38	Roofing	Roof		Shingle
RM02-39	"	"		Sealant

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WESTON SOLUTIONS

CLIENT/SUBJECT _____ SHEET ____ of ____

TASK DESCRIPTION _____ W.O. NO. _____

PREPARED BY _____ DEPT _____ DATE _____ TASK NO. _____

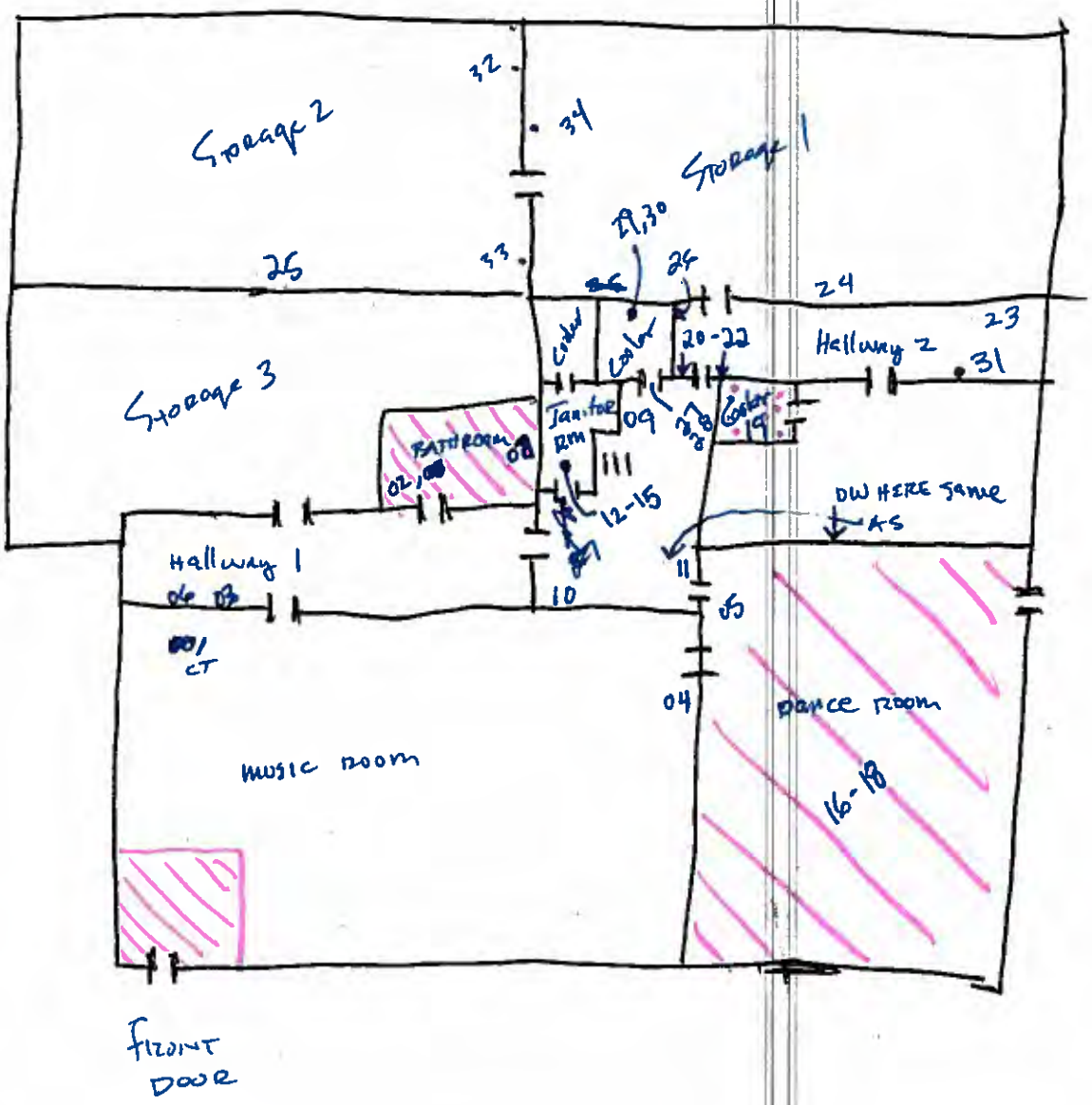
MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

APPROVED BY _____

DEPT _____ DATE _____

Building 4 main floor



an employee-owned company

WESTON SOLUTIONS

CLIENT/SUBJECT _____ SHEET ____ of ____

TASK DESCRIPTION _____ W.O. NO. _____

PREPARED BY _____ DEPT _____ DATE _____ TASK NO. _____

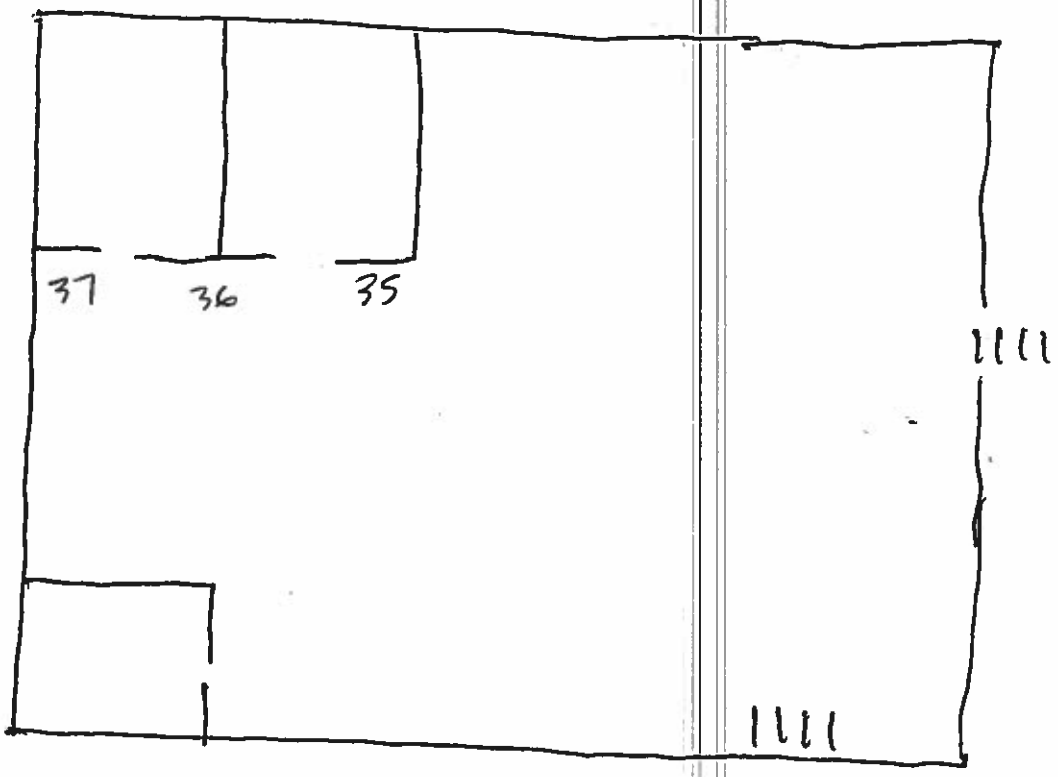
MATH CHECK BY _____ DEPT _____ DATE _____

METHOD REV. BY _____ DEPT _____ DATE _____

APPROVED BY _____

DEPT _____ DATE _____

Building 4 (Music Room)
Basement



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ATTACHMENT C

Data Quality Objectives Worksheet

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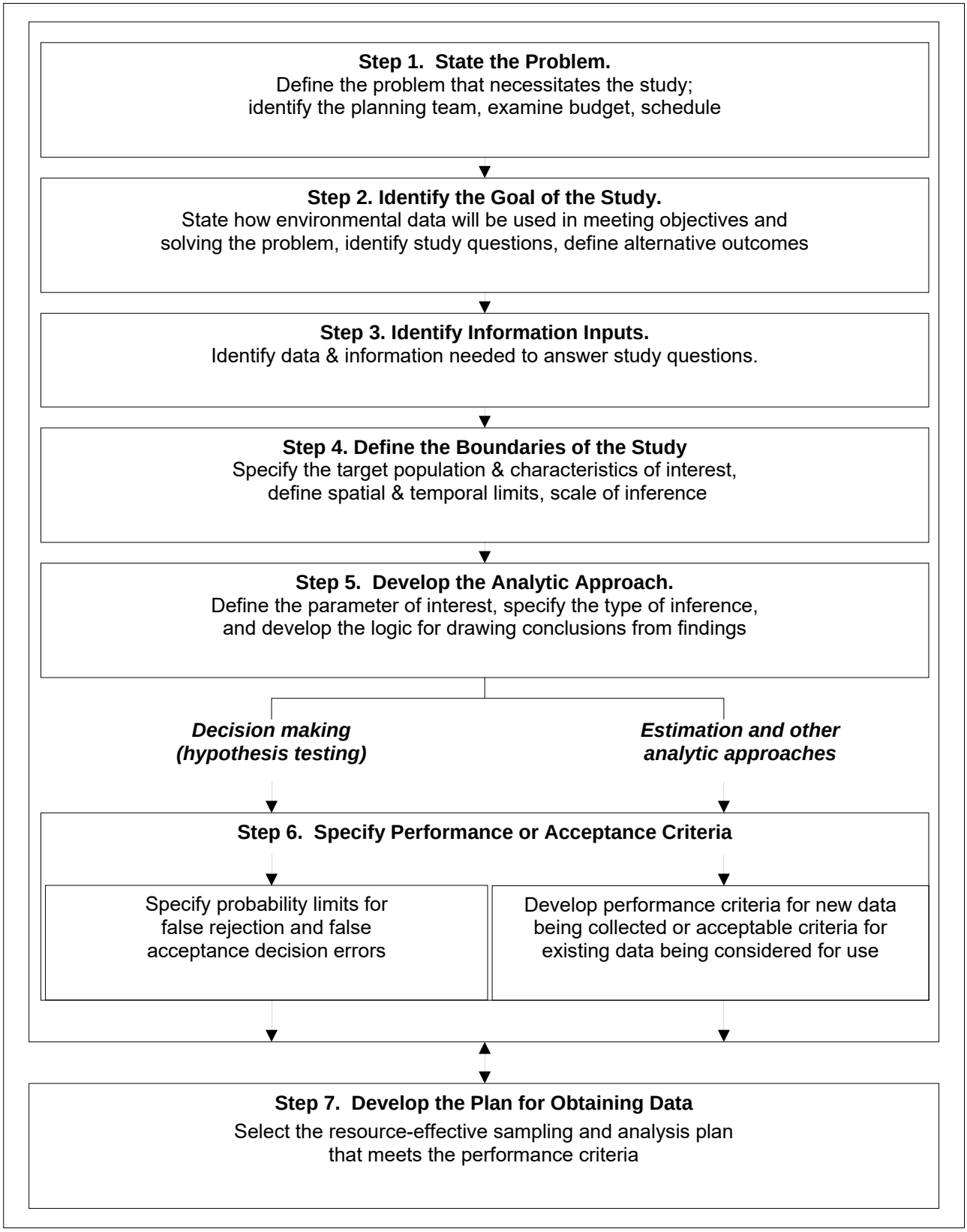

Figure 2. The Data Quality Objective Process

ATTACHMENT D

Standard Operating Procedures

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Lead Paint Screening SOP

XRF Guidance for Innov-X

Revised 3/2/2017

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1. Background

This Standard Operating Procedure (SOP) is designed to provide an overview of the data processing steps required to import Innov-X X-Ray Fluorescence (XRF) data generated using the Alpha and Omega models into Scribe. Only trained individuals following all safety protocols should use the XRF analyzers.

There are two types of Innov-X XRF analyzers that the Region 8 EPA Warehouse currently has. They are the Omega and the Alpha. The Alpha is appropriate for Lead-Based Paint analysis along with Soils analysis. The Omega is only appropriate for Soils analysis. For soils analysis, these analyzers may be used in-situ (directly on the ground) or ex-situ (bagged soil or prepared in a sample cup). Guidance on using the XRF analyzer should be procured from the manufacturer. Region 8 START procedure for operating the XRF may be generated and will be contained in a separate SOP. This SOP will focus solely on managing the data generated using the XRF instruments.

2. Pre-Screening data input

Before using the XRF analyzer, it is necessary to identify information about the sample. This information can be entered into the XRF instrument or may be documented in the logbook. The type of information to capture is noted in Section 2.2.1 below. If entered into a logbook, it is important to also capture the Reading Number.

2.1. After standardization has passed, click the “Info” button

2.2. If electing to enter the information directly into the instrument, enter it into the various fields titled “Field 1”, “Field 2”, etc. For example, Field 1 would contain the location data, Field 2 would contain the depth info, etc. It is important that the data adheres to the site specific data management plan.

2.2.1. Location, depth, time, and comments are the common fields to input.

2.3. Navigate back to the analysis tab and perform your analysis.

2.4. Repeat procedure for each analysis performed

2.5. If electing to enter the information in the logbook, it is recommended to create a small table in your logbook with the following fields; Reading No, Date, Time, Location, Depth, and Comments. Additionally, it is recommended to include fields for contaminants of concern (arsenic, lead, cadmium, etc.). Entering it into the logbook ensures you have a backup copy of your data (in case of instrument failure) and also allows you to go back and manually enter pertinent data into the export file prior to importing to Scribe.

3. Data Export

3.1. Omega XRF Analyzer

3.1.1. Select Results Management from Setup tab.

3.1.2. Select date of Results.

3.1.3. Rename the export file in the input window on the top of the screen. Only edit the final part of the input, do not edit the file path. It is a good idea to put a site identifier in the export name to allow for recall at a later date.

3.1.4. Select a .csv file type.
3.1.5. Select Save
3.1.6. Export begins; all options will be deactivated until export is complete.
3.1.7. Connect Omega to PC via USB cable.
3.1.8. Windows Mobile Device Center will open. Note: if using Windows 10, Sync Center will be used to manage the connections between the Omega and the PC.
3.1.9. Select Connect without Setting Up>File Management>Browse the contents of your device. (do not select Set Up Your Device; this will rename Omega after the connected PC).
3.1.10. Follow the filepath that was designated in step 3.1.3. It is set up to currently be /Storage/Export/
3.1.11. The exported file will be contained in folder as .csv.
3.1.12. Save to user computer or site hard drive.

Note: exported files are stored in My Documents for 24 hours. Files remain on Omega, but may require re-export if user needs to resave files 24 hours after the initial export.

3.2. Alpha XRF Analyzer

Note: The memory of the iPAQ is limited, so erasing data on a periodic basis is necessary. Microsoft Active Sync is required to connect to and pull data from the iPaq. Download: http://www.microsoft.com/en-us/download/details.aspx?id=15. If a Windows 10 computer is used, Sync Center (comes installed on computer) is required to connect to the iPaq.

3.2.1. Navigate to Results screen via the View tab.
3.2.2. Select File>Export Results.
3.2.3. User can select to export all readings or readings from specific dates. User can also select that all modes be exported or a specific mode.
3.2.4. Select OK.
3.2.5. On the Save As screen, the User can change the file name, folder, and location.
3.2.6. Select Save.
3.2.7. Exit out of the Innov-X program and detach iPAQ unit from the analyzer.
3.2.8. Using the docking station, connect the iPAQ to a computer and open Microsoft Active Sync (or Sync Center for Windows 10).
3.2.9. Once the application connects to the iPAQ, click file management to browse the contents of the device.
3.2.10. The default file path is Storage Card>INNOVX.
3.2.11. Look for the file name and copy over the .txt file.
3.2.12. Eject the iPAQ using the Safe Remove Hardware feature on the taskbar before disconnecting the USB
3.2.13. Open the .txt file and right click to select all and copy the text.
3.2.14. Open Microsoft Excel and paste the data.
3.2.15. Format the table to ensure proper translation into Scribe.

4. XRF Cup Analysis

Soil samples may be collected, processed, and analyzed in XRF cups according to EPA Method 6200. When used with known standards, these results can be run through the validation

database. The SOP for the cup analysis will be located elsewhere, this SOP focuses on the data management needed.

For proper validation and results, the sieve chosen should be noted.

4.1. Omega XRF Analysis

4.1.1. Connect to the XRF to PC using the USB Cable and Microsoft Mobile Device Center/ and EveryWAN software

4.1.2. The selected standard must be run at least 7 times during each analysis group, preferably evenly distributed throughout the group. **Only choose one standard per analysis group. The appropriate standard should be selected based on the anticipated range of your decision criteria/action level.**

4.1.3. Use EveryWAN to analyze samples and export data

4.2. Alpha XRF Analysis

4.2.1. Disconnect the PDA from the instrument

4.2.2. Set up the XRF in the desktop and insert the PDA into the holster

4.2.3. The selected standard must be run at least 7 times during each analysis group, preferably evenly distributed throughout the group. **Only choose one standard per analysis group. The appropriate standard should be selected based on the anticipated range of your decision criteria/action level.**

4.2.4. Analyze the samples and export data

Table 1
Standard Reference Material Analyte Concentrations
(mg/kg)

SRM Number	**2704**	**2709**	**2710**	**2711**
Description	**Buffalo River Sediment**	**San Joaquin Soil**	**Montana Soil**	**Montana II Soil**
As	17	10.5	0.154%	107
Ag			40	6
Ba	413	979	792	730
Cd	2.94	0.371	12.3	54.1
Co	13.57	12	5.99	9.89
Cr	121.9			52.3
Cu		33.9	0.342%	140
Fe	3.97%	3.36%	4.32%	2.82%

SRM Number	2704	2709	2710	2711
Description	**Buffalo River Sediment**	**San Joaquin Soil**	**Montana Soil**	**Montana II Soil**
Hg		0.9	9.88	7.42
Mn	544	529	0.214%	675
Ni	42.9	85	8	21.7
Pb	150	17.3	0.552%	0.140%
Rb		99	117	120
Se		1.5	1	
Sr			255	242
Ti	0.457%	0.336%	0.311%	0.317%
Zn	408	103	0.418%	414

Choose the standard with values closest to your anticipated results

5. Validation Database

Samples that are dried, sieved, cupped, and analyzed can be validated using the validation database. However, this should be discussed with the PM of the project prior to importing as laboratory data.

5.1. Save a copy of the validation database to your computer. The database is called "XRF Validation.V7.mdb" and is available in the documents section of the EPA OSC Region 8 Data Management Materials webpage (response.epa.gov/R8Data)

5.2. Open the validation database

5.3. QA the column headings in the XRF export. Headings should match the field names in the table "GammaGenericPRN_Soil"

5.4. QA the XRF data file

5.4.1. Correct sample IDs, including standards

5.4.2. Make sure the values in the standard and standardization look correct

5.4.3. Review any short run-time results

5.4.4. Check for any other errors

5.4.5. If you ran a sample more than 1 time, you must either pick which record you want to keep or give one of the records an alternate name. (The database cannot work with IDs that are listed more than once)

5.5. Save changes as a .xls or .xlsx Excel file

5.6. Open the XRF Validation.V7.mdb

The user interface will open automatically. If you inadvertently close this, you can navigate back to it by double clicking on the form called "Main" in the menu on the left side of the screen

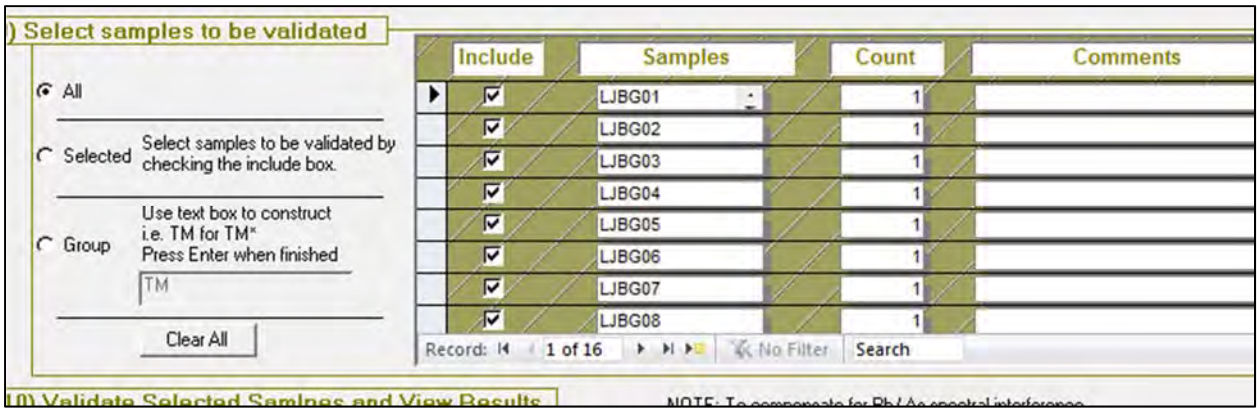
5.6.1. Select the XRF instrument ID (they are labeled with the EPA Warehouse IDs)

5.6.2. Double click in the filepath box to browse to you XRF excel file

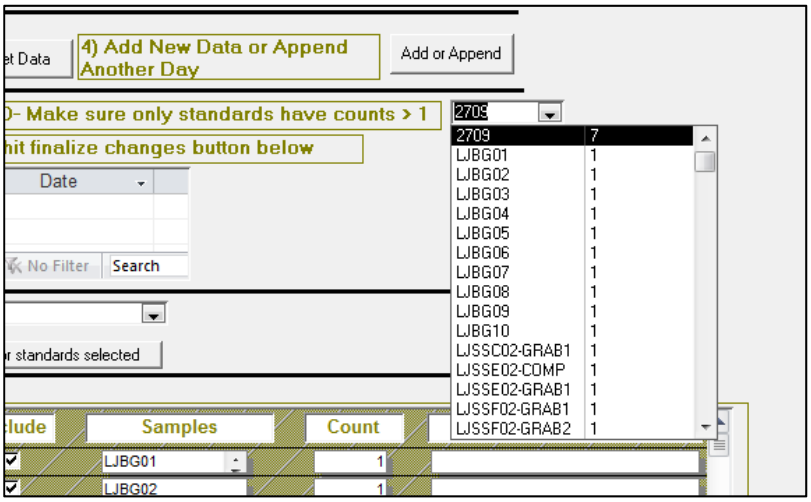
5.6.3. Click the "Import" button

5.6.4. Click the "Reset Data" button

5.6.5. Click the "Add or Append" button (if you are on track, at this point your sample IDs will show up in the table under the "Step 9" header as shown below)



5.6.6. Review the sample counts in the dropdown, the only sample with more than one should be standards



5.6.7. Check for duplicates in the grid, if you need to revise any sample IDs you can do it in the grid and then click "Finalize Changes"

5.6.8. Select the standard you used (typically 2709)

5.6.9. Select samples for validation. You can either select individual samples with the check boxes in the table, leaving the radio button on "selected" or you can select all by moving the radio button to "All." (You may get a warning that you are about to update rows, this is ok, click yes)

5.6.10. Click validate. This will cause an access table to pop up with the validated data. Review data for discrepancies and start over if errors exist. When you have finished reviewing the table, close it and you will return to the Main form

5.6.11. Click “Update Scribe Table”. This will cause an access table to pop up with the validated data in a normalized scribe compatible format. Review data for discrepancies and start over if errors exist. When you have finished reviewing the table, close it and you will return to the Main form.

5.6.12. Alternatively, you may export the data into a .csv file

Troubleshooting:

- If the XRF field for sample date did not export, the validation database will not allow you to continue. Manually enter a date or re-export from the XRF
- Sometimes the XRF exports fields you do not need – you can customize these in the XRF settings

6. Import to Scribe

Most data collected with the XRF will be imported as Monitoring data. If analyzed using EPA Method 6200 with the correct cupping procedure, they may be imported as laboratory analysis. This should be discussed with the PM of the project prior to importing as laboratory data.

6.1. To import the validated data into Scribe, Select Import>Custom Import and under Data Category choose “Monitoring Data”. Direct the Scribe custom import tool to the validation database and select the table in the validation database called “Scribe” OR select the .csv file you exported in step 5.6.12

7. Formatting In-situ XRF Data for Importing into Scribe Monitoring Table

(Note: the database is currently only set up to export lead and arsenic for monitoring. If you need other elements talk to your Data Manager to have the formatting queries modified)

7.1. Open the .xlsx file exported from the instrument. In the .xlsx file change the following column names

7.1.1. “As” to “Arsenic”

7.1.2. “Pb” to “Lead”

7.1.3. “Field 1” to “Location

7.1.4. “Date” to “Mon_Date”

7.1.5. “Time” to “Mon_Time”

7.2. Delete records for standardizations

7.3. Check the spreadsheet for any duplicate entries – delete any duplicates or give them unique IDs

7.4. Delete all columns necessary to make your import have the following columns

- Mon_Date
- Mon_Time
- Reading Number
- Livetime
- Mode
- Location

- Elements (delete columns where the data is blank)

7.5. Open the Access database “In Situ Formatting”
7.6. Select the tab for External Data > In the ‘Import and Link’ selection, select the Excel icon
7.7. Navigate to your re-formatted .xlsx equipment export, using the browse button
7.8. Select the equipment export
7.9. Select the radio button for ‘Append a copy of the records to the table:’ and select ‘Raw XRF Data’ from the dropdown
7.10. Select ok, and click through the prompts to import
  7.10.1. If you get a primary key error, it is probably a type conversion error for the time field. Go back into your equipment export, select the time column, hit Control+1 to bring up the properties box, and make sure the column is formatted as time ##:##:##
  7.10.2. Any other import errors are probably the result of an improperly formatted spreadsheet – open the table in access called ‘Raw XRF Data’ and make sure all the columns match those on your spreadsheet and revise as necessary
7.11. Once your data is successfully imported run the query called “Q_XRF_Mon_Import
7.12. This will bring up a table showing the data you just imported in a Scribe Monitoring Table compatible format.
7.13. From here you must export the table to excel (.csv) and import it into scribe (you can’t import directly from the access because the database is in an .accdb format which scribe does not recognize): external data tab> export section> excel
7.14. If you are routinely using the database over the course of a project and only want to create an import for one day of in situ data add a criteria to the Q_XRF_Mon_Import query for date
  7.14.1. Open the query in design view
  7.14.2. In the column ‘Mon_Date’ enter the date you would like to see in the ‘Criteria’ row
  7.14.3. You can either enter one date (in the format #9/10/2014#) or select for dates before or after a given date (in the format >=#9/10/2014# or >#9/10/2014#)

United States
Environmental Protection
Agency

EPA 600/R-10/069 August 2009 www.epa.gov/ord

Standard Operating Procedure for Surface Paint Sample Collection Using a Modified Wood Drill Bit with a Variable-Speed Portable Electric Drill

SCIENCE

Office of
Research and Development
National Exposure
Research Laboratory

EPA/600/R-10/069 August 2009 www.epa.gov/ord

Standard Operating Procedure for Surface Paint Sample Collection Using a Modified Wood Drill Bit with a Variable-Speed Portable Electric Drill

Prepared by

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Disclaimer

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1.0 PRINCIPLE AND APPLICABILITY

Exposure to lead (Pb) may adversely impact children's brains, nervous systems, and many organs. An estimated 310,000 U.S. children ages 1 to 5 have elevated blood leads. In the United States, the major exposure pathway for children to Pb is from deteriorated Pb-based paint (LBP), Pb-contaminated house dust, and residential soil. Approximately 40% of all U.S. housing units (about 38 million homes) have some LBP.[1] The Federal regulated lead standard has been defined by the U.S. Department of Housing and Urban Development (Title X of the Housing and Community Development Act, 1992)[2] as equal to or greater than 0.5% Pb by weight or 1.0 mg Pb/cm^2. Homes built before 1978 are the most likely to contain LBP. Each year, more than 10 million renovation activities occur in homes, child-care facilities, and schools potentially containing LBP. To reduce the exposures to lead hazards during renovation, the U.S. Environmental Protection Agency (EPA) promulgated the "Lead; Renovation, Repair, and Painting Program; Final Rule" (RRP) in April 2008. The rule requires the use of inexpensive test kits. However, no currently available commercial test kit can meet the performance requirements of no more than 5% false negative results at levels greater than the Federal regulated level and no more than 10% false positive results at levels less than the Federal regulated level.[3] Additionally, the test kit procedure should be inexpensive, take less than an hour per sample, and be easy to perform.

The simple, commercially produced test kits currently available for home testing for lead in paint are very sensitive but do not provide quantification of the lead to meet the specifications in the RRP. As noted in Gutknecht et al., there are several field techniques already available for direct (in situ) quantitative analysis of lead in painted surfaces, including field-portable, X-ray fluorescence and portable laser microprobe spectrometry.[4] The instrumentation for these methods is relatively expensive and requires extensive training. Additionally, there are numerous less expensive field methods available for quantitatively measuring lead in solution. These include electrochemical reduction/oxidation (anodic stripping voltammetry), complexation (colorimetry), or precipitation (gravimetry). However, to apply these methods, paint must first be removed quantitatively from the surface and quantitatively solubilized. Grinding may be needed to facilitate solubilization. Using the assumption that the Pb paint must be removed to achieve the goals of the renovation and repair rule, then there is a need for a new and simple method for sample collection of paint from surfaces.

This standard operating procedure (SOP) describes a new, rapid, and relatively inexpensive way to remove a precise area of paint from the substrate of building structures in preparation for quantitative analysis. This method has been applied successfully in the laboratory, as well as in the field. It is a general use SOP and intended to be used by trained nontechnical workers.

2.0 SUMMARY OF METHODS

This SOP describes a new method for paint collection that involves removal of the paint using a modified drill bit mounted in a variable-speed drill. The major advantage offered by this method is that it results in both collection and grinding of the paint sample in one step. Grinding of the paint into small particles facilitates extraction of the lead from the paint. As a service to the user of this SOP, the basics of ASTM E 1729-05,[5] which involves removal of the paint using a chisel with or without heating with a hot air gun to soften the paint, are described as an alternate method of paint collection.

2.1 Paint Removal Using a Modified Drill Bit and Variable-Speed Drill

A paint sample of known area is precisely removed down to the substrate using a modified 1/2-in (1.27-cm) drill bit and a portable, variable-speed electric drill. The drill bit grinds the paint into a powder while removing it. On vertical surfaces, the ground paint is dropped into a paper funnel that directs the sample into a 15-mL plastic centrifuge tube for analysis as per EPA "Standard Operating Procedure for the Grinding and Extraction of Lead in Paint Using Nitric Acid and a Rotor/Stator System Powered by a High-Speed Motor"[6] or some other method. The paint removed from a horizontal surface using the drill bit is removed by sweeping it onto a piece of glazed weighing paper using a small brush.

2.2 Alternate Method of Paint Removal Using a Wood Chisel with or without a Hot Air Gun

Removing paint from metal or hard masonry may not be feasible using the modified drill bit method without predrilling a pilot hole to keep the bit in place during the drilling process. Also, drilling holes may not be acceptable if the metal objects are architecturally significant. In this situation, the paint is better removed using a 3/8-in or 1-cm wood chisel. The area to be sampled is marked on the paint using a pencil and template, and then circumscribed with the chisel, a knife, or a scalpel. The paint sample then is lifted out using the chisel. Brittle paint may be broken up manually by crushing within the weighing paper. Less brittle samples may be cut into smaller pieces using the scalpel on a hard, flat surface (e.g., glass) or using scissors. The paint may be softened before circumscribing and before lifting with the chisel by using a hot air gun. The reader is referred to ASTM Method E1729-05 for a further description of the procedure.[5]

2.3 Performance of the Modified Drill-Bit-Based Method

The method performance has been determined by gravimetry and by collection and analysis of samples of the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 8680 Paint on Fiberboard.[7]

Recovery efficiency for vertical surface sampling was determined by taping one of the funnels to a wall, pouring a known weight of powdered paint into the funnel, and collecting the paint in a preweighed test tube at the bottom of the funnel; recovery was determined as the weight collected in the tube compared to the amount poured into the funnel. Recovery efficiency for horizontal surface sampling was determined by placing a known weight of powdered paint into the depression left on a painted board after taking out a sample by the procedure described in this SOP and then collecting the paint by sweeping it onto a piece of glaze weighing paper and weighing the collected dust; recovery was determined as the weight collected on the paper compared to the amount placed into the depression. Replicate paint dust samples of about 0.1, 0.2, and 0.3 g were used, and all tests for both vertical and horizontal collection methods showed recoveries greater than 99%.

Six samples of certified NIST RM 8680 Paint on Fiberboard[7] (actually collected by RTI for EPA/NIST in the 1990s) were characterized initially by sampling and acid extraction/inductively coupled plasma-optical emission spectrometry (ICP-OES) measurement.[8, 9] The paint samples were removed from the fiberboard pieces using the modified drill bit method described in this SOP, and these samples were then ground/extracted using the rotor/stator method described in the EPA "Standard Operating Procedure for the Grinding and Extraction of Lead in Paint Using Nitric Acid and a Rotor/Stator System Powered by a High-Speed Motor."[6] Measurement of the lead in the extract was performed using ICP-OES with the same procedure used in the Environmental Lead Proficiency Analytical Testing Program (ELPAT).[10] Results are shown in Table 1. As noted, the average recovery exceeds 95%, and there is no significant difference between the expected values and the measured values.

Table 1. Results of Analysis of Six NIST RM 8680 Paint-on-Fiberboard Samples Collected Using the Modified Wood Drill Bit Method

NIST Fiber Board, RM 8680[a]	ICP-OES Pb Conc.[b] (mg/cm^2)	NIST Value (mg/cm^2)	Recovery Based on Expected Value (%)
KB2	1.20 ± 0.12	1.25 ± 0.35	96.0
TD5	1.48 ± 0.05	1.21 ± 0.38	122
DG2	1.13 ± 0.07	1.14 ± 0.32	99.1
HA3	1.28 ± 0.36	1.31 ± 0.34	97.7
MD2	1.09 ± 0.09	1.10 ± 0.30	99.1
JH1	1.57 ± 0.09	1.29 ± 0.40	122
			Av 106 ± 12 (11%)

[a]Paint samples preground with wood drill bit during sample collection prior to rotor/stator grinding.
[b]Conc. = concentration

2.4 Performance of the Alternate Chisel-Based Method

The reader is referred to ASTM Method E1729-05 for information confirming the performance of this method.[5]

3.0 DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

A number of acronyms and abbreviations are used in this SOP; these and their meanings are shown below.

- ASTM – ASTM International
- ELPAT – Environmental Lead Proficiency Analytical Testing Program
- EPA – U.S. Environmental Protection Agency
- ICP-OES – inductively coupled plasma-optical emission spectrometry
- LBP – lead-based paint
- NIST – National Institute of Standards and Technology
- Pb – elemental or ionic lead
- QC – quality control
- RRP – Lead; Renovation, Repair, and Painting Program; Final Rule
- RTI – RTI International
- SOP – standard operating procedure
- SRM – NIST Standard Reference Material

4.0 HEALTH AND SAFETY WARNINGS

4.1 Use of Equipment

The drill and modified drill bit used in this method do not present any major hazard to the user. The user is to follow the safety rules normally associated with use of power tools, including

- wearing safety glasses when operating the drill,
- taking care not to get cut or punctured from the wood drill bit, and
- avoiding wearing especially loose clothing that could get entangled in the operating drill.

If the paint samples are removed using the alternate chisel and hot air gun method, there are several precautions to be taken, including

- using the scalpel, hobby knife, or any other tools to circumscribe the paint sample before removal and the chisel with caution to avoid slips and possibly getting cut or punctured;
- wearing safety glasses when operating the hot air gun and using the chisel; and
- avoiding directing the hot air gun at a painted surface for an extended period of time, as this may result in overheating and possibly a fire. Heating/burning the paint at temperatures above 1100° F (593 °C) can release lead vapor into the air. Repeated exposure can be very hazardous to your health.

4.2 Paint Preparation

- When the paint is ground using the modified drill bit sampling method described in this SOP, care must be taken to avoid any inhalation of this dust.
- Any LBP or paint dust must be washed from the hands before eating or drinking. Keep food and drinks away from areas with lead paint and paint dust.

5.0 EQUIPMENT, SUPPLIES, AND REAGENTS

5.1 Apparatus

5.1.1 Variable-Speed, Portable (or Line-Powered) Electric Drill

- Variable-speed, portable drill, Model 6260 by Skill, Robert Bosch Tool Corporation, Mt. Prospect, IL[11]
  - 3/8-in (1.0-cm) chuck
  - variable speed (0 to 2,500 rpm)
  - 5.0 amp
- Or equivalent variable-speed (0 to 2,500 rpm), electric drill with 3/8-in (1.0-cm) chuck

5.1.2 Modified Wood Bit

A steel, 1/2-in (1.27-cm) wood bit prepared as shown in Figure 1. Carefully use a metal file to remove most of the center point taking care not to damage the flat edge of the bit that will cut into the painted surface. File down the point to approx. 3/16 in (0.5 cm) in length, so that only a small center point remains to hold the bit in place while drilling.

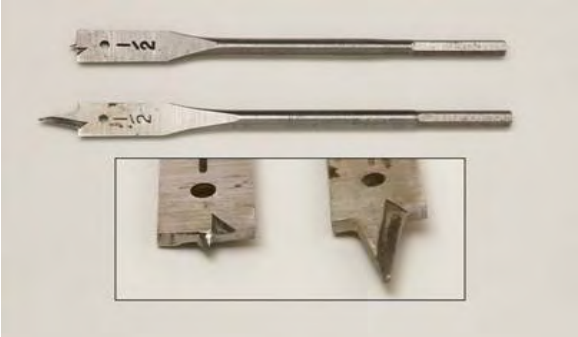

Figure 1. Drill bits shown with reduced and standard centering pins.

5.1.3 Dust Scattering Guard To Be Used During Sampling

One-inch (2.5-cm) section of PVC plastic pipe having approximately 1 1/8-in (2.9-cm) inside diameter (see Figure 2)

5.1.4 Other Materials and Supplies for Sampling Using Modified Drill Bit

5.1.4.1 Adhesive tape to secure funnel to wall and sample tube to funnel

5.1.4.2 Balance with readability of ±0.001 g, Gempro500 from Precision Weighing Balances, Bradford, MA, or equivalent (for quality control [QC] sample preparation)

5.1.4.3 Brush, 1/2-in (1.3-cm) bristle and 7-in (18-cm) length, VWR 17216-026, or equivalent

Figure 2. Section of PVC plastic pipe used to prevent scattering of dust during drilling.

5.1.4.4 Disposable paper funnels with slick interior walls. Large funnel, Part # FF03-0140, and small funnel, Part # FF05-0120, from S&S Concepts, Inc., Elk Grove, IL,[12] or equivalent. The top (large) end of the funnel should be approximately 4.25 in (10.8 cm) across with square sides. The bottom of the funnel should be approximately 0.25 in (0.64 cm) across so that it will fit in the 15-mL vial. Cut two "V"-shaped notches into two opposite faces at the top of the larger funnel approximately 1 3/4 in (4.4 cm) deep. This will allow the sample area to be below the top of the funnel and allow the drill bit shaft to be perpendicular to the sampling surface (see Figure 3).

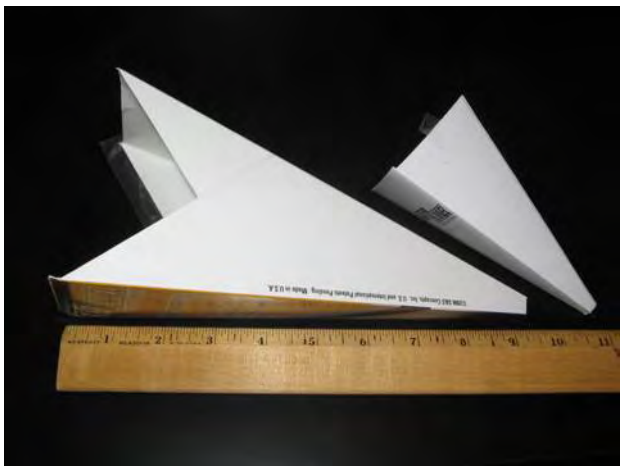

Figure 3. Paper funnels used to collect sample. The small funnel is taped to the end of the large funnel to act as one funnel with an appropriately sized outlet to fit into a 15-mL collection tube.

5.1.4.5 Glycine weighing paper for collecting paint from horizontal surfaces, approximately 4 x 4 in (10.2 x 10.2 cm), VWR 12578-165, or equivalent

5.1.4.6 15-mL plastic centrifuge tube for sample collection from paper funnel or weighing paper, VWR Catalog No. 21008-918, or equivalent

5.1.5 Equipment To Be Used If Sampling by the Alternate Method Using a Chisel and Hot Air Gun

5.1.5.1 Adhesive tape to secure funnel to wall and sample tube to funnel

5.1.5.2 Brush, 1/2-in (1.3-cm) bristle and 7-in (18-cm) length, VWR 17216-026, or equivalent

5.1.5.3 3/8-in or 1-cm, high-quality steel, wood chisel. [*Note*: A 3/8-in chisel is 0.952 cm in width. If a 3/8-in chisel is used, additional effort will be needed to remove the 1 x 1-cm area delineated with template and pencil. A 1-cm chisel may be located on the Internet (e.g., http://uk.shopping.com/xFS?KW=+10+mm+wood+chisel&CLT=SCH) or from a woodworking supply store that carries metric tools.]

5.1.5.4 Hot air gun with temperatures less than 1100° F (593 °C), Model HT 775 Heat Gun, Wagner Spray Tech Corp., Minneapolis, MN,[13] or equivalent

5.1.5.5 15-mL plastic centrifuge tube for sample collection from paper funnel or weighing paper, VWR Catalog No. 21008-918, or equivalent

5.1.5.6 Plastic or metal 1-cm square template to delineate 1 x 1-cm sample. Prepare by precisely cutting 1 x 1-cm hole in metal sheet or rigid plastic sheet as shown in Figure 4.

Figure 4. Photograph of 1 x 1-cm opening cut into plaster smoothing tool.

5.1.5.7 Scalpel or knife for circumscribing samples, VWR 25853-003, or equivalent

5.1.6 Cleaning and Rinsing

5.1.6.1 Deionized water for rinsing down drill bit, PVC tube, and/or chisel

5.1.6.2 Laboratory detergent, Alconox, VWR 21835-032, or equivalent. Prepare wash water in 5-L carboy following instructions on detergent container.

5.1.6.3 Laboratory wipe, Kimwipe, VWR 21905-026, or equivalent

5.1.6.4 Two wide-mouth, 5-L polyethylene carboys, one for storage of soap water for washing and one for rinse water waste, VWR 80094-464, or equivalent

5.2 Safety Equipment

Items to be used include the following.

5.2.1 Fire extinguisher if using hot air gun

5.2.2 Optional—work gloves to protect hands during drilling and using hot air gun and/or chisel

5.2.3 Safety goggles, VWR 10837-120 or equivalent

6.0 QUALITY CONTROL AND QUALITY ASSURANCE

QC activities to be practiced during the performance of this method include the following.

- Use only clean, 15-mL plastic centrifuge tubes, drill bit, PVC plastic dust scatter control tube, and chisel. If these are not clean, they must be thoroughly washed in soapy water, rinsed thoroughly in deionized water, and then air dried or blotted dry with a laboratory wipe before use.
- Clean funnel and fresh weighing paper. Use a new funnel for every sample or clean a used funnel with a lightly wetted lab towel and allow to air dry.
- Carefully record the sample tube label number on a sampling log and/or in a field notebook. Adequately describe the sample collection location and characteristics of the paint, such as estimated thickness, color, and number of layers.
- Prior to collecting samples, a QC sample should be prepared for about every 20th sample anticipated to be collected. This will consist of nominally 0.1 g of a NIST paint reference material, such as NIST SRMs 2580 at nominally 4% Pb,[14] 2581 at nominally 0.5%,[15] or 2582 at nominally 200 mg/kg.[16] Alternatively, excess Environmental Lead Proficiency Analytical Testing (ELPAT)[10] program materials may be purchased from the American Industrial Hygiene Association[17] for this purpose. The samples are to be weighed to within ±0.001 g (±1 mg). Simple scales for use in the field are available for this purpose, for example, the Gempro500 from Precision Weighing Balances, Bradford, MA; in the laboratory, a standard analytical balance is used to weigh the paint samples. The weighed QC sample is to be poured through a vertically mounted, clean funnel into a test tube following the standard procedure. Also, a QC sample is to be placed on a well-brushed, presampled place on a horizontal surface and then collected following the standard procedure.

7.0 PROCEDURE

7.1 Vertical Surface Sampling Procedure Using a Modified Wood Bit and a Variable-Speed Electric Drill

7.1.1 Remove the cap from the 15-mL vial and tape the vial to the bottom of the smaller paper funnel that is taped to the larger funnel.

7.1.2 Tape the funnel to the vertical surface (see Figure 5).

Figure 5. Paper funnel attached to wall for collection of drilled-out paint sample.

7.1.3 Hold the plastic pipe section in place at the sampling position.

7.1.4 Press the modified drill bit point into the surface to be sampled within the plastic pipe section just above the funnel notch (see Figure 6).

Figure 6. Sampling vertical surface using modified drill bit, PVC plastic pipe section, combined paper funnels, and 15-mL plastic centrifuge tube.

7.1.5 Drill slowly, which will minimize any material being thrown outside the funnel. Take care to keep the drill bit perpendicular to the surface. Drill cautiously and deliberately until the paint is removed, leaving only the substrate. A 1.27-cm^2 paint sample will be collected with the 1/2-in (1.27-cm) modified drill bit.

7.1.6 Carefully remove the drill bit and plastic pipe section, taking care that all loose particles fall into the funnel.

7.1.7 Tap the plastic pipe and the sides of the funnel to shake any material that may cling to the sides of these into the sample collection tube.

7.1.8 Use a clean brush to transfer any additional paint from the sample location, the plastic pipe section, and the drill bit into the funnel and then sweep down the sides of the funnel to direct remaining particles into the sample tube. Tap the brush lightly on the edge of the funnel to shake residual particles in the brush into the funnel.

7.1.9 Remove the labeled tube from the bottom of the funnel and replace the cap.

[*Note*: Old, thick, brittle paint samples may break as the drilling is being performed, as illustrated in Figure 7. If the samples are to be weighed, this is not an issue. If they are to be analyzed on the basis of area, it will be necessary to estimate the additional area of the sample collected.]

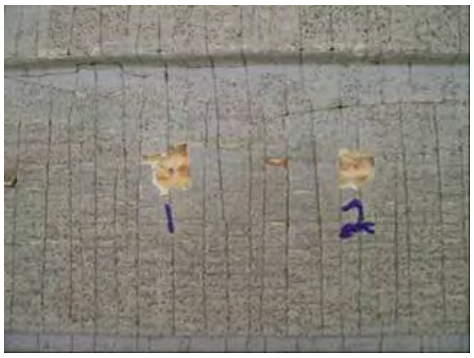

Figure 7. Illustration of the unwanted breakage that may occur when using the modified drill bit method to collect old, thick, brittle paint samples.

7.2 Horizontal Surface Sampling Procedure Using Modified Wood Bit and a Variable-Speed Portable Electric Drill

7.2.1 Press the modified drill bit point into the surface to be sampled within the plastic pipe section.

7.2.2 Drill slowly, which will minimize any material being thrown outside the plastic pipe section. Take care to keep the drill bit perpendicular to the surface. Drill cautiously and deliberately until the paint is removed, leaving only the substrate. A 1.27-cm^2 paint sample will be collected with the 1/2-in (1.27-cm) modified drill bit.

7.2.3 Carefully remove the drill bit and plastic pipe section, taking care that all loose particles remain on the sampling location.

7.2.4 Use a clean brush to wipe any additional paint from the PVC plastic pipe section and the drill bit onto a piece of glazed weighing paper.

7.2.5 Using the brush, carefully sweep the sample from the test surface onto this same weighing paper. Tap the brush lightly on the edge of ones' finger to shake residual particles in the brush onto the paper.

7.2.6 Pour the sample from the weighing paper into a labeled sampling tube, gently tap the paper to remove residual particles, and cap the tube.

7.3 Alternate Vertical Surface Sampling Procedure Using Wood Chisel and Hot Air Gun

7.3.1 Use the 1 x 1-cm plastic template or metal template and a pencil or other marking tool to delineate the 1-cm^2 area to be sampled. Remove the template and use a scalpel, hobby knife, or the chisel to cut around the edges of the 1-cm^2 sample area.

7.3.1.1 Optionally, one may use the hot air gun to soften the paint before circumscribing the sample with a cutting tool. The paint should be heated until just soft or just starting to blister.

7.3.2 Remove the cap from the 15-mL vial, and tape the vial to the bottom of the paper funnel.

7.3.3 Tape the funnel to the vertical surface (see Figure 5).

7.3.4 Use the wood chisel to slowly and deliberately remove the paint, taking care that it falls into the funnel. The chisel should be pushed with steadiness and deliberation so as to remove the entire paint sample without removing any substrate.

7.3.5 Tap on the sides of the funnel to shake any material that may cling to the sides of the funnel into the sample tube. If the paint sample is too large to pass through the funnel into the sample tube, one will need to turn the funnel over and "pour" the paint sample into the sample tube. ASTM Method E1729-05[5] calls for taping a tray made from folded 8.5 x 11-in (22 x 28-cm) paper under the collection site for catching the paint sample. If the sample is too large to fit into the tube, it should be placed on a piece of weighing paper, the paper folded over the paint, and the paint sample carefully broken into two or three smaller pieces by manual pressure so as to fit in the sample tube; any small particles created during this process should be brushed into the sample tube.

7.3.6 Use a clean brush to wipe any additional paint from the sample location and the wood chisel into the funnel and then sweep down the sides of the funnel to direct remaining particles into the sample tube. Tap the brush lightly on the edge of the funnel to shake residual particles in the brush into the funnel.

7.3.7 Remove the sample tube from the bottom of the funnel and replace the cap.

7.4 Alternate Horizontal Surface Sampling Procedure Using Wood Chisel and Hot Air Gun

7.4.1 Use the 1 x 1-cm. plastic template or metal template and a pencil or other marking tool to delineate the 1-cm^2 area to be sampled. Remove the template and use a scalpel, hobby knife, or the chisel to cut around the edges of the 1-cm^2 sample area.

7.4.1.1 Optionally, one may use the hot air gun to soften the paint before circumscribing the sample with a cutting tool. The paint should be heated until just soft or just starting to blister.

7.4.2 Use the wood chisel to slowly and deliberately lift up and remove the paint. The chisel should be pushed with steadiness and deliberation so as to remove the entire paint sample without removing any substrate.

7.4.3 Using a clean small brush, carefully and thoroughly sweep the sample onto the glazed weighing paper. ASTM Method E1729-05[5] calls for taping a tray made from folded 8.5 x 11-in (22 x 28-cm) paper at the edge of the sampling site for collecting the paint sample.

7.4.4 Transfer the sample from the weighing paper into the labeled sample tube. Use the brush to sweep any remaining particles from the paper into the tube, lightly tap the brush fibers over the opening of the tube, and replace the cap. If the sample is too large to fit into the tube, is should be placed on a piece of weighing paper, the paper folded over the paint, and the paint sample carefully broken into two or three smaller pieces by manual pressure so as to fit in the sample tube; any small particles created during this process should be brushed into the sample tube. If necessary, use a scalpel or scissors to cut a large sample into smaller pieces.

7.4.5 Lightly tap the brush fibers over the opening of the tube before capping it.

8.0 DATA CALCULATION

The collected paint sample may be measured by its area (cm^2) or by its mass or weight (g). The analysis following extraction will yield a value of total µg or mg of Pb in the extract. To calculate the concentration in weight per unit area, divide the total value for the Pb measured by the area of the paint sample. For example,

$$\text{mg Pb/cm}^2 = \text{mg Pb measured/area of paint sample in cm}^2.$$

To calculate the concentration in percent, divide the total µg or mg of lead measured by the mass of the paint sample and multiply by 100. For example,

$$\text{\% Pb} = 100 \times (\text{mg Pb measured/mg of paint sample extracted}).$$

9.0 DATA AND RECORDS MANAGEMENT

Keeping accurate and complete records will help assure that the final results of the testing can be used to make decisions about risk and the need for lead-in-paint treatment. Activities to be performed include those that follow.

- Maintain all records in a bound notebook or on a form prepared specifically for recording information pertinent to this SOP. The forms shall be maintained in a binder.
- Each paint sample shall be given an identifying name or number that is recorded along with a description of the sample. This description shall indicate the source of the paint, including identification of the building, room or other space, and the sampling points in the room or space; it is recommended that digital photographs of the sampling points be taken. Records of the physical attributes of the paint, including color, estimated number of layers, estimated thickness, and degree of brittleness shall be collected.

- The label placed on the 15-mL extraction tube shall be the same as the name or number of the paint sample. If the tube is given a different label, an accurate record must be maintained that relates the tube label to the name or number of the paint sample placed in the tube.
- The date and time of the paint sample collection shall be recorded in the notebook or on the form.
- The person performing the paint sample collection shall be identified in the notebook or on the form.

10.0 WASTE MANAGEMENT

There are several forms of waste generated during the operation of this SOP; they are discussed below.

10.1 Wash Water

The wash water from cleaning the drill bit, PVC plastic tube, and/or chisel is to be poured into a 5-L, polyethylene carboy that is carefully labeled with a description of the contents or can simply be poured down the drain because the lead in the wash water will be minimal.

10.2 Leaded Paint

Excess paint chips or paint powders that are no longer needed are to be placed in a resealable plastic bag. The bag is to be labeled with a description of the contents, the source(s) of the paint, and the name of the person who has placed these materials in the bag. This waste paint shall be delivered to a commercial firm that specializes in removal of hazardous waste.

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(11) Robert Bosch Tool Corporation, Mt. Prospect, IL. Skil,Model 6260. (Available from home hardware stores.)

(12) S&S Concepts, Inc., Elk Grove, IL. Large funnel, Part # FF03-0140 and small funnel, Part # FF05-0120. (Available from the manufacturer directly or automobile supply stores.)

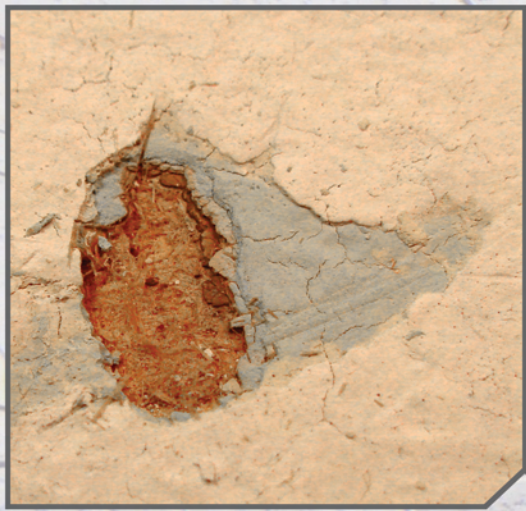
(13) Wagner Spray Tech Corp., Minneapolis, MN. Model HT 775 Heat Gun. (Available from home hardware stores.)

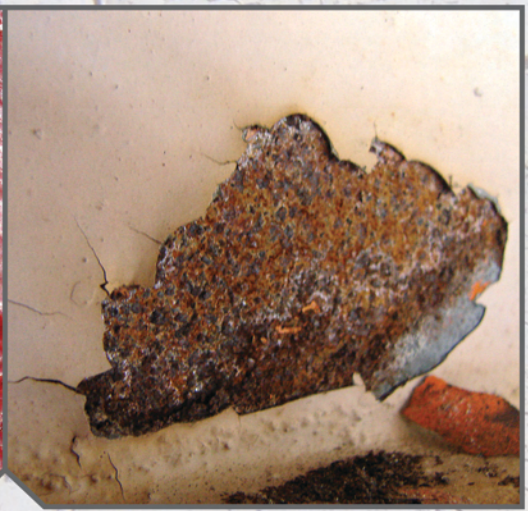
(14) NIST. 1996. Certificate of Analysis. Standard Reference Materials 2580, Powdered Paint, Nominal 4% Lead. National Institute of Standards and Technology: Gaithersburg, MD.

(15) NIST. 1997. Certificate of Analysis. Standard Reference Materials 2581, Powdered Paint, Nominal 0.5% Lead. National Institute of Standards and Technology: Gaithersburg, MD.

(16) NIST. 1996. Certificate of Analysis. Standard Reference Materials 2582, Powdered Paint, Nominal 200mg/kg Lead. National Institute of Standards and Technology: Gaithersburg, MD.

(17) American Industrial Hygiene Association, 2700 Prosperity Ave., Suite 250, Fairfax, VA 22031.





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ATTACHMENT E

Phase II ESA Photo log

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PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No. 1	Date: 10/21/2016
Photo Coordinates	
Lat	46.447842
Long	-108.54425
Direction Photo Taken: 321.654205607477	
Description: Facade of the Central School Campus Music Room Building.	

Photo No. 2	Date: 10/20/2016
Photo Coordinates	
Lat	46.447944
Long	-108.544564
Direction Photo Taken: 47.8295605858855	
Description: Newer vinyl windows with LBP on window frames.	

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No.	Date:
3	10/20/2016

Photo Coordinates	
Lat	46.448014
Long	-108.544617

Direction Photo Taken:
39.4121996303142

Description:

LBP present on the window frame, white siding above the door, and the red door.

Photo No.	Date:
4	10/20/2016

Photo Coordinates	
Lat	46.448228
Long	-108.544319

Direction Photo Taken:
324.021660649819

Description:

LBP present on both doors and frames. Also the location of the two lead-in-soil samples.

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No.	Date:
5	10/20/2016

Photo Coordinates	
Lat	46.448053
Long	-108.544289

Direction Photo Taken:
258.765625

Description:

Back storage room area. Drywall and plaster in these rooms were confirmed to be ACM.

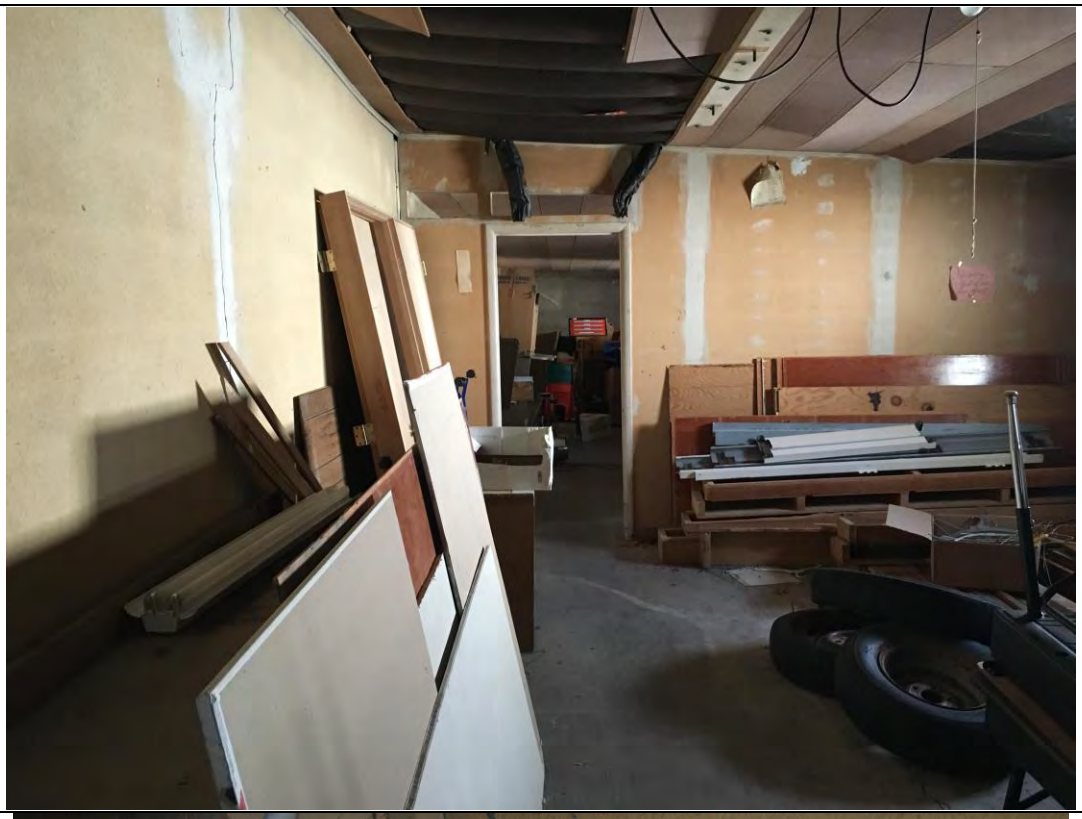


Photo No.	Date:
6	10/20/2016

Description:

Confirmed ACM plaster sample CSC-B4-PL02-24.

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No.	Date:
7	10/20/2016

Description:

Confirmed ACM plaster sample CSC-B4-PL02-25.

Photo No.	Date:
8	10/20/2016

Description:

Confirmed ACM door caulk sample CSC-B4-DC01-30.

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No.	Date:
9	10/20/2016

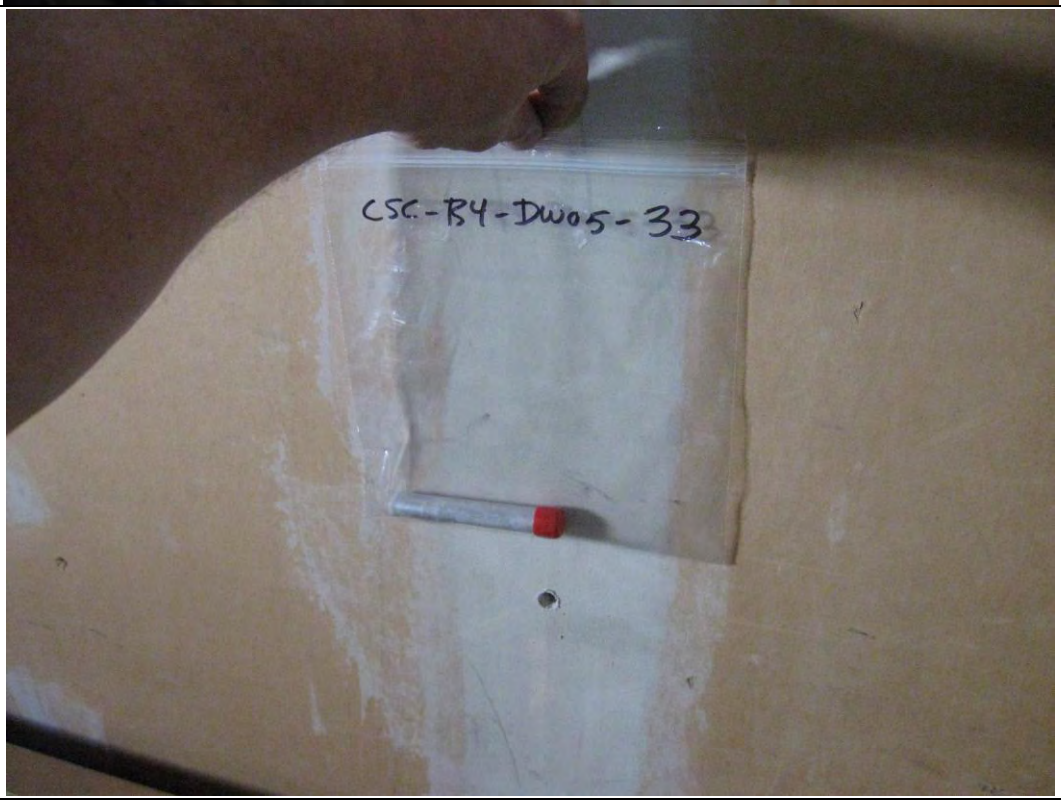
Description:

Confirmed ACM drywall sample CSC-B4-DW05-32.

Photo No.	Date:
10	10/20/2016

Description:

Confirmed ACM drywall sample CSC-B4-DW05-33.



PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No.	Date:
11	10/20/2016

Description:

Confirmed ACM drywall sample CSC-B4-DW05-34.

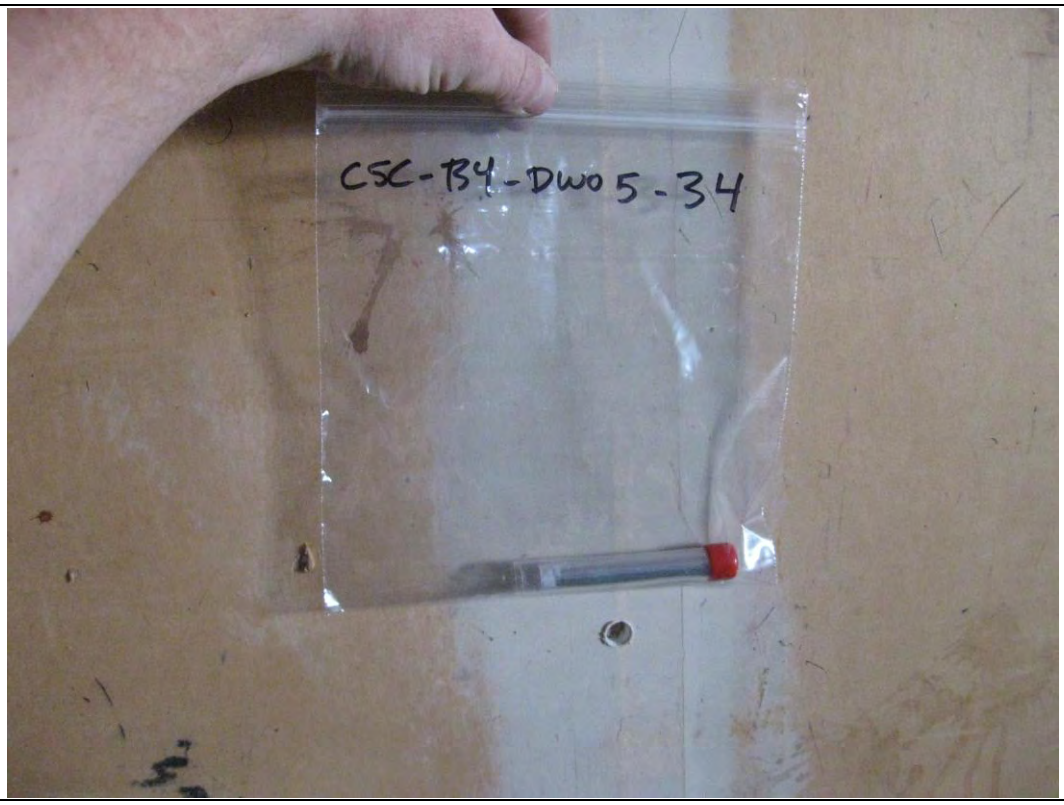


Photo No.	Date:
12	10/20/2016

Photo Coordinates	
Lat	46.447956
Long	-108.545189

Direction Photo Taken:
101.546391752577

Description:
LBP present on white wood paneling. Also fiberglass insulation is seen here.

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No. 13	Date: 10/20/2016
Photo Coordinates	
Lat	46.448086
Long	-108.544297

Direction Photo Taken:
68.744966442953

Description:

ACM plaster walls and LBP on walls, door, and window frames.

Photo No. 14	Date: 10/20/2016
Photo Coordinates	
Lat	46.448058
Long	-108.544311

Direction Photo Taken:
265.955284552846

Description:

Vermiculite present around coolers. Sample CSC-B4-VI01-26 taken here was trace for asbestos but was point counted below one.

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No. 15	Date: 10/20/2016
Photo Coordinates	
Lat	46.447967
Long	-108.544167
Direction Photo Taken: 240.892806770099	
Description: Mold encountered on wood in the plenum.	

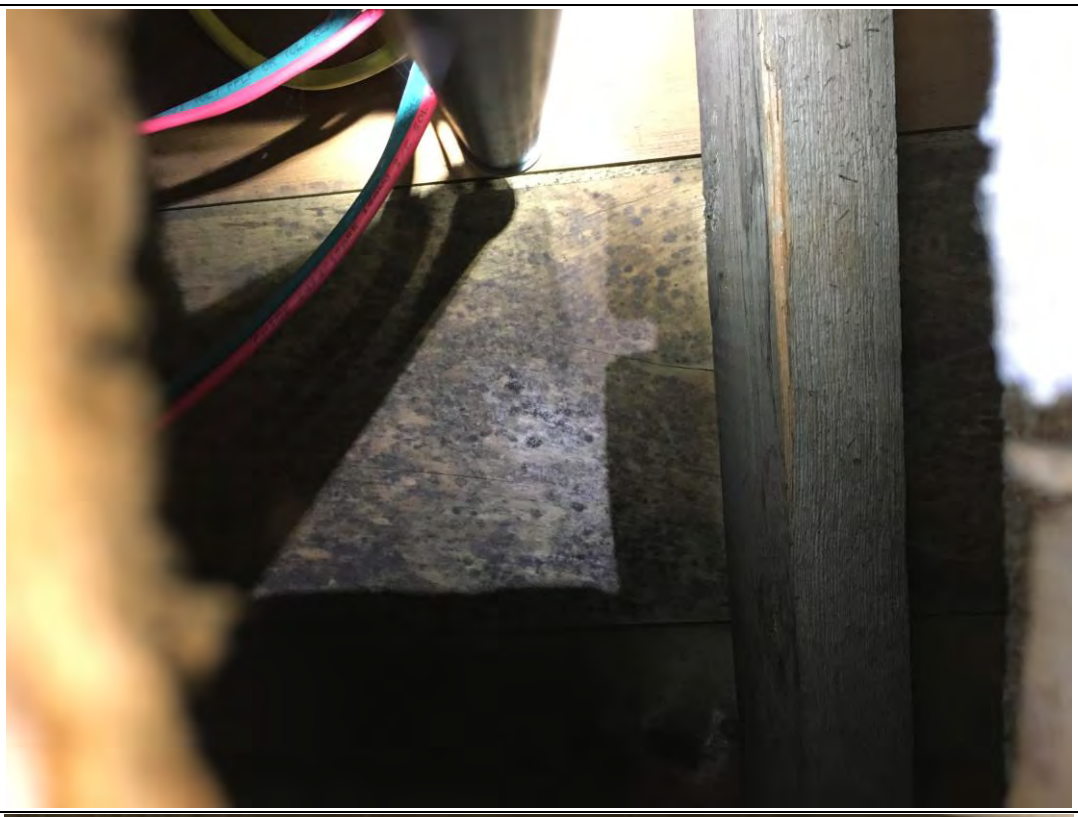


Photo No. 16	Date: 10/20/2016
Photo Coordinates	
Lat	46.448039
Long	-108.544311
Direction Photo Taken: 1.71108995716326	
Description: Potential PCB containing ballast observed.	

PHOTOGRAPH LOG

Project Name:	Site Location:	Project No.
Central School Campus – Music Room	Roundup, Montana	0003/1608-10

Photo No. 17	Date: 10/20/2016
Photo Coordinates	
Lat	46.448228
Long	-108.544197

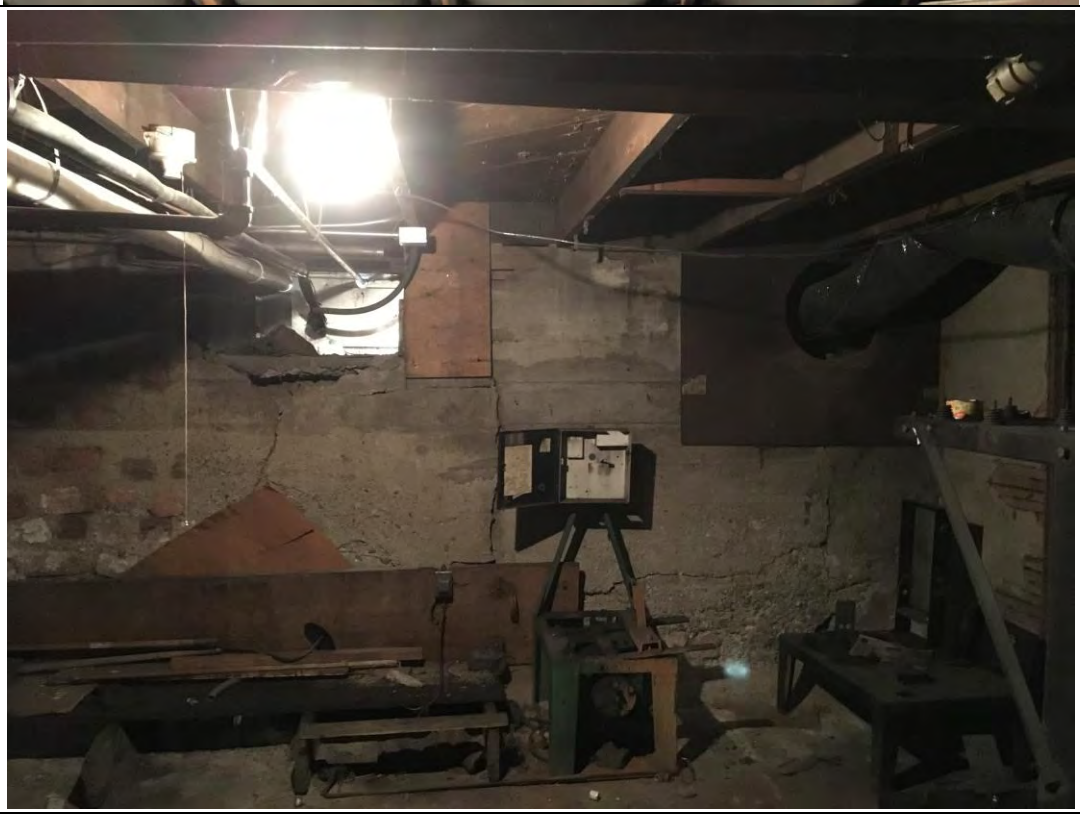
Direction Photo Taken:
167.260377358491

Description:

Wool insulation present on ceiling in back storage area.

Photo No. 18	Date: 10/20/2016
Photo Coordinates	
Lat	46.448189
Long	-108.544

Direction Photo Taken:
78.987460815047

Description:

Some piping in the basement. Only fiberglass or rubber insulations were observed.