0078808

DOE/RL-2008-50
Revision 0

Sampling and Analysis Plan for the Washington State Department of Ecology Comparison of Discrete and Multi-Increment Sampling for Site Characterization and Cleanup

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Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

attached to 0078807

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APPROVAL

DOE/RL-2008-50, Rev. 0, *Sampling and Analysis Plan for the Washington State Department of Ecology Comparison of Discrete and Multi-Increment Sampling for Site Characterization and Cleanup*

for FMR

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8/28/08
Date

APPROVAL

DOE/RL-2008-50, Rev. 0, *Sampling and Analysis Plan for the Washington State Department of Ecology Comparison of Discrete and Multi-Increment Sampling for Site Characterization and Cleanup*

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8/27/08
Date

APPROVAL

DOE/RL-2008-50, Rev. 0, *Sampling and Analysis Plan for the Washington State Department of Ecology Comparison of Discrete and Multi-Increment Sampling for Site Characterization and Cleanup*

Dennis A. Faulk
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9/5/08
Date

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EXECUTIVE SUMMARY

This sampling and analysis plan (SAP) defines the approach to conduct a comparison of three sampling designs on two selected waste sites, in support of a study designed by the Washington State Department of Ecology (Ecology). The objective of Ecology's study is to compare the data generated using three different sampling approaches on the same site, both prior to and after contamination remediation by soil removal. This comparison will include evaluation of the application of the *Model Toxics Control Act* (MTCA) "three-part rule" (WAC 173-340-740(7)(d&e)) to the data sets generated using the three different sampling designs.

The sites were selected jointly during screening meetings including Ecology, U.S Department of Energy (DOE) and contractor personnel. One site was to chosen to represent sites with contamination displaying a comparatively homogenous distribution, while the other was chosen to display one or more "hot spots" of localized high contamination relative to the rest of the site. Each site will be characterized using two discrete sampling approaches, judgemental and systematic. A third sampling approach, multi-incremental sampling (MIS), will also be used to characterize each site.

The overall scope of the sampling identified in this SAP are (1) to provide the data needed to verify that the selected sites demonstrate the appropriate level, nature and distribution of contamination; (2) provide initial characterization samples for each test site using three different sampling approaches; (3) to provide radiological field screening data to support contamination removal activities, and (4) to provide final confirmation data, again using the same three sampling approaches.

The field work will be carried out in three phases. The first phase (pre-screening) will collect a limited number of samples for lab analysis to confirm the acceptability of the preferred test sites. The second phase (variance) will collect a full suite of discrete and MIS samples for laboratory analysis to generate pre-cleanup characterization data for each site. The third phase (confirmatory) will be to collect a full suite of discrete and MIS samples for verification after removal of contaminated soil from the test sites. The variance and confirmatory sampling data will be used to generate performance comparisons between the data generated using each sampling approach.

This SAP only provides direction for the field sampling and radiological screening activities, which will be performed on the Hanford Site by DOE contract personnel. All collected soil samples will be provided to Ecology for submittal to an offsite analytical laboratory. All review, validation, and analysis of the resulting chemical analysis data will be performed by Ecology personnel.

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TERMS

ALARA	as low as reasonably achievable
BARCT	best available radiological control technology
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQA	data quality assessment
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ft	feet
MEI	maximally exposed individual
MIS	multi-incremental sampling
MTCA	*Model Toxics Control Act*
N/A or NA	not applicable
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
QA	quality assurance
QAPjP	quality assurance project plan
QC	quality control
RCT	radiological control technician
SAP	sampling and analysis plan
TEDE	total effective dose equivalent
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
UPR	unplanned release
WAC	*Washington Administrative Code*
WIDS	Waste Information Data System
WSCF	Waste Sampling and Characterization Facility

METRIC CONVERSION CHART

Into metric units			Out of metric units		
If you know	Multiply by	To get	If you know	Multiply by	To get
Length			**Length**		
inches	25.40	millimeters	millimeters	0.03937	inches
inches	2.54	centimeters	centimeters	0.393701	inches
feet	0.3048	meters	meters	3.28084	feet
yards	0.9144	meters	meters	1.0936	yards
miles (statute)	1.60934	kilometers	kilometers	0.62137	miles (statute)
Area			**Area**		
square inches	6.4516	square centimeters	square centimeters	0.155	square inches
square feet	0.09290304	square meters	square meters	10.7639	square feet
square yards	0.8361274	square meters	square meters	1.19599	square yards
square miles	2.59	square kilometers	square kilometers	0.386102	square miles
acres	0.404687	hectares	hectares	2.47104	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.34952	grams	grams	0.035274	ounces (avoir)
pounds	0.45359237	kilograms	kilograms	2.204623	pounds (avoir)
tons (short)	0.9071847	tons (metric)	tons (metric)	1.1023	tons (short)
Volume			**Volume**		
ounces (U.S., liquid)	29.57353	milliliters	milliliters	0.033814	ounces (U.S., liquid)
quarts (U.S., liquid)	0.9463529	liters	liters	1.0567	quarts (U.S., liquid)
gallons (U.S., liquid)	3.7854	liters	liters	0.26417	gallons (U.S., liquid)
cubic feet	0.02831685	cubic meters	cubic meters	35.3147	cubic feet
cubic yards	0.7645549	cubic meters	cubic meters	1.308	cubic yards
Temperature			**Temperature**		
Fahrenheit	subtract 32 then multiply by 5/9ths	Celsius	Celsius	multiply by 9/5ths, then add 32	Fahrenheit
Energy			**Energy**		
kilowatt hour	3,412	British thermal unit	British thermal unit	0.000293	kilowatt hour
kilowatt	0.94782	British thermal unit per second	British thermal unit per second	1.055	kilowatt
Force/Pressure			**Force/Pressure**		
pounds (force) per square inch	6.894757	kilopascals	kilopascals	0.14504	pounds per square inch

06/2001

Source: *Engineering Unit Conversions*, M. R. Lindeburg, PE., Third Ed., 1993, Professional Publications, Inc., Belmont, California.

SAMPLING AND ANALYSIS PLAN FOR THE WASHINGTON STATE DEPARTMENT OF ECOLOGY COMPARISON OF DISCRETE AND MULTI-INCREMENT SAMPLING FOR SITE CHARACTERIZATION AND CLEANUP

1.0 INTRODUCTION

Washington Administrative Code (WAC) 173-340-702(11) states that the Washington State Department of Ecology (Ecology) will review and, as appropriate, update the *Model Toxics Control Act* (MTCA) regulations WAC 173-340-700 through 173-340-760 at least once every five years. One aspect under consideration for review is the flexibility of MTCA's three-part decision rule [WAC 173-340-740(7)] for demonstration of achievement of a site cleanup goal. This "rule" can be simplified as follows:

1. The upper one-sided 95% confidence limit on the true population mean calculated from the sampling data cannot exceed the applicable clean-up level, and

2. No individual sample concentration can exceed twice the applicable clean-up level, and

3. Fewer than 10% of the individual sample concentrations can exceed the applicable clean-up level.

(Note that this is a simplification of the clean-up criteria found in WAC 173-340-740(7)(d&e). Additional information regarding key assumptions and calculation approaches are also described in the referenced regulation.)

Typically discrete sampling has been used to provide data for evaluation using this decision rule.

An alternative strategy to discrete sampling is multi-increment sampling (MIS). This design involves taking a large number of identical-sized increments across a site or portion of a site. These increments are combined to generate a single sample. When processed according to careful protocols, the resulting sample can generate a more accurate and precise estimate of the mean contaminant concentration across the sampled area. However, the single mean value is not necessarily compatible with the current MTCA three-part rule.

Ecology has designed a field demonstration that would compare the performance of discrete sampling versus MIS sampling on two selected sites (Ecology 2008). One site (216-S-19 Pond) is expected to display a relatively homogenous or uniform contamination across the site and another site (UPR-200-E-56) is expected to display one or more "hot-spots." These demonstration sites would be characterized prior to remediation and also after remediation using both sampling approaches. The U.S. Department of Energy, Richland Operations Office (DOE-RL) has agreed to assist with the selection of candidate sites, support removing contaminated soil from two locations, and to provide the field resources to perform the sampling and analysis for the study.

This sampling and analysis plan (SAP) defines the approach to conduct characterization sampling at two demonstration sites. Chapter 1.0 provides project background, defines the project objectives and identifies the preferred and alternate test sites. Chapter 2.0 is the activity specific quality assurance project plan. The project field sampling plan is presented in Chapter 3.0.

The overall goals of the sampling identified in this SAP are to provide the data needed to evaluate the comparative performance of discrete sampling versus MIS sampling, and to provide a data set for

evaluation of various modifications to the MTCA three-part test as appropriate to provide flexibility appropriate for the use of MIS data.

1.1 PROJECT GOALS

The goals of the Ecology comparison study are: (1) Compare the performance of two commonly-applied discrete sampling methods (systematic random and judgemental) with an MIS method in surficial soils at a homogenously- and heterogeneously-contaminated demonstration site.; (2) Evaluate the data relative to the MTCA three-part decision rule for cleanup confirmation; (3) Compare descriptive statistics such as mean and variance across the three different sampling strategies. Two intermediate project goals are required for completion of the field component of the study: (4) Develop contaminated soil profiles sufficient for disposal of excavated material, and (5) Perform all activities in a manner that is safe and protective of human health and the environment. These goals will be met by performance of the field sampling by the DOE contractor personnel in accordance with this SAP, chemical analysis of the resulting samples by an off-site laboratory selected by Ecology, and by the analysis of the resulting data by Ecology.

1.2 PROJECT SCOPE

This SAP describes sampling of two waste sites for initial characterization of contaminant distribution and then again, after remediation by removal, to demonstrate accomplishment of cleanup goals. One demonstration site is expected to display relatively uniform contamination levels across the site, while the other is expected to contain one or more areas of elevated contamination levels ("hot-spots").
Overall sampling efforts for the project include the following:

- Site Pre-Screening sampling. A limited number of discrete judgemental samples will be taken from each of two preferred sampling sites (216-S-19 Pond and UPR-200-E-56). These samples will be provided to an offsite laboratory for analysis of a broad spectrum of analytes to determine whether the preferred sites display contaminant levels and distributions that will be acceptable for the sampling demonstration. Based on the results of the pre-screening, Ecology and DOE-RL will approve the use of the preferred sites or will decide to pursue use of alternative sites.

- Site initial (variance) sampling. Sampling across the site before contaminated soil removal (following removal of the clean stabilizing soil cover). Sampling will be performed using two different discrete-sampling designs and also using an MIS design. The resulting data will be used to develop initial contaminant level and distribution statistics and also to compare the results using three different sampling designs.

- Waste characterization sampling and field monitoring. During the contaminated soil removal process, soil samples will be collected for characterization of waste materials (i.e., excavated soil) to ensure compliance with the Environmental Restoration Disposal Facility (ERDF) waste acceptance criteria (WCH-191, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*). In addition, radiological field screening will verify complete contaminant removal, using beta/gamma radiation as an indicator of residual cesium-137, and also as a generic contaminant indicator.

- Site closeout sampling. Sampling of the bottom and sides of the excavation after physical removal of contaminated soil. Sampling will be performed using two different discrete-sampling designs and also using an MIS design. The resulting data will be used to compare the results using three different sampling designs. The resulting data will also be used to verify that the bottom and side-walls of the excavated waste sites attain applicable cleanup criteria.

1.3 SELECTION OF DEMONSTRATION SITES

The sampling demonstration required the identification of two contaminated waste sites within the Hanford Facility. One was to be contaminated with a chemical constituent of regulatory interest to Ecology in a relatively homogenous distribution arcross the site. This would be called the homogenous site. A second site was required that would be contaminated in a less homogenous way and would contain one or more localized areas of relatively higher contamination levels (hot-spots). This site would be called the heterogenous site.

Several meetings between Fluor Hanford (DOE contractor) and Ecology occurred where the parties reviewed potential site descriptions from the Waste Information Data System (WIDS) database. From the hundreds of WIDS entries, a set of four candidate sites were selected – a primary and back-up homogenous site and a primary and back-up heterogeneous site.

1.3.1 The Hanford Site

The Hanford Site (Figure 1-1) is a 1,517 km^2 (586 mi^2) Federal facility located in southeastern Washington State along the Columbia River. From 1943 to 1990, the primary mission of the Hanford Site was the production of nuclear materials for national defense. In July 1989, the 100, 200, 300, and 1100 Areas of the Hanford Site were placed on the National Priorities List (40 *Code of Federal Regulations* [CFR] 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List") pursuant to the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) *of 1980.*

The Central Plateau is located in the central portion of the Hanford Site and is divided into three areas: 200 East Area, 200 West Area, and 200 North Area. Operations in the 200 East and 200 West Areas were related to chemical separation, plutonium and uranium recovery, processing of fission products, and waste partitioning. Major chemical processes in the Central Plateau resulted in delivery of high-activity waste streams to systems of large underground tanks called "tank farms." The liquid wastes often were neutralized before being sent to the tanks and later evaporated (concentrated). The storage tanks were used to allow the heavier constituents to settle from the liquid effluents, forming sludge. Low-activity liquid wastes were discharged to trenches, cribs, drains, and ponds, most of which were unlined. The 200 North Area formerly was used for the interim storage and staging of irradiated fuel.

1.3.2 Homogenous Sites

The primary homogenous site is the dried 216-S-19 Pond, located south of the 200 West Area perimeter fence to the south of 222-S and 222-SA Buildings (Figure 2-1). The pond was opened in February 1952 and closed in October 1984. Except for a period from December 1954 through October 1955, the pond received effluent from the 222-S/SA Laboratory ventilation cooling water and miscellaneous wastes from laboratory hoods and decontamination sinks via the 207-L Retention Basin. From December 1954 to October 1955, the site was inactive because the radionuclide concentration in the 207-L Retention Basin liquid waste was abave the prescribed disposal guidelines and building effluents were rerouted to the 261-S-20 Crib. The site was stabilized in October 1984 and posted as an Underground Radioactive Material zone. The waste streams were rerouted to the 216-S-26 Crib. In December of 1953, contamination up to 200 mR/hour was measured at the ground surface over an area measuring approximatey 3 feet by 300 feet. Over time, the beta/gamma radioactivity has decayed until presently there is no activity remaining that is detectable at the ground surface with field radiation monitoring instruments.

In the event that the primary site proves unacceptable, the 216-S-5 Crib has been identified as a backup. The site consists of a gravel-filled crib and an overflow trench. The crib was constructed of two lengths

of perforated, corrugated metal pipe that form a cross. The crib has been surface stabilized and is marked as Underground Radioactive Material. The overflow trench is located south of the crib structure. It is actually this overflow trench which is proposed as a study site. The 216-S-5 Crib was built in March 1954 as a temporary replacement for the grossly contaminated 216-S-17 Pond to receive REDOX condensate and cooling water with a low potential for contamination. In 1956, the large cooling water discharge volumes from REDOX made it necessary to cut a hole along the top edge of the crib to discharge overflow cooling water to a trench immediately southwest of the crib structure rather than allowing the crib to flood. The overflow of 50-100 gallons per minute represented approximately 5% of the total flow to the 216-S-5 Crib and continued until September 1957. In September of 1956, the REDOX A-2 dissolver and H-4 coils failed, increasing the radioactivity of the cooling water and condensate waste stream. The dose rates along the edge of the crib overflow area increased from 100 to 350 mR/hr with some spots reading up to 17 R/hr. In 1957, the site was deactivated by valving out and locking the pipeline to the unit and the effluent was rerouted to the 216-S-16 Pond. In 1974, four "cave-in" depressions were filled in. The 216-S-5 Crib was stabilized in August 1990.

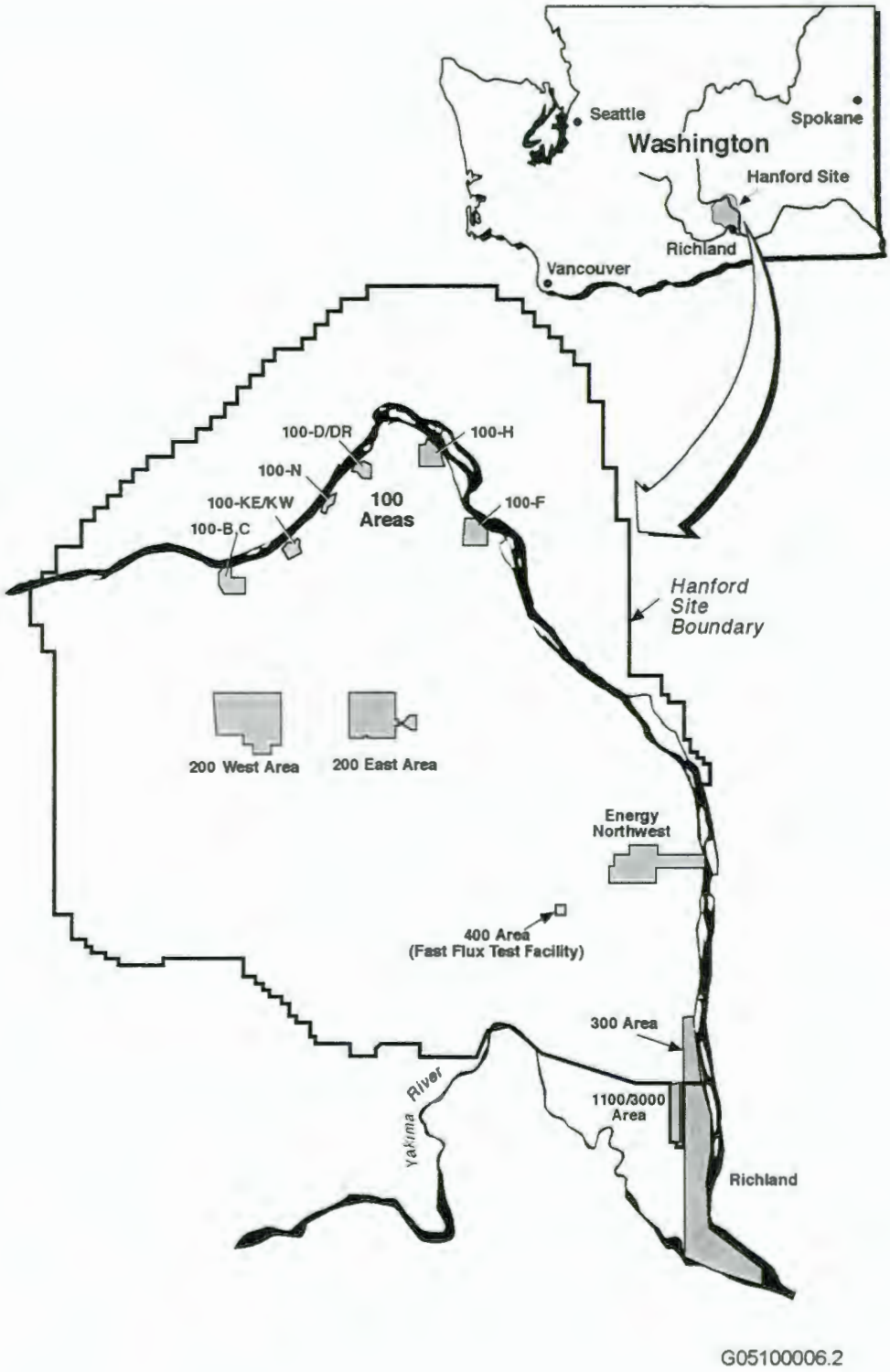

Figure 1-1. Hanford Site.

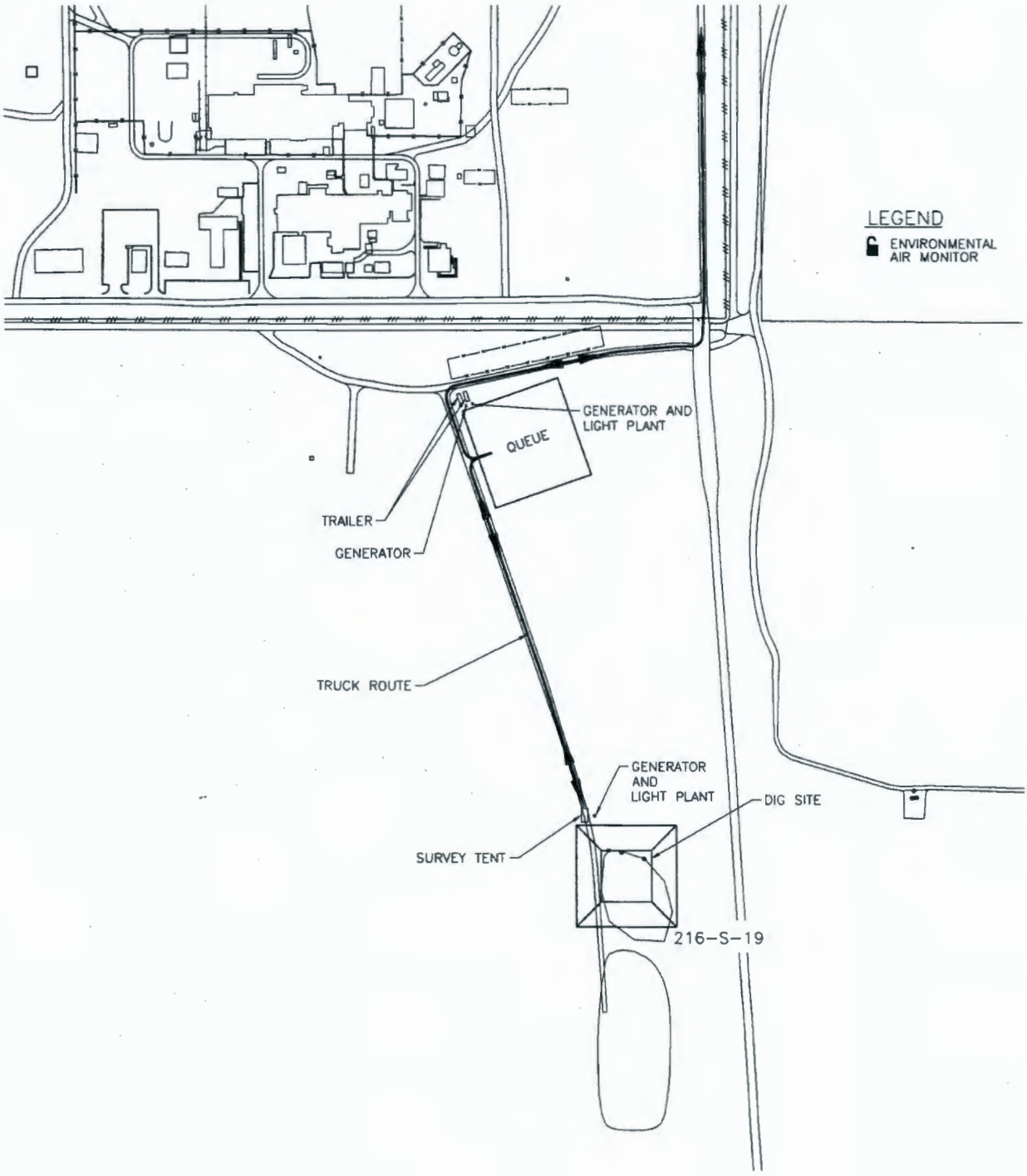

Figure 1-2. 216-S-19 Waste Site

1.3.3 Heterogeneous Sites

The primary heterogeneous site is UPR-200-E-56, a surface-stabilized area located north of the west end of the 216-A-24 Crib (Figure 1-3). In June 1979 a construction contractor backfilling around new tanks in 241-AN Tank Farm had mistakenly selected a borrow area adjacent to the 216-A-24 Crib instead of a designated area further to the north. Beta contamination of 8,000 counts per minute was found in the excavation, on earthmoving equipment and in the soil removed from the excavation. It is believed that this contamination was due to lateral migration of leachate from the adjacent 216-A-24 Crib. Several hundred cubic yards of contaminated soil were taken back out of the 241-AN Tank Farm and returned to the excavation. This volume was insufficient to fill the excavation, so contaminated soil and vegetation from nearby perimeter fences and the northeast fence line of 241-C Tank Farm were also placed into the excavation. This area was used again in 1985 to dispose of contaminated soil from the 244-A Lift Station area. A 6-8 inch layer of clean soil was placed on top of the filled excavation and posted Underground Radioactive Material.

The backup heterogeneous site is trench 216-U-5 and adjacent trench 216-U-6, located northwest of the 221-U building. These sites received unirradiated uranium waste from the cold start-up run at 221-U in March 1952. U-5 is approximately 10 feet by 40 feet, while U-6 is approximately 10 feet by 75 feet. Records indicate that both 216-U-5 and 216-U-6 received approximately 2,250,000 L of liquid waste containing approximately 200 Kg of nitrate. Both trenches were interim stabilized in 1994 with 2 feet of clean dirt, and marked Underground Radioactive Material.

1.4 WASTE SITE CONTAMINANTS

Based on discussions with DOE-RL and Ecology, sampling activities will provide samples for analysis by Ecology for the constituents and methods shown in Table 1-1. Many of the constituents are classes of compounds detectable by the identified analytical methods. Pre-screening phase samples will be analyzed for the entire suite of analytes (methods) in Table 1-1. Based on the results of the pre-screening samples, some parameters may be removed from the variance and closeout sampling analyte list.

Table 1-1. MIS Pilot Study Analytical Parameters.

Analytical Parameter	Analysis Method
Gamma Spectroscopy	EPA 901.1
Uranium (total)	ASTM D3972-90M
Plutonium Isotopic	ASTM D3972-90M
Total Radiostrontium	ASTM D5811-95M
Metals	EPA 6010B
Mercury	EPA 7471A
Total Cyanide	EPA 9010A
Anions	EPA 300
Semivolatiles	EPA 8270
Tributyl phosphate (TBP)	EPA 8141
PCB Congeners	EPA 1668a

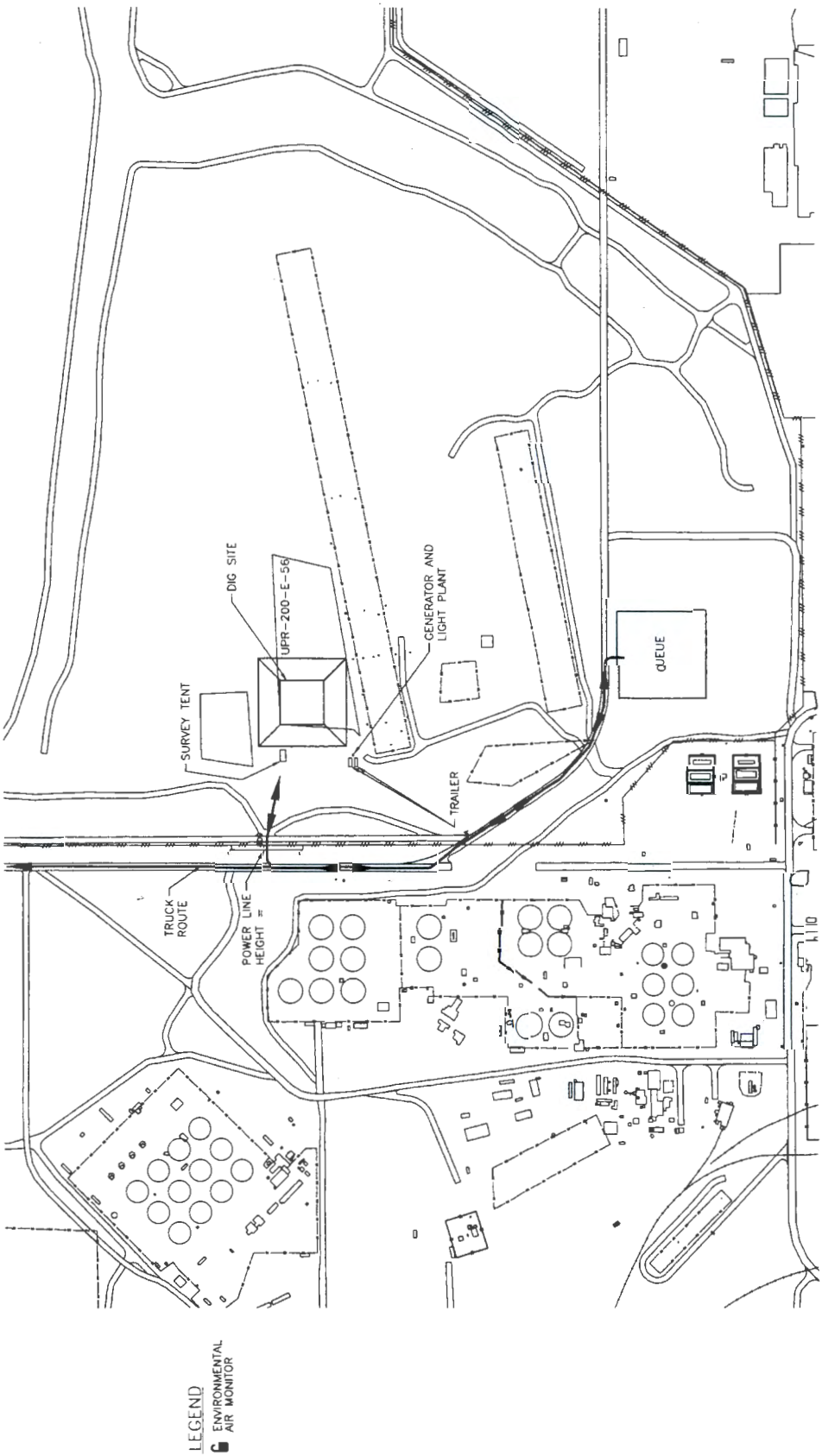

Figure 1-3. UPR-200-E-56 Waste Site.

1.5 GENERAL SAMPLE DESIGN CONCEPTS

The project field activities will begin with visual site walkdown of the candidate sites. Limited sample collection and screening will be used to finalize the selection of one homogenous and one heterogeneous site.

After selection of the final two sites, the clean soil cover will be removed from not less than 0.5 acres of soil (two 0.25 acre plots). Following this initial removal, the demonstration site characterization, or variance sampling, will occur on the exposed contaminated soil. This will include the use of two different discrete sample designs (systematic random and judgemental) and an MIS design. The two discrete sampling designs are outlined in EPA (2002) and have been described by others (Gilbert and Pulsipher (2005). The MIS approach is described by various authors [Ramsey, et. al. (1989), Pitard (1993), Gy (1998), Gerlach and Nocerino (2003), Ramsey (2004)]. The characterization data sets will be used both to compare the results of differing sampling designs but also to direct remedial soil removal activities.

During contaminated soil removal, field analysis and/or radiological screening will be used to direct work crews and guide the extent of soil removal.

Finally, after field observations and measurements indicate that sufficient contaminated soil has been removed, or that soil has been removed to a depth of 15 feet, the final closure sampling will be initiated. Closure sampling will include both systematic random and judgemental discrete sample collection as well as MIS samples.

The following sections detail the approach to initial prescreening, site characterization, removal field screening, and final closure sampling.

1.5.1 Site Prescreening and Final Selection

The preferred homogenous (216-S-19) and heterogenous (UPR-200-E-56) sites will be pre-screened to provide a rough indication of the nature and distribution of contamination and to determine if there is a radiological indicator present. This pre-screening will include shallow borings at locations judged to reveal the highest likelihood of contamination as well as contaminant distributions with depth. This field work is preliminary and will be accomplished independently of this SAP in accordance with approved procedures and work control.

In-situ radiological surveys will also be performed as recommended in Section 5.3.3.2, "Land Area Surveys" and Section 5.5, "Final Status Surveys" of *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM 2000). These surveys will be performed using instrumentation capable of detecting cesium-137 concentrations of 0.5 pCi/g. Potential field radiological instrumentation may include a Geiger-Mueller (GM) or sodium iodide detector (NaI).

1.5.2 Waste Characterization and Field Screening During Soil Removal

During soil removal, field radiological screening as described in the previous section will be used to direct removal and as an indicator of the completeness of contamination removal.

For the sampling effort, field screening will be used to establish site radiological contamination levels. In addition, field screening for radiological contamination (cesium-137) may be used as a "tracer" to locate areas of chemical contamination. If field-screening results indicate the presence of radiological contamination, the areas can be further characterized with laboratory analytical samples. Further details regarding field screening are presented in Chapter 3.0.

1.5.3 Site Characterization (Variance Sampling) and Final Closure Sampling

The nature of the Ecology Sampling Study waste sites supports the use of systematic random and judgemental designs as defined in EPA/240/R-02/005, *Guidance on Choosing a Sampling Design for Environmental Data Collection* (EPA 2002). In addition, a multi-incremental sampling design will be performed as part of this study.

1.5.3.1 Systematic Random Sampling

In systematic random sampling, an initial sampling point is selected at random, and all remaining sample locations are specified in relation to the initial random point, according to a regular pattern (e.g., grid or transect). Systematic random sampling is used to ensure complete coverage of an area, but to introduce a random component such that the resulting data may be treated statistically. This design can disclose hot spots and other heterogeneities on the scale of the grid spacing. Systematic random sampling may perform poorly when unrecognized trends occur in the contaminant distribution. For this demonstration, the grid shape and size will be determined by the number of samples and identified demonstration area size.

Detailed discussion of the systematic random sampling design for the two demonstration sites is described in Section 3.0

1.5.3.2 Judgemental Sampling

Judgemental sampling designs have been used for waste characterization to ensure compliance with the receiving facilities' waste acceptance criteria. Judgemental sampling is not a statistically-based design, and therefore does not generate data which are amenable to statistical treatment.

Judgmental sample point selection is based on professional judgement and field cues. Samples will be collected from site locations where existing analytical data, process knowledge, and field radiological surveys indicate maximum contamination, or "worst case," concentrations are expected. These waste sites have attributes such as visible surface debris, known discharge release points in engineered structures such as cribs or french drains, or subsurface debris that can be identified by surface geophysics techniques, or have a primary constituent which has a gamma/and or beta emitter that can be identified by surface/near surface radiological surveys. Therefore, sampling in a judgemental manner will typically maximize the likelihood of data collection in the area of greatest impact associated with the release. Additional efforts may be needed to determine the worst-case location for the sample(s) collection within these sites, such as driven soil probes and gamma logging, which will provide additional data on gamma-emitting radionuclides to support the focused sampling regime.

The number of samples, the depth of sampling, the types of samples, and their locations would be developed judgmentally based on site knowledge and some field observations and screening results. Sampling locations will be selected during site walk downs by Ecology and prime contractor technical staff familiar with the waste sites in question. The primary judgment used in selecting sample locations/materials is field-screening results (e.g., detectable radioactive contamination as defined with field instruments) or suspicious locations/materials based on visual inspection (e.g., stained soil areas or debris known to represent hazardous/dangerous/ radioactive waste in the past).

Details of the focused sampling design are presented in Chapter 3.0.

1.5.3.3 MIS Sampling

The multi-incremental method of sampling is used to control the fundamental error, as well as the grouping and segregation error for an average, based on collecting an adequate sample mass (Ramsey et al. 1989, Pitard 1993, Gy 1998, Gerlach and Nocerino 2000, Ramsey 2004, Smith 2004).

For the Ecology study, each site will be divided into "blocks" of approximately ¼ acre in size. Each block will be divided into a grid with 100 nodes, with one increment collected from each grid unit at a depth interval of 0-4 inches, accumulated in a single container. Once filled with 100 increments, this container will be referred to as the "parent" sample. The soil composing the parent sample will then be sub-sampled using a hundred-increment tray, with each sample bottle for analysis holding one portion of each of the 100 increments in the tray. At a minimum, at least three bottles of sample material will be generated per sample analysis, with each bottle containing at least 20 grams of sample material. The laboratory will process the entire sample volume in a bottle for one analysis. The diagram (Figure 1-3) provides a visual representation of the multi-incremental sampling process. Field replicates will be collected as identified in Table 3-1.

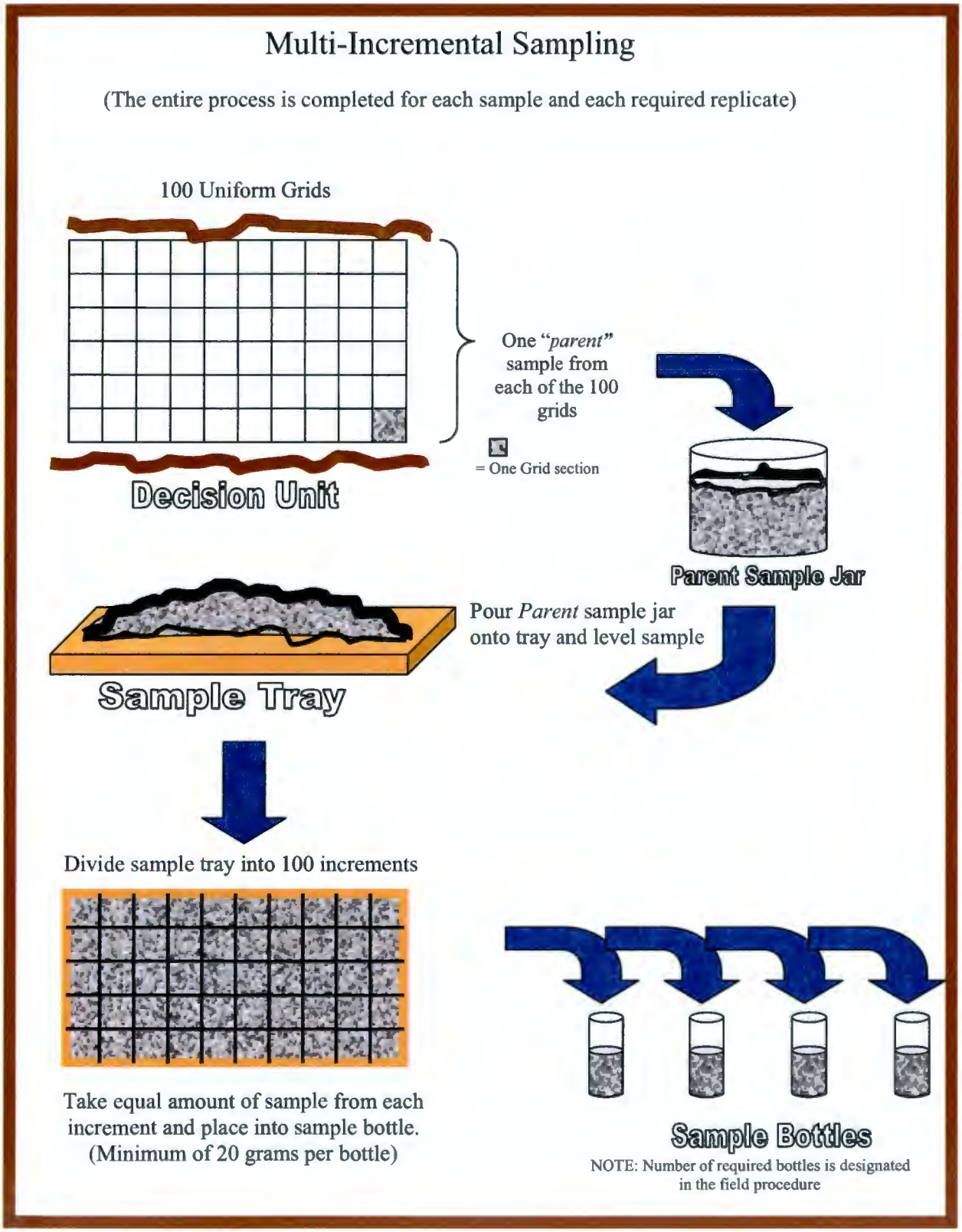

Figure 1-3. Multi-Incremental Sampling.

1.6 WASTE DISPOSITION OPTIONS

Project activities will result in generation of waste. The majority of the contaminated media likely will be designated as low-level waste; however, quantities of mixed waste, dangerous waste, and solid waste not contaminated with hazardous substances may be generated.

Waste generated will be disposed at an appropriate disposal site, most likely the ERDF. Recycling and/or reuse options will be evaluated and implemented where possible to reduce the volume of material disposed.

Contaminated waste for which no reuse, recycle, or decontamination option is identified will be assigned an appropriate waste designation (e.g., solid, asbestos, polychlorinated biphenyl, radioactive, dangerous, or mixed) and disposed at an approved disposal location. For the purposes of this project, most of the contaminated waste generated during implementation of this project is assumed to be disposed onsite at the ERDF in accordance with the CERCLA onsite identification. Alternate potential disposal locations may be considered during the project if a suitable and cost-effective location is identified. Alternate potential disposal locations will be evaluated using appropriate performance standards to ensure that they are adequately protective of human health and the environment.

The ERDF is considered to be onsite under CERCLA for management and/or disposal of waste from this project. There is no requirement to obtain a permit to manage or dispose CERCLA waste at the ERDF. It is expected that the great majority of the waste generated during the project can be disposed of onsite at the ERDF. For waste that must be sent offsite, including the Central Waste Complex, the U.S. Environmental Protection Agency (EPA) must make a determination in accordance with 40 CFR 300.440, "National Oil and Hazardous Substances Pollution Contingency Plan," "Procedures for Planning and Implementing Off-Site Response Actions," regarding acceptability of the proposed disposal site for receiving this CERCLA removal action waste. Because the Central Waste Complex is considered offsite for the management of CERCLA waste from this project, an offsite determination must be made by the EPA before shipment of project waste to the Central Waste Complex.

1.7 PROJECT ASSUMPTIONS

The following project assumptions are based on project team discussions.

1. This study assumes that 216-S-19 Pond contains relatively uniform contamination based on process history of the waste site.

2. This study assumes that UPR-200-E-56 contains heterogeneous contamination based on the process history of the waste site.

3. Field screening for radiological contamination will be used as an indicator of contamination.

4. Removal of the contaminated soil will cease at 15 ft. bgs. If close-out sampling indicates that contamination exists above applicable clean-up levels, the waste site will be stabilized (backfilled) and the corresponding operable unit will document a final remedial decision for the waste site in a Record of Decision.

5. DOE contractor personnel will conduct the judgemental and MIS sampling, with direction from Ecology.

6. Five MIS replicates will be adequate to capture the variability associated with MIS.

7. Blocks of 0.25acre are representative of residential exposure units.

8. Ecology will pay for all analytical costs associated with the pre-screening, variance, and close-out sampling. Samples will be provided to Ecology in the 200 Area for shipment to their contract laboratory. If additional sampling for ERDF waste acceptance is needed, DOE-RL will pay for those analytical costs.

2.0 QUALITY ASSURANCE PROJECT PLAN

The quality assurance project plan (QAPjP) establishes the quality requirements for environmental data collection, including sampling, field measurements, and laboratory analysis. This QAPjP complies with the requirements of the following:

- *"Sampling Protocols to Evaluate Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC Decision Rules for Compliance Using Multi-Incremental and Discrete Sampling Strategies"*, Ecology, 2008
- DOE O 414.1C, "Quality Assurance"
- 10 CFR 830, Subpart A, "Quality Assurance Requirements"
- EPA/240/B-01/003, EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5 (EPA 2001), as amended.

The following sections describe the quality requirements and controls applicable to this investigation. Correlation between EPA/240/B-01/003 (QA/R-5) requirements and this SAP is provided in Table 2-1.

Table 2-1. Quality Assurance Crosswalk.

EPA QA/R-5 Criteria	EPA QA/R-5 Title	Reference Section
Project Management	Project/Task Organization	2.1, 2.1.1
	Problem Definition and Background	1.0, 1.1, 1.2
	Project Task Description	1.0, 1.1, 1.2
	Quality Objectives and Criteria	1.5, 2.3
	Training/Qualifications	2.1.2
	Documents and Records	2.6, 2.7, 3.6
Data Generation and Acquisition	Sample Process Design	1.6, 3.1, 3.2
	Sampling Methods	1.6, 3.1, 3.3, Table 3-1
	Sample Handling and Custody	2.4, 3.4
	Analytical Methods	1.4, 2.3
	Quality Control	2.2, 2.3, 2.4
	Instrument/Equipment Testing, Inspection and Maintenance	2.3.1
	Instrument/Equipment Calibration and Frequency	2.3.1, 2.5, 2.7
	Inspection and Acceptance of supplies and consumables	2.3.1
	Non Direct Measurement/Direct Measurement	1.4
	Data Management	2.6

Table 2-1. Quality Assurance Crosswalk.

EPA QA/R-5 Criteria	EPA QA/R-5 Title	Reference Section
Assessment and Oversight	Assessment and Response Actions	2.5.1
	Reports to Management	2.5.2
Data Validation and Usability	Data Review, Verification and Validation	2.7
	Verification and Validation Methods	2.7
	Reconciliation with User Requirements	2.9

EPA = U.S. Environmental Protection Agency

2.1 PROJECT MANAGEMENT

The following subsections address the basic areas of project management and will ensure that the Ecology Sampling Study project has a defined goal, the participants understand the goal and the approach to be used, and the planned outputs have been appropriately documented.

2.1.1 Project/Task Organization

Ecology personnel will be responsible for definition of the project design and sampling design details. Ecology, DOE and contractor personnel will select the appropriate locations for the sampling demonstrations and will agree on the final selection of homogenous and heterogeneous test locations. DOE contractor personnel will be responsible for collecting, packaging, and shipping soil and other media samples to the laboratory. The project organization, in regard to sampling and characterization, is described in the subsections that follow and is shown graphically in Figure 2-1. With the exception of the DOE Remedial Project Manager, all other roles and responsibilities are completed by the primary contractor or its approved subcontractor. Note: For each functional primary contractor role, there is a corresponding oversight role within DOE.

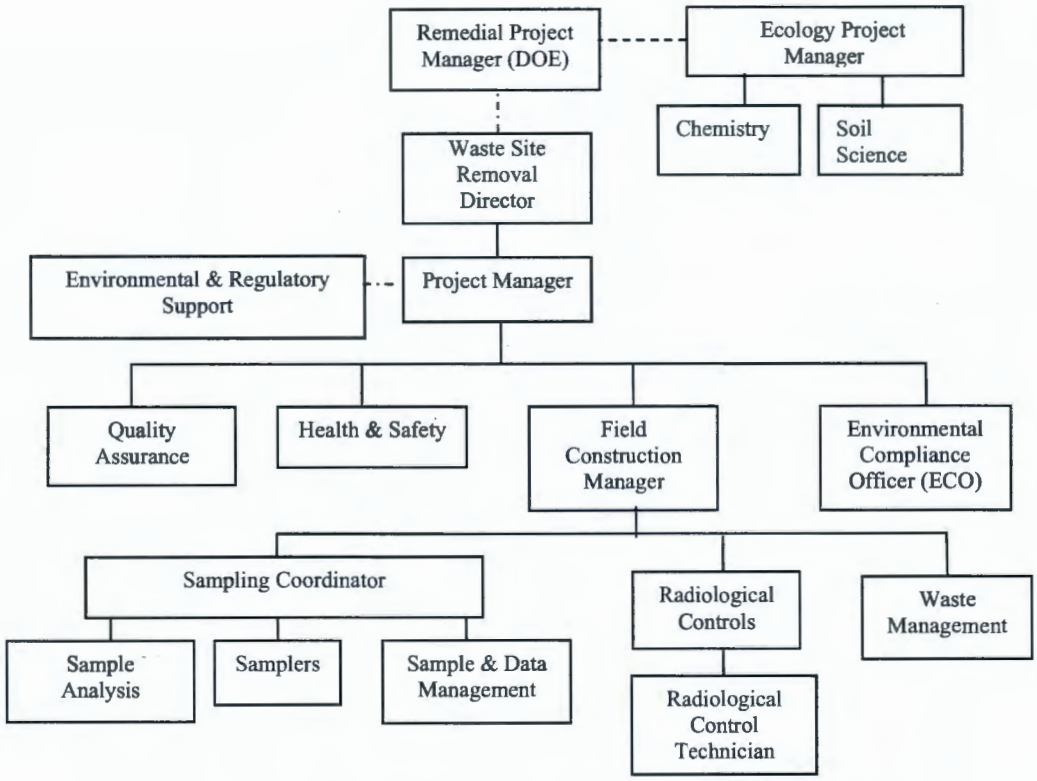

Figure 2-1. Project Organization.

2.1.1.1 Remedial Project Manager

The Remedial Project Manager is a DOE-RL employee who directs response efforts and coordinates all other efforts for this remedial action per 40 CFR 300.120. Therefore, changes to the field sampling plan may be made in the field by the designated Remedial Project Manager.

2.1.1.2 Ecology Project Manager

The Ecology Project manager defines the details, objectives and approach for the field study. The Ecology Project manager will approve all project implementing documents (including this SAP) and will approve major changes to the project documents. The Ecology project manager will define and/or approve the selection of specific waste sites, sampling design, selection of analytical parameters and will manage chemical analysis as well as data validation and analysis. The Ecology Project Manager will have direct reporting technical support.

2.1.1.3 Waste Site Removal Director

The Director of Waste Site Remediation provides oversight for all activities and coordinates with RL, regulators, and primary contractor management in support of sampling activities. In addition, support is provided to the Ecology Sampling Study Project Manager to ensure that the work is performed safely and cost-effectively.

2.1.1.4 Project Manager

The Project Manager is a DOE contractor person who is responsible for the coordination of all contractor resources and is the prime contact for the financial, logistical, and technical components of project

performance. The project manager directs the efforts of the Quality Assurance, Health and Safety, Field Construction and Environmental Compliance support managers.

2.1.1.5 Quality Assurance

The Quality Assurance Lead is matrixed to the Project Manager and is responsible for quality assurance (QA) issues on the project. Responsibilities include oversight of implementation of the project QA requirements; review of project documents, including data quality objective (DQO) summary reports, SAPs, and the QAPjP; and participation in QA assessments on sample collection and analysis activities, as appropriate.

2.1.1.6 Health and Safety

The Health and Safety organization responsibilities include coordination of industrial safety and health support within the project as carried out through health and safety plans, job hazard analyses, and other pertinent safety documents required by Federal regulation or by internal primary contractor work requirements. In addition, assistance is provided to project personnel in complying with applicable health and safety standards and requirements. Personnel protective clothing requirements are coordinated with Radiological Controls Lead.

2.1.1.7 Field Construction Manager

The Field Construction Manager has the overall responsibility for supporting the Sampling Coordinator in the planning, coordination, and execution of field characterization activities. Responsibilities also include directing training, mock-ups, and practice sessions with field personnel to ensure that the sampling design is understood and can be performed as specified. The Field Construction Manager communicates with the Ecology Sampling Study Project Manager to identify field constraints that could affect the sampling design. In addition, the Field Construction Manager directs the procurement and installation of materials and equipment needed to support the field work.

2.1.1.8 Environmental and Regulatory Support

The Environmental and Regulatory Support Lead is responsibilities include development and documentation of the sampling DQOs and sampling and analysis plans as appropriate, which includes the sampling design and associated presentations and the resolution of technical issues. Environmental and Regulatory Support personnel may perform walkdowns or assessments per Section 2.5.1 of this SAP.

2.1.1.9 Environmental Compliance Officer

The Environmental Compliance Officer provides technical oversight, direction and acceptance of project and subcontracted environmental work and develops appropriate mitigation measures with a goal of minimizing adverse environmental impacts. The Environmental Compliance Officer also reviews plans, procedures and technical documents to ensure that all environmental requirements have been addressed, identifies environmental issues that affect operations and develops cost effective solutions, and responds to environmental/regulatory issues or concerns raised by DOE and/or regulatory agency staff.

2.1.1.10 Sampling Coordinator

The Sampling Coordinator's specific responsibilities include conversion of the sampling design requirements into field task instructions that provide specific direction for field activities. The Sampling Coordinator also provides oversight of the Sample and Data Management Organization and the Field Samplers, develops and oversees the implementation of the Letter of Instruction to the Sample Analysis

Contractor, and oversees data validation. For the scope described within this SAP, most of the sample analysis will be performed by off-site laboratories, selected and managed by Ecology. The Sample and Data Management Organization will have little involvement in the off-site analysis. However, some on-site analytical work will be necessary for waste characterization profile development for ERDF acceptance, which will require Sample and Data Management support.

The Samplers collect all samples, including replicates/duplicates and prepare all sample blanks according to the sampling and analysis plan and corresponding field procedures and work packages. The Samplers also complete the field logbook and chain-of-custody forms, as well as any shipping paperwork. The Samplers also prepare the samples for shipment to the Ecology-selected laboratory.

The Sample Analysis organizations will only be involved in the waste characterization profiling of the excavated soil, providing chemical analysis of samples of excavated soil.

2.1.1.11 Radiological Controls

The Radiological Controls Lead is responsible for the radiological/health physics support within the project. Specific responsibilities include conducting as-low-as-reasonably-achievable (ALARA) reviews, exposure and release modeling, and radiological controls optimization for all work planning. In addition, radiological hazards are identified and appropriate controls are implemented to maintain worker exposures to hazards at ALARA levels (e.g., personal protective equipment). Radiological Controls interfaces with the project health and safety representative and plans and directs radiological control technician (RCT) support for all activities.

The Radiological Control Technicians are responsible for performance of all field activities related to radiological control, under the direct supervision of the Radiological Controls Lead.

2.1.1.12 Waste Management

The Waste Management Lead communicates policies and procedures and ensures project compliance for storage, transportation, disposal, and waste tracking in a safe and cost-effective manner. Other responsibilities include identifying waste management sampling/characterization requirements to ensure regulatory compliance and interpreting the characterization data to generate waste designations, profiles, and other documents that confirm compliance with waste acceptance criteria.

2.1.2 Training Requirements

Typical training requirements or qualifications have been instituted by the primary contractor management team to meet training requirements imposed by the Project Hanford Management Contract, regulations, DOE orders, DOE contractor requirements documents, American National Standards Institute/American Society of Mechanical Engineers, *Washington Administrative Code*, etc. For example:

- Training requirements or qualifications needed by sampling personnel will be in accordance with quality assurance requirements.
- The environmental, safety and health training program provides workers with the knowledge and skills necessary to safely execute assigned duties. Field personnel typically will have completed the following training before starting work:
  - Occupational Safety and Health Administration 40-hour hazardous waste worker training and supervised 24-hour hazardous waste site experience

- 8-hour hazardous waste worker refresher training (as required)
- Hanford general employee radiation training
- Radiological worker training.

A graded approach is used to ensure that workers receive a level of training that is commensurate with their responsibilities and that complies with applicable DOE orders and government regulations. Specialized employee training includes pre-job briefings, on-the-job training, emergency preparedness, plan of the day, and facility/worksite orientations.

2.2 FIELD QUALITY CONTROL

Field quality control (QC) samples will be collected to evaluate the potential for cross-contamination and to provide information pertinent to field variability. Field QC for this project will require the collection of field replicates (duplicates), trip or field blanks, and equipment blanks. Soil QA/QC samples will be collected to provide for data validation and shipped to the laboratory with the other samples. The quality control samples will be assigned a unique sample identifier and number similar to the soil samples.

2.2.1 Field Replicates (Duplicates)

Field replicate (duplicate) samples are used to evaluate sample consistency and the precision of field sampling methods. For the discrete sampling approaches, field duplicates will be taken randomly at a rate of 1 per 10 samples. For multi-increment samples, the field replicates will be collected as four additional multi-increment samples in each block; i.e., a total of five multi-increment samples will be collected from the site targeted for field QC. The field replicate samples shall be retrieved from the same depth interval as the primary multi-increment sample but at different randomly-selected locations within each grid

2.2.2 Field Matrix Spike Duplicates

Field matrix spike duplicate samples will be collected along with the original sample as a split from one sample.

2.2.3 Field or Trip Blanks

Field or Trip Blanks are collected, containerized and handled in the same manner as the samples. These blanks can be used to indicate sample contamination throughout the entire process (a field blank) or just the shipment process (a trip blank). Field and trip blanks will consist of silica sand, or other appropriate media, placed in containers and analyzed the same as the samples they correspond with.

2.2.4 Equipment Blanks

Equipment blanks are collected for any soil-sampling device that is reused. Equipment blanks will be collected at a frequency of 1 blank per day per matrix or 1 blank per 20 samples per matrix (whichever is more frequent). Equipment blanks will consist of silica sand or deionized water poured over the decontaminated sampling equipment and placed in containers, as identified on the project Sampling Authorization Form. Equipment blanks will be analyzed the same as the samples they correspond with.

If disposable (i.e., single-use) equipment is used, equipment blanks will not be required.

2.2.5 Prevention of Cross-Contamination

Special care should be taken to prevent cross-contamination of soil samples to avoid the following common ways in which cross-contamination or background contamination may compromise the samples:

- Improperly storing or transporting sampling equipment and sample containers
- Contaminating the equipment or sample bottles by setting the equipment/sample bottle on or near potential contamination sources (e.g., uncovered ground)
- Handling bottles or equipment with dirty hands or gloves
- Improperly decontaminating equipment before sampling or between sampling events.

2.3 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Quality objectives and criteria for soil measurement data are presented in the Ecology project plan (Ecology 2008). These objectives apply to the sample analysis which is outside the scope of this plan.

2.3.1 Measurement and Testing Equipment

Measurement and testing equipment used in the field or in the laboratory that directly affects the quality of analytical data will be subject to preventive maintenance measures to ensure minimization of measurement system downtime. Laboratories and onsite measurement organizations must maintain and calibrate their equipment. Maintenance requirements (such as parts lists and documentation of routine maintenance) will be included in the individual laboratory and the onsite organization QA plan or operating procedures (as appropriate). Calibration of laboratory instruments will be performed in a manner consistent with SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods* (EPA 1999), as amended, or with auditable DOE Hanford Site and contractual requirements. Calibration of radiological field instruments is discussed in Section 2.7.

Consumables, supplies, and reagents will be reviewed per SW-846 requirements and will be appropriate for their use. Note that contamination is monitored by the QC samples discussed in Section 2.3.3.

2.3.2 Laboratory Sample Custody

Sample custody during laboratory analysis will be addressed in the applicable laboratory standard operating procedures. Laboratory custody procedures will ensure the maintenance of sample integrity and identification throughout the analytical process.

2.3.3 Quality Assurance Objective

The QA objective of this plan is to develop implementation guidance that will provide data of known and appropriate quality. Data quality is assessed by representativeness, comparability, accuracy, precision, and completeness. The applicable QC guidelines, quantitative target limits, and levels of effort for assessing data quality are dictated by the intended use of the data and the nature of the analytical method. Each of these is addressed below.

2.3.3.1 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration and distribution of the radiological constituents in the matrix sampled. Sampling plan design, sampling techniques, and

sample handling protocols (e.g., storage, preservation, and transportation) have been developed and are discussed in subsequent sections of this document. The documentation will establish that protocols have been followed and will ensure sample identification and integrity.

2.3.3.2 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using standard procedures, consistent methods, and consistent units. Actual detection limits will depend on the sample matrix and the sample quantity available. Data will be reported as defined for specific samples.

2.3.3.3 Accuracy

Accuracy is an assessment of the closeness of the measured value to the true value. Radionuclide measurements that require chemical separations use this technique to measure method performance. For radionuclide measurements that are analyzed by gamma spectroscopy, laboratories typically compare results of blind audit samples against known standards to establish accuracy. Validity of calibrations are evaluated by comparing results from the measurement of a standard to known values and/or by generation of in-house statistical limits based on three standard deviations (+/- 3s).

2.3.3.4 Precision

Precision is a measure of the data spread when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference for duplicate measurements.

2.3.3.5 Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement process and the complete implementation of defined field procedures.

2.3.3.6 Detection Limits

Detection limits are functions of the analytical method used to provide the data and the quantity of the sample available for analyses.

2.3.4 Laboratory Quality Control

The laboratory method blanks and laboratory control sample/blank spike are defined in Chapter 1 of SW-846 and will be run at the frequency specified in Chapter 1 of SW-846.

2.4 SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES

Soil sample preservation, containers, and holding times for the nonradiological and radiological analytes of interest and physical property tests are presented in Table 2-3. Final sample collection requirements will be identified on a sampling analysis form/chain-of-custody.

Table 2-2. Bottle Requirements for One Sample Set.

Analytes/Method	Bottle Type	Holding Time
Anions (EPA 300.0)	Poly	28 days/14 days after extraction
ICP Metals (EPA 6010)	Poly	6 months
Mercury	Poly	28 days

Table 2-2. Bottle Requirements for One Sample Set.

Analytes/Method	Bottle Type	Holding Time
PCBs	Glass	14 days to extract/ 40 days overall
Gamma Spectroscopy	Poly	none
Uranium	Poly	none
Radiostrontium	Poly	none
Semivolatiles	Glass	14 days to extract/ 40 days overall
Cyanide	Poly	14 days
Tributyl Phosphate	Glass	14 days to extract/ 40 days overall

All samples should be stored at 4° C.

2.5 ONSITE MEASUREMENTS QUALITY CONTROL

The collection of QC samples for onsite measurement QC is not applicable to the field-screening techniques described in this SAP. Field-screening instrumentation will be calibrated and controlled according to Section 2.7, as applicable.

2.5.1 Assessments and Response Action

The primary contractor Environmental & Regulatory Compliance or Quality Assurance groups may conduct random surveillance and assessments to verify compliance with the requirements outlined in this SAP, project work packages, procedures, and regulatory requirements.

Deficiencies identified by these assessments will be reported in accordance with existing programmatic requirements. Central Plateau Projects Quality Assurance coordinates the corrective actions/deficiencies in accordance with the primary contractor QA program. When appropriate, corrective actions will be taken by the DOE Contractor Project Manager or Ecology Project Manager.

2.5.2 Reports to Management

Management will be made aware of all deficiencies identified by self-assessments. Identified deficiencies will be reported to the primary contractor Director, Waste Site Remediation, as appropriate.

2.6 DATA MANAGEMENT

All analytical data will be provided directly to Ecology by their identified laboratory.

Planning for sample collection and analysis will be in accordance with the programmatic requirements governing fixed laboratory sample collection activities, as discussed in the sample team's procedures. The contractor will maintain custody from field sampling planning, through field sampling and field analytical screening, and collection/packaging of the samples for transfer to Ecology custody and shipping to the analytical laboratory. In the event that specific procedures do not exist for a particular work evolution, or it is determined that additional guidance to complete certain tasks is needed, a work package will be developed to adequately control the activities, as appropriate. Examples of the sample team's requirements include activities associated with the following:

- Chain of custody/sample analysis requests
- Project and sample identification for sampling services

- Logbooks, checklists
- Sample packaging

Approved work control packages and procedures will be used to document radiological measurements when this SAP is implemented. Examples of the types of documentation for field radiological data include the following:

- Instructions regarding the minimum requirements for documenting radiological controls information as per 10 CFR 835, "Occupational Radiation Protection"

- Instructions for managing the identification, creation, review, approval, storage, transfer, and retrieval of primary contractor radiological records

- The minimum standards and practices necessary for preparing, performing, and retaining radiological-related records

- The indoctrination of personnel on the development and implementation of sample plans

- The requirements associated with preparing and transporting regulated material.

2.7 VALIDATION AND VERIFICATION REQUIREMENT

This SAP covers field activities and does not include the generation of analytical data. Therefore no validation or verification of laboratory data will be required. Relative to analytical data in sample media, physical data and/or field screening results are of lesser importance in making inferences of risk. Because of the secondary importance of such data, no validation for physical property data and/or field screening results will be performed. However, field QA/QC will be reviewed to ensure that the data are useable. Field instrumentation, calibration, and QA checks will be performed in accordance with the following.

- Calibration of radiological field instruments on the Hanford Site is performed under contract by Pacific Northwest National Laboratory, as specified in their program documentation.

- Daily calibration checks will be performed and documented for each instrument used to characterize areas that are under investigation. These checks will be made on standard materials that are sufficiently like the matrix under consideration that direct comparison of data can be made. Analysis times will be sufficient to establish detection efficiency and resolution.

The approval of field-data collection plans by the Radiological Controls organization represents the data validation and usability review for handheld field radiological measurements.

2.8 DATA QUALITY ASSESSMENT

The Data Quality Assessment (DQA) process is not within the contractor's scope of the project.

2.9 MODIFICATIONS TO THIS PLAN

This plan incorporates the intent of Ecology as represented in the Project Protocols Document (Ecology 2008). Specific changes to the details associated with the sampling (e.g. number, location, bottles, etc.) can be accomplished by a change request signed by Ecology and documented in the Tri-Party Agreement project manager meetings.

3.0 FIELD SAMPLING PLAN

3.1 SAMPLING OBJECTIVES

The primary objective of the field sampling plan is to clearly identify and describe the sampling and analysis activities that will be conducted to support the Ecology Sampling Comparison Study. The field sampling plan uses the sampling approaches developed by Ecology and revised during discussions between Ecology, DOE and contractor representatives. The overall sampling strategy is outlined in Table 3-1. Minor or expected changes to the field sampling plan may be made in the field by the designated field superintendent with verbal confirmation with the Ecology technical project representative. These changes include number and location of the prescreening samples, precise number of random systematic samples, or other parameters specifically identified within this SAP as, "per Ecology direction." Major changes can be accomplished in accordance with Section 2.9.

3.2 SAMPLING SEQUENCE

The sampling activities will be conducted in four distinct phases: pre-screening, variance sampling, waste characterization and field screening during excavation, and closeout sampling. The pre-screening sampling will be conducted first. Based on the results of the pre-screening sampling, Ecology and DOE-RL may elect to proceed with the rest of the study using one or both of the preferred sites. Alternatively, Ecology and DOE-RL may elect to pursue one of the back-up sites. In addition, Ecology may modify the analytical parameter list for one or more of the sites.

After the sites have been confirmed, the clean fill (approximately 2 to 5 ft.) overlying the contamination of the sites will be removed. Waste characterization sampling for ERDF acceptance and field radiological screening will be performed. After removal of the clean fill, the variance sampling will be performed.

After the variance sampling is completed, the contamination within the test sites will be removed by excavation, and the final closeout sampling will be completed.

3.3 FIELD MEASUREMENTS

3.3.1 Surface Radiation Survey

A surface radiation survey will be performed on the soil at each waste site, to document existing surface contamination and to support preparation of supporting health and safety documentation. Surface radiation surveys will be conducted by qualified radiological control technicians. A survey report will be prepared documenting the results of each survey. Post-sampling surveys also will be performed at each sampling site to ensure that sampling activities have not contributed to surface contamination.

3.3.2 Radiological Screening

For the sampling effort at the Ecology Sampling Study Waste Site excavations, field screening will be used to establish site radiological contamination levels. In addition, field screening for radiological contamination will be used as a tracer to locate areas of chemical contamination, because process knowledge shows that discharges to the Ecology Sampling Study Waste Sites contained both radiological and chemical constituents. If field-screening results indicate the presence of cesium-137 or strontium-90, the areas with the highest levels of contamination will be further characterized with analytical samples to identify the contaminant(s) levels. Although radiological screening provides a powerful tool to characterize the study area with high-density field data, with low detection limits, there is uncertainty involved. The primary assumption is that the radiological and chemical contamination are co-located.

3.4 SOIL SAMPLES

3.4.1 Systematic Random

A number of sample sites will be chosen and evenly gridded based on the MIS grid system. A unique flagging system will be used to distinguish the discrete locations. For planning purposes, forty sample locations are estimated. However, Ecology will perform an a priori power analysis for information and comparison to the actual number of samples taken. In addition, Ecology will also perform an a posteriori analysis (e.g. bootstrapping) to assess whether a smaller number of discrete samples could have adequately represented the waste site.

The decision unit for each site will be designated as one MIS block for each quarter acre. More detail on the MIS approach is defined below. Since each MIS block will require 100 flag gridded sampling points 40 discrete samples can be proportioned out evenly throughout the MIS grids across the blocks. (e.g., four blocks will have 10 discrete samples take per block). A random location within the first grid unit will be selected by dividing the block into 100 sub-units and selecting one using a two-digit random number (i.e., the first digit is the "across" distance and the second is the "down" distance). All remaining samples will be taken from this analogous location within the respective grid units. Although the first grid unit location will be selected carefully with measured distances, all the rest of the sample locations will be located approximately by the field samplers "by eye."

3.4.2 Judgmental

The judgemental sampling design will consist of five (5) samples taken from each site. The judgmental sampling point expected to provide the highest concentration will be selected by site knowledge, historical outfall location, and radiochemical field screening. Remaining samples needed will be chosen by fanning out from the highest initial contaminated sample site.

3.4.3 Overview of Block MIS

Block MIS involves dividing an area of interest, such as a waste site (in this evaluation 0.5-acre portions of each site), into subunits called blocks. The block size of interest for this pilot study corresponds to an approximate residential lot size, 0.25 acres. Each waste site is divided into two 0.25 acre blocks. The proposed 0.5 acre removal site is shown in Figures 1-2 and 1-3 for each waste site.

The sampling design for each MIS sample will employ a random start over a systematic grid, consisting of 100 increments. A fixed number of MIS samples (n=5) will be collected for each 0.25 acre block. Multiple MIS blocks (b) may be required to cover the entire waste site, resulting in [n x b] MIS samples for the entire waste site decision unit (Davidson 2006).

3.4.4 MIS Sampling Procedure

MIS sampling and subsampling will be performed by DOE contractor sampling personnel in accordance with an approved procedure, within an approved work package.

Before sampling begins, a local background activity reading will be taken at a location selected in the field. Field screening will be used to identify detectable radiological contamination, adjust block boundaries if needed, assist in determining sample shipping requirements, determine equipment/personnel decontamination needs, and support worker health and safety monitoring.

Field-screening instruments will be used, maintained, and calibrated in accordance with the instrument program, manufacturers' specifications, and other approved procedures.

3.4.5 Sample Preparation

All soil samples taken within the pre-screening, variance, and closeout sampling will be sieved through a 2mm sieve per WAC 173-340-740(7)(a).

DOE contractor personnel will collect and prepare the pre-screening, variance and closeout samples for shipment to the Ecology-identified laboratory. DOE contractor personnel will also perform the MIS subsampling activities necessary to prepare samples for chemical analysis by the laboratory.

DOE contractor personnel will collect the soil waste profile samples and will perform all radiological field screening during the soil excavation phase.

3.4.6 Sampling Locations and Frequency

Table 3-1 lists the sampling techniques and the samples required for the Ecology Sampling Study. Table 3-1 also summarizes the number of samples required for each location or media. While it is expected that the sample locations will be sampled once, all the sites or media are accessible and additional sampling may be conducted if the initial results prove to be insufficient to support Ecology comparison requirements.

3.4.7 Bottle Schedule

For each discrete sample, samplers will fill two sample bottles:

(2) – 8oz Poly bottle for Anions, Metals, Mercury, Cyanide, U, Pu, gamma and Sr

(1) – 8oz Glass bottle for Semivolatiles, PCB's and Tributyl Phosphate

For each MIS sample, the sampling team will collect a parent sample per Sections 3.4.3 and 3.4.4. The parent sample will be subsampled using a 100-compartment tray to generate a series of identical samples of nominally 20 g. The exact number will depend on the QC requirements of the laboratory selected to perform the analytical work, but will likely be the following:

(1) sample for each analysis for each replicate

(5) extra samples for each replicate for reruns, laboratory accidents, etc.

(16) extra samples per block for laboratory QC (double samples for one replicate)

The schedule above would generate 16 samples for each of five replicates per block plus 16 extra QC samples for a total of 96 sample bottles per block. The large number of small samples is required as the laboratory will be directed to process the entire contents of each sample bottle for each sample analysis.

Table 3-1. Ecology Sampling Study Operable Unit Waste Site Remediation Sampling Plan.

Sampling Phase	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
Pre-Screening	Radiological and chemical data for verification that the primary heterogeneous and homogenous sites are appropriate for the study. Alternatively that the alternate site provides a more appropriate site. Resulting data will also be used to modify the COC list for the more involved variance and closeout sampling phases.	216-S-19 • Collect one or more discrete samples at the assumed worst-case location (near discharge pipe outlet) • Perform full suite of laboratory analyses for radiological and chemical constituents listed in Table 1-1, unless otherwise specified. • Photographic documentation of the sampling activities may be used for documentation purposes. UPR-200-E-56 • Collect one or more discrete samples at approximately 5 to 6 feet bgs (based on field screening) at a random location within the 0.5 acre proposed removal site (at the direction of the project manager and Ecology technical personnel). • Perform full suite of laboratory analyses for radiological and chemical constituents listed in Table 1-1, unless otherwise specified. • Photographic documentation of the sampling activities may be used for documentation purposes.	One set of samples from the depth identified as worst-case underneath the overlying clean fill. At the discretion of the field technical lead, a second set of samples may be taken if two areas of significant radioactivity, but differing appearance are observed. A full set of samples from each of the locations where the clean fill has been removed. At the discretion of the field lead, additional sampling locations may be identified if there is an indication of differing character of the existing contamination.	All radiological and chemical constituents listed in Table 1-1, unless otherwise specified by Ecology.

Table 3-1. Ecology Sampling Study Operable Unit Waste Site Remediation Sampling Plan.

Sampling Phase	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
Variance Sampling	Chemical and radiological data which will be used to define the nature and extent of initial contamination, and also to provide data which Ecology will use to compare three identified sampling approaches.	• Remove approximately 2 feet of clean soil from a 0.5 acre area near the presumed outfall pipe to the 216-S-12 pond (North side of waste site). • Remove approximately 5 feet of clean soil from 0.5 acres within the E-56 area. • Perform field radiological survey(s) of soil surface document results, including location and depth of collection. • Each site will be divided into "blocks" which will represent decision units. • Each block will be marked with a 10x10 grid for guiding the random systematic and MIS sampling • Collect 5 MIS samples per block • Collect five judgemental samples per site at the locations for which field radiological screening shows the highest contamination. • Identify the random start location within the grids per section 3.4.1. Collect 40 systematic samples from the total number of grid units within the site. (i.e., if there are 4 blocks, there will be 4x100 or 400 grid units and 1 out of 10 blocks will be sampled). • Perform full suite of laboratory analyses for radiological and chemical constituents listed in Table 1-1, unless otherwise specified. • Photographic documentation of the sampling activities may be used for documentation purposes. • Prepare a radiological survey report to document the field information gathered.	Five MIS samples per block Five judgmental samples per site 40 random systematic samples per site In addition, collect one duplicate discrete sample from each waste site (the five MIS samples are considered replicates) plus one field blank and one trip blank for laboratory analysis for each sampling day. All samples will be collected from 0-4 inches in depth and sieved through a 2mm sieve.	All radiological and chemical constituents listed in Table 1-1, as modified per the pre-screening phase results, unless otherwise specified by Ecology.

Table 3-1. Ecology Sampling Study Operable Unit Waste Site Remediation Sampling Plan.

Sampling Phase	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
Field screening prior to and during soil removal	Chemical and radiological data to compare with ERDF acceptance criteria and radiological field data to guide soil removal.	• Collect samples of the most highly contaminated soil to develop a waste profile for each site. • Collect continuous or near-continuous field radiological screening data to guide soil removal activities and verify adequate removal of soil.	One sample for the parameters of interest to ERDF. Continuous field radiological screening data located as necessary.	Gamma spectroscopy, radiostrontium, ICP metals, Mercury, Cyanide, IC Anions, Semivolatiles (including TBP) and the following specific alpha radioisotopes: Pu 238, Pu 239/240, U234, U235, U238, Am241, Np237, Ra226, and Am/Cm
Closeout Sampling	Chemical and radiological data which Ecology will use to compare final closeout verification data using the three identified sampling approaches.	• Perform field radiological survey(s) of soil surface document results, including location and depth of collection. • Each site will be divided into "blocks" which will represent decision units. • Each block will be marked with a 10x10 grid for guiding the random systematic and MIS sampling • Collect five judgemental samples per site at the locations for which field radiological screening shows the highest contamination. • Identify a new random start location within the grids per section 3.4.1. Collect 40 systematic samples from the total number of grid units within the site. (i.e., if there are 4 blocks, there will be 4x100 or 400 grid units and 1 out of 10 blocks will be sampled). • Collect 5 MIS samples per block • Perform full suite of laboratory analyses for radiological and chemical constituents listed in Table 1-1, unless otherwise specified.	Five judgmental samples per site 40 random systematic samples per site 5 MIS samples per block In addition, collect one duplicate discrete sample from each waste site (the five MIS samples are considered replicates) plus one field blank and one trip blank for laboratory analysis for each sampling day. All samples will be collected from 0-4 inches in depth and sieved	All radiological and chemical constituents listed in Table 1-1, as modified per the pre-screening phase results, unless otherwise specified by Ecology.

Table 3-1. Ecology Sampling Study Operable Unit Waste Site Remediation Sampling Plan.

Sampling Phase	Data Needs	Recommended Sampling Approach	Location and Number of Samples	COPCs
		• Photographic documentation of the sampling activities may be used for documentation purposes. • Prepare a radiological survey report to document the field information gathered.	through a 2mm sieve	

Note: Equipment blanks will be collected as described in Section 2.2.3.
COC = contaminant of concern
COPC = contaminant of potential concern

3.5 SAMPLING PROCESSES

The sampling processes to be implemented in the field shall be implemented consistent with the requirements outlined in the *Hanford Federal Facility Agreement and Consent Order Action Plan* (Tri-Party Agreement) (Ecology et al. 2003), Section 7.8, "Quality Assurance," and *Sampling Protocols for the Proposed Sites to Evaluate Model Toxics Control Act Cleanup Regulation Chapter 173-303 WAC Decision Rules for Compliance Using Multi-Incremental and Discrete Sampling Strategies* (Ecology 2008). The project will use DOE contractor sampling personnel to perform the sample collection associated with the Ecology Sampling Study Waste Site Remediation project. The approved sampling organization will perform the sample collection activities in accordance with established instructions for sample collection, collection equipment, and sample handling.

3.6 SAMPLE MANAGEMENT

Sample and data management activities will be performed in accordance with the prime contractor quality assurance program. Sample preservation, container, and holding-time requirements will be indicated on Chain-of-Custody/Sample Analysis Request forms in accordance with SW-846, this project QAPjP and SAP, and the specific analytical method prepared for specific sample events.

Soil sampling and field measurements will be conducted according to the following approved work processes.

Sample Identification. Each sample will be identified and labeled with a unique sample number. The sample location, depth, and corresponding numbers will be documented in the sampler's field logbook.

Each sample container will be labeled with the following information, using a waterproof marker on firmly affixed, water-resistant labels:

- Unique number
- Sample collection date/time
- Name/initials of person collecting the sample
- Analysis required
- Sample weight
- Preservation method, if applicable.

Field Sampling Log. All information pertinent to field sampling and analysis will be recorded in bound logbooks in accordance with SW-846. The sampling team will be responsible for recording all relevant sampling information. Entries made in the logbook will be dated and signed by the individual who made the entry.

Sample Custody. A chain-of-custody record will be initiated at the time of sampling and will accompany each set of samples provided to Ecology or shipped directly to the laboratory. The analyses requested for each sample will be indicated on the accompanying Chain-of-Custody/Sample Analysis Request form. Chain-of-custody procedures will be followed throughout sample collection, transfer, analysis, and disposal to ensure that sample integrity is maintained. Each time responsibility for custody of the sample changes, the new and previous custodians will sign the record and note the date and time. The sampler will make a copy of the signed record before the sample is shipped and will transmit it to the Project Manager within 24 hours of shipping.

A custody seal (i.e., evidence tape) will be affixed to the lid of each sample jar in a manner that would indicate tampering. The container seal will be inscribed with the sampler's initials and the date sealed.

Sample Containers and Preservatives. Level I EPA precleaned sample containers will be used for soil samples. Container sizes may vary, depending on laboratory-specific volumes needed to meet analytical detection limits. If, however, the dose rate on the outside of a sample jar, or the curie content, exceeds levels acceptable by an offsite laboratory, the Sampling Coordinator/Field Samplers can send smaller volumes to the laboratory after consultation with the Project Manager who will communicate with Ecology to determine acceptable volumes. Final container types and volumes will be provided by the Waste Sampling and Characterization Facility (WSCF) and the Sampling and Mobile Laboratory organization.

Sample Shipping. A radiological control technician will survey each sample jar to verify that the container is free of smearable surface contamination. The radiological control technician also will measure the radiological activity on the outside of the sample container (through the container) and will mark the container with the highest contact radiological reading in millirem per hour. Activity level determinations will be made by utilizing dose rates, and ratioed against a bounding isotopic distribution, or transported in accordance with provisions in an approved sample routine radiological shipping record. This information, along with other data that may prequalify the samples, will be used to select proper packaging, marking, labeling, and shipping paperwork in accordance with U.S. Department of Transportation regulations (49 CFR, "Transportation") and to verify that the sample can be received by the offsite analytical laboratory.

As a general rule, waste profile samples for ERDF acceptance will be sent to the WSCF. All other samples will be provided to Ecology for shipment to a laboratory of their choice. If agreed by the Ecology PM and Project Manager, the contractor may ship samples directly to Ecology's laboratory. Samples with activities less than 1 mR/h may be shipped to an offsite laboratory. Samples with activities greater than 1mR/hour will be held pending Ecology determination of whether they will be acceptable for offsite transportation and laboratory acceptance, or if an onsite lab may be used.

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4.0 STANDARDS CONTROLLING RELEASES TO THE ENVIRONMENT

4.1 RADIOLOGICAL AIR EMISSIONS

The Revised Code of Washington (RCW) 70.94, "Washington Clean Air Act," requires regulation of radioactive air pollutants. The state implementing regulation WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," sets standards that are as stringent or more so than the federal *Clean Air Act of 1990* and Amendments (42 United States Code 7401 et seq.), and under the federal implementing regulation, 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." EPA's partial delegation of the 40 CFR 61 authority to the State of Washington includes all substantive emissions monitoring, abatement, and reporting aspects of the federal regulation. The state standards protect the public by conservatively establishing exposure standards applicable to even the maximally exposed public individual. Under the Washington Administrative Code [WAC 246-247-030(15)], the "Maximally exposed individual" (MEI) is any member of the public (real or hypothetical) who abides or resides in an unrestricted area, and may receive the highest total effective dose equivalent (TEDE) from the emission unit(s) under consideration, taking into account all exposure pathways affected by the radioactive air emissions. All combined radionuclide airborne emissions from the DOE Hanford Site "facility" are not to exceed amounts that would cause an exposure to any member of the public of greater than 10 mrem/yr effective dose equivalent. The state implementing regulation WAC 246-247, "Radiation Protection – Air Emissions," which adopts the WAC 173-480 standards and the 40 CFR 61, Subpart H standard, requires verification of compliance with the 10 mrem/yr standard, and would potentially be applicable to this pilot study field investigation.

The WAC 246-247 further addresses emission sources emitting radioactive airborne emissions by requiring monitoring of such sources. Such monitoring requires physical measurement of the effluent or ambient air. The substantive provisions of WAC 246-247 that require monitoring of radioactive airborne emissions would be applicable to this pilot study field investigation.

The above state implementing regulations further address control of radioactive airborne emissions where economically and technologically feasible (WAC 246-247-040(3) and -040(4), "Radiation Protection - Air Emissions," "General Standards," and associated definitions). To address the substantive aspect of these requirements, best or reasonably achieved control technology will be addressed by ensuring that applicable emission control technologies (those successfully operated in similar applications) will be used when economically and technologically feasible (i.e., based on cost/benefit). If it is determined that there are substantive aspects of the requirement for control of radioactive airborne emissions, then controls will be administered as appropriate using reasonable and effective methods.

4.2 CRITERIA/TOXIC AIR EMISSIONS

Under WAC 173-400, "General Regulations for Air Pollution Sources," and WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," requirements are established for the regulation of emissions of criteria/toxic air pollutants. The primary nonradioactive emissions resulting from this pilot study field investigation will be fugitive particulate matter. In accordance with WAC 173-400-040, "General Standards for Maximum Emissions," reasonable precautions must be taken to (1) prevent the release of air contaminants associated with fugitive emissions resulting from excavation, materials handling, or other operations; and (2) prevent fugitive dust from becoming airborne from fugitive sources of emissions. The use of treatment technologies that would result in emissions of toxic air pollutants that would be subject to the substantive applicable requirements of WAC 173-460 are not anticipated to be a part of this pilot study field investigation. Treatment of some waste encountered during the investigation may be required to meet ERDF waste acceptance criteria. In most cases, the type of treatment anticipated

would consist of solidification/stabilization techniques such as macroencapsulation or grouting, and WAC 173-460 would not be considered an ARAR. If more aggressive treatment is required that would result in the emission of regulated air pollutants, the substantive requirements of WAC 173-400-113(2) and WAC 173-460-060 would be evaluated to determine applicability.

Emissions to the air will be minimized during implementation of this pilot study field investigation through use of standard industry practices such as the application of water sprays and fixatives. These techniques are considered to be reasonable precautions to control fugitive emissions as required by the regulatory standards.

4.3 RADIOLOGICAL AIRBORNE SOURCE INFORMATION

The total potential fugitive emissions were calculated for this pilot study field investigation.

There is a potential for particulate radioactive airborne emissions to result from the investigation activities. The primary radionuclide detected within each site, at this time, is represented by cesium-137. Emissions and dose information related to the excavation activity are provided in Tables 4-1 and 4-2. The estimates shown for abated emissions very conservatively assume no abatement affect. Therefore, the Abated and Unabated estimates are listed as the same.

Each calculation is based on excavation of 0.5 acre of land down to a depth of 15 feet using a density of 1.7 g/cm^3 for soil and a radiological soil survey thickness of 1 cm. It was assumed that the worst-case isotope was cesium-137 and that the contamination was spread throughout the extire excavation.

Table 4-1. Dose Calculations for the UPR-200-E-56 Pilot Study Field Investigation.

Nuclide	Radionuclide Inventory (Ci)[a]	40 CFR 61, Appendix D, Release Factor	Abated and Unabated Release Rate (Ci/yr)	200 East Area <40 m Dose-per-Unit Release Factor (mrem/Ci)	Unabated and Abated Dose to MEI (mrem/yr)
Cesium-137	3.33	1.0E-03	3.33E-03	2.7E-01	8.99E-04
				TEDE Totals:	**8.99E-04**

[a] Cs-137 curie value was calculated from an 8,000 counts per minute measurement identified in the WIDS database.
40 CFR 61, "National Emission Standards for Hazardous Air Pollutants."
MEI = maximally exposed individual.
TEDE= total effective dose equivalent.

Table 4-2. Dose Calculations for the 216-S-19 Pilot Study Field Investigation.

Nuclide	Radionuclide Inventory (Ci)[a]	40 CFR 61, Appendix D, Release Factor	Abated and Unabated Release Rate (Ci/yr)	200 West Area <40 m Dose-per-Unit Release Factor (mrem/Ci)	Unabated and Abated Dose to MEI (mrem/yr)
Cesium-137	0.21	1.0E-03	2.10E-04	3.1E-01	6.51E-05
				TEDE Totals:	**6.51E-05**

[a] Cs-137 curie value was calculated from an 500 counts per minute measurement identified in the WIDS database.
40 CFR 61, "National Emission Standards for Hazardous Air Pollutants."
MEI = maximally exposed individual.
TEDE= total effective dose equivalent.

For UPR-200-E-56, the distance to the Laser Interferometer Gravitational Wave Observatory receptor is 16,630 m east-southeast of the 200 East Area. This is the nearest public location where the hypothetical maximally exposed individual (MEI) might be located. Dose factors used specific to this location were taken from *Calculating Potential-to-Emit Radiological Releases and Doses* (DOE/RL-2006-29). The total unabated and abated potential-to-emit to the receptor from this pilot study field investigation is 8.99E-04 mrem/yr.

For 216-S-19, the distance to the Laser Interferometer Gravitational Wave Observatory receptor is 18,310 m east-southeast of the 200 West Area. This is the nearest public location where the hypothetical maximally exposed individual (MEI) might be located. Dose factors used specific to this location were taken from DOE/RL-2006-29. The total unabated and abated potential-to-emit to the receptor from this pilot study field investigation is 6.51E-05 mrem/yr.

4.4 EMISSION CONTROLS

Due to the simple nature of the investigation, no elaborate best available radiological control technology (BARCT) analysis was performed in regards to potential emissions. In general, the BARCT evaluation for an outdoor relatively short-term action supports using proven technology on a cost/benefit basis. Based on analysis of the potential emissions and analysis of available control technologies, the following controls have been selected for use during the investigation.

- Water will be applied, as needed, during any excavation and backfilling activities, for suppression of fugitive emissions and dust.

- Fixatives will be applied to contaminated soil and/or debris and equipment, as needed, to minimize airborne contamination during the investigation for fugitive emissions and dust. Fixative application techniques may include spraying, brushing on, pouring or some other method, as necessary.

- Fixatives or cover material (e.g., soil, gravel, etc.) will be applied to disturbed contaminated soils, associated with the investigation, when field activities will be inactive more than 24 hours except as noted in the next bullet.

- If the sustained wind speed is predicted overnight to be greater than 32 km/hr (20 mph) based on the Hanford Meteorological Station afternoon forecast, fixative or cover material will also be applied, as needed prior to occurrence of the predicted winds. This will allow the project enough time, if necessary, to prepare for the application of dust control measures. If a fixative has already been applied and the fixed contaminated items will remain undisturbed, further use of fixatives will not be needed. The fixatives or other controls will not be applied when the contaminated items are frozen, or it is raining, snowing, or other freezing precipitation is falling at the end of work operations.

- Field activities should be temporarily ceased and the area should be placed in a safe configuration if contamination control measures are not adequate, based on site conditions (e.g., excessive wind).

- The waste packages will remain closed, except during packaging and waste inspection activities, once they are staged, but within the CERCLA Waste Container Storage Area.

- Operational limits for removable or transferable contamination levels will be established in the activity work packages and associated radiation work plans. Fixatives or other controls will be employed if removable or transferable contamination levels (other than specks of contamination)

above 100,000 disintegrations per minute per 100 square centimeters beta/gamma or exceeding 2,000 disintegrations per minute per 100 square centimeters alpha are measured or expected.

4.5 MONITORING

The calculated unabated annual dose combined for all related activities during this pilot study field investigation is below 0.1 mrem/year; therefore, this activity is not subject to continuous emissions monitoring as required byWAC 246-247-075(1). Periodic confirmatory measurement will be provided, however, as required by WAC 246-247-075(3) and (8). Alternative monitoring techniques have been considered and radiological surveys are sufficient to meet the periodic confirmatory measurement requirement.

Monitoring for diffuse and fugitive emissions will be conducted and will consist of radiological surveys using hand-held instruments at the excavation activities. Both alpha and beta/gamma surveys will be performed for all removable contamination surveys and for soil surveys (direct readings).

Excavation activities will be stopped if removable or transferable contamination (other than specks of contamination) with detection readings greater than 500,000 disintegrations per minute per 100 square centimeters beta/gamma or greater than 28,000 disintegrations per minute per 100 square centimeters alpha is encountered on the soil outside of active work areas posted for contamination control and the area stabilized. The size of the posted area at any one time will be minimized to facilitate contamination control. Excavation in that area will not continue until an internal review of the work and encountered conditions has been performed and an internal determination has been made that no threat to personnel safety or the environmental exists, or until proper controls (i.e., removal and disposal, water, fixatives, or covers) have been put in place to mitigate any further potential for emissions, and Ecology and DOE-RL have been contacted and briefed of the situation.

5.0 REPORTING REQUIREMENTS FOR NONROUTINE RELEASES

The following reporting requirements apply for hazardous substances that could be released during this pilot study field investigation.

5.1 FEDERAL HAZARDOUS SUBSTANCE

40 CFR 302 requires immediate notification to the National Response Center on discovery of a release of a hazardous substance into the environment in excess of a reportable quantity.

40 CFR 355 requires immediate notification to the community emergency coordinator for the local emergency planning committee and to the State Emergency Response Commission for a release of a reportable quantity of an extremely hazardous substance, a comprehensive release of a reportable quantity of an extremely hazardous substance, or a CERCLA hazardous substance.

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6.0 HEALTH AND SAFETY

All field operations will be performed in accordance with prime contractor health and safety requirements outlined in a separate document. In addition, a work control package will be prepared that will further control site operations. This work package will include an activity hazard analysis, and will reference applicable radiological control requirements.

The sampling processes and associated activities will take into consideration exposure reduction and contamination control techniques that will minimize radiation exposure to the sampling team, as required by minimum requirements established by 10 CFR 835, and provide the basis for consistent and uniform implementation of radiological control requirements.

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7.0 MANAGEMENT OF WASTE

All waste (including unexpected waste) generated by sampling activities will be managed in accordance with a waste management plan, published in a separate document. Unused samples and associated laboratory waste for the analysis will be dispositioned in accordance with the laboratory contract and agreements for return to the project site. Pursuant to 40 CFR 300.440, EPA Unit Manager approval is required before returning unused samples or waste from offsite laboratories.

In addition, EPA Unit Manager approval is required before shipping sample waste from Hanford onsite laboratories (e.g., 222-S Analytical Laboratories or WSCF) back to the waste site of origination.

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