Comprehensive Monitoring Program
Sampling and Analysis Plan

for the

UMATILLA CHEMICAL AGENT DISPOSAL
FACILITY
AND UMATILLA CHEMICAL DEPOT
HERMISTON, OREGON

Final Revision 3

May 28, 1999

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1.0 Introduction Organization

The Umatilla Chemical Depot (UMCD) is located in Northeastern Oregon in Umatilla and Morrow counties, and is approximately six miles southwest of the City of Umatilla, Oregon. The UMCD stores chemical agents in projectiles, ton containers, rockets, bombs, spray tanks, and land mines. The Umatilla Chemical Agent Disposal Facility (UMCDF) is being constructed within the UMCD boundaries. The UMCDF will consist of numerous components, some of which are incinerators, brine reduction equipment (flash evaporators and drum dryers), waste storage areas, and laboratory and support facilities. The purpose of the UMCDF is to destroy the UMCD stockpile of chemical weapons.

The U.S. Army Program Manager for Chemical Demilitarization (PMCD) applied for a hazardous waste permit in March 1995. Prior to issuance of the permit, the Oregon Department of Environmental Quality (Oregon DEQ) conducted a pre-trial burn risk assessment (pre-RA) to provide preliminary estimates of potential human health and ecological risks associated with operation of the UMCDF. The pre-RA indicated that the UMCDF would not have an adverse effect on human health or the environment (Ecology and Environment, 1997).

Following an extensive public comment period, the Environmental Quality Commission and Oregon DEQ issued the Permit (I.D. No. OR6 213 820 917) for the Storage and Treatment of Hazardous Waste ("Hazardous Waste Permit") to the UMCD and the UMCDF on February 12, 1997. The Hazardous Waste Permit was re-issued with a new identification number (ORQ 000 009 431) in January 1999. As a result of public comment, the Environmental Quality Commission required that the UMCD and UMCDF establish a Comprehensive Monitoring Program (CMP).

The purpose of the CMP is to confirm the projections of the pre-RA. The CMP will monitor for the presence of chemical warfare agents and other analytes to document that concentrations in air, soil, surface water, and biota during and after UMCDF operations remain at or below the concentrations predicted in the pre-RA. The CMP is divided into three phases : baseline, operational, and post-operational monitoring. The baseline phase is two years prior to the start of the thermal operations. Operational monitoring will begin at the start of thermal operations. Post-operational monitoring will begin following the conclusion of hazardous waste treatment operations at UMCDF.

This document discusses all the requirements for performing the CMP and to meet the conditions of the Hazardous Waste Permit for the UMCDF. The organization of the document is based on the U.S. Environmental Protection Agency's requirements for quality assurance project plans for environmental data operations (EPA, 1997). The appendixes include the sampling methods for air monitoring, collection of soil, surface water, and biota, and site descriptions.

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2.0 Project/Task Organization

The purpose of this Sampling and Analysis Plan (SAP) is to provide the requirements needed to conduct the sampling and analysis for the CMP for the UMCD and UMCDF. Figure 2-1 shows the organization for the CMP. The SAP will be conducted for Raytheon Demilitarization Company (RDC) by the CMP Contractor. The CMP Contractor will be responsible for field sampling, laboratory analyses, data validation, statistical analyses, and report preparation (Figure 2-2). RDC will implement the CMP contract under the direction of the U.S. Army Project Manager for Chemical Stockpile Disposal (PMCSD) and as specified in the Hazardous Waste Permit for the UMCDF issued by the Environmental Quality Commission and Oregon DEQ.

The CMP Contractor shall identify the individuals and/or organizations participating in the project and discuss their specific roles and responsibilities. The CMP Contractor shall ensure that the Project Quality Assurance manager is independent of the unit generating the data. The CMP Contractor shall describe the organizational relationships and levels of communication among all project participants including subcontractor relationships.

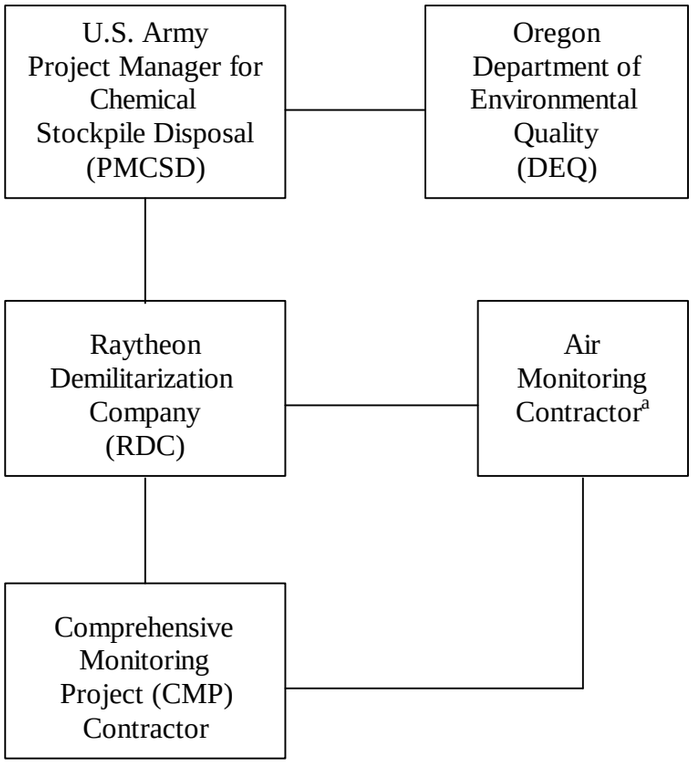

Figure 2- 1: Comprehensive Monitoring Program Organization Chart

[a]The Air Monitoring Contractor is the on-site chemical demilitarization laboratory contractor.

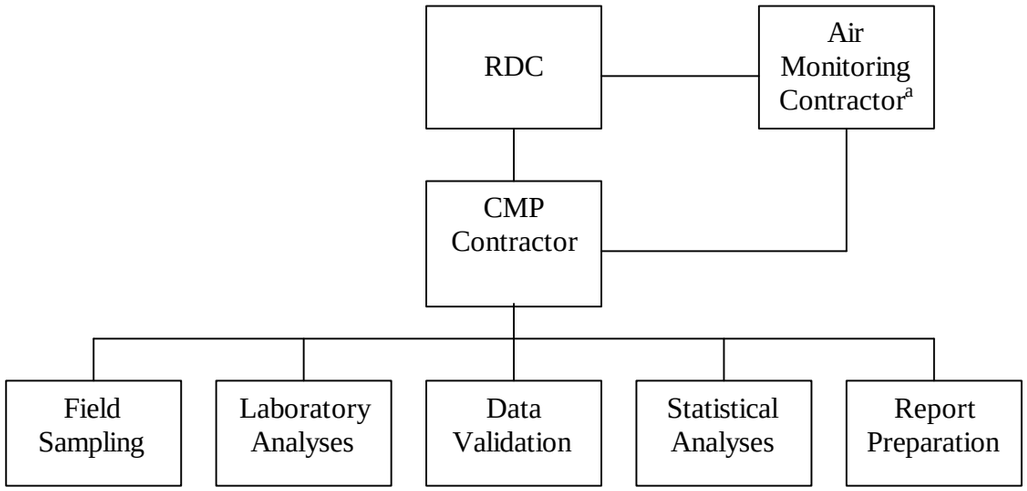

Figure 2- 2. Comprehensive Monitoring Program Contractor Organization Chart

[a]The Air Monitoring Contractor is the on-site chemical demilitarization laboratory contractor.

Table 2- 1. Roles and Responsibilities for Leads in Figure 2-2

Role	Responsibilities
RDC Technical Manager	Receives direction from PMCSD and provides oversight to the Air Monitoring Contractor and CMP Contractor. Receives all reports of nonconformance corrective actions, and is responsible for changes to procedures and methodologies to prevent recurrence.
Air Monitoring Contractor Project Manager	Receives direction from RDC. Provides on-site chemical demilitarization laboratory services. Operates all air monitoring systems (DAAMS) and analyzes all air monitoring samples. Provides laboratory results to CMP Contractor for data validation of results and inclusion of the data in quarterly and annual reports.
CMP Contractor Project Manager	Receives direction from RDC. Provides oversight to field samplers, laboratories, data validators, and statisticians. Has responsibility and authority to effect corrective actions on a day-to-day basis and reports nonconformance to the RDC technical manager. Responsible for overseeing sample collection and tracking from the field through the laboratory. Notifies the RDC Technical Manager in case of nonconformances with sample handling procedures and laboratory holding times. Responsible for overall health and safety program, preparation of health and safety plan, and conducting appropriate training. Notifies the RDC Technical Manager of any nonconformances with health and safety procedures/practices.
Field Sampling Task Manager*	Receives direction from CMP Contractor Project Manager. Leads all field sampling activities and is responsible for field records. Initiates chain-of-custody documentation. Responsible for implementing health and safety procedures in the field. Notifies CMP Contractor Project Manager of any disturbances at sites or any nonconformances with field sampling activities. Provides input to the quarterly and annual reports.
Laboratory Analyses Task Manager*	Receives direction from CMP Contractor Project Manager. Oversees all laboratory activities. Notifies CMP Contractor Project Manager in case of nonconformances with laboratory activities.
Data Validation Task Manager*	Receives direction from CMP Contractor Project Manager. Oversees all data validation activities. Notifies CMP Contractor Project Manager in case of nonconformances with data validation. Provides input to the quarterly and annual reports.
Statistical Analyses Task Manager*	Receives direction from CMP Contractor Project Manager. Oversees all statistical analyses. Notifies CMP Contractor Project Manager in case of nonconformances with the data. Provides input to the quarterly and annual reports.
Report Preparation Task Manager*	Receives direction from CMP Contractor Project Manager. Oversees the development of the quarterly and annual reports. Notifies CMP Contractor Project Manager in case of nonconformances with the reports.

*CMP Contractor may choose to combine these tasks.

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3.0 Problem Definition

The CMP is designed to meet the conditions of the Hazardous Waste Permit for the UMCDF. The purpose of the program is to confirm the projections of the pre-RA – the UMCDF would not have an adverse effect on human health or the environment. The CMP will monitor for the presence of chemical agents and other analytes to document that concentrations in air, soil, surface water, and biota during UMCDF operations remain at or below the concentrations predicted in the pre-RA.

The CMP does not provide monitoring for public or worker safety, or provide real-time data for use in any type of emergency response scenario. This type of monitoring is covered by the U.S. Army's Chemical Stockpile Emergency Preparedness Program. The CMP also does not include the agent monitoring which occurs within the UMDCF and the UMCD storage area.

The CMP will monitor air deposition of chemical agents and risk driving analytes (RDAs) in air, soil, surface water, and biota at the sites selected in the CMP Workplan (Tables 3-1 and 3-2). Monitoring of these media prior to trial burns at the UMCDF will be used to calculate a baseline threshold value for each analyte (See Table 3-1 for RDAs). Operational monitoring after the trial burn will be compared to the baseline threshold values to determine if statistically significant increases are occurring during operation of the UMCDF. The CMP Workplan describes how to calculate the baseline threshold values and how to compare operational and post-operational monitoring samples to the baseline threshold values. The data collected during the CMP will be available for use in future risk assessments.

Table 3-1: Chemical Agents to be Monitored

Abbreviated Name	Chemical Name
GB	O-isopropyl methylphosphonofluoridate
VX	O-ethyl-S-(2-diisopropylaminoethyl) methylphosphonothiolate
HD	bis(2-chloroethyl)sulfide

Table 3-2: Risk Driving Analytes to be Monitored[a]

Metals	**PCBs (Polychlorinated Biphenyls)[c]**
antimony	3,3',4,4'-tetrachlorobiphenyl (PCB 77)
arsenic	2,3,3',4,4'-pentachlorobiphenyl (PCB 105)
beryllium	2,3,4,4',5-pentachlorobiphenyl (PCB 114)
cadmium	2,3',4,4',5-pentachlorobiphenyl (PCB 118)
chromium	2',3,4,4',5- pentachlorobiphenyl (PCB 123)
manganese	3,3',4,4',5- pentachlorobiphenyl (PCB 126)
mercury	2,3,3',4,4',5'-hexachlorobiphenyl (PCB 156)
thallium	2,3,3',4,4',5'- hexachlorobiphenyl (PCB 157)
	2,3',4,4',5,5'- hexachlorobiphenyl (PCB 167)
Semivolatile Organics	3,3',4,4',5,5'- hexachlorobiphenyl (PCB 169)
bis(2-ethylhexyl)phthalate	2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)
4-methylphenol	2,2',3,4,4',5,5'- heptachlorobiphenyl (PCB 180)
	2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)
Furans (Polychlorinated Dibenzofurans)[b]	
2,3,7,8-tetrachlorodibenzofuran	**Dioxins (Polychlorinated Dibenzodioxins)[b]**
1,2,3,7,8-pentachlorodibenzofuran	2,3,7,8-tetrachlorodibenzo-p-dioxin
2,3,4,7,8- pentachlorodibenzofuran	1,2,3,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-hexachlorodibenzofuran	1,2,3,4,7,8- hexachlorodibenzo-p-dioxin
1,2,3,6,7,8- hexachlorodibenzofuran	1,2,3,6,7,8- hexachlorodibenzo-p-dioxin
1,2,3,7,8,9- hexachlorodibenzofuran	1,2,3,7,8,9- hexachlorodibenzo-p-dioxin
2,3,4,6,7,8- hexachlorodibenzofuran	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-heptachlorodibenzofuran	1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin
1,2,3,4,7,8,9-heptachlorodibenzofuran	

[a] Hydrogen chloride was identified in the pre-RA but is not included in this Table due to the fact that hydrogen chloride is an unstable compound that will decompose upon contact with alkaline soils and water. Periodic sampling minimizes the likelihood of detecting this compound.

[b] Dioxins and furans can be formed from the operation of boilers, automobile exhaust, and brush fires. The dioxin 2,3,7,8 - tetrachlorodibenzo-p-dioxin was evaluated for the pre-RA. All of the polychlorinated dibenzodioxins and polychlorinated dibenzofurans required for a Toxic Equivalency calculation will be monitored for the CMP.

[C] All PCB congeners required for a Toxic Equivalency calculation will be monitored for the CMP.

4.0 Project/Task Description

The purpose of this SAP is to establish the processes and criteria for the comprehensive monitoring of the UMCDF (Zone 1) and identified areas outside the UMCDF (Zones 2 and 3). The sample site locations are described in Appendix D. These areas will be monitored for the presence of chemical agents and other analytes to document the concentrations in air, soil, surface water, and biota during UMCDF operations (Table 4-1).

Table 4- 1. Sites, Media, and Analytes for CMP

		Chemical Agents Sampling		Risk Driving Analytes Sampling		
Zone	Total Sites	Air	Soil	Soil	Biota	Water
1	19	12	4	10	9	-
2	8	-	4	8	8	4
3	7	-	1	7	2	-

There are five major tasks to be performed by the CMP Contractor: 1) field sampling; 2) laboratory analyses; 3) data validation; 4) statistical analyses; and 5) report preparation (see Figure 2-2). This SAP contains requirements for these tasks.

4.1 Field Sampling

Ambient air sampling will be performed only in Zone 1 for chemical agents (Table 3-1) and is known as the perimeter monitoring network (PMN). The air samples will be collected by a system of negative-pressure tubes, called the Depot Area Air Monitoring System (DAAMS). DAAMS tubes are filled with an adsorbent material and a vacuum pump continuously draws air through each tube. Any chemical agents, GB (commonly called " sarin"), VX, and/or HD (commonly called "mustard") in the air will be trapped on the adsorbent material. The tubes are changed out every 12 hours and sent to the UMCDF laboratory for analysis. Baseline air samples will be collected for one year prior to the beginning of thermal operations, which will provide hundreds of data points for each chemical agent at each location. The data will be used to establish baseline threshold values in air for chemical agents and note any interferences before the UMCDF has started thermal operations. Further discussion on ambient air sampling can be found in Appendix B.

The timetable for collection of the baseline soil, surface water, and biota samples is a two-year period prior to the beginning of thermal operations. In the event that there is a delay in the start of operations at UMCDF, quarterly sampling will continue even if eight quarters of data have already been collected. Collections will be performed on a quarterly basis during winter, spring,

summer, and fall. The quarterly collection period will involve a ten working day window that allows sufficient time to collect biota and for appropriate weather considerations. The winter quarter will be timed to coincide with a temperature inversion. The results of each quarterly collection period will be summarized in quarterly reports. In order to calculate the baseline threshold values of chemical agents and RDAs, there must be five or more sampling events. A report summarizing the first year of baseline sampling will include recommendations for the sampling frequency and number of samples to be taken prior to thermal operations in order to ensure that a sufficient amount of data will be collected for calculating the baseline threshold values.

Soil samples are being collected to determine if statistically significant increases in chemical agents and RDAs are occurring due to air deposition when comparing baseline levels to UMCDF operation levels. There are 25 sites that will be sampled and analyzed for risk driving analytes. In addition, nine of the 25 sites will have soil samples analyzed for chemical agents. All of the sites are covered in vegetation, which will interfere with the analysis of the soil and increase the variability of the quarterly monitoring. In order to minimize the variability within a site and between sites, soil sampling stations will be constructed at each site for quarterly monitoring.

The quarterly monitoring soil sampling stations consist of an excavated area (50 cm by 50 cm, and 20 cm deep), lined with Tyvec, and filled with soil representative of the soil in the surrounding area. Prior to installation of the soil sampling stations, a geologist will visually inspect the soils in the vicinity of each sample site to determine the appropriate soil type. This will be documented in the first quarterly report. The top 1 cm surface of the stations will be sampled.

To monitor long-term deposition, three additional soil sampling stations will be constructed at three sites in Zone 1 (Sites 1-3, 1-4, and 1-7) for annual monitoring. The annual monitoring soil sampling stations will have a larger excavated area (approximately 50 cm by 130 cm, and 10 cm deep) yet will be constructed in the same manner as the quarterly monitoring soil sampling stations. The area of the station will be divided into 10 areas, each 25 cm by 25 cm. Annually, a new area of the station will be sampled to a depth of 1cm.

In case of snow covering the ground, no soil samples will be taken until the snow has melted since the snow will interfere with monitoring from air deposition. If the samples are delayed considerably, then the analytical results will be reported in the next quarterly report. Further discussion on soil sampling can be found in Appendix C.

Surface water samples are being collected to determine if statistically significant increases in RDAs are occurring when comparing baseline levels to UMCDF operation levels. They are being collected at four sites in Zone 2. The samples can be collected in a bucket on a line by standing along the dam or bridge at Sites 2-4 and 2-2. Surface water can be collected at Sites 2-1 and 2-5 while standing along the shore of the ponds or by wading into the water. Dedicated Teflon sampling buckets will be used for each site and will be cleaned before field sampling. In case ice covers the surface of the water, no sample will be taken. Water samples will be taken when the ice has melted since the ice will interfere with monitoring from air deposition. If the samples are delayed considerably, then the analytical results will be reported in the next

quarterly report. A sample will not be taken during the ten-day sampling event in the summer sampling period if the pond has dried up and there is no surface water. Further discussion on surface water sampling can be found in Appendix C.

Biota samples are being collected to determine if statistically significant increases in RDAs are occurring due to air deposition when comparing baseline levels to UMCDF operation levels. Vegetation, insects, and small mammals will be collected at 19 sites throughout Zones 1, 2, and 3. The most predominant forms of vegetation at all the sites are grasses. The surface of the grasses will accumulate contaminants from air deposition throughout the year even though the grass species will be dormant for a period of time. Samples of the grasses will be collected by walking a transect and sampling the grasses along random points of the transect. Sampling will involve cutting the shoots at a height approximately 4 cm above the soil surface and placing the grass shoots in certified cleaned glass containers. The roots will not be sampled. Further discussion on vegetation sampling can be found in Appendix C.

Insects are an important part of the food chain in the shrub-steppe habitat. Because they interact with soil and vegetation, they will likely accumulate air deposited contaminants from both of those media. Crawling insects will be collected in pit falls set up overnight at random points along a transect. Flying and hopping insects will be collected with a sweep net during the evening while the sampler walks along a transect. All insects will be composited in certified cleaned glass containers. Further discussion on insect sampling can be found in Appendix C.

In addition to insects, small mammals are an important part of the food chain in the shrub-steppe habitat. Mice will be the most abundant small mammals at the sampling sites. Since mice generally live more than one year, they will likely assimilate more air deposited contaminants than grasses and insects. The organic contaminants will concentrate in the fatty tissues of the body, while the heavy metals will concentrate in the muscles. Therefore, separate individuals will be analyzed for the risk driving analytes. A combination of snap traps and Sherman live traps should be used. Snap traps should be used in Zone 1, where the diversity of small mammals is low and the incidence of catching undesirable species is low. Sherman live traps should be used in Zones 2 and 3, especially at sites near residential areas. Traps will be set up at the sites in a 10 m by 10 m grid (or equivalent spacing depending on size of sample site) during the evening, and they will be recovered early the following morning. The specimen for metal analyses will be put in certified cleaned glass containers, separate from the specimen for organic analyses. Metal analyses will be done on the specimen without skin, stomach, and intestines. Organic analyses will be done on whole bodies. Further discussion on small mammal sampling can be found in Appendix C.

4.2 Laboratory Analyses

Laboratory analyses will be done on all media for the specified analytes. Appropriate quality assurance/quality control protocols will be followed as discussed in later sections of the SAP. The laboratories will deliver analytical data packages for air, soil, surface water, and biota samples in an electronic and hard copy format to the CMP Contractor (or to the Data Validators

if the CMP Contractor prefers). Information from the laboratory will be entered into the CMP database.

4.3 Data Validation

Data validation will be done by a third party, independent from the CMP Contractor and the laboratories. The data validation packages will be delivered electronically to the CMP Contractor. Data validation results (flags on data that do not meet all the quality objectives) will be included in the CMP database.

4.4 Statistical Analyses

Statistical analyses are critical to achieve the purpose of the CMP. Baseline threshold values will be calculated for monitoring prior to operation of the UMCDF based on the statistical approach in Oregon DEQ guidelines. Monitoring results after operation of the UMCDF begins will be statistically compared to baseline threshold values to determine if there are significant increases in analyte concentrations.

4.5 Report Preparation

The monitoring results will be reported quarterly. Statistical analyses and recommendations for future monitoring will be reported in annual reports. See Reporting Section (Section 20.0) for more information.

5.0 Quality Objectives for Measurement Data

Data quality objectives are the quantitative and qualitative descriptions of the quality of data required to support the project decision-making process and ensure that data to be collected will be of known and appropriate quality. The data quality objectives provide the mechanism for ongoing control and evaluation of measurement data quality throughout the course of the project. The quality assurance/quality control effort will focus on controlling measurement error within the established limits, and will ultimately provide a database for estimating the field and analytical uncertainty in the measurement data.

This SAP has been developed to provide specific quality assurance/quality control guidelines for the implementation of sampling and analytical programs to meet the project data quality objectives and to ensure precision, accuracy, completeness, comparability, and representativeness of all analytical data. All CMP Contractors and subcontractors will follow the requirements specified in this SAP.

For this project, goals have been defined (as described further below) for each data quality objective to assess the performance of the measurement system. Data will be analyzed from field and laboratory quality assurance/quality control samples to provide an estimate of how well the goals were achieved.

For projects involving environmental measurements, the Environmental Protection Agency (EPA) has established the following data quality objectives : precision, accuracy, representativeness, completeness, and comparability (PARCC Parameters). The PARCC Parameters will be evaluated using the UMCDF Data Validation Methodology (RDC, 1999). The PARCC Parameters are discussed further below.

5.1 Field Quality Assurance Objectives

The following section applies to field quality assurance of soil, surface water, and biota samples. For further information on the field quality assurance for air monitoring at the DAAMS stations, see U.S. Army, 1998b.

5.1.1 Precision

Precision will be expressed in terms of the relative percent difference (RPD) for those samples where both the sample and the duplicate are greater than five times (5X) the Practical Quantitation Limit (PQL). An RPD less than 35 percent for soil and biota samples or 20 percent for surface water samples indicates that the variability is small and the samples come from the same population.

For those samples where either the sample value or the duplicate/split value are less than five times the PQL, precision will be evaluated in terms of the range between the sample and the

duplicate/split. A range of <2X PQL for soil and biota samples or <1X PQL for surface water samples indicates the variability is small and the samples come from the same population.

It should be noted that greater variability between samples increases the uncertainty in the results. If samples are found to be outside these criteria, then field-sampling procedures will be evaluated to identify corrective actions, if necessary.

5.1.2 Accuracy

Field instruments and equipment will be calibrated, as needed, to ensure accuracy of the measurement of field parameters. Equipment blanks will be used to verify that the sample collection and handling process has not affected the quality of the samples. Equipment blanks will be used to measure the cleanliness of sampling equipment for each media. Equipment blanks will be prepared in the field by simulating the collection of a sample through a decontaminated piece of equipment. Organic-free reagent water will be used. Equipment blanks will be analyzed for chemical agents and RDAs. Blanks that exhibit contamination in excess of method detection limits will result in corrective action. The nature of the corrective action will be assessed on an individual basis.

5.1.3 Representativeness

The sampling procedures presented in Appendix C were designed to ensure a representative sample for each matrix in the field. Precision of field duplicates will be used to evaluate representativeness, the degree to which the data accurately and precisely represents the characteristic of the population, natural variation at the sampling point, or the environmental condition.

5.1.4 Completeness

The completeness goal for sampling during the baseline period is to obtain at least five data points. There will be some incomplete sampling events due to conditions beyond the control of the CMP Contractor, i.e., evaporation of surface waters during the summer, disruption of small mammal traps by larger animals, or a lack of insect populations during the winter. These events will be tracked to help predict sampling success in year two of the baseline period as well as in the operational and post-operational monitoring periods. To meet the completeness goal, a limit must be established for human error, i.e ., failed holding times, sample container breakage, or chain-of-custody errors. Data will be tracked from the field to ensure 95 percent completeness. If this level is not obtained, then sampling procedures will be reviewed by the CMP Contractor Project Manager and corrective actions will be initiated. Corrective actions could be changes in procedures to be implemented the next quarter, or they could include a resampling effort to be completed before the next sampling period begins. Collection of quality control samples (e.g., equipment blanks) is discussed in Section 12 and Appendices B and C. The CMP Contractor must ensure that all of the quality control samples have been included with each sample set.

5.1.5 Comparability

The sampling method shall remain constant for each media and site in order to ensure comparability of data over time.

5.2 Laboratory Quality Assurance Objectives

The following section applies to laboratory quality assurance objectives of soil, surface water and biota samples. For further information on the laboratory quality assurance objectives for air monitoring at the DAAMS stations, see U.S. Army, 1998b.

Analytical laboratory quality assurance/quality control samples will be used to check the precision and accuracy of the measurement system in the laboratory. Analytical laboratory quality assurance/quality control samples will include calibration blanks, matrix blanks, method (or reagent) blanks, laboratory duplicates, quality control check samples, matrix spikes/matrix spike duplicates, and surrogates. Analytical laboratory quality control samples are described further in Section 12.0.

5.2.1 Precision

Precision measures the reproducibility of measurements of the same physical and chemical property under a given set of conditions. It is a quantitative measure of the variability of a group of measurements compared to their average value. The measure used to estimate the precision of a method is the standard error of the estimates for the least square regression line of "measured" versus “target" concentrations. Analytical precision for a single analyte is expressed as a percentage, with the difference between results of matrix spike samples and matrix spike duplicates for a given analyte divided by the average result.

Precision will be determined through the use of matrix spikes and matrix spike duplicates for the analytical work performed. The laboratory will select 1 sample in 20 aliquots (or 1 per batch) and split the sample into 3 aliquots , whichever is the smaller number. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. Precision will be evaluated in accordance with the UMCDF Data Validation Methodology (RDC, 1999).

5.2.2 Accuracy

Accuracy is a measure of bias in the measurement system. It is the degree of agreement of a measurement or average of measurements with an accepted reference or true expected value. The closer the numerical value of the measurement comes to the true value or actual concentration, the more accurate the measurement. Possible sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. The objective is to minimize determinate errors so that each analytical method performs within its specified quality control limits.

Accuracy can be determined from the results of matrix spike analyses performed at the rate of 1 set every 20 samples or 1 per batch. Laboratory surrogate compounds are also commonly used as

a measure of the accuracy of analysis. Laboratory surrogates are compounds structurally and chemically similar to the analytes of interest and are usually specified in the analytical methods used, e.g., with semivolatile organic compounds. Analytical accuracy may be expressed as the percent recovery of an analyte that has been added to an environmental sample at a known concentration before analysis. The recovery of the surrogate is calculated and compared to the known quantity added to the samples to assess the accuracy of the analysis. Surrogate compounds are added to all standards, quality control samples, and unknown samples.

5.2.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, natural variation at a sampling point, or an environmental condition. If the same results are reproducible, the data obtained can be said to represent the environmental condition. Representativeness is achieved through sampling program design. Criteria for representativeness are met by ensuring that sampling locations are selected properly and that standard protocols are used so that the resulting data represents the chemical conditions existing at the site at the time of sample collection. For the samples where both results are greater than five times (5X) the PQL, representativeness is evaluated by calculating the RPD between analytical results for field duplicate/split samples. For the samples where either the sample value or the duplicate/split value are less than five times (5X) the PQL, representativeness will be evaluated in terms of the range between the sample and the duplicate/split.

5.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system per analyte compared with the amount that was expected to be obtained under optimum conditions. Completeness of the data will be calculated by dividing the number of valid measurements obtained by the number of measurements planned. For data to be considered valid, it must meet all the acceptance criteria stated in the UMCDF Data Validation Methodology (RDC, 1999). The data quality objective for completeness is 95 percent to allow for errors throughout data collection, transport, and analysis. If this level is not obtained then sampling and laboratory procedures will be reviewed by the CMP Contractor Project Manager and corrective actions will be initiated.

5.2.5 Comparability

Comparability is a qualitative characteristic expressing the confidence with which one data set can be compared with another. The comparability goal is achieved through using standard techniques to collect and analyze representative samples, and reporting analytical results in appropriate units. Duplicate samples collected and analyzed using the exact same methods and key quality control elements will provide a means to evaluate comparability.

6.0 Training Requirements/Certifications

6.1 General Training Requirements

The CMP Contractor shall establish and implement a training program that details the processes for identifying statutory, regulatory, or professional certifications that may be required to perform specific operations. Additionally, the training program shall describe the processes for identifying, designing, performing, and documenting technical, quality, and management training, as applicable.

This training program shall include initial and continuing training and qualifications. Objective evidence of personnel training/qualifications shall be documented and maintained as a record. The retention period for training records shall be established.

6.2 Specific Training

Monitoring at the UMCD may require site-specific training per the policies of Raytheon Demilitarization Company. This may include training on issues of security and in evacuation routes. Given the varying conditions of the sampling region (extreme heat to snow/ice) a health and safety plan must be implemented to ensure worker safety.

Field sampling personnel performing biota collections must be able to identify in the field each species of plant, mammal and insect being collected. A bachelor's degree in the physical or life sciences; or equivalent combination of experience, education, and training ; is required. Certification in first aid and CPR is also required, with annual retraining. Small mammal collection may require protective equipment due to the presence of the Hantavirus in the deer mice population in the region.

Data Validators are responsible for data validation and reporting activities. Data Validators must have a minimum of a bachelor's degree in chemistry or any physical or life science with a minimum of 40 hours of training in data validation under the supervision of a Senior Validator. The Senior Validator provides oversight and sign-off on all work performed by Data Validators. The Senior Validator must have a bachelor's degree in chemistry or any physical or life science, plus one year experience performing data review and validation. All Data Validators and the Senior Validator shall be trained to the UMCDF Data Validation Methodology (RDC, 1999).

The Statistical Analyst is responsible for calculating the baseline threshold values and for any statistical comparisons of data. The Statistical Analyst must have a minimum of a bachelor's degree in mathematics or statistics with a minimum of 40 hours of training in statistics under the supervision of a Senior Statistician. The Senior Statistician provides oversight and sign-off on all work performed by the Statistical Analyst. The Senior Statistician must have a bachelor's degree in mathematics or statistics, plus one year experience performing statistical analyses.

Report writers must have a minimum of a bachelor's degree in any physical or life science or an equivalent combination of education, training, and experience.

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7.0 Documentation and Records

A system shall be established and implemented for timely preparation, review, approval, issuance, use, control, revision, and maintenance of documents that prescribe work activities and specify requirements. Additionally, a system shall be documented and implemented for identifying, preparing, approving, transmitting, correcting, distributing, retaining, retrieving, and disposing of records.

7.1 Document Control

Document control shall include measures by which documentation can be controlled, tracked, and updated in a timely manner to ensure applicability and correctness. Control measures shall be used to ensure that documents are reviewed for adequacy, approved for release by authorized personnel, and distributed to RDC, PMCSD, and Oregon DEQ.

Revised documents shall be reviewed and approved by the appropriate organizations that participated in the original review and approval, unless designated otherwise. The nature of the change(s) shall be identified within the document or in appropriate attachments.

Obsolete or superseded documents shall be identified, and measures taken to promptly remove or otherwise control these documents to prevent their inadvertent use.

7.2 Instructions, Procedures, and Drawings

Activities shall be described by documented instructions, procedures, or drawings that include quantitative or qualitative acceptance criteria, as appropriate, that can be used to determine whether activities are satisfactorily accomplished.

Instructions, procedures, and drawings shall be reviewed and approved by appropriately qualified individuals. Revisions to instructions, procedures, and drawings that affect the process or are technical shall receive the same level of review and approval as the original document. Editorial changes may be made to these documents without review and approval.

Procedures shall include, but not be limited to, the following:

- Environmental, health, and safety activities
- Sampling activities
- Assessment activities
- Sample shipping and receipt
- Sample chain-of-custody
- Sample storage
- Sample preparation
- Sample analysis
- Standard preparation and handling

- Post-analysis sample handling
- Data security and confidentiality
- Control of reagents and water quality
- Cleaning laboratory glassware
- Waste disposition
- Decontamination of field sampling equipment
- Control and transfer of electronic data
- Records management.

7.3 Records

Documents designated to become records shall be legible, accurate, complete, and appropriate to the work performed. Corrections to these documents shall be made by drawing one line through an error, initializing and dating the correction, and justifying the correction (if not self-explanatory). Changes to computerized data records shall be identified so that the original and corrected entries are retrievable, and the individual initiating the changes can be identified.

A documented records control system shall be established. The system shall include the following:

- Specifications of items, data, and processes of the records to be controlled
- Requirements for the preparation, review, approval, and maintenance of records to accurately reflect completed work and to fulfill statutory requirements
- Requirements and responsibilities for records transmittal, distribution, change, retention, protection, preservation, traceability, archival, retrieval, and disposal
- Verification that records received are legible and are in agreement with the transmittal document
- Requirements for access to and control of the files
- Procedures for the control and accountability of records removed from storage locations
- Procedures for filing of supplemental information and disposing of superseded records
- Storage of records in a manner approved by the organizations responsible for the records
- Replacement, restoration, or substitution of lost or damaged records
- Procedures for data correction that include how corrections are to be made and establish who is authorized to change or correct data.

Sufficient records shall be prepared and maintained in order to readily reconstruct technical- and quality-affecting activities.

8.0 Sampling Process Design (Experimental Design)

The experimental design for this SAP addresses the purpose of the CMP:

> Concentrations of chemical agents and risk driving analytes in air, soil, surface water, and biota at the sites selected in the CMP Workplan will be monitored to calculate a baseline threshold value prior to thermal operations by the UMCDF. Monitoring will determine if statistically significant increases are occurring during operation of the UMCDF and the data will be available for use in future risk assessments.

This section includes a schedule, rationale for the experimental design, sampling design assumptions, procedures for locating and selecting environmental samples, and classification of measurements as critical or non-critical.

8.1 Schedule

Quarterly field sampling will be conducted during the baseline period and after operations begin at the UMCDF. Table 8-1 suggests the schedule per quarter of the CMP. The schedule is based on experience with field sampling, holding times, and Hazardous Waste Permit requirements. The winter quarter field sampling event should take place during a temperature inversion.

Table 8- 1. Schedule for CMP Quarterly Activities

	Time to Completion*
Field Sampling (soil, surface water, biota)	10 working days at beginning of quarter
Laboratory Analytical Data Reports	30 calendar days from the end of field sampling event
Data Validation Reports	15 calendar days from the receipt of Laboratory Analytical Data Reports
Quarterly Report	15 calendar days from the receipt of Data Validation Reports

*Note: these times are approximate and may be adjusted by the CMP Contractor.

Air samples will be taken continuously (in triplicate). These DAAMS tubes are replaced every 12 hours. The quarterly period will end for DAAMS sampling on the date coinciding with the end of the field sampling (ten working days after the beginning of the quarter). Results of the air samples will be submitted to the CMP Contractor within 30 calendar days of the sampling period. The air sample data and validation results will be included with the soil, surface water and biota portions in the quarterly report.

8.2 Rationale for Experimental Design

Quarterly sampling is important to the purpose of the CMP – calculate baseline threshold values prior to operation of UMCDF, and determine if statistically significant increases are occurring during operation of the UMCDF. The geographical spread and variety of ecosystems found across the CMP sample sites adds to the heterogeneity of the monitoring effort. Repeated sampling in these locations is important in decreasing the variability of the monitoring results and increasing the ability to detect significant impacts during the operation of the UMCDF.

Field sampling may require up to ten working days to access all sample sites and collect all media. In particular, the collection of small mammals at 19 sites will require careful planning. Small mammal traps should be set in the evening and collected in the morning, based on the activity of these organisms. If insufficient organisms are collected on the first night, then traps should be set again the following evening.

During the winter and summer quarters, there might be difficulty collecting surface water samples. If ice has formed at the four water bodies in Zone 2, and the thickness of the ice is such that it cannot be broken easily, then a sample should not be taken. Another problem with ice formation is that when ice forms, contaminants are excluded from the ice crystals and contaminants can be concentrated in the free water below. This would increase the variability of the information collected at the sample site. Snow could cause a similar problem to ice in that a soil sample collected from under the snow would not represent any contaminants from the air trapped in the snow. If ice or snow is found at sample sites, then the field samplers should return during the remainder of the ten-day sampling period to determine if a sample can be taken at the site. If ice or snow persists beyond the ten-day sampling period, then a sample will be taken at a latter date and the analytical results of those samples will be included in the next quarterly report. In contrast, it is possible that surface water will be unavailable at these sample sites during the summer months due to evaporation. Field samplers should return during the remainder of the ten day sampling period to determine if a sample can be taken at the site.

Field sampling in the winter quarter will be scheduled around a temperature inversion. Temperature inversion describes the stable atmospheric condition during a period of high pressure when a gradation of temperatures is formed where the ground is colder than the layers above. Temperature inversions can last up to a week during the winter and are characterized by heavy fog. At this time, air deposition will not be distributed by winds and will concentrate near the origin of deposition.

Air deposited contaminants will collect on the vegetation and soils. It is important to analyze both of these media to understand if significant increases in deposition are occurring over time. Vegetation samples can be variable based on weather conditions, e.g., wind and rain. Soil sampling may be difficult to perform due to heavy vegetation coverage at many sample sites. Such variables will increase the variance in analyte monitoring (during baseline and operation), and any activities which can reduce the variability with monitoring within a sample site and over time will increase the opportunity to determine impacts from UMCDF operations.

To calculate the baseline threshold values in accordance with Oregon DEQ guidelines, there must be a minimum of five sampling events (see Section 18.3). If more than nine sampling events are available (such as with the air monitoring), then more robust statistical procedures (called parametric evaluations) can be used. Parametric evaluations will decrease the variance of the baseline threshold values, which will decrease the "environmental noise" when determining if significant increases are occurring during operation of the UMCDF.

8.3 Design Assumptions

Based on the results of the pre-RA, the list of risk driving analytes were chosen (see Table 3-1). This list of metals and organic compounds are known to disperse in the air and collect in the environment. The media that are to be sampled are important for determining if concentrations remain at or below the concentrations in the pre-RA. The experimental design has been optimized to monitor for any significant increases of these analytes during UMCDF operations.

8.4 Procedures for Locating and Selecting Environmental Samples

The frequency of sampling and the sample site locations were chosen during the development of the CMP Workplan. The reasons for choosing the sample locations are discussed in the CMP Workplan. Soil sampling stations will be constructed at each site where soil samples are to be taken. Upon completion of the soil sampling station, a Global Position System (GPS) measurement will be taken. A map showing the GPS locations can be found in Appendix D (Figure D-1).

Based on the review of the available meteorological, air dispersion modeling, and population data, the Perimeter Monitoring Network should be composed of sampling stations in all directions deployed as close to the UMCD fence line as possible. All sites require easy access and utilities.

8.5 Classification of Measurements as Critical or Non-critical

All media should be collected at all designated sites every quarter. Critical measurements include obtaining five or more samples for every media at every site during the baseline sampling period. If less then five samples are collected for every media at every site, then baseline threshold values cannot be calculated and action criteria for operational monitoring cannot be established.

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9.0 Sampling Methods Requirements

Sampling methods requirements include instructions on the sampling methods, equipment, sample containers, sample preservation, and holding times. The sampling methods requirements for air monitoring can be found in Appendix B. The sampling methods requirements for soil, surface water, and biota can be found in Appendix C.

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10.0 Sample Handling and Custody

Health and safety procedures shall guide the decisions of the field samplers such that their health and safety is protected during collection and handling of the samples. These procedures shall include guidelines on sampling surface water (considering weather conditions and access to water), sample sites with obstructions (e.g., crossing barbed-wire fences), and the collection and handling of biota. In particular, the latter must include following guidelines for working with rodents potentially infected with Hantavirus (CDC, 1993; Mills et al., 1995 a and b)

Procedures shall describe methods to ensure that samples are identified and controlled in a consistent manner. The identification system shall ensure traceability of samples from the time and place of collection through shipment to authorized persons or organizations and/or disposition. The quality control (QC) samples shall be identified within project documentation to enable tracing the relationship of QC data to specific samples. Each sample shall have a unique identification number and shall be recorded in appropriate field and project documentation (i.e., field data sheets) with information describing the sample. A label or tag shall be applied to the sample container and include the sample identification number, date and time of collection, media, preservative used, analysis required, and the collector's initials or signature.

Whenever possible, sample preservatives shall be added to the sample container before sample collection or immediately upon sample collection. The analytical procedure should specify the acceptable preservation technique (acidification, chemical addition, or refrigeration/freezing).

Samples shall be placed in coolers containing ice immediately after sampling. QC samples shall also be placed in the cooler, along with a temperature sample if one is collected. The temperature sample shall be read upon receipt at the laboratory and shall be within 4 ±2°C. If this temperature measurement exceeds the required range, an evaluation shall be made as to the appropriateness of sample analysis (see Section 16.0, Corrective Actions and Assessment).

Procedures shall establish methods to control samples during handling and transfer to preclude loss of identity, damage, deterioration, and loss of sample. Chain-of-custody documentation accompanying samples shall be maintained at all times. The field custodian completes, dates, and signs the appropriate section of the chain-of-custody. Verification of sample identification and integrity shall be performed before acceptance of the sample from another staff member or organization for introduction to storage or delivery to the laboratory. When transferring samples, the person who accepts the samples shall legibly print and sign their name and record the date and time of the transfer on the chain-of-custody record. If the transfer of custody is between companies, the company affiliation must be noted along with the signatures.

Only the necessary information should be transmitted to the laboratory, not including the source of the sample or observations. The unique sampling number should not be too descriptive as to allow bias on the part of the laboratory technicians.

Table 10-1 lists the minimum of information required in the field records and on the completed chain-of-custody form.

Table 10- 1. Information Required in Field Record and Chain-of-Custody Forms

Required Information	Field Records	Chain-of-Custody*
Project name	X	X
Unique sampling number	X	X
Date and time sample collected	X	X
Analysis required	X	X
Name of sampler	X	
Signature of sampler		X
Source of sample (name, location, etc.)	X	
Matrix		X
Grab or composite designation		X
Preservatives		X
Observations, including weather or disturbances	X	
Serial number of certified bottles and transportation containers	X	
Signatures of individuals involved in sample transfer		X
Date and time of transfers		X

*Note that the shipper is not required to sign off on the chain-of-custody form, but that the shipping papers will serve as part of the chain-of-custody records.

11.0 Analytical Methods Requirements

In conducting the CMP, the selected laboratories must be able to analyze the projected number of samples within the required holding times and comply with analytical and quality assurance/quality control criteria specified in this SAP. The laboratory will provide analytical services that subscribe to appropriate procedures and protocols described herein. Air will be monitored with DAAMS tubes, which will be analyzed according to methods detailed in Table 11-1. Soil, surface water, and biota samples will be analyzed according to the methods detailed in Tables 11-2 through 11-4.

Method testing shall be performed for each method described in Tables 11-1 through 11-3. The Reporting Detection Limit (RDL) is the level that the laboratory is required to meet or be below when determining the following:

- Method Detection Limit (MDL) is a measure of the minimum concentration of a sub stance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero, and is determined from the analysis of a sample in a given matrix containing the analyte (40 CFR Part 136 Appendix B). Analytical MDLs are determined by procedures described in 40 CFR Part 136 Appendix B and in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846* (EPA, 1986). MDLs will be determined for chemical agents analyses.

- Practical Quantitation Limit (PQL) is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operations. Analytical PQLs are determined by using the procedures described in SW-846. PQLs will be determined for organic analyses.

- Instrument Detection Limit (IDL) is a measure of the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero. Analytical IDLs are determined by procedures described in *U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) for Inorganic Analyses* (ILM02.0). IDLs will be determined for metals analyses.

Concentrations of polychlorinated biphenyl (PCB) coplanar congeners will be determined using a modification of SW-846 Method 8082. For those individual congeners which coelute, the peak will be assigned to the congener required for the Toxic Equivalency (TEQ) calculation. These congeners are listed in Tables 11-2, 11-3, and 11-4. PCB 118 and PCB 123 coelute, and consequently will be reported as a sum. PCB 156 and PCB 157 also coelute, and consequently will be reported as a sum. In addition to the listed congeners, total PCBs will be reported by integrating the entire chromatogram. Further information about TEQ calculations can be found in Section 18.4

Table 11-1: Analytical Methods, Preparations, Reporting Detection Limits, and Holding Times for Air Media

Air Media	Method and Preparation	Reporting Detection Limit	Holding Time
GB, VX, and HD	JI-0000-M-553[1]	GB: $3X10^{-6}$ mg/m^3 VX: $3X10^{-6}$ mg/m^3 HD: $1X10^{-4}$ mg/m^3	7 days from collection to extraction, 7 days from extraction to analysis

[1]Modification of method based on U.S. Army, 1997a and 1997b.

Table 11- 2. Analytical Methods, Preparations, Reporting Detection Limits, and Holding Times for Soil Media

Type		Soil Media	Method	Preparation	Reporting Detection Limit	Holding Time
Metals		Antimony, Arsenic, Beryllium, Chromium, Manganese, Thallium Cadmium	[1] SW-846 Method 6010B	SW-846 Method 3051	1.0 mg/kg 0.5 mg/kg 1.5 mg/kg 1.0 mg/kg 0.033 mg/kg	180 days from collection
Metals		Mercury	[1] SW-846 Method 7471A	SW-846 Method 7471A	1.0 mg/kg	28 days from collection
Organic	Semivolatile	4-Methylphenol	[1] SW-846 Method 8270C	SW-846 Method 3540C (Soxhlet Extraction)	333 µg/kg	7 days from collection to extraction, 40 days from extraction to analysis
Organic	Semivolatile	bis(2-Ethylhexyl) phthalate				
Organic	PCB	PCB 77, PCB 105, PCB 114, PCB 118, PCB 123, PCB 126, PCB 156, PCB 157, PCB 167, PCB 169, PCB 170, PCB 180, PCB 189	[1,4] SW-846 Method 8082	SW-846 Method 3540 or equivalent	33 µg/kg	7 days from collection to extraction, 40 days from extraction to analysis
Organic	Dioxin/Furans	2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8,9-OCDD 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, 1,2,3,4,6,7,8,9-OCDF	[1] SW-846 Method 8290	Extraction described in method	1 pg/g	30 days from collection to extraction, 45 days from extraction to analysis
Chemical Agent	GB/VX	O-isopropyl methyl-phosphonofluoridate and O-ethyl-S-(2-diisopropyl-aminoethyl)methyl-phosphonothiolate	[2] Labor-atory Specific Method	Laboratory Specific Method	To Be Determined (Based on MDL Studies)[3]	7 days from collection to extraction, 7 days from extraction to analysis
Chemical Agent	HD	bis(2-chloroethyl)sulfide				

[1]Method Blank (MB), Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS).
[2]MS/MSD, MB, Spiked MB (SpkMBlk)
[3]The detection limits for chemical agents in soil are laboratory-specific, but are determined in accordance with SW-846 and 40 CFR Part 136 Appendix B, with the following exceptions:

- The MDL study is not repeated if the calculated detection limit is not within 10 times the spike level;
- Seven replicates will be used
- The spike level is within 10 times 20 ppb for GB and VX, and 200 ppb for HD.

[4]This method has been modified as mentioned in text.

Table 11- 3: Analytical Methods, Preparations, Reporting Detection Limits, and Holding Times for Surface Water Media[1]

Type		Surface water Media	Method[2]	Preparation	Reporting Detection Limit	Holding Time
Metals		Antimony, Arsenic Beryllium, Chromium Manganese Thallium Cadmium	SW-846 Method 6010B	SW-846 Method 3010A	10 µg/L 5 µg/L 15 µg/L 10 µg/L 0.02 µg/L	180 days from collection
Metals		Mercury	SW-846 Method 7470A	SW-846 Method 7470A	10 µg/L	28 days from collection
Organic	Semivolatile	4-Methylphenol	SW-846 Method 8270C	SW-846 Method 3510C (Sep-funnel Liquid/Liquid Extraction)	1 µg/L	7 days from collection to extraction, 40 days from extraction to analysis
Organic	Semivolatile	bis(2-Ethylhexyl) phthalate			10 µg/L	
Organic	PCB	PCB 77, PCB 105, PCB 114, PCB 118, PCB 123, PCB 126, PCB 156, PCB 157, PCB 167, PCB 169, PCB 170, PCB 180, PCB 189	[3]SW-846 Method 8082	SW-846 Method 3510C or 3520C	1 µg/L	7 days from collection to extraction, 40 days from extraction to analysis
Organic	Dioxin/Furans	2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8,9-OCDD 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, 1,2,3,4,6,7,8,9-OCDF	SW-846 Method 8290	Extraction described in method	10 pg/L	30 days from collection to extraction, 45 days from extraction to analysis

[1]Equipment Blanks will be analyzed using the parameters listed in this table. In addition, equipment blanks will also be analyzed for chemical agents using the parameters for chemical agents listed in Table 11-2.
[2]Method Blank (MB), Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS).
[3]This method has been modified as mentioned in text.

Table 11- 4: Analytical Methods, Preparations, Reporting Detection Limits, and Holding Times for Biota Media (Including Vegetation, Insects and Small Mammals)

Type		Biota Media	Method[1]	Preparation	Reporting Detection Limit	Holding Time
Metals		Antimony, Arsenic, Thallium Beryllium, Chromium Manganese Cadmium	EPA Method 200.8	NOAA (1993) Or equivalent total digestion	0.1 mg/kg 0.2 mg/kg 0.2 mg/kg 0.02 mg/kg	180 days from collection
		Mercury	EPA Method 245.6	NOAA (1993) Or equivalent total digestion	0.01 mg/kg	28 days from collection
Organic	PCB	PCB 77, PCB 105, PCB 114, PCB 118, PCB 123, PCB 126, PCB 156, PCB 157, PCB 167, PCB 169, PCB 170, PCB 180, PCB 189	[2]SW-846 Method 8082; Krahn et al. (1988)	NOAA (1993)	1 µg/kg	7 days from collection to extraction, 40 days from extraction to analysis
	Dioxin/Furans	2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, 1,2,3,4,7,8-HxCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,6,7,8-HpCDD, 1,2,3,4,6,7,8,9-OCDD 2,3,7,8-TCDF, 1,2,3,7,8-PeCDF, 2,3,4,7,8-PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, 1,2,3,7,8,9-HxCDF, 2,3,4,6,7,8-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, 1,2,3,4,6,7,8,9-OCDF	SW-846 Method 8290	Extraction described in method	1 pg/g	30 days from collection to extraction, 45 days from extraction to analysis

[1]Method Blank (MB), Matrix Spike (MS), Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS).
[2]This method has been modified as mentioned in text.

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12.0 Quality Control Requirements

Quality control requirements are discussed for field sampling and laboratory analyses.

12.1 Field Quality Control

To assess the quality of the field sampling technique, field quality control samples will be collected. Procedures for collection of field samples are described in Appendices B and C and are designed to ensure the collection of a representative sample while minimizing the potential for contamination from external sources.

Three types of field quality control samples will be required:

- Split samples for insect and small mammals media : Field splits will be used to assess the homogenization techniques.

  Samples will be collected, homogenized, then divided into two equal parts for analysis. Care will be taken to make both samples representative of materials present, including heterogeneities. When possible, soil samples will be halved lengthwise to make two samples. Care will be taken to make field splits indistinguishable so that personnel performing analyses cannot determine which samples are splits.

  At a minimum, ten percent of each media samples will be prepared and analyzed as splits for parameters of interest. Since there are 19 sites where insects are collected, a total of two samples will be prepared as splits. Since there are 19 sites where small mammals are collected, a total of two samples will be prepared as splits.

  Note: If sufficient individual small mammals are collected for a duplicate sample at a site, then the organisms will be randomly separated into two individual samples and homogenized for analysis. If a duplicate sample is collected a split sample is not necessary.

- Duplicate samples for soil, surface water, and plant media : Field duplicates will be used to assess the reproducibility of sample collection techniques.

  A single sample will be collected and placed in a sample container. Immediately another sample will be taken and placed in another sample container. Care will be taken to make field splits indistinguishable so that personnel performing analyses cannot determine which samples are duplicates.

  At a minimum, ten percent of each media samples will be prepared and analyzed as duplicates for parameters of interest. Since there are 25 sites where soil samples are collected for risk driving analytes, a total of three samples will be collected in duplicate. Since there are nine sites where soil samples are collected for chemical agents, a total of one sample will be collected in duplicate. Since there are four sites where surface water will be

collected, a total of one sample will be collected in duplicate. Since there are 19 sites where plant media will be collected, a total of two samples will be collected in duplicate.

- Equipment Blanks : Equipment blanks will be used to verify that the sample collection and handling process has not affected the quality of the samples. Equipment blanks will be used to measure the cleanliness of sampling equipment for each media. Each quarter, one equipment blank will be prepared in the field by simulating the collection of samples for all types of media through decontaminated sampling equipment. Organic-free reagent water will be used. The equipment blank will be analyzed for chemical agents and RDAs.

All field quality control samples will be recorded as such in the field records.

Equipment blanks will be prepared in the field prior to sampling. Sample duplicates or splits will be prepared in the field and will be handled exactly the same as other field samples throughout the analytical procedure. These quality control samples will be analyzed by the laboratory to assess the quality of the sampling methodology. Field QC samples will remain blind to the laboratory.

12.2 Laboratory Quality Control

Internal quality control is an important part of the measurement system to ensure that analytical results are reliable and that data integrity is maintained. Laboratory performance will be evaluated through analysis of laboratory quality control samples (in conjunction with field quality control samples, as appropriate).

The CMP Data Validators will evaluate the analytical performance of the laboratory by reviewing the results from analysis of the blank, matrix spike, surrogates, duplicate, and quality control check samples. Evaluation will also be based upon instrumental calibration, instrument performance, percent recovery of internal standards, adequacy of reported detection limits, obtained precision of replicate analyses, and comparison of the percentage of missing or undetected substances among replicate samples. A list of sources of standards will be provided upon request from the analytical laboratory.

The following describes the batch preparative quality control samples that may be required by the analytical method and as indicated on Tables 11-1 through 11-3.

- Method Blank (MB): A Method Blank consists of Type II ASTM water that is subjected to the sample preparation or extraction procedures and analyzed as a sample. It serves to measure contamination associated with laboratory storage, preparation, or instrumentation. One MB is required for every 20 samples analyzed.

  If the analyte of interest is above the reporting detection limit, corrective action should be taken except for common solvents, such as methylene chloride, acetone, toluene, and 2-butanone.

- Spiked Method Blank (SpkMBlk): A Spiked Method Blank consists of Type II ASTM water to which known amounts of analyte have been added and is subjected to the sample preparation or extraction procedures and analyzed as a sample. One SpkMBlk is required for every 20 samples analyzed.

- Surrogates: Surrogates are measured amounts of certain compounds added before preparation or extraction of a sample. These compounds are similar to the chemical of interest, but differ by molecular weight or chemical configuration (e.g., ortho vs. meta). The recovery of a surrogate is measured to determine systematic extraction losses of analytes. Six surrogate standards will be added prior to extraction of the sample to monitor the extraction efficiency of the method.

- Matrix Spike (MS): A Matrix Spike is an aliquot of sample to which known amounts of analyte have been added. It is subjected to the sample preparation or extraction procedures and analyzed as samples. The stock solutions used for spiking are purchased or prepared independently of calibration standards. One MS is required per 20 samples analyzed.

  The spike recovery measures the effects of interferences in the sample matrix and reflects the accuracy or the determination.

- Matrix Spike Duplicate (MSD): A Matrix Spike Duplicate is an additional aliquot of sample to which known amounts of analyte have been added and subjected to the same preparation and analytical scheme as the original sample. The RPD between duplicate spikes measures the precision of a given analysis. One MSD is required per 20 samples analyzed.

- Laboratory Control Standards (LCS): Laboratory Control Standards may either be a standard reference material which is a material similar in nature to the sample being processed [certified by the National Institute of Standards and Technology (NIST) or other agencies, to the extent possible] and to which known amounts of analyte have been added or an aliquot of Type II ASTM water to which known amounts of analyte have been added. They are subjected to the sample preparation or extraction procedure and analyzed as samples. The stock solutions used for laboratory control standard recovery tests the function of analytical methods and equipment. One LCS is required per 20 samples analyzed.

Specific laboratory control procedures are in place for analysis of DAAMS tubes (U.S. Army, 1998b).

The laboratory shall qualify data in accordance with the UMCDF Data Methodology (RDC, 1999).

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13.0 Instrument Calibration and Frequency

Chemical measurements are made using a system that includes sample preparation and measurement processes. All aspects of the measurement process should be calibrated. Temperature, pressure, humidity, particle size, volumetric capacity, mass, and flow rate data may be needed as well, requiring accurately calibrated instrumentation for their measurement. Accordingly, any of the instruments, standards, and methods used for these purposes should be calibrated to assure that their accuracy is within acceptable limits.

13.1 Calibration Records

The laboratory shall keep a record of raw calibration data for all methods. Calibration records (initial calibration, initial calibration verification, and continuing calibration verification) shall include the raw calibration data, associated reports, date of analysis, and analyst's name or initials, at a minimum. Calibration data shall be traceable to the standards used. All samples analyzed shall be traceable to the calibration under which the results were produced. Sample analysis can only proceed when measurement systems are accurately calibrated. Records shall be maintained according to Section 7.0, Documentation and Records.

13.2 Balances, Thermometers, and Pipettes

Calibration records of measurement devices such as balances and thermometers for critical mass and temperature measurement shall be maintained. All analytical balances shall be calibrated annually, at a minimum, by an approved metrology organization. An approved metrology organization is one that has been evaluated and selected on the basis of specified criteria consistent with industry standards for the calibration of balances (see Section 14.0, Procurement of Items and Services). These records shall contain the date of calibration, initials of the person performing the calibration, the identity of the device or serial number, and the date the calibration expires. This information shall be affixed on or near the balance. Acceptable balance calibration shall be verified and documented daily when in use. The accuracy of thermometers and thermocouples used for critical temperature measurements (e.g., refrigerator temperature for sample storage) shall be verified annually by comparing readings of such devices with readings of a NIST-traceable, factory-certified thermometer.

It is considered good laboratory practice that mechanical pipettes used for critical measurements be verified to ensure acceptable performance. Daily, before use, single-delivery volume checks should be performed and documented.

There are more specific calibration procedures relating to the DAAMS equipment in U.S. Army, 1998b.

13.3 General Requirement for Standards

Standards used for calibration of measurement systems shall be traceable to a nationally or internationally recognized standard agency source or measurement system, if available. A

program for verifying and documenting the accuracy and traceability of all working standards against appropriate primary grade standards or the highest quality standards available should be routinely followed.

Standards used for calibration shall be accompanied by a certificate or record that includes the vendor, lot number, purity, date of preparation and/or expiration, and concentration of the standard material. At a minimum, the following information shall be maintained on standard preparations and, if possible, placed on the label:

- Name of preparer
- Date prepared
- Standard identification
- Dilution performed
- Final concentration
- Expiration date or shelf life.

When recognized standard material is not available or its purchase is impractical, the laboratory should attempt to purchase standard material from a reliable source. The laboratory shall have procedures in place to determine the acceptability of such materials.

13.4 Calibration of Laboratory Measurement Systems

The calibration process correlates instrument response to an established concentration. Calibration procedures shall be established by the laboratory and shall consider the manufacturer's recommendations and the requirements of the methods stated in Tables 11-1 through 11-3.

The initial calibration verification checks the accuracy of the calibration and the standards used for that purpose. A level of independence shall exist between materials used for calibration and for initial calibration verification when such materials are available. When an independent source is not available, the laboratory should attempt to purchase an alternate lot of the same material.

The continuing calibration verification checks the stability of the original calibration over time. This standard may be from the same source as that used for either calibration or initial calibration verification.

The minimum requirements of calibration, frequency, and acceptance criteria for laboratory measurement systems are found in the methods stated in Tables 11-1 through 11-3.

The laboratory is required to take corrective action when measurement systems fail calibration QC criteria. Sample analysis shall not proceed until the calibration QC criteria have been met.

13.5 Instrument/Equipment Maintenance

A periodic preventative and corrective maintenance program for instrumentation and equipment shall be described and implemented. This assures the availability and satisfactory performance of the instrumentation and equipment. Equipment and/or instrumentation requiring periodic maintenance shall be identified. All instrumentation/equipment subject to maintenance or repair shall be recalibrated as necessary before use.

The following items should be considered for inclusion in the program:

Routine inspections (e.g., daily, weekly, or as needed) should be based on the manufacturer's recommendations, performed by the responsible staff, and followed by corrective actions, if necessary. Anomalies should be noted in a logbook, record sheet, or electronic record system, which will be kept close to the instrument/equipment.

- Significant corrective action(s) for the instrument/equipment should be documented in a logbook, record sheet, or electronic record system. The notation should include a description of the corrective action, the date performed, and the initials of the person who performed the corrective action.
- Instrument/equipment maintenance should be performed by appropriate personnel. This could include services provided through an external maintenance contract.
- Instrument/equipment maintenance and repairs should be documented, including the date and signatures of personnel who performed the maintenance, in a logbook, record sheet, or electronic records system. This documentation should be reviewed annually.
- Critical spare parts list and an inventory should be maintained. If applicable, a written contingency plan specifying backup equipment should be established.

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14.0 Procurement of Items and Services

A process shall be established and implemented to control purchased items and services (e.g., metrology services, analytical services, certified sample bottles, standards, reagents). Procured items and services shall meet established requirements and perform as specified. Prospective suppliers shall be evaluated and selected on the basis of specified criteria. Processes to ensure that approved suppliers continue to provide acceptable items and services shall be established and implemented.

The procurement process shall describe provisions for the following:

- Defining applicable technical and administrative requirements for subcontracted services and items including acceptance criteria
- Selecting qualified subcontractors
- Verifying that qualified subcontractors can continue to provide acceptable products and/or services
- Accepting purchased items and/or services
- Receiving and maintaining procurement records including evidence of conformance
- Documenting nonconforming items and services.

Qualified suppliers and, as necessary, subtier suppliers shall be monitored periodically to ensure that acceptable items and services continue to be supplied.

Procurement documents shall contain information clearly describing the item or service needed and associated technical and quality requirements. Procurement documents shall specify the quality system requirements within this plan for which the supplier is responsible. Procurement documents shall be reviewed for accuracy and completeness by qualified personnel before release. Changes to procurement documents shall receive the same level of review and approval as the original documents.

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15.0 Data Management

Data management consists of five areas where data is collected, analyzed, and reported : field sampling data, laboratory analyses, data validation, statistical analyses reports, and quarterly/ annual reports. A database will be maintained and will contain fields to store all areas identified above. As much as possible, data will be transferred electronically through the data management areas to avoid transcription errors. The CMP Database Manager will be responsible for checking that all data entered into the database or transferred into the database is consistent and correct, including field, laboratory, validation, and statistical information. This includes meeting all records management criteria in Section 7.3. In addition, the CMP Database Manager will be responsible for checking the consistency of units and terminology in the data fields.

15.1 Database for Data Management

The notes from field sampling events must be recorded and entered into the database. The database will be used to generate unique sample identification numbers. Field notes will include the following for each site:

- Date and time
- Weather conditions (site specific as well as daily average conditions)
- Field screening measurements
- Chain-of-custody information
- Any nonconformance with SAP

The laboratories will develop Contract Laboratory Program (CLP)-equivalent analytical data packages. These packages will be electronically delivered to the CMP Contractor, who will deliver the packages to the CMP Contractor Data Validators. The CMP Contractor will enter the electronic information into the database, including the laboratory verification results. The CMP Contractor Data Validators will send an electronic copy of the validated data packages to the CMP Contractor, and the validation flags will be entered into the database.

The results of the certified statistical analyses will be included in the database. Quarterly and annual reports will contain in formation from the databases. Section 20.0, Reporting, contains more information about the reports.

15.2 Data Management Requirements

All raw data and data packages associated with the analysis of CMP project samples must be archived for a minimum of five years after closure of the UMCDF. This includes field notebooks, data notebooks, hardcopies of data packages from laboratories and CMP Contractor Data Validators, certified statistical analysis reports, and any associated workbooks and calculations. The analytical laboratory will provide notification to the CMP Contractor prior to the disposal of any archived materials.

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16.0 Corrective Actions and Assessment

16.1 Corrective Action

A system shall be established and implemented to identify, correct, and prevent quality problems. Items, services, and processes that do not meet established requirements shall be identified, controlled, and corrected according to the importance of the problem and the work affected. For significant problems, correction shall include identifying the causes of problems and working to prevent their recurrence. Item characteristics, process implementation, and other quality-related information shall be reviewed, and the data shall be analyzed to identify items, services, and processes needing improvement. Examples of conditions where corrective action is required are as follows:

- Documentation errors
- Diverse trends in the analysis of standards
- Failure to comply with approved technical and administrative procedures
- Failure to follow the preventative maintenance program
- Failures in instrument systems that would impact data quality or delivery
- Failures in performance evaluation sample analysis audits, surveillances, and assessments
- Validation and/or verification issues negatively impacting reported results
- Recurring adverse problems
- Misidentification or mishandling of samples
- Nonconforming materials, parts or components

The corrective action process shall describe the provisions for determining the cause of nonconforming items and processes. The extent of analysis shall be commensurate with the importance of the significance of the problem (i.e., graded approach).

The corrective action process shall include the following requirements: 1) determining the significance of the problem, 2) taking effective corrective action based on the potential impact on the data quality, 3) eliminating or minimizing the recurrence of the problem, and 4) verifying implementation of corrective action.

Provisions for making corrective actions shall include, but not be limited, to the following:

- Determining the cause of the adverse condition
- Determining the technical and work activities associated with the quality problem
- Ascertaining the quality problem's generic implications
- Determining the extent to which similar quality problems have been recognized
- Determining the effectiveness of corrective actions that were taken
- Determining the impacts on the completed work

- Recommending actions that can be taken by the responsible organization to prevent recurrence
- Determining whether stopping the work associated with the activity is necessary
- Determining measures to prevent the use of nonconforming materials, parts, or components including identification, documentation, evaluation, disposition and segregation (where practical)

Significant problems discovered by project personnel must be reported to the CMP Contractor Project Manager and RDC Technical Manager immediately for resolution. Significant problems involving data quality or sample integrity must be thoroughly documented.

The RDC Technical Manager must be included on the distribution of all audit reports. Significant problems encountered in day-to-day operations must be reported to line management immediately by the CMP Contractor Project Manager.

16.2 Assessments

Assessments are evaluations intended to provide an increased understanding of the program or system being evaluated and to provide a basis for improving such programs or systems. An assessment program shall be documented and implemented to determine the effectiveness of systems and verify that activities comply with the stated requirements.

The program shall include:

a) Documented schedule
   - Topic area
   - Organization to be audited
   - Approximate date the audit will be performed

b) Assessor qualifications, responsibilities, authorities, and accountabilities

c) Audit plans prepared, reviewed, and approved prior to initiation, including:
   - The organization and work that will be audited
   - The location, time, and dates of duration
   - The documents that specify the criteria against which the work will be measured
   - The identification of assessment personnel
   - Signatures and dates of approval

d) Checklists used during the assessment process

e) Reporting of audit results which include:
   - A specified format
   - Reference to the assessment plan

- A summary of the results of the assessment
- A discussion of the deficiencies, observations, and concerns that were identified as a result of the assessment
- Action owner(s)
- Associated dates for follow-up actions
- Required distribution for all related documentation

At a minimum, the laboratory and/or field assessment program shall address the following types of assessments:

a) Management Assessments – Assessments directed by those immediately responsible for overseeing and/or performing the work. The following is evaluated:
   - Effectiveness of management control systems
   - Adequacy of resources and personnel
   - Effectiveness of training and assessment
   - Applicability of data quality requirements

b) Technical System Assessments – Assessments directed by the laboratory or the field and/or program quality assurance function. Technical system assessments consist of a review of laboratory or field operations, specific procedures, and related documentation. Areas of interest may include:
   - Measuring and testing equipment calibration or control procedures
   - Document control procedures
   - Technical procedure compliance
   - Adherence to data quality requirements
   - Identification, control, storage and preservation of samples or standards

c) Performance Evaluation Assessments – Assessments coordinated by the quality assurance function, whenever practicable, that are generally blind or double-blind tests introduced into the field or lab to provide information regarding the effectiveness of these processes. Performance evaluation programs may be either external to the organization, internal, or both.

d) Data Quality Assessments – Assessments used to evaluate the degree of conformance to data quality requirements. They should be performed by the quality assurance representative, whenever practicable.

e) External Assessments – Assessments performed by agencies or groups not under the control of management. External assessments may consist of inspections, interviews, and/or evaluations that focus on the ability to meet program requirements. Management shall be responsible for initiating, tracking, following up, and documenting all corrective actions that are required as a result of external assessments.

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17.0 Reports to Management

A formal mechanism for reporting the status of the program to the CMP Contractor management shall be established and implemented. At a minimum, reports shall be issued annually. The reporting system shall identify the following:

- Frequency schedule for quality assurance, tasks, and subcontractor reports
- Report recipient(s)
- Report preparer(s)
- Quality assurance reports should include a summary of the results on the following:
    - Performance evaluation assessments
    - Technical system assessments
    - Management system assessments
    - External audits and surveillance activities
    - Data quality and validation assessments
    - Regulatory compliance issues
    - Corrective actions and status
    - Supplier/subcontractor performance

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18.0 Data Verification, Validation, Statistical Analyses, and Toxic Equivalency

18.1 Data Review and Verification

The CMP Contractor Project Manager ensures that soil, surface water, and biota field data is reviewed. Data concerning the DAAMS tubes will be reviewed before the information is submitted to the CMP Contractor. Analytical data shall be reviewed for technical adequacy by laboratory personnel other than the person performing the work before reporting.

Data review shall consist of:

- Evaluation of method and quality control performance
- Accurate transcriptions
- Correct calculations
- Overall consistency and reasonableness of the data
- Appropriate corrective action, if necessary.

The CMP Contractor shall prepare and implement procedures for the verification of supplied data and resolution of anomalies. Verification activities shall include, but not be limited to the following:

- Verification that the amount of data requested matches the amount of data received (number of samples for requested methods and analytes)
- Verification of procedures/methods used
- Verification that documentation/deliverables are complete
- Verification that hardcopy and electronic versions of the data are identical
- Verification that data seem reasonable based on analytical methodologies.

18.2 Data Validation

Data validation will be performed by a third party (not by the laboratory or the CMP Contractor). The laboratory will supply CLP-equivalent analytical data packages intended to support data validation by the third party. The laboratory will be required to submit data packages that are supported by quality control test results and raw data.

Controls will be in place to preserve the electronic data sent to the validators and allow additions to be made only, not changes to the raw data.

There are three validation levels:

Level A. This level of data validation includes:

- verification of required deliverables,
- requested versus reported analyses,
- evaluation and qualification of results based on holding times, and
- qualification of results based on method blank results.

Level B. This level of data validation includes all items identified in Level A plus evaluation and qualification of results based on the following:

- matrix spike/matrix spike duplicate (MS/MSD) analysis,
- surrogate recoveries, and
- internal standards performance.

Level C. This level of data validation includes all items identified in Levels A and B plus evaluation and qualification of results based on the following:

- initial and continuing instrument calibrations (standards and blanks)
- laboratory control samples,
- instrument tuning,
- analytical sequence, and
- internal standards performance.

At least one soil, surface water, or biota laboratory analysis package per quarter will be validated by the third-party data validators to Level C. Half of the remaining soil, surface water, or biota samples will be validated by the third party data validators to Level B, with the other half validated to Level A. Through the course of a year, data packages containing soil, surface water, and biota must be validated at Level C for each analyte. Three of the air laboratory analysis packages per quarter will be validated to Level C; three packages per quarter will be validated to Level B; and three packages per quarter will be validated to Level A. The UMCDF Data Validation Methodology will be used (RDC, 1999).

18.3 Statistical Analyses

The soil, surface water and biota data collected during the baseline segment, before UMCDF operations, will be used to calculate baseline threshold values for chemical agent and RDAs at each sampling site. Air sample data collected during this baseline period will be treated in the same manner; however, any decisions based on the presence or absence of chemical agent will have a different impact on operations. Data rejected during data validation will not be included in statistical analyses. The methods discussed below will determine the levels of chemical agent and RDAs (or interferences) that are detected in the environment before the start of UMCDF

operations. Figure 18-1 presents the methodology for determining the baseline threshold values. In addition, the maximum concentration of the baseline samples will be used for comparison to operational sampling. The maximum value will be determined after the removal of outliers, where appropriate (when using Oregon DEQ Method A or B) (DEQ, 1994).

18.3.1 Sample Size Criteria

Oregon DEQ requires that five samples be collected to evaluate baseline threshold concentrations. If between five and eight samples are collected, then the data must be analyzed using the nonparametric method that calculates the 95-percent upper confidence limit (UCL) based on the inter-quartile range (IQR) (Oregon DEQ Method B). If nine or more samples have been collected, then the baseline threshold value will be calculated based on the parametric methods below (Oregon DEQ Method A).

18.3.2 Baseline Threshold Evaluation for Five to Eight Samples

If there are between five and eight samples, then a nonparametric method will be used to calculate the 95-percent UCL. This is done using the IQR as described in Oregon DEQ Method B. Nondetectable values will be replaced with one-half of the Practical Quantitation Limit (PQL) prior to calculating the baseline threshold. Leaving any suspect outlying data in the data set, the median, 75th percentile, and 25th percentile are calculated. The IQR is the difference between the 75th and 25th percentiles. The 95-percent UCL is defined as the median plus 2 times the IQR. Method B describes an outlier as a value exceeding the median plus 3 times the IQR. The maximum baseline concentration will be calculated after the removal of outliers.

18.3.3 Baseline Threshold Evaluation for Nine and Greater Samples

According to Oregon DEQ Method A, the baseline threshold value is determined with a 95% UCL if 50% of the samples are detected above the PQL. This contrasts with EPA guidance, in which the baseline threshold value is equal to the 95/95 upper tolerance limit (USEPA, 1989 and 1992). The confidence interval based on the mean of the sample data in the baseline study is equal to the sample mean plus the product of the "t" statistic and the sample standard deviation.

The "t" statistic is dependent on the number of samples and may be found in tables provided in the Oregon DEQ Soil Clean-up Manual (DEQ, 1994). Prior to calculating the 95-percent UCL, nondetectable values will be treated and outlier data will be removed.

Nondetectable values of chemical agent and RDAs are likely to occur during the baseline study. There are various methods to treat nondetectable values before calculating the baseline threshold value. In data sets where there are less than 15-percent nondetectable values, the nondetectable values will be replaced with one-half the PQL. If there are more than 15-percent but less than 50-percent nondetectable values, then the mean and standard deviation of the baseline data set will be adjusted using Cohen's adjustment as described in USEPA guidance (USEPA, 1989).

Parametric evaluations are dependent on the underlying distribution of the data set. The procedures included in Oregon DEQ Method A assume that the data are normally distributed.

The distribution is tested for normality by calculating the coefficient of variation, which is equal to the standard deviation divided by the mean. In general, if the coefficient of variation is less than one, then the data is normally distributed and no data transformations are necessary. If the coefficient of variation is greater than one, the data cannot be assumed to be normally distributed. In this case, the data will be evaluated for lognormality. First, calculate the natural logarithm of each sample value [for example, $\ln(x_1)$, $\ln(x_2)$ ... $\ln(x_3)$]. Then, the mean and standard deviation of the data set are calculated using the log values. If the coefficient of variation using the log transformed data is less than one, then the data are considered to be lognormally distributed. If the coefficient of variation using the log-transformed data is greater than one, then the baseline threshold will be determined using the nonparametric procedure described previously (Oregon DEQ Method B).

Before calculating the baseline threshold, Oregon DEQ states that American Society for Testing and Materials (ASTM) Standard E 178-94 should be used to remove outlier observations. For extreme values, a statistical test will be performed to determine whether the outlier or outliers are from the same population as the other baseline sample values. The test hypothesis is that all sample values come from the same distribution. For the one -percent significance level, the critical value is taken from Table I of ASTM E 178-94. If the test statistic exceeds the critical value, then the hypothesis is rejected and the sample point is removed from the data set. This method will also be used to remove outliers for the determination of the maximum baseline concentration when there are nine or more samples.

18.3.4 Evaluation of Sparse Data Sets

When the nondetectable values exceed 50 percent of the data set, USEPA guidance (USEPA, 1992) will be used to determine the baseline threshold. If the data set contains between 50 - and 90-percent nondetectable values, then the maximum value is the baseline threshold. If the data set contains between 90- and 100-percent nondetectable values, then the data is modeled as a rare event, and the Poisson upper tolerance limit is the baseline threshold. If all samples are nondetectable values, then the baseline threshold is set to the detection limit for the purposes of statistical comparisons.

18.3.5 Assessment of Operational and Post-Operational Data

For each sampling site and analyte (chemical agent or RDA), the operational sampling data set will be compared to the baseline threshold determined for that sampling site and analyte (Figure 18-2). According to the Oregon DEQ Soil Clean-up Manual (DEQ, 1994), there are two steps in the procedure for comparing operational sampling data to baseline sampling data. First, each operational sample value is compared to the baseline threshold. If all operational sample values are less than the baseline threshold, then there is no action taken and the results are documented in a quarterly data report. The second step is taken if any operational sample value exceeds the baseline threshold. The operational sample value is compared to the maximum baseline value calculated previously. If the maximum baseline value is greater than the operational sample value, then there is no action taken and the results are documented in a quarterly data report.

If the evaluations indicate increases of chemical concentrations, additional data analysis may include the following:

- Evaluation of the magnitude of the result relative to the baseline threshold and maximum baseline values;
- Evaluation of the historical frequency of results that exceed the baseline threshold and maximum baseline values for that site and medium;
- Determination of the spatial and temporal distribution of results that exceed the baseline threshold and maximum baseline values;
- Evaluation of the analytical uncertainty;
- Evaluation of the toxicity of the particular analyte exceeding the baseline threshold and maximum baseline values;
- More rigorous data validation for the applicable data set.

The results of any applicable data analysis activities will be presented in the quarterly report.

Based on the results of the data analysis, the following actions will be considered for results that exceed the baseline threshold and maximum baseline values:

- Identification of any UMCDF and/or UMCD chemical release events during the previous quarter;
- Review of agricultural activities (such as spraying of pesticides) that have occurred in the vicinity of the sample site during the previous quarter;
- Review of operation upsets of other nearby potential sources of the analyte (especially combustion sources);
- Collection of additional samples from the same medium during the subsequent sampling event;
- Addition or more frequent analysis (such as monthly sampling) if the increase is found in samples that may not be available during all of the seasonal sampling events (such as water, insects, small mammals);
- Use of analytical methods that may indicate the source of the increase (such as pesticide analyses that may indicate agricultural spraying) or that may add information regarding the toxicological significance of the increase (such as metals speciation).

Selection of appropriate action will be made in consultation with the Oregon DEQ.

18.3.6 Additional Analyses

Additional analysis will be dependent on the number of operational sampling periods and the number of samples within a zone determined to be greater than both the maximum baseline concentration and baseline threshold. In the early stages of sampling, characteristics of the sampling zone may be used to determine the range of variability in contaminant concentrations that could be expected across the site. This range would provide an indication of how much greater an operational sample concentration might be before reaching a level of concern.

Descriptive statistics including the sample size, mean, standard deviation, the 25-, 50-, and 75-th percentiles, and minimum and maximum values of the baseline threshold values and maximum baseline concentrations for each analyte will be used to characterize each zone. A contour plot of the larger value of either the baseline threshold or the maximum baseline concentration will be used to provide a visual characterization of the spatial distribution of the baseline concentrations

of selected contaminants. Sites within a zone will be determined to be of the same population if they are contained in the same cluster using a multivariate cluster analysis and all detected analytes. Sites within a zone that are designated as separate clusters will be identified and characterized with descriptive statistics. Physical characteristics of these sites will be noted to determine a potential reason for the existing differences.

In the early stages of operational sampling, there may be few to no operational samples determined to be larger than both the baseline threshold and the maximum baseline concentration. In this case, operational observations will be determined to be statistically significantly greater than baseline if they can be considered an outlier from the baseline site data using the method described in ASTM E 178-94. The magnitude of the operational sample concentration will be compared to the mean baseline concentration for the cluster for which that site belongs. If the operational sample concentrations fall within a 95% confidence interval for this baseline cluster, then there is no further action taken and the results are documented in a quarterly data report. If the operational sample is greater than the upper confidence limit, then other evaluations in Figure 18-2 will be considered.

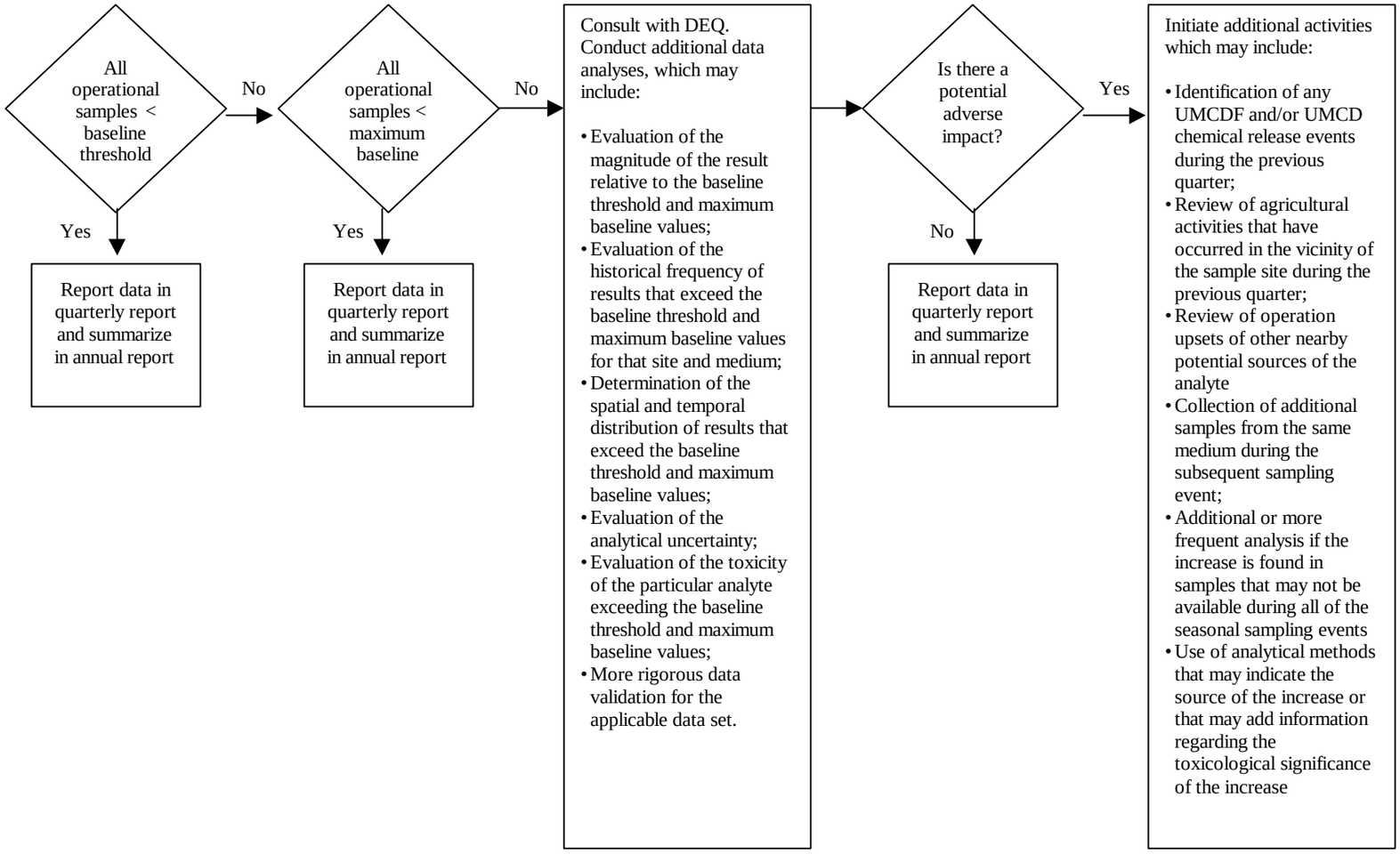
The location of all contaminants determined to be greater than both the baseline threshold and the maximum baseline concentration will be examined. If particular sites are continually showing elevated levels of contaminants with a potential adverse impact, then this information will be documented. Activities that may affect the concentration of contaminants at these sites will be identified, and additional sampling or analytical techniques may be requested (Figure 18-2).

If there are at least three operational sampling values for a given site (i.e., at least three sampling periods) or at least three sampling values within the same cluster from at least three sampling periods with elevated concentrations of contaminants, then a Mann-Whitney test will be conducted to determine if the operational samples are statistically greater than the baseline. The Mann-Whitney tests the null hypothesis H_0: the populations of baseline and operational concentrations have identical distributions against the alternative H_1: the populations differ with respect to location. If greater than five operational sampling values at a given site (or within a cluster over more than five sampling periods) have elevated contaminant concentrations, then a regression analysis will also be conducted to determine if the concentrations are increasing significantly with time either at the site or within the cluster. A contour map of elevated contaminant concentrations will be used to document potential spatial trends in the data.

18.4 Toxic Equivalency Calculations

Seven dioxin congeners, 10 furan congeners, and 13 PCB coplanar congeners will be monitored for the CMP (Table 3-2). These compounds will be used to calculate a Toxic Equivalency (TEQ) for the mixture using Toxicity Equivalency Factors (TEFs) in accordance with USEPA methodology (USEPA, 1998). The TEFs for each compound are shown in Table 18-1. The TEQ for each compound is calculated by multiplying the concentration of individual congeners by their respective TEF. The sum of the TEQ concentrations for the individual congeners is the TEQ concentration for the mixture. Both the TEQ concentration for the mixture and the concentrations of individual compounds will be evaluated in statistical analyses.

Figure 18- 1. Comparison of Operational Sampling to Baseline Sampling Based on Oregon Department of Environmental Quality Guidelines[a]



[a]Oregon DEQ, *Soil Cleanup Manual*, Oregon Department of Environmental Quality, Waste Management and Cleanup Division, OAR 340-122-045 and 046, April 1994

Table 18-1: Toxic Equivalency Factors for Dioxins, Furans, and PCBs

Analyte	TEF
Dioxins	
2,3,7,8-tetrachlorodibenzo-p-dioxin	1.0
1,2,3,7,8-pentachlorodibenzo-p-dioxin	0.5
1,2,3,4,7,8- hexachlorodibenzo-p-dioxin	0.1
1,2,3,6,7,8- hexachlorodibenzo-p-dioxin	0.1
1,2,3,7,8,9- hexachlorodibenzo-p-dioxin	0.1
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	0.01
1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin	0.001
Furans	
2,3,7,8-tetrachlorodibenzofuran	0.1
1,2,3,7,8-pentachlorodibenzofuran	0.05
2,3,4,7,8- pentachlorodibenzofuran	0.5
1,2,3,4,7,8-hexachlorodibenzofuran	0.1
1,2,3,6,7,8- hexachlorodibenzofuran	0.1
1,2,3,7,8,9- hexachlorodibenzofuran	0.1
2,3,4,6,7,8- hexachlorodibenzofuran	0.1
1,2,3,4,6,7,8-heptachlorodibenzofuran	0.01
1,2,3,4,7,8,9-heptachlorodibenzofuran	0.01
1,2,3,4,6,7,8,9-octachlorodibenzofuran	0.001
PCBs	
3,3’,4,4’-tetrachlorobiphenyl (PCB 77)	0.0005
2,3,3’,4,4’-pentachlorobiphenyl (PCB 105)	0.0001
2,3,4,4’,5-pentachlorobiphenyl (PCB 114)	0.0005
2,3’,4,4’,5-pentachlorobiphenyl (PCB 118)	0.0001
2’,3,4,4’,5- pentachlorobiphenyl (PCB 123)	0.0001
3,3’,4,4’,5- pentachlorobiphenyl (PCB 126)	0.1
2,3,3’,4,4’,5’-hexachlorobiphenyl (PCB 156)	0.0005
2,3,3’,4,4’,5’- hexachlorobiphenyl (PCB 157)	0.0005
2,3’,4,4’,5,5’- hexachlorobiphenyl (PCB 167)	0.00001
3,3’,4,4’,5,5’- hexachlorobiphenyl (PCB 169)	0.01
2,2’,3,3’,4,4’,5-heptachlorobiphenyl (PCB 170)	0.0001
2,2’,3,4,4’,5,5’- heptachlorobiphenyl (PCB 180)	0.00001
2,3,3’,4,4’,5,5’-heptachlorobiphenyl (PCB 189)	0.0001

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19.0 Software and Database Control

Software systems can be separated by application into two categories: administrative and technical. Administrative software systems are used to manage the workflow or to monitor performance against administrative requirements. Examples of administrative software systems are those that control sample tracking, procedural control, training, and reporting. Technical software systems are used to control laboratory systems and to accumulate and reduce data. Examples of technical software systems are those that provide instrument interface, calculations, calibration control, and control charts. Databases may be included in administrative or technical software.

Software control requirements applicable to commercial and laboratory-developed software shall be developed and implemented.

For commercial software, acceptance testing shall be performed when installed, after changes, and periodically during use, as appropriate.

For laboratory-developed software, a copy of the original program code shall be maintained, acceptance tested, and all changes shall include a description of the change, authorization for the change, and test data that validates the change.

Requirements shall be established and implemented for the backing up of software and electronic data at regular intervals. The frequency of the backups shall be based on the quantity of data and the impact of data or software loss.

Software user manuals shall be available to personnel using the software.

Software error detection and reporting systems shall be established and implemented.

Calculation of statistical analyses using software will be verified by the CMP Contractor Senior Statistician. The CMP Contractor Senior Statistician will confirm that the data were correctly entered into the software and verify that the decisions made by the CMP Contractor Statistician followed the statistical approach in Section 18.3. The CMP Contractor Statistician and Senior Statistician will sign a certification statement and sign each page of applicable spreadsheet printouts.

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20.0 Reporting

There are three types of reports that will be developed as part of the CMP: 1) quarterly reports; 2) annual reports; and 3) information distributed on an Internet server. These reports will function to keep the RDC, PMCSD, Oregon DEQ, and the public informed of the results of the CMP.

20.1 Quarterly Reports

The CMP Contractor will prepare quarterly reports. Quarterly reports will be distributed to the RDC, PMCSD, and Oregon DEQ. In addition, the quarterly reports will be submitted to the Hermiston Public Library. The reports will contain all information collected over the previous quarter, including a summary of field observations, all laboratory and data validation results, and a summary of any reports of deficiencies or nonconformances. After operation of UMCDF begins, during operational monitoring, the quarterly monitoring reports will also include comparisons to baseline threshold values. After the first four quarters of operational monitoring, the reports will also include trending analyses.

20.2 Annual Reports

Annual reports will summarize the previous four quarters of monitoring. The annual report will summarize field activities, laboratory results and any changes to the SAP. Annual reports will be distributed to the RDC, PMCSD, and Oregon DEQ.

The first annual report before operation of the UMCDF, during baseline monitoring, will include recommendations for sampling the remaining year of baseline sampling. Such recommendations might include additional sampling events to make up for missed samples due to adverse weather conditions. This will be necessary in order to calculate the baseline threshold values, which require five or more sampling events at every site for every media and analyte (see Section 18.3, on Statistical Analyses).

Baseline threshold values for all sample sites, based on media and analyte, will be reported in the second annual report, upon completion of baseline monitoring. Comparison of operational monitoring results will be included in all subsequent annual reports.

20.3 Information Distributed on an Internet Server

Following acceptance of the quarterly reports by Oregon DEQ, a summary of the data will be available openly at a URL address that the public can access. Annual reports will be made available in the same fashion after acceptance by Oregon DEQ.

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21.0 References

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Appendix A - Acronym List

ALD	Analytical Laboratory Department
ASTM	American Society for Testing and Materials
CLP	Contract Laboratory Program
CMP	Comprehensive Monitoring Program
DAAMS	Depot Area Air Monitoring System
DEQ	Oregon Department of Environmental Quality
EPA	Environmental Protection Agency
GPS	Global Positioning System
GB	O-isopropyl methylphosphonofluoridate, common name " sarin"
HD	bis(2-chloroethyl)sulfide, common name "mustard"
IDL	Instrument Detection Limit
IQR	Inner Quartile Range
LCS	Laboratory Control Standard
MB	Method Blank
MDL	Method Detection Limit
MQL	Method Quantification Limit
MRL	Method Reporting Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
PARCC	Precision, accuracy, representativeness, completeness and comparability
PCB	Polychlorinated biphenyl
PMCD	U.S. Army Program Manager for Chemical Demilitarization
PMCSD	U.S. Army Project Manager for Chemical Stockpile Disposal
PMN	Perimeter Monitoring Network for air sampling on UMCD perimeter
PQL	Practical Quantitation Limit
Pre-RA	Pre-Trial Burn Risk Assessment

RCRA	Resource Conservation and Recovery Act
RDA	Risk Driving Analyte
RDC	Raytheon Demilitarization Company
RDL	Reporting Detection Limit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SpkMBlk	Spiked Method Blank
SW-846	EPA publication entitled "Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods"
TEF	Toxicity Equivalency Factors
TEQ	Toxic Equivalency
UCL	Upper Confidence Limit
UMCD	Umatilla Chemical Depot
UMCDF	Umatilla Chemical Agent Disposal Facility
USEPA	U.S. Environmental Protection Agency
VX	O-ethyl-S-(2-diisopropylaminoethyl) methylphosphonothiolate

Appendix B - Sampling Methods for DAAMS Only

B.1 Background

This sampling plan appendix will cover the monitoring required to provide a historical record of agent concentrations at the Umatilla Chemical Depot (UMCD). Air sampling on the perimeter of the UMCD is termed the "perimeter monitoring network" (PMN) and is accounted for by Zone 1 (See Table B-1 and Figure B-1). Each PMN station operates independently using Depot Area Air Monitoring System (DAAMS) tubes, and the tubes are collected for laboratory analysis.

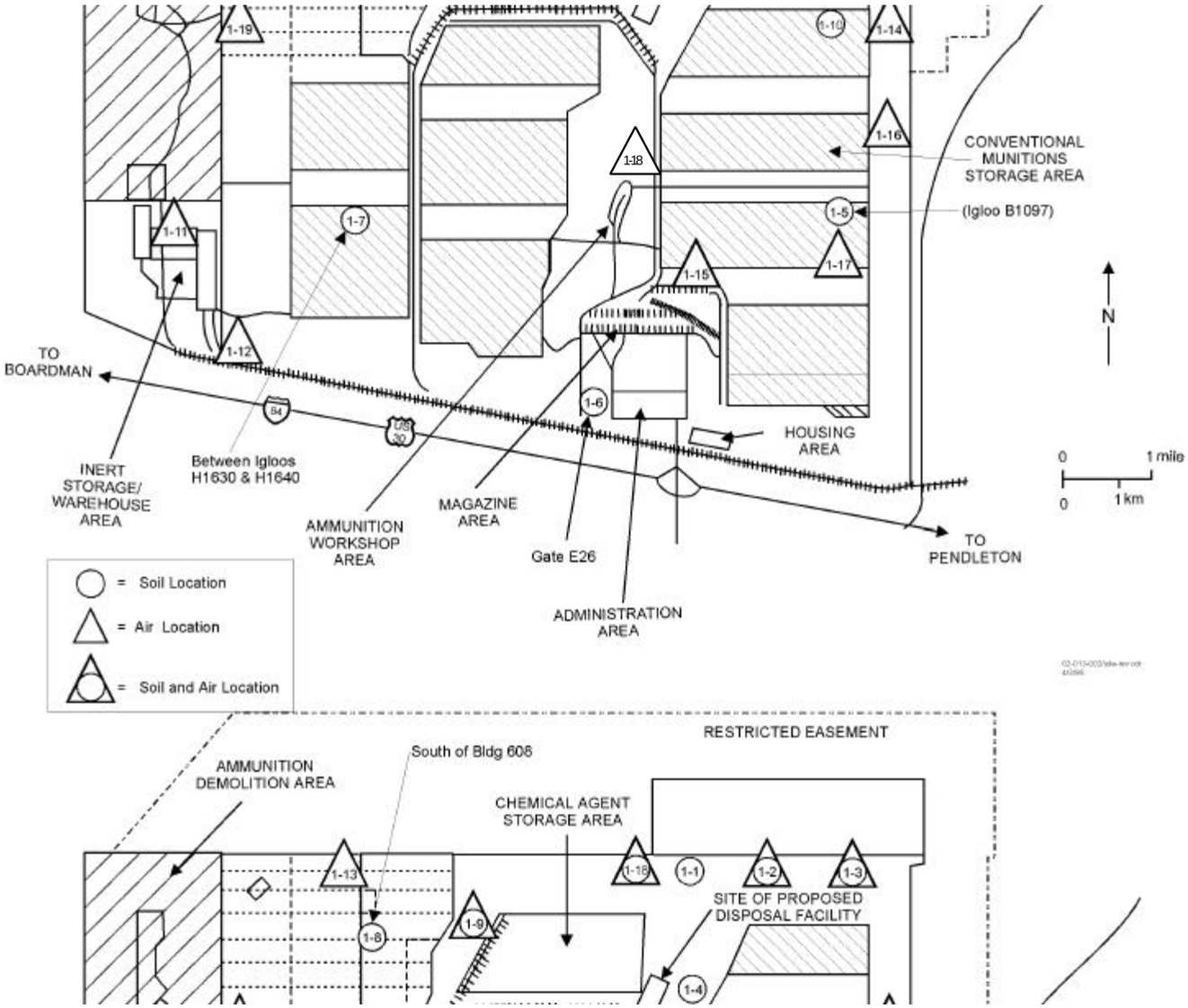
This sampling plan does not cover monitoring for public or worker safety because the PMN cannot provide real-time data to any central emergency response location (U.S. Army, 1998c). The monitoring for public or worker safety is covered by the U.S. Army's Chemical Stockpile Emergency Preparedness Program.

Table B- 1. Zone 1 Site Numbers and Locations

Site	Location Description
1-2	Inside the southwest corner of the intersection of Rim Rd and North Patrol Rd
1-3 *	Southwest of the intersection of North Rd and East Patrol Rd
1-9	Adjacent to Ironwood Rd, 0.5 miles south of North Patrol Rd; in the vicinity of the gate to Area IV
1-11	Near the southeast corner of Building 202
1-12	Northeast corner of the intersection of South Rd and West Patrol Rd
1-13	Intersection of Maple Rd and North Patrol Rd
1-14	0.25 miles North of E Street on East Patrol Rd
1-15	0.25 miles east of Rim Rd on Birch Rd (near Less Than Truckload Building)
1-16	0.5 miles south of E Street on East Patrol Road
1-17	Adjacent to igloo B-1032
1-18	North of K-Block on North Patrol Rd
1-19	100 feet east of intersection of West Patrol Rd and unmarked road (unmarked road is 0.3 miles south of intersection of Badger Road and West Patrol Rd)

* This is the subsistence farmer position from the pre-RA.

Figure B- 1. Map of Zone 1 Sampling Locations



The CMP baseline air sampling data will identify important parameters prior to UMCDF thermal operations. The CMP baseline air sampling may reveal information regarding offsite interference (for example, aerial spraying of pesticides near a PMN monitoring station) that can elicit false positive and/or false negative analytical responses within the instrumental system. The PMN baseline monitoring is expected to reveal interferents prior to operations, allowing protocols to be established that improve the reliability of the agent PMN system. An interference study was already conducted on air samples collected at the UMCD from 10 April 1995 through 14 April 1995 and 19 June 1995 through 23 June 1995 (PMCD, 1996). Methylisothiocyanate was found to be an interferent for VX and GB analyses. Benzothiozole and EPTC (trade name, Eptam) were found to be interferents for HD analyses. The reliability of the agent PMN system may be improved by the use of different analytical columns, additional filters before the air enters the DAAMS tubes or changes in the chromatographic method such as altered temperature ramp or carrier gas flow rate. These options will be evaluated on a case-by-case basis in the event that interferents are encountered.

The most likely points of early detection, should there be a release, are at the UMCDF stack, the UMCDF building filters, and the UMCD storage structures. Air monitoring will not be conducted in Zones 2 and 3 due to the dilution factors involved in sampling at locations beyond the UMCD boundary. The need to sample a large volume of air would introduce interference from industrial and agriculture sources or automobile exhaust.

B.2 Sampling Frequency

Air sampling at the PMN locations is continuous. DAAMS air samples will be collected in Zone 1 every 12 hours. The CMP air monitoring consists of three periods : baseline, operational, and post-operational monitoring.

The baseline monitoring will be conducted prior to the start of UMCDF thermal operations. Baseline DAAMS air samples will commence one year prior to the start of thermal operations. The data will be used to establish baseline levels before the UMCDF has started thermal operations. One year of air sampling will provide over 700 data points at each location for each of three agents (GB, HD, VX) which is adequate to establish the baseline levels.

The operational monitoring will begin at the start of thermal operations and continue through completion of all hazardous waste treatment operations at the UMCDF. Operational air samples will be collected in Zone 1 every 12 hours.

The post-operational monitoring will be conducted for one year after completion of all hazardous waste treatment operations at the UMCDF. Post-operational air samples will be collected in Zone 1 every 12 hours.

B.3 DAAMS Sampling

Each DAAMS station consists of tubes filled with an adsorbent material and a vacuum pump to continuously draw air through each tube. The adsorbent material traps chemical agent. The tubes are changed every 12 hours and sent to the laboratory for analysis.

The chemical demilitarization laboratory will maintain standard operating procedures to accurately record the possession and handling procedures for each sample from the moment of collection through the moment of disposal. Individuals collecting samples shall follow published EPA-approved procedures and site-specific procedures, as approved by the site-specific, state, or local agencies (U.S. Army, 1998b).

B.3.1 Unique Identification of Sample Lines

The Systems Contractor laboratory will provide unique identification (e.g., color coding) for the terminating end of all DAAMS sample transfer lines. Identification must include the station number and the location (name) of the sample point (See Table B-1). This unique identification minimizes errors and assists the operator for sample transfer line connection and sample line challenging (U.S. Army, 1998b).

B.3.2 Quality Control Sample Preparation

Quality Plant sample is a quality control sample which has been spiked with a solution of analyzed dilute chemical agent and aspirated in the field. Quality Plant samples within ten percent of the hazard level and ten percent of the reporting limit are routinely employed to assess the performance of DAAMS methods. DAAMS Quality Plant samples are to be sampled in the same manner as other samples, including the use of VX conversion pads (as required), the sample line, instrument, laboratory analysis (as required), and data processing.

Quality Laboratory and Reportable Limit samples are quality control samples that have been spiked with a solution of analyzed dilute chemical agent in the laboratory and have not been aspirated in the field. The Quality Laboratory and Reportable Limit samples are used to check in/out-of-control status of the gas chromatographs.

B.3.3 DAAMS Samples

DAAMS samples, as used at the PMN, are designed to provide a historical record of the chemical agent measurements at the general population limit level and will be employed for the CMP. Air Monitoring Department personnel (primarily Monitoring Technicians) will initiate chain-of-custody documents, place the DAAMS tubes in the field to sample, record sample information, retrieve the DAAMS samples, deliver the DAAMS samples to the Analytical Laboratory Department, and transfer custody of the DAAMS samples to the Analytical Laboratory Department Sample Custodian. The Analytical Laboratory Department sample custodian will coordinate DAAMS sample analysis. All broken DAAMS tubes will be returned to the laboratory. The Analytical Branch will document broken tubes. DAAMS tubes broken

after aspiration will be separated from the other DAAMS tubes to ensure there is no possible cross contamination.

For VX DAAMS samples, a V-to-G conversion pad is installed at the distal end of each sample line. V-to-G conversion pads will be changed routinely as specified in the system contractor laboratory standard operating procedure.

For HD DAAMS samples, an NO_x pre-filter will be used. The NO_x pre-filter will be changed every two weeks. The DAAMS sequencer timer will be set to within 3.0 minutes of the control room time.

DAAMS analysis consists of gas chromatographic separation followed by flame photometric detection. Confirmation consists of gas chromatograph separation followed by mass spectral detection.

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Appendix C – Sampling Procedure for Soil, Surface Water and Biota

C.1 Introduction

The Comprehensive Monitoring Program (CMP) was designed to monitor for the presence of chemical agents and other risk driving analytes in air, soil, surface water, and biota at the Umatilla Chemical Depot (UMCD). Before UMCDF operations begin, monitoring will be used to determine baseline threshold values for chemical agents and/or risk driving analytes (RDAs) at respective sites. After UMCDF thermal operations begin, monitoring will be used to determine whether concentrations of chemical agents or RDAs from air deposition have significantly increased compared to baseline threshold values.

This sampling plan appendix will cover the monitoring required for soil, surface water and biota to provide a historical record of the chemicals of interest at the UMCD. The area surrounding the Umatilla Chemical Agent Disposal Facility (UMCDF) is divided into three zones:

- Zone 1 includes the UMCDF and extends to the UMCD fence line (perimeter). Zone 1 is the site most likely to have elevated concentrations of agent and RDAs. See Figure C-1.

- Zone 2 extends from the UMCD fence line out to a 50-kilometer (31 mile) radius from the UMCDF common stack. See Figure C-2.

- Zone 3 extends from Zone 2 to approximately 100 kilometers. See Figures C-3 and C-4.

Figure C- 1. Zone 1 Sampling Locations

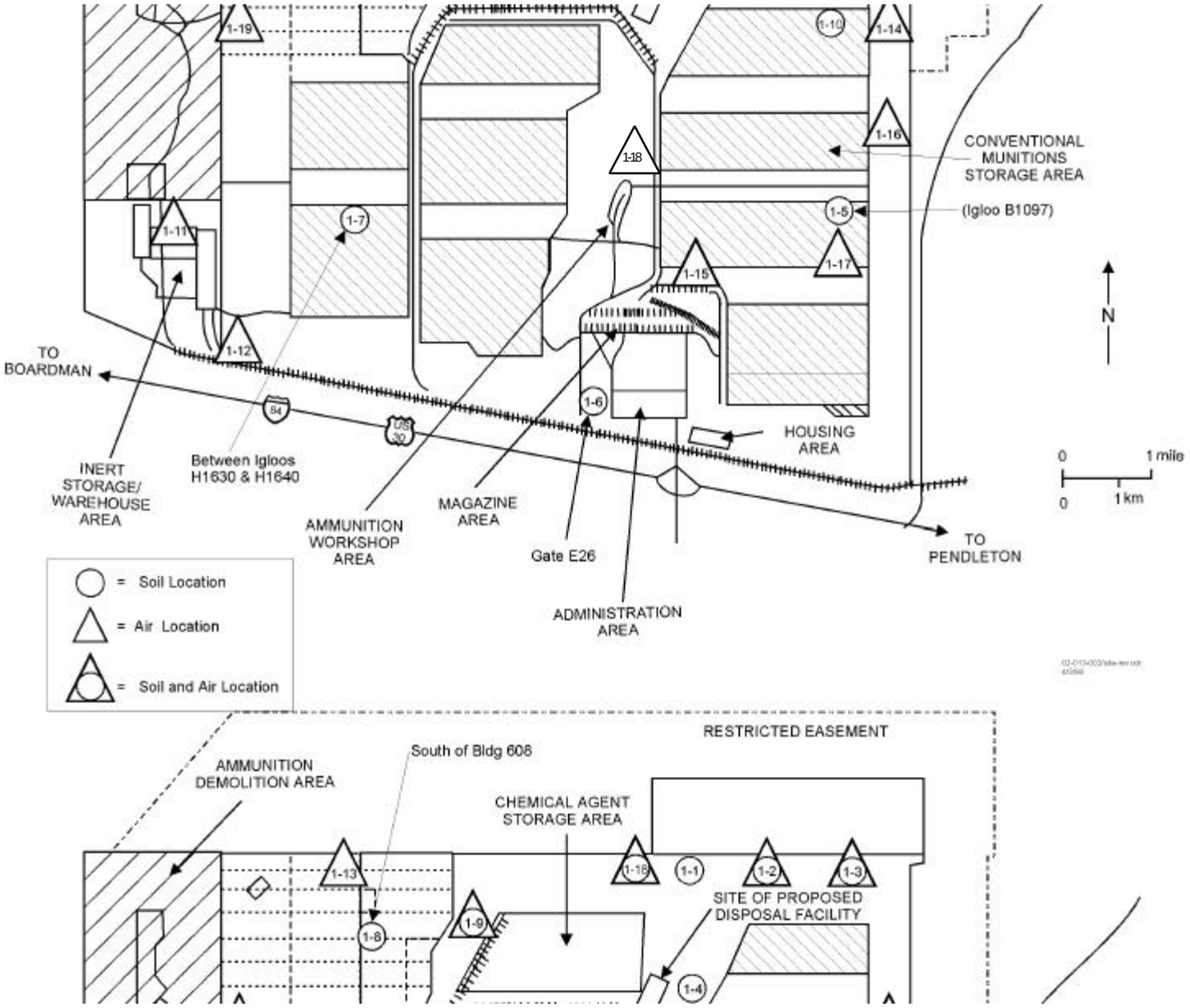


Figure C- 2. Map of Zone 2 Sample Locations

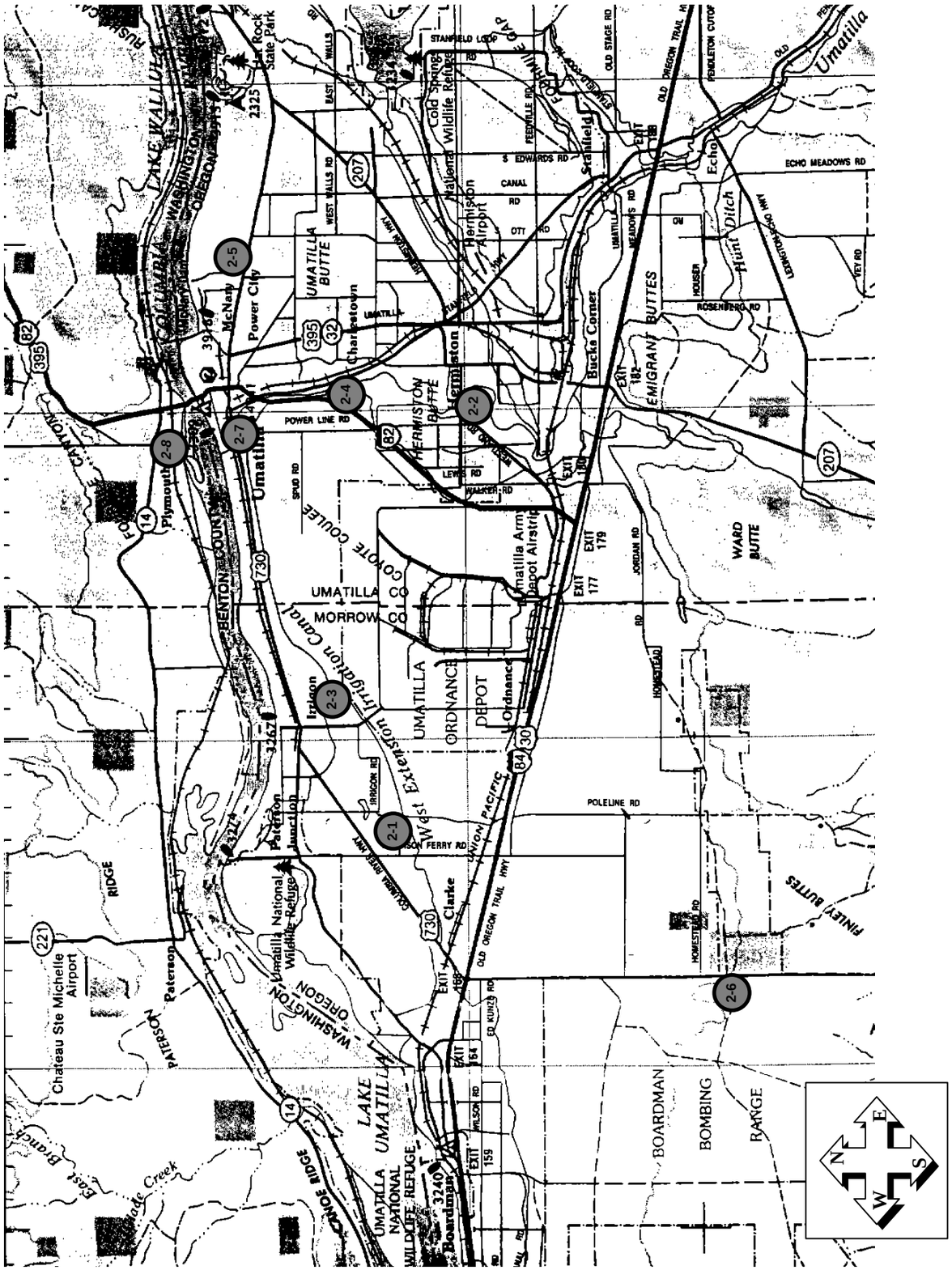


Figure C- 3. Map of Zone 3 Sample Locations in Umatilla County, Oregon

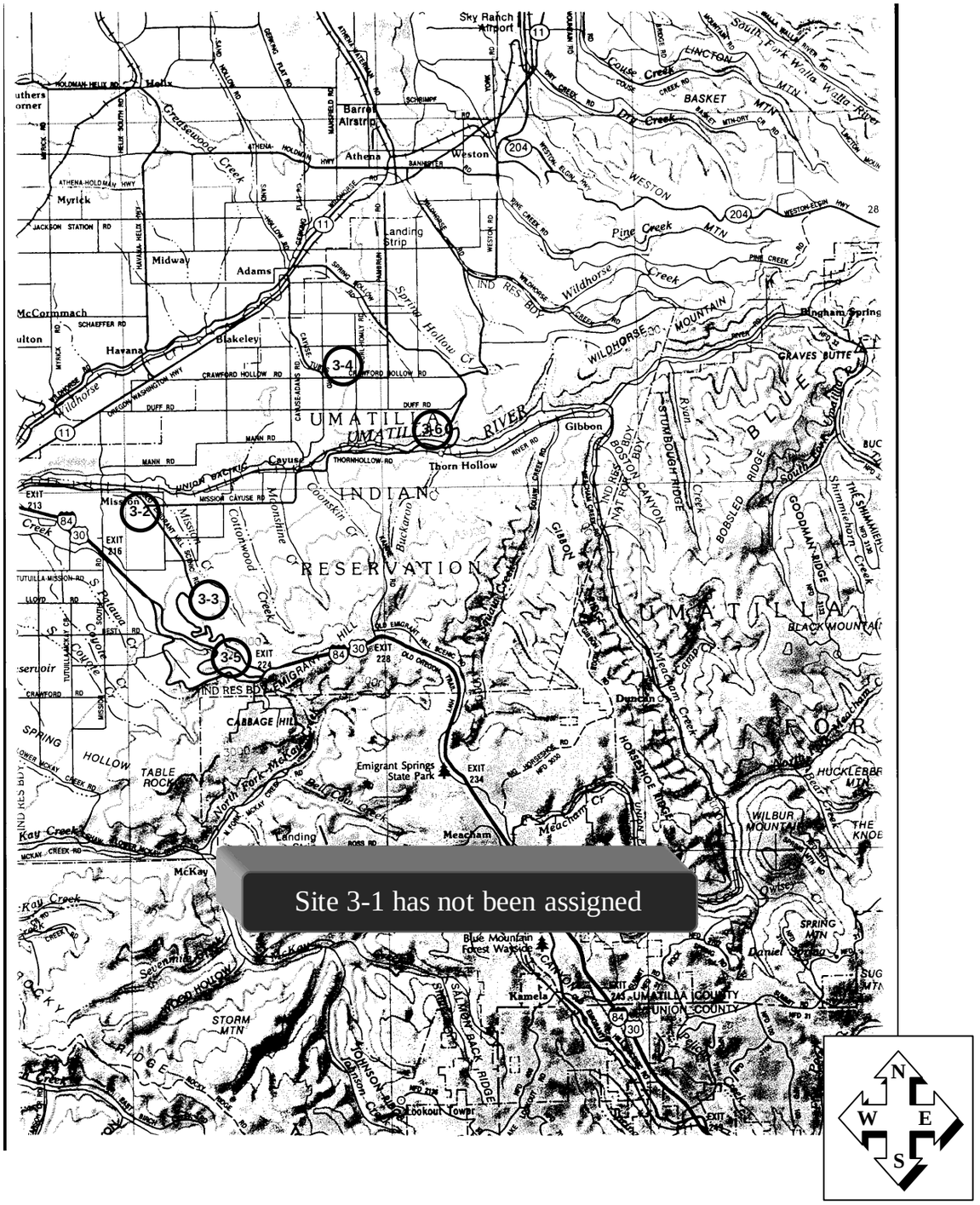
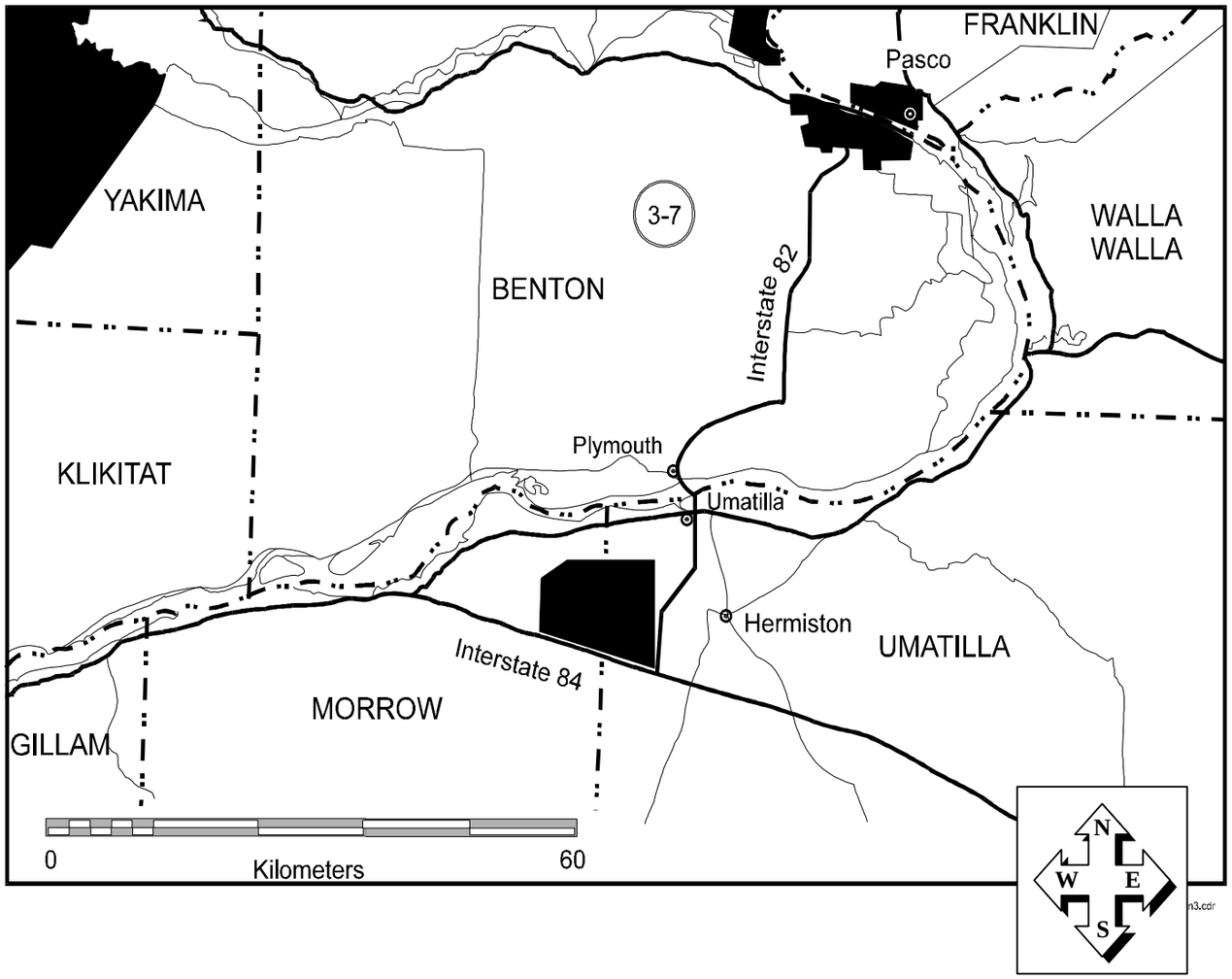


Figure C- 4. Zone 3 Sample Location in Benton County, Washington



C.2 Soil, Surface Water, and Biota Sampling Frequency

The sampling frequency will be quarterly for the baseline monitoring (before UMCDF operations), operational monitoring (after UMCDF thermal operations begin), and post-operational monitoring (one year after completion of all operations at UMCDF). In order to calculate baseline threshold values for the soil at each site, a minimum of five sampling events must occur before thermal operations. The optimal number for calculating baseline threshold values is nine sampling events.

The operational monitoring will begin at the start of thermal operations and continue through completion of all hazardous waste treatment operations at the UMCDF. Operational soil samples will be collected on a quarterly basis. In three sites (Sites 1-3, 1-4, and 1-7), additional soil samples will be taken annually to monitor long-term deposition.

The post-operational monitoring will be conducted for at least one year after completion of all hazardous waste treatment operations at the UMCDF. Post-operational soil samples will be collected on a quarterly basis and annually at Sites 1-3, 1-4, and 1-7.

To ensure comparability, the same sample locations are expected to be monitored throughout the lifetime of the CMP. If a station becomes unavailable due to a change in land use or for other reasons, it will be relocated as near as is reasonable to the original location. In addition, consistent sampling methods must be used at each site from one sampling period to the next. For example, sampling may include random sampling within a grid or transect, but the procedure must be performed in the same manner every sampling event. Maintaining this type of consistency is important to reducing the variability of the monitoring results. However, the sample sites themselves may require different methods be used to sample the same media, e.g., sampling from a bridge versus wading into the pond.

A winter sampling event should be scheduled to coincide with temperature inversion conditions and a time in which the UMCDF is conducting thermal operations. If the temperature inversion persists for several days, then it will be feasible to coordinate the sampling events with the inversion conditions. Contact the Pendelton Weather Station to determine if weather conditions indicate an up-coming temperature inversion.

There are other reasons that will influence the frequency of sampling. For example, due to weather conditions or other environmental factors, biota may not always be available at the identified locations. Also, surface water samples should not be taken if there is ice because the ice will affect the concentration of soluble analytes in the water column.

If ice or snow is present during a sampling event, soil and water samples should not be taken. Samplers should return during the ten-day sampling period to determine if a sample can be taken. If weather conditions do not improve during the ten-day sampling period, then the samples should be taken as soon as the snow and ice are not present and the analytical results will be reported in the next quarterly report.

C.3 Cleaning Procedures for Sampling Equipment

This section describes the general procedures for cleaning field sampling equipment before and after use. Care needs to be taken to minimize contamination of the sampled media and to prevent cross-contamination between sites. Dedicated sampling equipment for each site will be used to minimize the number of quality control samples and decrease the amount of time spent in the field cleaning equipment. All equipment that will come in direct contact with the samples need to be made of an inert material, e.g., Teflon or stainless steel. Cleaning the equipment will take place in a controlled environment with proper ventilation and with proper waste-disposal protocol. Equipment will be cleaned at least 48 hours before use, and will not be stored for more than 14 days.

The sample bottles are not required to be cleaned using these procedures, as they will be pre-cleaned using EPA-certified methods.

Equipment

The following equipment may be needed to clean the field sampling equipment:

- Laboratory-grade detergent (e.g., Alconox)
- Reagent-grade hexane
- Pesticide-grade isopropanol
- Deionized water
- 50% Hydrochloric acid solution (made from reagent-grade hydrochloric acid)
- Acid-resistant bins
- Safety goggles
- Acid-resistant, solvent-resistant gloves
- Acid-resistant, solvent-resistant aprons
- Aluminum foil
- Cardboard boxes

Cleaning Procedures for Teflon Equipment, Before Field Sampling Event

1. Put on safety goggles, acid-resistant gloves, and acid-resistant apron for every step of this activity.

2. Wash all Teflon equipment with laboratory-grade detergent. Rinse with deionized water.

3. In a fume hood, prepare a 50% hydrochloric acid solution from reagent-grade hydrochloric acid. Place Teflon equipment in an acid-resistant bin. Soak equipment in 50% hydrochloric acid solution for 24 hrs. After 24 hrs, remove Teflon equipment and rinse equipment five times in deionized water. Rinsing equipment with deionized water can be done outside of the fume hood.

4. Let equipment dry in the air.

5. Wrap equipment in aluminum foil and label foil with appropriate site designation (e.g. “Site 2-2”). Place in cardboard box for transport to field.

Cleaning Procedures for Stainless Steel or Aluminum Equipment, Before Field Sampling Event

1. Put on safety goggles, solvent-resistant gloves, and solvent-resistant apron for every step of this activity.

2. Wash all stainless steel equipment with laboratory-grade detergent. (Note: All equipment for use with small mammals will be cleaned with Alconox disinfecting detergent.) Rinse with deionized water.

3. In a fume hood, place all stainless steel equipment in bin. Rinse equipment with reagent-grade hexane. Then rinse equipment with pesticide-grade isopropanol. Then rinse equipment three times with deionized water. Rinsing equipment with deionized water can be done outside of the fume hood.

4. Let equipment dry in the air.

5. Wrap equipment in aluminum foil and label foil with appropriate site designation (e.g. “Site 2-2”). Place in cardboard box for transport to field.

Cleaning Procedures for Equipment, After Field Sampling Event

1. After equipment is used in the field, the equipment should be placed back in aluminum foil to prevent cross-contamination.

2. All equipment used in the field should be thoroughly cleaned in laboratory-grade detergent and rinsed with deionized water.

3. Let equipment dry in the air.

4. Store in dry location until next quarter’s field sampling.

C.4 Soil Sampling

Soil samples are collected at 25 sites in all Zones. See Table C-1 for site numbers and descriptions of soil sampling in Zones 1, 2, and 3. In order to reduce interferences from vegetation and decrease variability within a site, soil sampling stations will be constructed at each site and the soil at the station will be sampled on a quarterly basis. At sites 1-3, 1-4 and 1-7, additional soil sampling stations will be constructed and will be sampled on an annual basis. This section discusses the procedures for constructing the soil sampling stations and sampling the soil.

Table C- 1. Site Number and Description for Surface Soil Analysis of RDAs and Agent

Site	Location Description	Agent	RDA
1-1	South of road cut, 0.2 mile east of Haul Rd on North Patrol Rd		X
1-2	Inside the southwest corner of the intersection of Rim Rd and North Patrol Rd		X
1-3[1,4]	Southwest of intersection of North and East Patrol Rds	X	X
1-4[4]	100 meters northeast of common stack (maximum deposition site)	X	X
1-5	Halfway between Avenue E and igloo B1097		X
1-6	20 meters north of gate E26 and 10 meters east of fence		X
1-7[4]	Halfway between igloos H1630 and H1640		X
1-8	Along ridge top 100 meters south of the center of Building 608		X
1-9	Ironwood Rd, ½ mile south of North Patrol Rd; near gate to Area IV	X	X
1-10	Adjacent to igloo D1257	X	X
2-1 [3]	Lower Sand Spring; 0.3 miles west and south on Depot Ln from intersection of Depot Ln and West 8th Rd	X	X
2-2 [3]	0.25 miles south of Highland Rd on Quick Rd		X
2-3[3]	Main canal of the West Extension Irrigation District and southwest of the Gate 68 lateral (~1.1 miles east of Division Street at Hoop-N-Holler Ln)		X
2-4 [2]	Three Mile Dam on west side of Umatilla River; upstream from irrigation dam	X	X
2-5	Conforth Ranch, north of the intersection of Beach Access Rd and Highway 730 (4.5 miles west of Diagonal Rd)		X
2-6	East side of the Boardman Bombing Range, ~ 200 feet inside gate on south side of main road, located 5.0 miles south of I-84 on Bombing Range Rd		X
2-7	Park at Tucker Rd and Stephens Ave (0.5 miles south of Highway 730 on Powerline Rd)	X	X
2-8	Plymouth Park at Lake Umatilla east of Plymouth off Christy Rd; in undeveloped field campsite 17	X	X
3-1	Location has not been assigned		
3-2	Mission area adjacent to ceremonial grounds		X
3-3 [3]	Old Emigrant Rd and Old Jeep Rd intersection; southeast of the hairpin turn ~3.5 miles south of Mission Rd	X	X
3-4 [3]	1/8 mile north of Tubbs Ranch Rd, 1/4 mile east of the USDA office building		X
3-5[3]	Cabbage Hill site; on Old Emigrant Road between the hairpin curve and Boiling Point; southeast of the cattle guard on the south side of the road		X
3-6	CTUIR fish hatchery at Umatilla River on Thorn Hollow Road		X
3-7 [3]	Southeast corner of intersection at Clodfelter Rd. and Bently Rd.		X

Notes:
1. This is the subsistence farmer position from the pre-RA.
2. This is the subsistence fisherman location evaluated in the pre-RA.
3. Sample location is on private property. Site will be relocated nearby if permission is revoked.
4. Long-term soil site.

C.4.1 Soil Sampling Station Construction

This section describes how to construct the quarterly monitoring soil sampling stations at each of the 25 sites listed in Table C-1, and the annual monitoring soil sampling stations at Sites 1-3, 1-4, and 1-7. The size of the station was designed to provide stability to the station and provide enough soil such that more than 1 Kg of soil volume can be collected every monitoring event throughout the baseline, operational, and post-operation phases of the CMP. Stations will be installed prior to the first sampling event, or upon permission from property owners.

Equipment

The following equipment may be needed to construct the soil sampling stations:

- Soil (sieved, sandy-loam) (80 Kg per quarterly monitoring site, 104 Kg per annual monitoring site)
- Spade-shaped shovels (2)
- Flat-edged shovel
- Leather gloves
- Measuring tape
- Bags for excavated soil
- Tyvec sheets
- Stainless steel knife with 1 cm wide blade
- Shearing scissors
- Camera and film (or digital camera)
- Bound field notebook
- GPS equipment

1. Locate a secluded, level area at the site for the soil sampling station (see Table C-1 and Appendix D).

2. Photograph the sampling location within its contextual setting prior to construction of station (wide-angle lenses are preferred). Take GPS measurement of the station.

3. Wearing leather gloves, use shovel to excavate an area for soil sampling station. The area for the quarterly monitoring station is 50 cm by 50 cm and a depth of 20 cm. The area for the annual monitoring station is 50 cm by 130 cm and a depth of 10 cm. Put excavated soil into bag such that the soil may be removed from the site.

4. Place Tyvec over excavated area. If more than one sheet of Tyvec is needed, then the seams should overlap by 5 cm.

5. Using a stainless steel knife with a 1 cm wide blade, pierce the Tyvec every 5 cm in a grid fashion. The width of the slit made be the knife should be no wider than the width of the knife's blade.

6. Using second shovel, place sieved, sandy-loam soil on Tyvec and fill excavated area. Level soil. Trim excess Tyvec to ground level.

7. Photograph completed station.

C.4.2 Soil Sampling

Soil samples are collected from the soil sampling stations and are analyzed for concentrations of chemical agents and RDAs (see Table C-1 for the sites that are also to be analyzed for chemical agents).

Equipment

The following equipment may be needed to collect soil samples:

- Camera and film (or digital camera)
- Masking tape
- Leather gloves
- Measuring tape
- Certified clean glass jars
- Trowel
- Sample labels
- Chain-of-Custody form
- Permanent marking pen (black ink)
- Appropriate work procedures and permits from the UMCDF
- Portable spring scale and appropriate accessories
- Cooler and ice (one cooler for each laboratory)
- Bound field notebook

Soil Sample Collection Procedure

1. Proceed to the soil sampling station at a site (see Table C-1 and Appendix D). Take care not to walk on or disturb the sampling area until after all of the monitoring samples are collected.

2. Photograph the sampling location within its contextual setting prior to collecting samples (wide-angle lenses with digital camera are preferred).

3. In the field notebook, record conditions at the site (e.g., weather, fire, etc.). If the sample site has been disturbed, notify the CMP Contractor Project Manager and/or supervisor so that corrective measures can be taken.

4. For the quarterly monitoring soil sampling stations : Using an additional certified clean glass jar, randomly select an edge of the station. Place the jar upside down on the soil. Press the jar into the soil 1 cm. Slide a trowel under the jar to cut the soil even with the bottom of lip of the jar. Lift the jar and trowel, turn them over, and let the soil fall back into the jar.

5. For the annual monitoring soil sampling stations : Measure off the next available 25 cm area using a measuring tape from the sides of the soil sampling station (Figure C-5). The soil sample should be collected as listed above for the quarterly monitoring soil sampling stations. The first sample to be collected from the annual monitoring soil sampling station

should be located at one end of the station. The second sample to be collected from the annual monitoring station should be located next to the first quadrant. The third sample to be collected from the annual monitoring station should be located above the first sample. By proceeding annually in this manner, a new and undisturbed quadrant will be sampled each year. In the field notebook, record the exact area of the annual monitoring soil sampling station where the soil sample was collected, and describe any changes to the station from the previous year (e.g., evidence of disturbance). Also, photograph the station showing where the soil sample was collected.

1	3	5	7	9
2	4	6	8	10

Figure C-5: Order of Sampling Quadrants in Annual Monitoring Soil Sampling Stations

6. Transfer the soil sample into the pre-tarred, pre-labeled sample jar.

7. Repeat until enough soil is collected from approximately one-fourth of the station's surface area. Avoid sampling the surface in areas of station that have been disturbed by the trowel or contain debris that might have accumulated since the last quarterly sampling event (e.g., vegetation).

8. Seal the certified clean glass jar with the appropriate lid.

9. Weigh the sample and record the weight on the chain-of-custody form.

10. Record the sample time on the chain-of-custody form. The sample date may be preprinted on the chain-of-custody form. If so, verify that the date is correct. Enter the sample date if it is not pre-printed on the sheet.

11. Verify that all samples have been collected from the site. Chemical agents and quality control samples (duplicates) will require filling additional sample jars.

12. Place the samples in a cooler on ice for transport back to CMP Contractor facilities.

13. Before submitting the samples to the analytical laboratory, the chain-of-custody forms and sample labels must be checked for accuracy by the CMP Contractor Field Sampling Task Manager. The reviewer should sign and date the chain-of-custody form in the appropriate locations.

14. For delivery to the laboratory, the field sampler should sign and date the chain-of-custody form in the "Relinquished By" space. The shipping papers will serve as the chain-of-custody for delivery to the laboratory. The laboratory will keep the front copy of the chain-of-

custody form. The original duplicate should be returned immediately to the CMP Contractor Field Sampling Task Manager. The CMP Contractor Field Sampling Task Manager will ensure that the original duplicate is given to the CMP database steward within two working days following sample collection.

15. The soil in the quarterly monitoring soil sampling stations should be leveled with a trowel before leaving the site. Remove any foreign objects from the soil, e.g., any plant material. For the annual monitoring soil sampling stations, the soil should not be leveled after sampling. However, every quarter, any plants growing in the annual monitoring soil sampling station should be removed with the least amount of disturbance to the soil's surface.

16. Notify the CMP Contractor Field Sampling Task Manager of any deviations from this procedure or if any unusual or noteworthy conditions exist.

C.5 Surface Water Sampling

Surface water sampling will be conducted at four sites in Zone 2. At Site 2-1 and 2-5, the samples will be collected by entering the water and immersing the sample bottle. At Sites 2-2 and 2-4, the samples will be collected from above (on the bridge or dam, respectively) by immersing a bucket on a line. Surface water samples will not be collected if weather or other factors produce unsafe sampling conditions. See Table C-2 for site numbers and descriptions of surface water sampling.

Table C- 2. Site Number and Description for Surface Water Analysis of RDAs

Site	Location Description
2-1 [1]	Lower Sand Spring; 0.3 miles west and south on Depot Lane from intersection of West 8 th Rd
2-2 [1]	Water samples collected from Highland Rd bridge over the Umatilla River
2-4 [2]	At Three Mile Dam on west side of Umatilla River ; upstream from irrigation dam.
2-5	Conforth Ranch, north of the intersection of Beach Access Rd and Highway 730 (4.5 miles west of Diagonal Rd)

Note: 1. Sample location is on private property. Site will be relocated nearby if permission is revoked.
2. This is the subsistence fisherman location evaluated in the pre-RA.

Equipment

The following equipment may be needed to collect surface water samples:

- Camera and film (or digital camera)
- Certified clean glass jars
- Teflon bucket on line
- Rubber hipboots or waist waders, as needed
- Towels
- Sample labels
- Two-inch wide clear tape to cover (protect) sample labels
- Security tape
- Chain-of-custody form
- Permanent marking pen (black ink)
- Appropriate work procedures and permits from UMCDF
- Portable spring scale and appropriate accessories
- Cooler and ice (one cooler for each laboratory)
- Bound field notebook
- GPS equipment

Surface Water Sample Collection Procedure

1. Proceed to GPS location at specific sampling location (see Table C-2 and Appendix D).

2. Observe sample location and record on the field record form (or in log book) any unusual conditions (i.e., excessive algae growth, presence of effluent at nearby drainage pipes, heavy surface debris, or extremely large amounts of suspended sediment).

3. Collect clean water from approximately mid-depth to avoid collecting sediment and surface debris. Rinse the sample container three times before collecting the sample.

4. Avoid areas of heavy surface debris.

5. Avoid hitting or agitating the bottom, which would re-suspend the sediments.

6. Rinse sample container three times with water to be sampled prior to sample collection.

7. When sampling flowing water, face the inlet of the sample container into the current.

8. Fill the sampler container and tighten the cap firmly.

9. Dry the outside of the sample container with a towel.

10. Seal the cap with security tape.

11. Record the date, time, and sample volume on the chain-of-custody form.

12. Check that the sample date and sample number are on the label and are accurate.

13. Make sure that the sampling dates on all sample labels are correct. Labels are often printed days or weeks before sampling, and the dates may need to be changed to reflect the correct sample date. Also ensure the sampling dates on the chain-of-custody forms match the dates on the corresponding labels.

14. Attach the sample label to the outside wall of the container.

15. Cover the sample label with a strip of two-inch wide clear tape to protect it from the water and to ensure that it remains affixed to the container.

16. Place the samples in a cooler on ice for transport back to CMP Contractor facilities.

17. Before submitting the samples to the analytical laboratory, the chain-of-custody forms and sample labels must be checked for accuracy by the CMP Contractor Field Sampling Task Manager. The reviewer should sign and date the chain-of-custody form in the appropriate locations.

18. For delivery to the laboratory, the field sampler should sign and date the chain-of-custody form in the “Relinquished By” space. The shipping papers will serve as the chain-of-custody for delivery to the laboratory. The laboratory will keep the front copy of the chain-of-custody form. The original duplicate should be returned immediately to the CMP Contractor Field Sampling Task Manager. The CMP Contractor Field Sampling Task Manager will ensure that the original duplicate is given to the CMP database steward within two working days following sample collection.

19. Notify the CMP Contractor Field Sampling Task Manager of any deviations from this procedure or if any unusual or noteworthy conditions exist.

C.6 Biota Sampling

Biota sampling will be performed four times a year for an extended period. Therefore, the species of plants, insects, and small mammals collected will be restricted, where possible, to reduce long-term impacts. See Table C-3 for site numbers and descriptions of biota sampling sites.

Plants collected will be limited to an abundant and fast-growing type that is most common to all sites, e.g., grasses. The grass type chosen may vary from site to site, but should be consistent within that site from one sample event to another. For example, bunch grasses are abundant at Site 1-8 and should be the only species collected there each time there is a sampling event. Plants collected must be identified to family, or species when possible. This must be recorded on the sample inventory sheet.

Insects collected in pit traps should also be identified to family or species. Since more individuals must be collected in order to meet the minimum sample-weight requirement, selection of insects will be less stringent.

Small mammals are less numerous than vegetation or insects, and collection of one individual will have a relatively larger impact upon the community. The sampling is designed to catch the minimum number of individuals that are needed for analysis. Another consideration when collecting animals is the niche that different species occupy. For example, the pocket mouse is mostly vegetarian, while the deer mouse is vegetarian as well as carnivorous. The differences in diet will add variability to the monitoring program. Thus, identification of the species captured for analysis is important, and only one species per site should be analyzed.

Table C- 3. Site Number and Location Description for RDAs in Biota

Site	Location Description
1-1	South of road cut, 0.2 mile east of Haul Rd on North Patrol Rd
1-2	Inside the southwest corner of the intersection of Rim Rd and North Patrol Rd
1-3[1]	Southwest of intersection of North Rd and East Patrol Rd
1-5	Halfway between Avenue E and igloo B1097
1-6	20 meters north of gate E26 and 10 meters east of fence
1-7	Halfway between igloos H1630 and H1640
1-8	Along ridge top 100 meters south of the center of Building 608
1-9	Ironwood Rd, ½ mile south of North Patrol Rd; near gate to Area IV
1-10	Adjacent to igloo D1257
2-1[3]	Lower Sand Spring; 0.3 miles west and south on Depot Ln from intersection with West 8 th Rd
2-2[3]	Sample 0.25 miles south of Highland Rd on Quick Rd
2-3[3]	Main canal of the West Extension Irrigation District and southwest of the Gate 68 lateral (~1.1 miles east of Division St at Hoop-N-Holler Ln)
2-4[2]	Three Mile Dam on west side of Umatilla River; upstream from irrigation dam
2-5	Conforth Ranch, north of Beach Access Rd & Hwy 730 intersection (4.5 miles west of Diagonal Rd)
2-6	At the east side of the Boardman Bombing Range, approximately 200 feet inside of a gate on the south side of the main road, located 5.0 miles south of I-84 on Bombing Range Rd
2-7	Park at intersection of Tucker Rd & Stephens Ave (0.5 miles south of Hwy 730 on Powerline Rd)
2-8	Plymouth Park at Lake Umatilla east of Plymouth off Christy Rd; in undeveloped field near campsite 17
3-2	Mission area adjacent to ceremonial grounds
3-3[3]	Old Emigrant Rd & Old Jeep Rd intersection ; SE of hairpin turn ~3.5 miles so. of Mission Rd

Notes:
1. This is the subsistence farmer position from the pre-RA
2. This is the subsistence fisherman location evaluated in the pre-RA.
3. Sample location is on private property. Site will be relocated nearby if permission is revoked.

C.6.1 Vegetation Sampling Procedures

Vegetation samples will be collected at all the sites described in Table C-3. The predominant grass species at each site will be collected by cutting the shoots off just above ground surface.

Equipment

The following equipment may be needed to collect vegetation samples:

- Camera and film (or digital camera)
- Compass
- Random numbers table (values from 0 to 360)
- Pruning shears or scissors
- Leather gloves
- Certified clean glass jars
- Masking tape
- Sample labels
- Chain-of-custody form
- Permanent marking pen (black ink)
- Appropriate work procedures and permits from the UMCDF
- Portable spring scale and appropriate accessories
- Cooler and ice (one cooler for each laboratory)
- Bound field notebook

Vegetation Sample Collection Procedure

1. Proceed to the soil sampling station at each sampling location (see Table C-3 and Appendix D). Select predominant grass species within the designated area for sampling. Record the relative percentages of each species collected on the chain-of-custody form in the comment column.

2. Photograph the sampling location within its contextual setting prior to collecting samples (wide-angle lenses are preferred).

3. Using a random numbers table with values from 0 to 360, determine the compass direction for establishing a transect. Proceed along transect and collect grass sample every four paces.

4. Collect samples away from the surface to avoid surface deposition. Using shears or scissors, cut the shoot of the grass at a height approximately 4 cm above the soil surface.

5. Collect ~55 grams of vegetation (weight should be based on the needs of the laboratory for all analytical procedures). The pieces cut should be no more than six-inches long.

6. Put the samples in a certified clean, pre-tarred glass jar, and put lid on jar.

7. Weigh the sample and record the weight on the chain-of-custody form.

8. Record the sample time on the chain-of-custody form. The sample date may be preprinted on the chain-of-custody form. If so, verify that the date is correct. Enter the sample date if it is not pre-printed on the sheet.

9. Place the samples in a cooler on ice for transport back to CMP Contractor facilities. Freeze sample prior to shipment to the analytical laboratory.

10. Before submitting the samples to the analytical laboratory, the chain-of-custody forms and sample labels must be checked for accuracy by the CMP Contractor Field Sampling Task Manager. The reviewer should sign and date the chain-of-custody form in the appropriate locations.

11. For delivery to the laboratory, the field sampler should sign and date the chain-of-custody form in the "Relinquished By" space. The shipping papers will serve as the chain-of-custody for delivery to the laboratory. The laboratory will keep the front copy of the chain-of-custody form. The original duplicate should be returned immediately to the CMP Contractor Field Sampling Task Manager. The CMP Contractor Field Sampling Task Manager will ensure that the original duplicate is given to the CMP database steward within two working days following sample collection.

12. Notify the CMP Contractor Field Sampling Task Manager of any deviations from this procedure or if any unusual or noteworthy conditions exist.

C.6.2 Terrestrial Invertebrate Samples

Terrestrial invertebrates will be collected at all the sites described in Table C-3. Flying and hopping insects will be collected with insect nets. Crawling insects will be collected in pit falls.

Equipment

The following equipment may be needed to collect soil samples:

- Camera and film (or digital camera)
- Compass
- Random numbers table (values from 0 to 360)
- Masking tape
- Latex gloves
- Certified clean glass jars
- Insect nets
- Pit falls (aluminum cans the size of coffee cans or paint cans)
- Post-hole digger
- Light trap

- Sample labels
- Chain-of-custody form
- Permanent marking pen (black ink)
- Appropriate work procedures and permits from the UMCDF
- Portable Pesola spring scale (1 kg capacity) and appropriate accessories
- Cooler and ice (one cooler for each laboratory)
- Bound field notebook

Terrestrial Invertebrate Sample Collection Procedure

1. Proceed to the soil sampling station at each sampling location (see Table C-3 and Appendix D).

2. Photograph the sampling location within its contextual setting prior to collecting samples (wide-angle lenses are preferred).

3. Collection with insect nets : Using a random numbers table with values from 0 to 360, determine the compass direction for establishing a transect. Using the nets, sweep along the designated transect. Remove insects from the nets wearing Latex gloves and place into the certified clean glass jar. Repeat until enough insects have been obtained for a sample.

4. Collection with pit falls : Using a post-hole digger, insert the digger into soil to remove enough dirt to place a pit fall trap (aluminum can) into the ground and flush with the surface of the soil. Place pitfalls in a grid every ten meters apart. The layout of the grid will depend on the sampling location (i.e., open field or next to a canal). Leave pitfalls in the ground during the sampling period. Check daily and place trapped insects into certified clean glass jars wearing Latex gloves. Repeat until enough insects have been obtained for a sample. Take measures to prevent tripping hazards associated with pit falls between quarterly sampling periods (e.g., filling hole by inverting can, or filling hole with soil).

5. Seal the certified clean glass jar with the appropriate lid.

6. Weigh the sample and record the weight on the chain-of-custody form.

7. Record the sample time on the chain-of-custody form. The sample date may be preprinted on the chain-of-custody form. If so, verify that the date is correct. Enter the sample date if it is not pre-printed on the sheet.

8. Place the samples in a cooler on ice for transport back to CMP Contractor facilities. Freeze sample prior to shipment to the analytical laboratory.

9. Collect ~55 g of insects (weight should be based on the needs of the laboratory for all analytical procedures). Light traps may be used if the two methods above are not efficient at obtaining an insect sample.

10. Before submitting the samples to the analytical laboratory, the chain-of-custody forms and sample labels must be checked for accuracy by the CMP Contractor Field Sampling Task Manager. The reviewer should sign and date the chain-of-custody form in the appropriate locations.

11. For delivery to the laboratory, the field sampler should sign and date the chain-of-custody form in the "Relinquished By" space. The shipping papers will serve as the chain-of-custody for delivery to the laboratory. The laboratory will keep the front copy of the chain-of-custody form. The original duplicate should be returned immediately to the CMP Contractor Field Sampling Task Manager. The CMP Contractor Field Sampling Task Manager will ensure that the original duplicate is given to the CMP database steward within two working days following sample collection.

12. Notify the CMP Contractor Field Sampling Task Manager of any deviations from this procedure or if any unusual or noteworthy conditions exist.

C.6.3 Small Mammal Sampling Procedures

Small mammals will be collected at all the sites described in Table C-3. Snap traps should be used in Zone 1 to collect small mammals. Sherman live traps should be used in Zones 2 and 3 to collect small mammals.

Equipment

The following equipment may be needed to collect soil samples:

- Camera and film (or digital camera)
- Masking tape
- Leather and Latex gloves
- Certified clean glass jars
- Snap traps
- Sherman live traps
- Bait – peanut butter and/or cheese
- Dissecting tools (stainless steel)
- Alconox (disinfecting solution)
- Deionized water
- Aluminum foil
- Sample labels
- Chain-of-custody form
- Permanent marking pen (black ink)
- Biological hazards bag
- Appropriate work procedures and permits from the UMCDF
- Portable Pesola spring scale (10, 30 and 100g capacity) and appropriate accessories

- Cooler and ice – blue, wet or dry (one cooler for each laboratory)
- Bound field notebook

Small Mammal Sample Collection Procedure

1. Proceed to the soil sampling station at each sampling site (see Table C-3 and Appendix D).

2. Photograph the sampling location within its contextual setting prior to collecting samples (wide-angle lenses are preferred).

3. Snap traps will be used in Zone 1. Sherman live traps will be used in Zones 2 and 3. Sampling locations will consist of trapping grids. Grid sites located in dry-land (terrestrial) locations will consist of a 10 x 10 arrangement of snap traps placed ten m apart. Grids in riparian areas or along irrigation canals will consist of a 2 x 25 arrangement of trapping stations ten m apart. The layout of the grid will depend on the sampling location (i.e., open field or next to a canal).

4. Traps are baited with peanut butter or cheese in the evening. The traps are checked early in the morning the day after they have been set.

5. While checking the trap line leather gloves should be worn. Animals trapped in Sherman live traps are to be euthanized using cervical dislocation. Determine and document the species, sex, weight, age, and reproductive condition as well as trap location, time of day, date, and weather condition. All specimens for analyses should be the same species.

6. Specimens for organic analyses are not dissected. Put clean pair of surgical gloves on, remove specimen from trap, and place specimen in a certified clean glass jar.

7. Specimens for metal analyses should be skinned first. Put clean pair of surgical gloves on and remove specimen from the trap. Place the small mammal on aluminum foil. The specimen should be in a "belly up, spread eagle" position. Using a blunt-ended, sharp dissecting scissors, make a cut just below the animal's jaw making sure only to penetrate the skin. Slip the sharp end of the scissors under the skin and cut along the long axis of the animal.

8. Using a pair of tweezers, lift a cut end of the skin and with the blunt end of the scissors and begin "peeling" the hide away from the carcass. Continue until entire hide is removed. With the entire hide removed rinse carcass with deionized water making sure to wash away any hair clinging to it. Dissect and remove the stomach and intestines.

9. Weigh the sample and record the weight on the chain-of-custody form.

10. Record the sample time on the chain-of-custody form. The sample date may be preprinted on the form. If so, verify that the date is correct. If not, enter the sample date on the form.

11. Place the samples in a cooler on ice for transport back to CMP Contractor facilities. Freeze sample prior to shipment to the analytical laboratory.

12. Repeat trapping process until enough small mammals have been obtained for a sample. Collect at least 21 g for metal analyses and 30 g for organic analyses (weight should be based on the needs of the laboratory for all analytical procedures).

13. Dispose of the aluminum foil and used surgical gloves in biological hazards bag, to avoid any cross contamination.

14. Before submitting the samples to the analytical laboratory, the chain-of-custody forms and sample labels must be checked for accuracy by the CMP Contractor Field Sampling Task Manager. The reviewer should sign and date the chain-of-custody form in the appropriate locations.

15. For delivery to the laboratory, the field sampler should sign and date the chain-of-custody form in the "Relinquished By" space. The shipping papers will serve as the chain-of-custody for delivery to the laboratory. The laboratory will keep the front copy of the chain-of-custody form. The original duplicate should be returned immediately to the CMP Contractor Field Sampling Task Manager. The CMP Contractor Field Sampling Task Manager will ensure that the original duplicate is given to the CMP database steward within two working days following sample collection.

16. Notify the CMP Contractor Field Sampling Task Manager of any deviations from this procedure or if any unusual or noteworthy conditions exist.

C.7 Order of Field Sampling Activities

The preceding methods for field sampling shall take place in an order such that the sampling activities will not damage or contaminate the samples to be collected. Figure C-5 is a flow diagram for the field samplers to follow during sample events at each site.

Figure C-6: Flow Diagram for Field Sampling of Soil, Surface Water and Biota

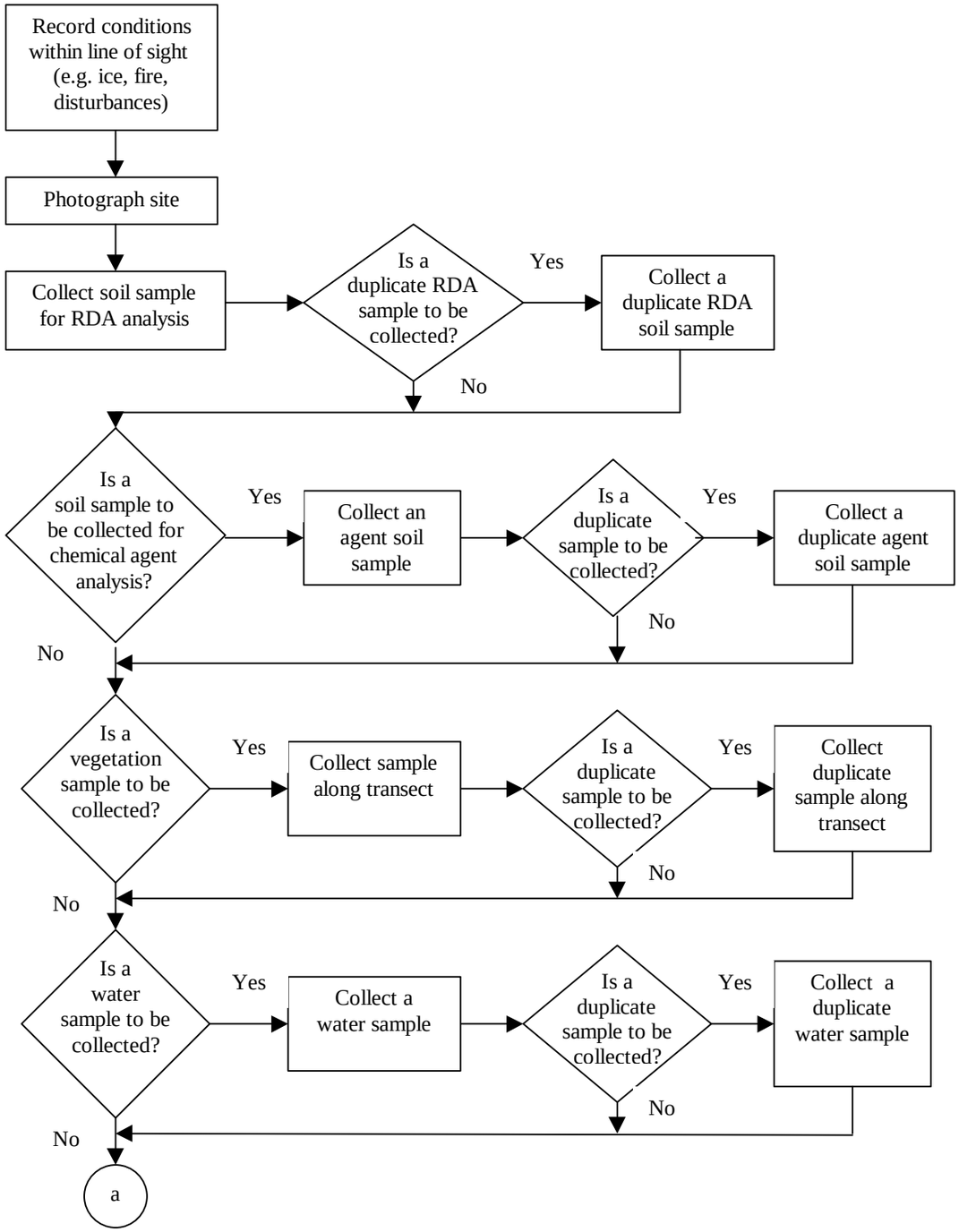
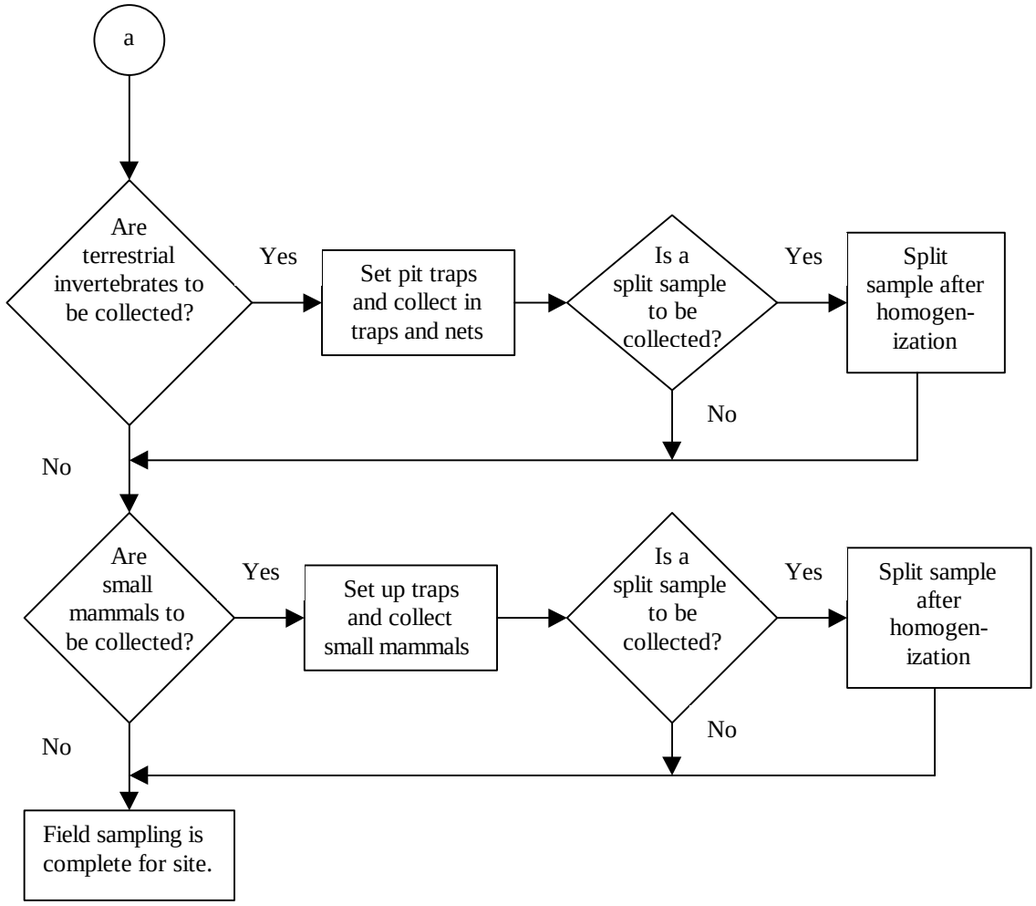


Figure C-6: Flow Diagram for Field Sampling of Soil, Surface Water, and Biota (Continued)



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Appendix D - Site Descriptions and Global Positioning System Locations for the Comprehensive Monitoring Program (CMP) Workplan

This appendix provides additional information about each site. Figure D-1 shows the GPS locations of each site. For security reasons, the coordinates for the sites will be maintained by RDC and CMP Contractor.

Zone 1

Site 1-1
Location: South of the road cut, 0.2 miles east of Haul Road on North Patrol Rd.
Sampling: RDAs in soil and biota
Orientation: North northeast of incinerator

Sandy soil, cryptogamic (CRG) layer. Mostly bunch grasses, yellow daisy-like flowers. No sage, rabbit or bitter brush.

Site 1-2
Location: Inside the southwest corner of the intersection of Rim and North Patrol Roads
Sampling: Agent in air ; RDAs in soil and biota
Orientation: Unknown

Sandy soils, CRG layer. Low shrubs, grasses (cheat grass), rabbit and bitter brush. Small burrowing holes, grasshoppers.

Site 1-3
Location: Southwest of the intersection of North and East Patrol Rds
Sampling: Agent in air and soil ; RDAs in soil and biota
Orientation: East Northeast of incinerator.

Sandy soils, CRG layer. Grasses predominate (cheat grass, some bunch grass). Rabbit brush (green and gray sub species). Grasshoppers.

Site 1-4
Location: 100 meters northeast of the common stack (area of maximum deposition).
Sampling: Agent and RDAs in soil
Orientation: Northeast of incinerator (100 yds)

Sandy and rocky soil. Very disturbed site, no CRG layer. Sampling may involve scraping the surface. Site will be barricaded to avoid further disturbance. Near storage (railroad) containers and pile of tarps. Right next to port-a-potties.

Site 1-5
Location: Halfway between Avenue E and igloo B1097
Sampling: RDAs in soil and biota
Orientation: Southeast of incinerator

Sandy soils, CRG layer and dry lichens. Pronghorn antelope scat, grasshoppers. Location good for small mammal and insect traps.

Site 1-6
Location: 20 m North of gate E26 and 10 m east of the fence
Sampling: RDAs in soil and biota
Orientation: South of Incinerator

Gravel surface, larger grain size. Not much CRG layer. Very disturbed site. Sparse biota, a few opportunistic weeds growing up.

Site 1-7
Location: Halfway between igloos H1630 and H1640
Sampling: RDAs in soil and biota
Orientation: Southwest of incinerator

Sandy soil, CRG layer. Low green perennials and grasses (cheat grass and bunch grass with flat blade). Good for small mammal and insect traps. Scarcity of burrowing holes, no brushes.

Site 1-8
Location: Along the ridge top 100 meters south of the center of Building 608
Sampling: RDAs in soil and biota
Orientation: West northwest of incinerator

Sandy soil with thin CRG layer. Grasses dominate, mostly bunch grass with some low growing rabbit brush. No tall bushes.

Site 1-9
Location: Adjacent to Ironwood Rd, ½ mile south of North Patrol Rd;
in the vicinity of the gate to Area IV
Sampling: Agent in soil and air ; RDAs in soil and biota
Orientation: Northwest of incinerator

Next to gate into restricted area. Sandy soil, CRG layer. Grasses dominate (cheat grass), other low ground cover. Not much in the way of sage or rabbit brush.

Site 1-10
Location: Adjacent to igloo D1257
Sampling: Agent in soil; RDAs in soil and biota
Orientation: East Southeast of Incinerator

Sandy soils, CRG layer. Low shrubs (rabbit brush and bitter brush). Holes of small borrowing animal, grasshoppers.

Site 1-11
Location: Near the southeast corner of Building 202
Sampling: Agent in air
Orientation: Southwest of Incinerator

Rocky substrate, opportunistic weeds and low shrubs. Kildeer. Near laydown yard and old power lines.

Site 1-12
Location: Northeast corner of the intersection of South and West Patrol Rds.
Sampling: Agent in air
Orientation: Southwest of Incinerator

Sage brush and bitter brush, cheat grass. Sage brush has died off in area of sampling, unknown reason. Railroad crossing 15 m north of site, not apparently used.

Site 1-13
Location: Intersection of Maple and North Patrol Rd.
Sampling: Agent in air
Orientation: Northwest of Incinerator

Rabbit brush dominates other brush species. Cheat grass, not as much CRG crust.

Site 1-14
Location: 0.25 mile North of E St. on East Patrol Rd.
Sampling: Agent in air
Orientation: East of Incinerator

Small clearing, bitter brush is dominant vegetation in surrounding area.

Site 1-15
Location: 0.25 miles east of Rim Rd on Birch Rd. (near Less Than Truckload Bldg.).
Sampling: Agent in air
Orientation: South southeast of incinerator

Disturbed area, rocky ground, weeds and grasses.

Site 1-16
Location: 0.5 miles south of E street on East Patrol Rd.
Sampling: Agent in air
Orientation: Southeast of Incinerator

Sandy soil with CRG layer. Bitter and sagebrush. Overhead power lines out of service.

Site 1-17
Location: Adjacent to igloo B1032
Sampling: Agent in Air
Orientation: Southeast of incinerator

Grasses and weeds. Low vegetation, some burrows evident. Lots of grasshoppers.

Site 1-18
Location: North of K-Block on North Patrol Road
Sampling: Agent in air
Orientation: North of incinerator

Low shrub area.

Site 1-19
Location: 100 feet east of intersection of West Patrol Rd. and unmarked road (unmarked road is 0.3 miles south of intersection of Badger Rd. and West Patrol Rd.)
Sampling: Agent in air
Orientation: West of Incinerator

Disturbed area, sandy soil, and slight CRG layer. Low growth vegetation and grasses (cheat grass).

Zone 2

Site 2-1

Location: Lower Sand Spring; 0.3 miles west and south on Depot Ln from intersection of Depot Ln. and West 8th Rd.
Sampling: Agent in soil; RDAs in surface water, soil, and biota
Orientation: West northwest of incinerator

Large pond with pasture and agriculture surrounding. Water level variable but appears to be available all seasons. Soil is mostly sandy with organics increasing near the shoreline. Lots of woody trees, Russian Olive, Cottonwood. Lots of vegetation along shore (grasses, sedges and rushes). Abundant fauna (grasshoppers and other insects), small minnows evident in shallow water. Good location for small mammal and insect traps. Sample surface water with Tygon tubing and pump.

Site 2-2

Location: 0.25 miles south of Highland Rd on Quick Rd. Water samples collected from Highland Rd bridge over Umatilla River.
Sampling: RDAs in soil, surface water and biota.
Orientation: East southeast of incinerator

Residential housing on west side of road. Steep slope to Umatilla River. Sandy soil supports multiflora rose bushes (rose hip berries) and tall weeds (shoulder high) in mint family. Good for small mammal and insect traps. Quail in vicinity, reeds (horse tail).
Surface water samples on bridge 150 m north of site. Umatilla River is very productive, lots of green algae in water or on bottom. Filter surface water before sending sample for analysis.

Special note: An effluent pipe is discharging upstream of the bridge, appears to be an irrigation return. Water is 25 m below bridge. Requires remote retrieval equipment.

Site 2-3

Location: Main canal of the West Extension Irrigation District and southwest of the Gate 68 lateral (approximately 1.1 miles east of Division Street at Hoop-N-Holler Lane)
Sampling: RDAs in soil and biota
Orientation: Northwest of incinerator

Description of site not available.

Site 2-4

Location: At Three Mile Dam on the west side of the Umatilla River (upstream from the dam).
Sampling: Agent in soil; RDAs in surface water, soil, and biota
Orientation: Northeast of incinerator

Wetland site for sampling surface water and biota. Both vascular and woody vegetation (salix, elodea). Water is stagnant and productive -- low flow and turbid, lots of floating material (duckweed). Good environment for mouse traps, may need pump and tubing to retrieve sample from wetland. On bluff above wetland is shrub-steppe environment for soil sampling (sandy substrate, low grasses and weeds). Good environment for insect pit traps.

Special note: GPS reading taken at dam to estimate distance upstream. Outflow pipe active 100 m north of dam flowing into wetland. Irrigation circle 400 m from upland area.

Site 2-5

Location: Conforth Ranch, north of the intersection of Beach Access Rd and Highway 730 (4.5 miles west of Diagonal Rd)
Sampling: RDAs in soil, surface water and biota.
Orientation: Northeast of incinerator

Rocky outcrop in surrounding wetland. Cattails and other aquatic plants dominate. Soil is sandy, appears dry at edge of wetland. Lots of woody plants (Russian Olive), some cheat grass. Good for small mammal and insect traps. Quail tracks and coyote pellets observed. Lichens and leafy rock cover on outcrop.

Site 2-6

Location: At the east side of the Boardman Bombing Range, approximately 200 feet inside of a gate on the south side of the main road, located 5.0 miles south of I-84 on Bombing Range Road
Sampling: RDAs in soil and biota
Orientation: Southwest of incinerator

Description of site not available.

Site 2-7

Location: Park near intersection of Stephens Avenue and Tucker Road.
Stephens Avenue is 0.5 mil es south of Highway 730 on Powerline Rd.
Sampling: Agent in soil; RDAs in soil and biota
Orientation: North northeast of incinerator

Down the hill (20m) from park's parking lot, river is another 50 m north. Wheat-type weeds are prolific, small foot path through weeds. Sagebrush is primary woody plant, lichens on north-facing slope, tumbleweeds. Quail in trees near river. Traps could be set off the foot path

Site 2-8

Location: Plymouth Park at Lake Umatilla east of Plymouth of Christy Rd. Located in the undeveloped field near campsite 17.

Sampling: Agent in soil ; RDAs in soil and biota

Orientation: North northeast of incinerator

Substrate is sandy loam. The undeveloped field contains mostly grasses and some small bushes. Good for small mammal and insect traps (grasshoppers).

Zone 3

Site 3-1
Location: Location has not been assigned
Sampling: Not available
Orientation: Unknown

Description of site not available.

Site 3-2
Location: Mission area adjacent to ceremonial grounds
Sampling: RDAs in soil and biota
Orientation: East southeast of incinerator

Weeds and grasses that are mowed on occasion, not apparently watered. Lots of woody trees surrounding, due to wet gulley south of sampling site. Wheat field on a hill further south. Tall shrubs and weeds (head high) among trees. Sandy loam under heavy organic layer. Excellent for small mammal and insect traps.

Special Note: Check mowing schedule so traps are not in areas to be mowed.

Site 3-3
Location: Intersection of Old Emigrant Rd and Old Jeep Rd.; southeast of the hairpin turn approximately 3.5 miles south of Mission Road.
Sampling: Agent in soil, RDAs in soil and biota
Orientation: East southeast of incinerator

Site is on the east side of a large hill, drainage basin is east of access road and downhill. Sandy sediments supporting prolific blackberry bushes, woody vegetation and tall grasses. Excellent for small mammal and insect traps. No obvious agriculture or grazing in immediate area.

Special Note: Downhill and downwind is an excavation site (.25 mile north/northeast).

Site 3-4
Location: One-eighth (1/8) mile north of Tubbs Ranch Road, 1/4 mile east of the USDA office building
Sampling: RDAs in soil
Orientation: East southeast of incinerator

Description of site not available.

Site 3-5

Location: Cabbage Hill site; on Old Emigrant Road between the hairpin curve and Boiling Point; southeast of the cattle guard on the south side of the road
Sampling: RDAs in soil
Orientation: East southeast of incinerator

Site is on the top of a hilly bluff , sandy sediments lie on top of rocky outcrop. CRG crust and burrowed holes. Bunch grasses and weeds. Good environment for small mammal and insect traps.

Site 3-6

Location: CTUIR fish hatchery at Umatilla River on Thorn Hollow Road
Sampling: RDAs in soil
Orientation: East southeast of incinerator

Description of site not available.

Site 3-7

Location: Southeast corner of Clodfelter Rd. and Bently Rd., in undeveloped corner of intersection.
Sampling: RDAs in soil
Orientation: North of incinerator, half way between Umatilla and Tri-Cities

Located in the undeveloped corner of intersection. Active agricultural fields surrounding area. Vegetation cover is mostly grasses with small bushes. Sandy soils.

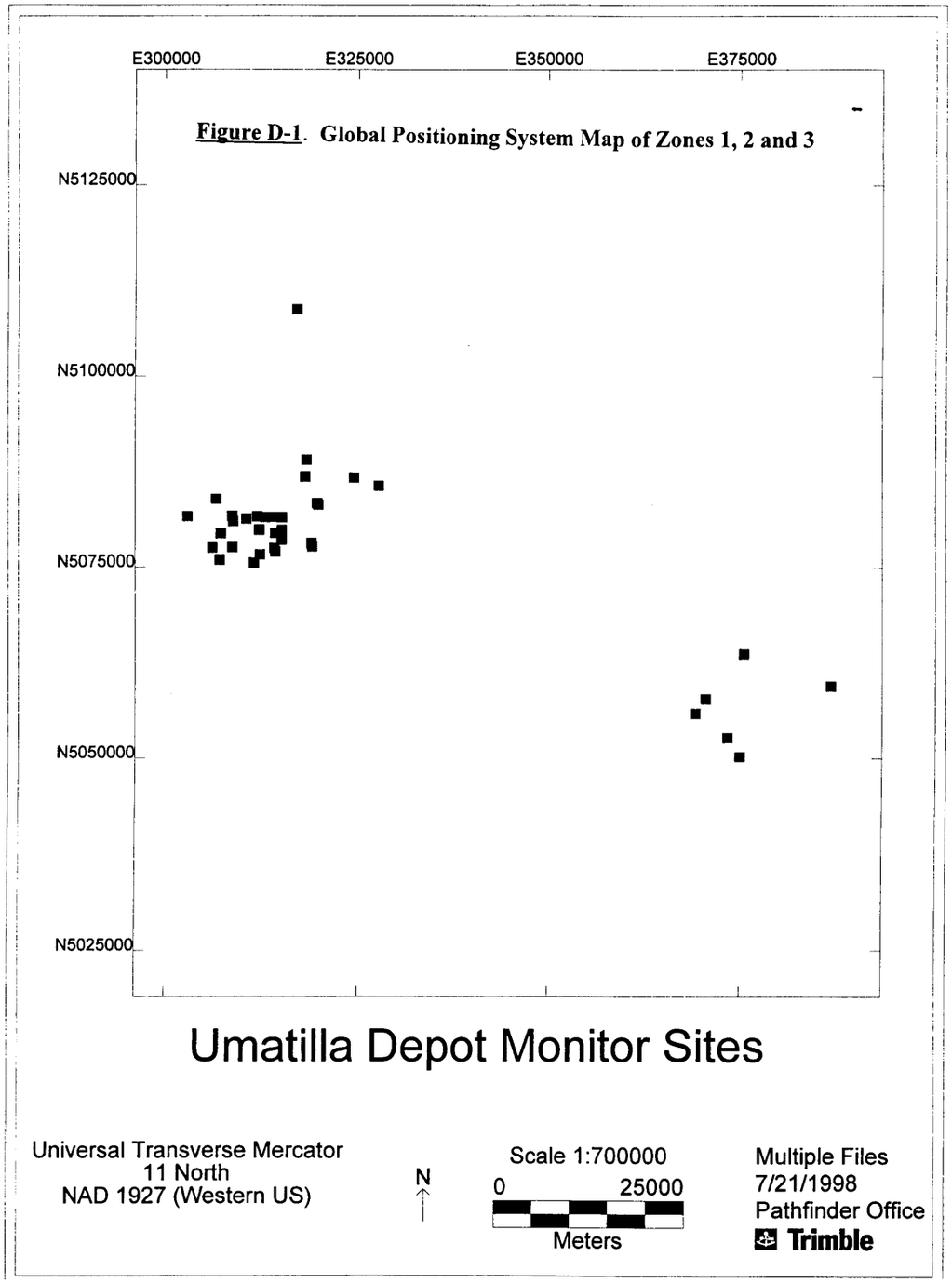

Figure D-1. **Global Positioning System Map of Zones 1, 2 and 3**