# APPENDIX B

# SAMPLING AND ANALYSIS PLAN

## CONCURRENCE PAGE

**Title:** Sampling and Analysis Plan for 200-UR-1 Unplanned Releases Waste Group Operable Unit

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(NOTE: To be completed following regulatory review and during incorporation of regulatory comments into Revision 0 of the Sampling and Analysis Plan)

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## TERMS

| | |
|---|---|
| AEA | alpha energy analysis |
| CAS | Chemical Abstracts Service |
| COC | contaminant of concern |
| COPC | contaminant of potential concern |
| CSM | conceptual site model |
| CV | cold vapor |
| d/min | disintegrations per minute |
| DL | detection limit |
| DQO | data quality objective |
| DR | decision rule |
| DS | decision statement |
| Ecology | Washington State Department of Ecology |
| EPA | U.S. Environmental Protection Agency |
| FS | feasibility study |
| GeLi | germanium-lithium |
| GRP | Groundwater Remediation Project |
| HEIS | Hanford Environmental Information System |
| HPGe | high-purity germanium |
| IC | ion chromatography |
| ICP | inductively coupled plasma |
| LARADS | Laser-Assisted Ranging and Data System |
| MARSSIM | *Multi-Agency Radiation Survey and Site Investigation Manual* (NUREG-1575, EPA/402/R-97/016, DOE/EH-0624) |
| N/A | not applicable |
| NaI | sodium iodide |
| OSWER | Office of Solid Waste and Emergency Response |
| OU | operable unit |
| PCB | polychlorinated biphenyl |
| PRG | preliminary remediation goal |
| PUREX | Plutonium-Uranium Extraction (Plant) |
| QAPjP | quality assurance project plan |
| QC | quality control |
| RAO | remedial action objective |
| RCT | radiological control technician |
| RECUPLEX | Recovery of Uranium and Plutonium by Extraction Plant |
| REDOX | Reduction-Oxidation (Plant) |
| RESRAD | RESidual RADioactivity (dose model) |
| RI | remedial investigation |
| RSD | relative standard deviation |
| RTD | remove/treat/dispose |
| SAP | sampling and analysis plan |
| SVOA | semivolatile organic analyte |
| TAL | target analyte list |
| TCL | target compound list |

| | |
|---|---|
| TCLP | toxicity characteristic leaching procedure |
| TIC | tentatively identified compound |
| Tri-Party Agreement | *Hanford Federal Facility Agreement and Consent Order* |
| UCL | upper confidence limit |
| UPR | unplanned release |
| VOA | volatile organic analyte |
| VOC | volatile organic compound |
| VSP | Visual Sample Plan (statistical software) |
| WAC | *Washington Administrative Code* |
| WIDS | *Waste Information Data System* |

# APPENDIX B

# SAMPLING AND ANALYSIS PLAN

## B1.0 INTRODUCTION

This sampling and analysis plan (SAP) presents the rationale and strategy for radiological surveys and sampling and analysis activities in support of removal actions or remediation decisions for the 200 UR-1 Operable Unit (OU) waste sites. The purpose of the surveys and sampling and analysis for sites identified for remove/treat/dispose (RTD) is to verify completeness of the removal activities and that excavated clean soil is appropriate for use as backfill. Sampling and analysis requirements to support waste designation decisions for excavated contaminated material also are provided.

This SAP includes the scoping sampling strategy and analytical requirements developed for the remedial investigation (RI) of the BC Controlled Area. This SAP also includes initial radiological survey specifications and data collection needed to support the performance of final status surveys, in accordance with NUREG-1575, EPA 402-R-97-016, DOE/EH-0624, *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM),- for site closeout of portions of the BC Controlled area.

This section provides general background information about the project. Additional discussion is presented in the work plan. Contaminants of concern (COC), preliminary remediation goals (PRG), and a summary of the data quality objectives (DQO) identified for waste sites identified for RTD or completion of an RI are presented.

## B1.1 BACKGROUND

The 200-UR-1 OU unplanned release (UPR) sites consist of locations where contamination has been identified as the result of spills or leaks to the ground surface, or from dissemination of radioactive particulates, plant materials, and/or animal feces. Many of the UPR sites resulted from loss of control of radioactive materials during waste transfer or containment in areas with process facilities, roads, railroad lines, or tank farms. A small number of UPR sites are associated with burial grounds, trenches, and cribs. Causes for the releases are attributed to administrative failures, equipment failures, operator error, and vegetation or animal intrusion.

The early definition of a UPR was exclusively a release of radioactive material. These releases were given site numbers beginning with the prefix UPR. More recently, releases of non-radiological, hazardous materials also have become part of the criteria defining UPRs. New releases, whether radiological or hazardous, usually are cleaned up shortly after they occur. Those not cleaned up are numbered, submitted to the *Waste Information Data System* (WIDS) Database as a "Discovery Item," and evaluated for acceptance as waste sites. The numbers assigned to recent UPRs no longer include the UPR prefix.

Table B-1 shows the 200-UR-1 sites currently identified for inclusion under the scope of this SAP.

## B1.2 200-UR-1 GROUP/WASTE SITE LOCATIONS

The 200-UR-1 waste sites are located in south-central Washington State within and adjacent to the Hanford Site's 200 Areas. Most of the UPR sites are located within the Central Plateau Core Zone. Plates 1, 2, and 3 in the work plan show the locations of all the UPR sites with respect to the entire 200 Areas and surrounding vicinity. Figures B-1 through B-14 show the locations of the UPR sites within each of the 200 Area closure zones.

## B1.3 PROCESS HISTORY OVERVIEW

The 200-UR-1 OU sites may have been contaminated with wastes generated by 200 Area processes, including the following:

- Bismuth/phosphate and lanthanum/fluoride (B and T Plants)
- Uranium recovery and scavenging operations (U Plant)
- Reduction-Oxidation (REDOX) (S Plant)
- Plutonium-Uranium Extraction (PUREX) Plant
- Strontium/cesium separations, recovery, and storage operations (Semi-works)
- Plutonium/americium scrap recovery processes (Recovery of Uranium and Plutonium by Extraction [RECUPLEX] Plant, Plutonium Recovery Facility, and americium recovery) along with several experiments including tritium production, uranium, plutonium, and thorium studies (Plutonium Finishing Plant/Z Plant)
- Tank farm tank condensate
- 200 Area decontamination wastes, which included wastes from the T Plant Complex after it was converted to a decontamination and equipment refurbishment facility in 1957. The 2706-T Building was used to steam clean heavy equipment and vehicles.

## B1.4 CONTAMINANTS OF CONCERN

Step 1 of the DQO process identifies the need to develop a list of COCs for 200-UR-1 waste sites. Development of the list of COCs is an essential step toward refining the conceptual site model (CSM). For the 200-UR-1 waste sites, a list of the potential radiological, organic, and inorganic COCs that were, or could have been, discharged to the 200-UR-1 OU waste sites was compiled based on the 200 Areas facility operations. This list was prepared after reviewing the DQO documents for the 200 Areas OUs including 200-CW-1, 200-CS-1, 200-CW-5, 200-LW-1, 200-LW-2, 200-MW-1, 200-PW-1, 200-PW-2, 200-PW-4, 200-TW-1, and 200-TW-2, and as outlined in DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program* (hereinafter referred to as the Implementation Plan).

The majority of the waste generated by the 200 Areas plant operations and contamination associated with the 200-UR-1 waste sites can be described as originating from a variety of liquid effluents containing radionuclides. In addition to radionuclides, other waste constituents may have included metals, inorganic chemicals, and semi-volatile and volatile organic chemicals. The analytical approach employed for this project generally targets the significant risk drivers that are representative of the waste constituents present. The general suite-type analytical techniques yield results on many metals and organic compounds, providing a cost-effective approach for determination of the constituents that could be present.

From an initial list of all contaminants that potentially could have been discharged to 200-UR-1 waste sites, a reduced list of contaminants was retained as a result of the DQO process. Additional COCs were added to the list through the investigation-derived waste DQO process. Development of the COC lists is described in WMP-19920, *Data Quality Objectives Summary Report for 200-UR-1 Operable Unit Unplanned Releases Waste Group* (pending) and is summarized in Section 3.6 of the 200-UR-1 work plan.

The 200-UR-1 COCs are identified in Table B-2. If contaminants not identified as COCs are detected during laboratory analysis, the data will be evaluated against regulatory standards, or risk-based levels if exposure data are available, and existing process knowledge in support of remedial action and waste designation decision making.

### B1.4.1 Preliminary Action Levels

**Direct Exposure Preliminary Remediation Goals**

The chemical and radionuclide contaminants from UPRs in the 200-UR-1 OU are expected to be located within 4.6 m (15 ft) of the ground surface and are not considered a threat to groundwater. Because there are no records of decision for the Central Plateau OUs, remedial action goals are not established. Therefore, PRGs are assigned that are consistent with the planned land uses for the Central Plateau. The chemical constituent PRGs for human health and environmental protection are consistent with those identified in WAC 173-340, "Model Toxics Control Act – Cleanup." The radionuclide soil cleanup standard of 15 mrem/yr above background is consistent with the U.S. Environmental Protection Agency's (EPA) radionuclide soil cleanup guidance, as described in Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-18, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination* (EPA 1997).

Radionuclide Constituent Preliminary Remediation Goals

For radiological constituents, OSWER Directive 9200.4-18 (EPA 1997) limits radiation doses from contaminated sites to 15 mrem/yr above natural background for 1,000 years following completion of cleanup. To determine if a site meets the 15 mrem/yr above background level, soil radionuclide concentrations (picocuries per gram [pCi/g]) are converted to a dose rate ([millirem per year [mrem/yr]) using a dose assessment model. The model used for this conversion is the RESidual RADioactivity (RESRAD) dose model (see *RESRAD for Windows* [ANL 2002]).

Chemical Constituent Preliminary Remediation Goals

PRGs for soil are consistent with those identified in WAC 173-340-705, "Use of Method B," and WAC 173-340-706, "Use of Method C." Cleanup levels for individual COCs occurring within the 200-UR-1 OU will be determined using the methodology consistent with Method B for sites located outside the Core Zone, and Method C for sites located inside the Core Zone.

## B1.5 DATA QUALITY OBJECTIVES

EPA/600/R-96/055, *Guidance for the Data Quality Objectives Process*, was used to support the development of this SAP. The DQO process is a strategic planning approach that provides a systematic process for defining the criteria that a data collection design should satisfy. Using the DQO process ensures that the type, quantity, and quality of environmental data used in decision-making will be appropriate for the intended application.

This section summarizes the key outputs resulting from the implementation of the seven-step DQO process. Additional details are provided in WMP-19920 (pending).

### B1.5.1 Statement of the Problem

The DQO process for the 200-UR-1 OU included development of sorting criteria to identify the sites that would be candidates for implementation of an expedited remedial approach. Sites were identified where the "observational approach" could be used for conducting remedial action. The objective of this approach is to collect real-time data (i.e., field screening) that can be used to guide remedial decisions. Verification of cleanup actions is achieved through collection of a final set of samples for laboratory analysis. For the UPR waste sites identified for the RTD remedial alternative, data regarding radiological and chemical constituents are needed.

The DQO also supported the objective of determination of characterization activities needed for disposal of waste removed from RTD sites. For waste disposition decisions, additional chemical and radiological characterization data are required.

Sorting criteria also were developed that identified candidate sites for completion of an RI/feasibility study (FS). The DQO process for the 200-UR-1 OU was used to determine the environmental measurements that would be necessary for characterization of sites identified for completion of an RI. RI data collection is used to refine the preliminary CSM, support an evaluation of risk, and evaluate a remedial alternative. For sites identified for RI/FS, data regarding nature and extent of contamination are needed.

As identified in Section 5.3 of the work plan and considered during development of the DQO, possible remedial alternatives for UPR sites include the following:

- No action
- Maintaining existing soil cover, institutional controls, and monitored natural attenuation
- Remove and dispose.

### B1.5.2 Decision Rules

Decision rules (DR) are developed from the combined results of DQO Steps 2, 3, and 4. These results include the principal study questions, decision statements, remedial action alternatives, data needs, COC action levels, analytical requirements, and the scale of the decisions. The DRs generally are structured as "IF…THEN" statements that indicate what action will be taken when a prescribed condition is met. The DRs incorporate the parameters of interest (e.g., COCs), the scale of the decision (e.g., location), the action level (e.g., COC concentration), and the actions that would result. The 200-UR-1 DRs are summarized in Table B-3. PRGs for radionuclides and for chemical constituents specified in the DRs are provided in Tables B-4 and B-5, respectively.

### B1.5.3 Error Tolerance and Decision Consequences

According to the guidance in Table 6-5 in WMP-19920 (pending), the sampling design rigor requirements are not significant because of the combination of low severity and continued accessibility of the sites for further sampling after verification or RI sampling. If the sampling design is determined to be inadequate, additional sampling may be performed. Section 4.2 of the work plan summarizes the sampling activities that are planned, as described in this SAP.

### B1.5.4 Sample Design Summary

Investigative and sampling techniques have been identified that are aligned with the key elements of the 200-UR-1 waste site CSMs (Figures B-15, B-16, B-17, and B-18). Different sampling approaches will be used for RTD versus RI/FS candidate sites. Special data collection requirements and sampling design specifications are identified for the BC Controlled Area (UPR-200-E-83). Characterization activities for the candidate RTD sites focus on identifying contaminated media/materials that require removal via the observational approach. Field-screening techniques will be used to determine lateral and vertical extent, as well as the contaminant concentrations. Confirmatory sampling will be conducted to support no action at a candidate RTD site, if current site conditions indicate a removal action is not required. For candidate RI/FS sites, data collection requirements are identified that define the site characteristics in support of remedial decision-making.

This SAP is to be used for scoping site characterization during RI of the BC Controlled Area and interim closure for RTD sites. Verification sampling is used to verify attainment of the remedial action objectives in support of interim closure. The media of interest is residual soil within the site excavation and the soil stabilization cover for use as backfill material.

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## B2.0 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. The overall QAPjP for environmental restoration waste sites in the 200 Areas is included in Appendix A of the Implementation Plan (DOE-/RL-98-28-). The QAPjP complies with the requirements of the following:

- DOE O 414.1A, *Quality Assurance*
- 40 CFR 830.120, "Quality Assurance Requirements"
- EPA/240/B-01/003, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, QA/R-5
- DOE/RL-96-68, *Hanford Analytical Services Quality Assurance Requirements Document.*

The Implementation Plan provides the general framework of technical and administrative requirements that apply to 200-UR-1 and other OUs in the 200 Areas.

The following sections describe the supplemental waste group quality requirements and the procedural controls applicable to this investigation. The 200 Areas QAPjP (Appendix A of the Implementation Plan) and this chapter will serve as the QAPjP for the 200-UR-1 data acquisition. Correlation between EPA/240/B-01/003 (QA/R-5) requirements and information provided in the 200 Areas QAPjP and/or this chapter is provided below.

| EPA QA/R-5 Criteria | EPA QA/R-5 Title | Reference Section |
|---|---|---|
| Project Management | Project/Task Organization | A2.1 (DOE/RL-98-28), Figure 1 (HNF-20635)[1] |
| | Problem Definition and Background | B1.5.1, B1.1 |
| | Project Task Description | B1.0, B2.0 |
| | Quality Objectives and Criteria | B1.5, B2.2 |
| | Special Training/Certification | B2.7 |
| | Documents and Records | B2.7 |
| Data Generation and Acquisition | Sample Process Design | B3.0 |
| | Sampling Methods | B2.7 |
| | Sample Handling and Custody | B2.7.4, B2.7.5, B2.7.6 |
| | Analytical Methods | B2.2, Tables B-6 and B-7 |
| | Quality Control | B2.1, B2.2 |

| EPA QA/R-5 Criteria | EPA QA/R-5 Title | Reference Section |
|---|---|---|
| Data Generation and Acquisition (cont) | Instrument/Equipment Testing, Inspection and Maintenance | B2.7 |
| | Instrument/Equipment Calibration and Frequency | B2.7 |
| | Inspection and Acceptance of supplies and consumables | B2.7 |
| | Non Direct Measurement | B1.1 |
| | Data Management | B2.5 |
| Assessment and Oversight | Assessment and Response Actions | B2.7 |
| | Reports to Management | B2.7 |
| Data Validation and Usability | Data Review, Verification and Validation | B2.6 |
| | Verification and Validation Methods | B2.6 |
| | Reconciliation with User Requirements | B2.5, A6.0 (DOE/RL-98-28) |

[1]HNF-20635, *Groundwater Remediation Project Quality Assurance Project Plan.*

## B2.1 FIELD QUALITY CONTROL

Field quality control (QC) samples will be collected to evaluate the potential for cross-contamination and laboratory performance. Field QC for sampling in the 200-UR-1 OU will require the collection of field duplicates, field splits, equipment rinsate blanks, and trip blank samples. The QC samples and the required frequency for collection are described in this section. QC samples will be collected as part of the verification sampling activities.

### B2.1.1 Field Duplicates

Field duplicates will be collected from a minimum frequency of 5 percent of total collected samples, or 1 field duplicate for every 20 samples (whichever is greater). The duplicate sample shall be taken in the same location as the selected primary sample using the same equipment and sampling technique. The sample media shall be homogenized, split into two separate aliquots in the field, and sent to the same laboratory. Field duplicates are used to evaluate the precision of field sampling methods.

### B2.1.2 Field Splits

One soil split sample shall be collected during soil sampling. The sample media shall be homogenized, split into two separate aliquots in the field, and sent to two independent laboratories. The split will be used to verify the performance of the primary laboratory.

The split sample will be obtained from sample media suitable for analysis at an offsite laboratory and shall be analyzed for all of the analytes listed in Tables B-6 and B-7.

### B2.1.3 Equipment Rinsate Blanks

Equipment blanks shall be collected from a minimum of 5 percent of the total collected soil samples, or 1 equipment blank for every 20 samples (whichever is greater) and will be used to verify the adequacy of sampling equipment decontamination procedures. The field geologist may request that additional equipment blanks be taken. Equipment blanks shall consist of pure deionized water washed through decontaminated sampling equipment and placed in containers, as identified on the project Sampling Authorization Form. Note that the bottle and preservation requirements for water may differ from the requirements for soil.

Equipment rinsate blanks shall be analyzed for the following:

- When characterization analysis is for radionuclides only
  - Gamma emitters
  - Gross alpha
  - Gross beta
- When characterization analysis is for radionuclides and chemical constituents
  - Gamma emitters
  - Gross alpha
  - Gross beta
  - Metals (excluding hexavalent chromium and mercury)
  - Anions
  - Semi-volatile organic analyte
  - Volatile organic analytes.

### B2.1.4 Trip Blanks

The volatile organic trip blanks will constitute approximately 5 percent of all samples designated for analysis of volatile organic compounds (VOC), or approximately one in every sixth batch (cooler) that contains samples requiring VOC analyses. The trip blank shall consist of pure deionized water added to clean sample containers in the Sample Shipping Facility. These containers will be transported to the field with the bottle set(s) and will be returned unopened to the laboratory. Trip blanks are prepared as a check for possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions. The trip blank shall be analyzed only for VOCs.

### B2.1.5 Prevention of Cross-Contamination

Special care should be taken to prevent cross-contamination of soil samples. Particular care will be exercised 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
- Improperly decontaminating equipment before sampling or between sampling events.

## B2.2 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Quality objectives and criteria for soil measurement data are presented in Table B-6 for radionuclides and Table B-7 for chemical analytes. Analysis of soil physical properties will be performed according to American Society for Testing and Materials procedures, if applicable.

## B2.3 SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES

Soil sample preservation, containers, and holding times for chemical and radiological analytes of interest and physical property test are presented in Table B-8. Final sample collection requirements will be identified on the Sampling Authorization Form.

## B2.4 ONSITE MEASUREMENTS QUALITY CONTROL

The collection of QC samples for onsite measurements is not applicable to field-screening techniques described in this SAP. Field-screening instrumentation will be calibrated and controlled according to the procedures identified in Section B2.7.

## B2.5 DATA MANAGEMENT

Data resulting from the implementation of this QAPjP shall be managed and stored by the Fluor Hanford Groundwater Remediation Project (GRP) organization responsible for sampling and characterization, in accordance with CP-GPP-EE-01-2.0, *Sample Event Coordination* and CP-GPP-EE-01-2.1, *Sampling Documentation Processing*. At the direction of the task lead, all analytical data packages shall be subject to final technical review by qualified personnel before the results are submitted to the regulatory agencies or before inclusion in reports. Electronic data access, when appropriate, shall be via a database (e.g., Hanford Environmental Information

System [HEIS] or a project-specific database). Where electronic data are not available, hard copies shall be provided in accordance with Section 9.6 of the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) (Ecology et al. 1989).

## B2.6 VALIDATION AND VERIFICATION REQUIREMENT

Validation shall be performed on completed data packages by qualified GRP Sample Management personnel or by a qualified independent contractor. Validation shall consist of verifying required deliverables, requested versus reported analyses, and transcription errors. Validation shall also include the evaluation and qualification of results based on holding time, method blanks, matrix spikes, laboratory control samples, laboratory duplicates, and chemical and tracer recoveries, as appropriate to the methods used. No other validation or calculation checks will be performed. At least 5 percent of all data shall be validated. Validation requirements identified in this section are consistent with Level C validation, as defined in CP-GPP-EE-01-2.5, *Environmental Information Systems – Data Package Validation Process*. No validation will be performed for physical data.

## B2.7 TECHNICAL PROCEDURES AND SPECIFICATIONS

Soil sampling and onsite environmental measurements will be performed according to Fluor Hanford procedures and the appropriate Waste Disposal/Groundwater Remediation Project procedures. Administrative, data management, personnel training, health and safety, and other applicable procedures also will be followed in conjunction with the acquisition of environmental data. Individual procedures that will be used during performance of this SAP include, but are not limited to, the following:

- Training/Certifications
  - HNF-PRO-459, *Environmental Training*
  - HNF-RD-11061, *Training Requirements*
- Documents and Records
  - HNF-PRO-10863, *Notebooks and Logbooks*
  - HNF-RD-210, *Records Management Program*
- General sampling and sample management
  - CP-GPP-EE-01-2.0, *Sample Event Coordination*
  - CP-GPP-EE-01-2.1, *Sampling Documentation Processing*

- GRP-EE-01-3.0, *Chain of Custody*
- GRP-EE-01-3.1, *Sample Packaging and Shipping*
- GRP-EE-01-3.2, *Field Decontamination of Sampling Equipment*
- GRP-EE-05-1.0, *Routine Field Screening*
- CP-GPP-EE-01-1.6, *Survey Requirements and Techniques*

- Soil and soil vapor sampling
  - GRP-EE-01-4.0, *Soil and Sediment Sampling*
  - GRP-EE-01-4.2, *Sample Storage and Shipping Facility*
  - GRP-EE-01-4.5, *Sample Compositing*
  - GRP-EE-05-3.2, *Field Screening Tedlar Bag Sampling*
  - GRP-EE-05-4.0, *Analysis of Volatile Organic Compounds in Vapor Samples Using the Brüel and Kjær 1302 and Innova 1312 Multi-Gas Analyzers*
- Instrument/Equipment Calibration and Testing
  - HNF-PRO-490, *Calibration Management Program*
  - GRP-PRO-8377, *Instrument Accuracy and Reliability (Calibration)*
- Supplies and Consumables
  - HNF-PRO-268, *Control of Purchased/Acquired Items and Services*
  - HNF-PRO-123, *Requesting Materials and Services*
- Excavation
  - CP-GPP-EE-01-5.2, *Test Pit Excavation in Contaminated Areas*
- Radiological Surveys, Protection and Control
  - HNF-13536, *PHMC Radiological Control Procedures*
  - HNF-5173, *PHMC Radiological Control Manual*
  - HNF-12494, *Environmental Radiological Measurement Plan for the Central Plateau Remediation Project*
  - HNF-IP-1277, *River Corridor Project Radiological Control Procedures*

- HNF-PRO-1623, *Radiological Work Planning Process*
- Waste Disposal/Groundwater Remediation Project (WD/GRP) Radiological Control Procedure (RCP) 4.5.1, *Portable Environmental Survey Instrument Operation*
- WD/GRP RCP 4.5.2, *Performance of Environmental Radiological Measurements*
- WD/GRP RCP 4.5.3, *MDA and Scan Speed Determination for Environmental Radiological Surveys*
- WD/GRP RCP 4.5.7, *Preparation of Environmental Radiological Survey Task Instructions (ERSTIs)*
- WD/GRP RCP 4.5.8, *Background Measurements for Environmental Radiological Surveys*
- WD/GRP RCP 4.5.9, *Documenting Environmental Radiological Measurements*
- WD/GRP RCP 5.6.15, *Operation of Mobile Surface Contamination Monitor II*
- HNF-13536 Procedure 3.1.2, "Evaluation of Outdoor Contamination Areas"

- Waste Management
  - BHI-EE-10, *Waste Management Plan* (blue sheeted, July 1, 2002), and Fluor Hanford waste management procedures as required
  - HNF-PRO-462, *Pollution Prevention*
  - HNF-PRO-15333, *Environmental Protection Processes*
  - HNF-PRO-15334, *Effluent and Environmental Monitoring*
  - HNF-PRO-15335, *Environmental Permitting and Documentation Preparation*
  - HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria*
  - WCP-2002-0002, *Waste Control Plan for the 200-PW-1 Operable Unit.*

Work also shall be performed in accordance with the following:

- Quality Assurance
  - HNF-20635, *Groundwater Remediation Project Quality Assurance Project Plan*
  - HNF-12494, *Environmental Radiological Measurement Plan for the Central Plateau Remediation Project*

- Quality Improvement
  - HNF-PRO-052, *Corrective Action Management*
  - HNF-PRO-298, *Noncomforming Items*
- Management Assessment
  - HNF-PRO-246, *Management Assessment*
- Data Management
  - CP-GPP-EE-01-2.4, *Environmental Information Systems – Data Package Technical Verification*
  - CP-GPP-EE-01-2.5, *Environmental Information Systems – Data Package Validation Process*
- Health and safety
  - CP-MD-017, *Safety Communications*
  - HNF-5173, *PHMC Radiological Control Manual*
  - HNF-PRO-121, *Heat Stress Control*
  - HNF-PRO-175, *Training Program Descriptions*
  - HNF-RD-10743, *Safety Communications*
  - HNF-RD-11812, *Occupational Noise Exposure and Hearing Conservation*
- Site-specific plans, as applicable:
  - Health and safety plans
  - Radiological evaluation and/or radiation work permits
  - Activity hazard analysis and/or job safety analysis.

### B2.7.1 Sample Location

Sample locations (e.g., sample grid nodes) shall be staked and labeled before starting the activity. The locations shall be staked by the technical lead or the field team leader assigned by the project manager. After the sample locations have been staked, minor adjustments to the location may be made to mitigate unsafe conditions, avoid structural interferences, or bypass utilities. Sample locations shall be identified during or after sampling in accordance with CP-GPP-EE-01-1.6. Changes in sample locations that do not impact the DQOs will require

approval of the project manager; however, changes to sample locations that result in impacts to the DQOs will require Washington State Department of Ecology (Ecology) concurrence.

### B2.7.2 Sample Identification

The GRP Sample and Data Tracking database will be used to track the samples from the point of collection and through the laboratory analysis process. The HEIS database is the repository for the laboratory analytical results. The HEIS sample numbers will be issued to the sampling organization for this project in accordance with CP-GPP-EE-01-2.0. Each chemical/radiological and physical properties sample will be identified and labeled with a unique HEIS sample number. The sample location, depth, and corresponding HEIS 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:

- HEIS number
- Sample collection date/time
- Name of person collecting the sample
- Analysis required
- Preservation method (if applicable).

### B2.7.3 Field Sampling Log

All information pertinent to field sampling and analysis will be recorded in bound logbooks in accordance with HNF-PRO-10863. The sampling team will be responsible for recording all relevant sampling information including, but not limited to, the information listed in HNF-PRO-10863. Entries made in the logbook will be dated and signed by the individual who made the entry.

### B2.7.4 Sample Custody

A chain-of-custody record will be initiated in the field at the time of sampling and will accompany each set of samples shipped to the laboratory(ies) in accordance with GRP-EE-01-3.0. The analyses requested for each sample will be indicated on the accompanying Chain-of-Custody 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 sample shipment and transmit it to GRP Sample Management within 24 hours of shipping, as detailed in CP-GPP-EE-01-2.1.

A custody seal (i.e., evidence tape) shall be used for each sample jar to demonstrate that tampering has not occurred. The container seal will be inscribed with the sampler's initials and the date sealed.

### B2.7.5 Sample Containers and Preservatives

Level I EPA pre-cleaned sample containers will be used for soil samples collected for chemical and radiological analysis. Container sizes may vary depending on laboratory-specific volumes/requirements for meeting 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 lead and task lead can send smaller volumes to the laboratory after consultation with GRP Sample Management to determine acceptable volumes. Preliminary container types and volumes are identified in Table B-8. The final types and volumes will be indicated on the Sampling Authorization Form.

### B2.7.6 Sample Shipping

The radiological control technician (RCT) will survey the outside of each sample jar to verify that the container is free of smearable surface contamination. The RCT also shall 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 either disintegrations per minute (d/min) or millirem per hour (mrem/h), as applicable. Unless pre-qualified, all samples will have total activity analysis performed before shipment by the Radiological Counting Facility, the 222-S Laboratory, or other suitable onsite laboratory. This information and other data that may pre-qualify 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 in accordance with the laboratory's acceptance criteria.

# B3.0 FIELD SAMPLING PLAN

## B3.1 GENERAL SAMPLING OBJECTIVES FOR REMOVE/TREAT/DISPOSE SITES

The DQO summary report for 200-UR-1 waste sites identified RTD candidate sites that could proceed to site cleanup through use of the observational approach.

The field-screening analyses performed during excavation are to provide the following:

- Ongoing guidance with regard to the extent of excavation
- Waste characterization for segregation and disposition decisions.

To document final site conditions, radiological surveys and analytical sampling data will be collected to meet the following objectives.

- Verify that COC levels in the site materials (e.g., soils or gravels) achieve the radiological and chemical action levels.
- Obtain mean or maximum concentrations (as appropriate) for COCs to support closure decisions for the RTD sites.
- Support the development of waste profiles for disposal and waste treatment decisions.

### B3.1.1 General Conceptual Site Models for Remove/Treat/Dispose Sites

Based on the CSMs developed for the UPR sites, if contamination is present, it is expected to occur within one of three potential depth intervals shown in Table B-9.

#### B3.1.1.1 Lateral Waste Site Boundaries

The 200-UR-1 waste sites identified for RTD may be covered by a layer of clean soil or gravel (stabilization cover). In some cases, the locations and dimensions of the release are clearly documented and/or delineated with fencing and posting. In other instances, the site locations are poorly defined or unknown. Because structures are not generally associated with UPRs, the defining physical features in the CSM are limited to surface soils. It is important to note that the lateral dimensions of many of the release areas are not well defined because the contaminated soil is covered by stabilizing fill. While the stabilizing cover effectively fixes surface contamination, it also masks waste site boundaries. If other specific site boundary information is not available, the soil stabilization cover will be used as the defining feature when establishing waste site boundaries.

#### B3.1.1.2 Vertical Contaminant Distribution

Waste sites consisting of windblown, disseminated contamination are assumed to occur at the ground surface to a maximum depth of approximately 0.3 m (1 ft). For liquid release sites, the contamination front may have reached the bottom of the surface soil zone (soil depth extending to 4.6 m [15 ft]).

Liquid release sites are assumed to have relatively homogenous contaminant distributions at the release point. Spurious, or "hot spot," contamination is not expected except where dripping has occurred during transport of liquids, such as with railroad tank cars. Sites with windblown contamination may be discontinuous, exhibiting hot spots. Because many of these sites may have been covered with stabilizing soil, it cannot be assumed that contamination decreases with depth from the current ground surface (i.e., top of stabilizing cover surface). However, contamination is expected to decrease with depth below the original release surface. The vertical contaminant distribution depends on the characteristics of the release (liquid or solid) and on contaminant mobility.

If the contaminated media originally released was solid (e.g., particulates, tumbleweed parts, or animal feces), then that media and the surface soils are considered contaminated. The underlying soils also are expected to be contaminated, to some nominal depth. If the release medium was liquid, then the soil is expected to be contaminated to a greater depth than at a site where a solid media was released.

## B3.2 SAMPLING OBJECTIVE – STABILIZATION COVER MATERIAL/SOIL

Site cover materials used to stabilize surface contamination are present at approximately one-half of all 200-UR-1 sites identified for RTD (see Appendix A, Table A-5). Cover materials generally are 1 to 2 ft in thickness and generally consist of soil and/or gravel. Some locations, particularly roads where spills have occurred, may have an asphalt cover. Both solid and liquid releases have been surface stabilized. The lateral extent of the stabilization cover generally is equal to or slightly larger than the area that was impacted by the release. The stabilization cover is a sampling objective for 200-UR-1 RTD sites (CSMs 1, 2, 3, and 4).

### B3.2.1 Sampling Design – Stabilization Cover Material/Soil

In most cases, the lateral extent of the stabilization cover material can be defined by visual inspection. The cover material will need to be removed to access the underlying contaminated soil. As the cover soils are excavated, radiological screening will be used to determine if radionuclide contamination is present on the exposed site surface and in the excavated material. Cover material will be removed in lifts to reduce the potential to mix the stabilizing material with the underlying contaminated media. However, some mixing is expected at the cover/contaminated soil interface. Removed material will be screened and segregated into potential clean or contaminated stockpiles. Analytical results that indicate contamination levels above action levels will be used in support of waste profiling and waste designation.

## B3.3 SAMPLING OBJECTIVE – CLEANUP VERIFICATION FOR WINDBLOWN MATERIALS AND SMALL LEAK/SPILL SITE SOILS

A contaminant depth of no more than 0.3 m (1 ft) is anticipated for sites that are included in the windblown and small leak/spill sites CSMs. Contaminated media at these waste sites include redistributed particulates or flake material resulting from emissions or residue on tanks that have been mobilized and distributed by wind. Some site contamination is the result of windblown radiologically contaminated tumbleweed parts. Animal ingestion of contaminants also has resulted in the presence of radioactive fecal material at some locations (CSM-1, Figure B-15).

Small-volume spills, drips, and leaks have occurred along some rail lines, in storage yards, and on road surfaces. These liquid releases may have penetrated further into underlying materials than windblown contaminants, but are not expected to exceed 0.3 m (1 ft) in depth (CSM-2, Figure B-16).

The physical setting for the windblown materials, animal feces, and vegetation parts includes land areas that are not directly associated with a particular building or structure. Radionuclides are the only COC for these sites. Because the composition of the liquid releases is not known, chemical and radiological contaminants are considered COCs for small leak/spill waste sites.

### B3.3.1 Sampling Design – Cleanup Verification for Windblown and Small Leak/Spill Site Soils

Cleanup actions may require removal of stabilization covers before excavating the contaminated media. The sampling design specifications for the stabilization cover are discussed above.

Because the expected depth of contamination is very shallow at these waste sites, RTD operations will consist of soil scraping or backhoe excavation to very shallow depths. The excavation operations will be performed to below the contaminated media, thereby exposing soils that contain background COC concentrations. Therefore, a two-step cleanup verification process will be employed, consisting of a gridded radiological survey and verification sampling.

The radiological survey grid will be established during site excavation and will provide a referenced coordinate system for field screening and verification sampling. The gridded radiological surveys will be a primary component of the observational approach used to monitor the progress of contaminant removal. Verification sampling will be performed by radioisotopic gamma spectroscopy analysis of combined sample aliquots (i.e., representative soil samples) at sites with redistributed solid contaminated media. Radioisotopic analyses will provide sufficient data with which to determine acceptability of the cleanup of sites consisting of radioactive windblown materials, animal droppings, and vegetation parts. Because the composition of the leak or spill is not known at the small leak/spill liquid release sites, laboratory analysis for radiological and chemical constituents will be performed.

The number of verification samples will be based on the site size and associated number of decision units. Verification sample locations will be statistically selected node locations from the radiological survey grid.

## B3.4 SAMPLING OBJECTIVE – CLEANUP VERIFICATION FOR MODERATE SCALE LEAK/SPILL SITE SOILS

Contaminated soils are not expected to exceed 2 m (6.6 ft) in depth for the sites associated with the 200-UR-1 moderate scale spill/leak CSM (Figure B-17). The physical setting for this group of sites principally consists of railroads. Some outlying areas, roads, and storage yards also are included. Lateral contaminant distribution is smaller at these site locations than at sites affected by wind-distributed materials.

Transportation of process liquids occurred using the railroad system and tanker cars. Radionuclides are assumed to be the primary COCs, but metals and organic constituents also may have been a component of the released liquid. Exact release locations are not specified in association with many of the rail line UPR sites because intermittent leaks and spills have occurred throughout segments of the rail system. Liquid releases also are documented at loading and unloading locations. Spills of contaminated solids and subsequent decontamination operations involving the use of water may have provided a mechanism for infiltration at some sites.

### B3.4.1 Sampling Design – Cleanup Verification for Moderate Spill/Leak Site Soils

Cleanup actions may require removal of stabilization covers before excavating the contaminated media. The sampling design specifications for the stabilization cover are discussed above.

RTD operations will consist of soil scraping or backhoe excavation to a depth of several feet. The excavation operations will be performed to below the contaminated media, thereby exposing soils that contain COCs at concentrations below PRGs and/or at background levels.

A radiological survey grid will be established during site excavation and will provide a referenced coordinate system for field screening, confirmation, and verification sampling. The gridded radiological surveys will be a primary component of the observational approach used to monitor the progress of contaminant removal. The confirmatory radiological sampling will be performed by radioisotopic analysis of soil composites in Marinelli beakers. Verification sampling will be analyzed for radiological and nonradiological COCs using a standard fixed laboratory. The number of verification samples will be based on the site size and associated number of decision units. Verification sample locations will be statistically selected node locations established from the radiological survey grid. Analytical results will be used for site closure.

## B3.5 SAMPLING OBJECTIVE – SITE CHARACTERIZATION OF LARGER SCALE SPILL/LEAK SITE SOILS

Several unique site locations have been identified where potentially larger liquid releases have occurred and the depth of soil contamination may extend to 4.6 m (15 ft). Composition of the liquid releases includes petroleum products (diesel or other hydrocarbons), solvents (hexone), tracers (calcium nitrate), and radioactive solutions (uranyl nitrate hexahydrate). In some cases, only the general area where the release occurred is documented. The lateral and vertical extent of the potentially impacted area is uncertain.

### B3.5.1 Sampling Design – Site Characterization of Larger Spill/Leak Site Soils

RTD operations at the larger spill leak sites will follow the general process described above for the moderate spill/leak sites. However, because of the nature of the release, removal activities potentially could extend to 4.6 m (15 ft). Chemical field-screening techniques will be used as appropriate for releases that may not have involved radioactive constituents (i.e., hydrocarbon spills). If contaminant levels exceeding PRGs are encountered below 4.6 m (15 ft), the regulators will be contacted to determine further actions.

## B3.6 USE OF THE OBSERVATIONAL APPROACH FOR REMOVE/TREAT/DISPOSE SITES

Under the observational approach, the cleanup process is streamlined such that characterization and remediation of a site will include the following:

- Verifying site boundaries
- Establishing a radiological survey and sampling grid
- Removal and radiological field screening of soil stabilization cover materials (if present) to expose the soil surface existing at the time of the release
- Gridded radiological survey of the exposed surface to determine the extent of contamination (if any) underlying the soil stabilization cover and locating the area with the highest level of contamination
- Sampling and analysis of soils, at the location with the highest level of contamination, for waste characterization
- Excavation of the contaminated media (soil, wood, concrete, asphalt, etc)
- A verification radiological survey and subsequent verification radiological soil sampling and laboratory analysis to document the successful removal of contaminated media to levels below remedial action levels

- Verification analysis for chemical COCs at sites where a liquid release reportedly occurred.

Site conditions may be encountered where specific monitoring and sample collection are required to meet additional project needs. Examples of these situations include the following:

- If action levels for health and safety are approached that require increased environment and worker protection, a sampling effort will be initiated. Action levels are defined in the appropriate documents (i.e., radiation work permit, health and safety plan) and will be referenced in the instruction guide.

- If visual anomalies are encountered during the excavation, a sampling effort may be initiated. Visual anomalies include discoloration of soils, appearance of a sheen on soil particles, obvious change in soil textural characteristics, structural materials are uncovered unexpectedly, or other unexpected changes in site conditions.

- If the waste profile, as indicated by onsite measurement, approaches the Environmental Restoration Disposal Facility waste acceptance criteria (BHI-00139, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*), a sampling effort will be initiated. The instruction guide will establish trip numbers in relation to the criteria that would initiate a sampling effort.

- Increases in contaminant levels determined by onsite measurement that indicate the presence of unexpected levels of contamination may require the initiation of a sampling effort.

- Other field conditions may be encountered in which additional sampling may be required. All sampling efforts will be evaluated by project and/or technical personnel to ensure that representative and quality samples and analyses are taken and performed to specifically address the field condition and in a cost-effective manner.

### B3.6.1 Radiological Field-Screening Methods

Potential radiological field-screening instrumentation and applications are shown in Table B-10.

#### B3.6.1.1 Radiological Screening for Excavation Guidance

For sites with radionuclide COCs, excavations will be guided by onsite measurements. Sodium iodide (NaI) detectors with the ability to discriminate the specific energy of the limiting action levels will be used to provide isotope-specific count rate information. Other detectors may be used on a case-by-case or site-specific basis.

NaI detectors will be used to verify that contamination levels are within allowable limits. If the onsite radiological measurements indicate acceptable levels of contamination for release, quick turnaround samples will be collected for high-purity germanium analysis. If the NaI and high-purity germanium analyses agree, the verification release process will be initiated.

If the surface radiation surveys indicate that the areas exceed release levels, samples will not be collected, because additional excavation is required. If, however, the general area contamination levels are deemed acceptable, but discrete hot spots are noted, samples will be collected from the hot spots for high-purity germanium analysis.

The surveys will be used to identify existing surface contamination and support decisions regarding health and safety requirements. Qualified RCTs shall conduct surface radiation surveys in accordance with applicable approved radiological procedures (see Section B2.7). A post-sampling survey also will be performed to document changes to the surface contamination levels as a result of sampling activities.

Radiological survey information will be used to make a decision concerning no action and/or completeness of soil removal actions. Gridded surveys will provide an estimate of the spatial variability of the radiological contamination. The surveys will be a combination of static counting, sequential static counting, and scanning counts, depending on the identity and level of contamination to be detected. Because of the unique size and contamination distributions, each site will require a slightly different design. In addition to identifying any areas of elevated residual radiological activity that can aid in the selection of focused samples, the data can be used to evaluate spatial variability for representative statistical sampling designs. To calculate survey scan rates and associated minimum detectable activities, the following formula may be used:

$$MDA = \frac{2.71 + 3.29\sqrt{T_S B\left(1 + \frac{T_S}{T_B}\right)}}{2.22 \times (E)(T_S) \times c}$$

where

MDA = minimum detectable activity, at the 95 percent confidence level (d/min/100 $cm^2$)
B = background count rate (counts per minute [c/min])
$T_S$ = sample counting time (min)
$T_B$ = background count time
E = efficiency of instrument
c = grams of dirt or material in the modeled area interrogated by detector (an 80 by 15 cm disk of soil weighs approximately $1.2 \times 10^5$ g)
2.22 = conversion factor from d/min to units of pCi/g.

**B3.6.1.2 Determination of Site-Specific Background**

The background used to determine the contamination level in each area will be determined on a site-by-site basis. Soil surfaces will be surveyed principally for cesium-137 using the NaI detector. Alpha- and beta-emitting isotopes will be screened by the use of scintillation detectors. In both cases, the laboratory data of concentration will be scaled to the field results to determine radioisotope spatial distribution and concentration. Whenever possible, the response of the instrument should be calibrated to respond to the specific radionuclides that would be present after decay and long-term environmental exposure.

### B3.6.2 Chemical Screening Measurements

Potentially applicable chemical field-screening methods are listed in Table B-11. Where field screening can be used to detect and quantify contaminant concentrations at the site, a relative percent difference (RSD) or ($s$) and ($\bar{x}$) can be computed. Non-detect results should be taken at half the detection limit for such computations (*Statistical Guidance for Ecology Site Managers* [Ecology 1992]). If more than 50 percent of the results are below detection, the field measurements are not suitable for computing an RSD or ($s$) and ($\bar{x}$).

Table B-11 lists the chemical field-screening methods that may be used at RTD sites during soil removal operations.

Chemical field screening may be employed to determine anomalous conditions, assess site contaminant variability, and confirm the need for remediation. The potential nonradiological COCs will be evaluated against potential screening technologies to determine if field screening offers an advantage. Censored data (non-detect results) are not likely usable when the practical quantitation limit of the field-screening method is equal to or above the action level.

Chemical field screening would be completed using the most practical techniques appropriate under expected sampling constraints. COC fate and transport, constituent location, and environmental impacts (such as degradation) must be considered in determining target compounds for field screening.

Field-screening instruments will be used, maintained, and calibrated in accordance with the manufacturer's specifications and other approved procedures. The field geologist will record field-screening results in the field log.

## B3.7 CONFIRMATORY SAMPLING FOR NO ACTION DECISIONS

Current levels of contamination are not known at many of the candidate RTD sites. For sites with a soil stabilization cover, the contaminant nature and extent may not be determined until the cover material is removed to expose the surface on which the release may have originally occurred. Because of past cleanup or decontamination operations, COC levels may be below PRGs or at background concentrations underlying the stabilization cover. At other candidate RTD sites, because of poor documentation concerning the level of prior cleanup activities or the extent of potential contamination, all or part of the site may have no COCs present, or the COCs occur at levels below PRGs. The initial radiological surveys performed at these sites will indicate whether radiological levels occur above background and/or PRGs. If radiological survey results indicate a removal action is not required, confirmatory samples will be collected. The confirmatory samples will be taken at the same frequency as proposed for verification sample collection following soil removal actions. At some site locations, anomalous conditions may require development of a site-specific sampling plan, with the number of samples required for site closeout determined on a statistical basis. Site-specific sampling plans will be developed in coordination with Ecology. Sites confirmed to not require a removal action will be proposed for no action through the process outlined in RL-TPA-90-0001, *Tri-Party Agreement Handbook*

*Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)."

## B3.8 VERIFICATION FOR USE OF THE REMOVED SOIL STABILIZATION COVER MATERIAL AS BACKFILL

Sampling and analyses of the soil stabilization cover removed as part of RTD site excavations will be conducted to verify that the spoil piles do not contain any COCs above remediation levels; this decision process is shown in Figure B-18. This verification will be accomplished by onsite radiological measurements during excavation, followed by discrete sampling and laboratory analyses, if needed, for COCs in accordance with standard methods. Samples will be analyzed for radiological COCs only at non-liquid release sites. At liquid release UPR sites, analysis for radionuclides and chemical constituents will be conducted. A standard fixed laboratory will perform the analyses with 5 percent validated data packages.

Sampling of the stabilized cover soil resulting from the site excavation process will be based on a statistical approach. Material verified as noncontaminated will be used for site backfill.

## B3.9 VERIFICATION OF SITE CLEANUP

At the end of excavation, the objective will be to verify that remaining site soils do not contain COCs above the remediation goals. This verification will be accomplished by standard analytical methods. All samples will be analyzed for COCs by a standard fixed laboratory with 5 percent validated data packages. The sampling strategy will be based on the use of a statistical approach. The overall sample design process using the observational approach for RTD sites is presented in Figure B-18. Samples will be analyzed for radiological COCs only at non-liquid release sites. At liquid spill or leak sites, analysis for radionuclides and chemical constituents will be conducted. As discussed with confirmatory sample collection above, anomalous conditions encountered during the removal action may require development of a site-specific sampling plan, with the number of samples required for site closeout determined on a statistical basis. If required, a site-specific sampling plan will be developed in coordination with Ecology.

## B3.10 IMPORTED BACKFILL

Imported backfill is soil taken from noncontaminated borrow sites. Acceptance or rejection of soils for backfill material will be based on existing knowledge of the prospective borrow areas. The imported backfill will be radiologically surveyed as a check for suitability for use as clean fill. Occasionally, clean rubble material may appropriate for use as backfill, provided prior approval is received. Acceptance of clean rubble will be based on a pre-approved acceptance or approval plan.

## B3.11 SUMMARY OF SAMPLE COLLECTION REQUIREMENTS FOR REMOVE/TREAT/DISPOSE SITES

Tables B-12, B-13, and B-14 identify the site media and quantification criteria used for determining the number of verification samples to be taken for analysis of the removed stabilization cover soils and the exposed excavation surface. Table B-15 shows the potential number of samples to be collected from currently identified RTD sites based on the estimated site area and required sample numbers specified in Table B-14. For sites where radiological surveys and/or other screening techniques have indicated that confirmatory sample collection is appropriate, sample quantities will be the same as if a removal action had been performed (i.e., verification sampling). Sample quantities will be adjusted, as needed, if a site-specific sampling plan has been prepared.

## B3.12 POTENTIAL SAMPLE DESIGN LIMITATIONS

The sample design developed for this SAP has several potential limitations that may affect the sampling results. Some of the factors that have the potential to affect the outcome of this sampling effort include the following.

- The sampling design is based on the use of multiple interdependent technologies to locate and characterize UPR sites. The overall success of this sampling effort depends on the effective use of the individual technologies.
- Large particle size ranges at soil, roadbed, and railroad line sites may make it more difficult to obtain representative soil samples.
- Because of inadequate historical documentation, construction of new facilities over old release locations, or other past activities, it may no longer be possible to locate some sites.

## B3.13 RADIOLOGICAL CONTROLS DURING SITE REMEDIATION ACTIVITIES

Excavation operations and soil sampling potentially could result in airborne exposure and contamination spread if not properly planned and controlled. Detailed pre-job planning and preparation may require the use of mockup staging.

## B3.14 REMEDIAL INVESTIGATION SAMPLING DESIGN – BC CONTROLLED AREA PHASE I SITE SCOPING

Using existing unpublished historical radiometric survey and analytical data, a preliminary CSM for the BC Controlled Area has been developed with three separate zones displaying different

radiological contamination characteristics (Figure B-19). Strontium-90 and cesium-137 are the primary COCs. Zone A, adjacent to the BC Cribs and Trenches, shows the highest level of radiological activity, with a nearly continuous lateral dissemination of contamination. Zone B is a transitional zone, with intermixed contaminated and noncontaminated regions. Zone C, the most extensive area, is mainly uncontaminated. This CSM delineates lateral changes in radiological contaminant density and activity.

Because of the nature and extent of contamination in the BC Controlled Area, a unique, phased sampling design will be used. For the first phase of the RI of the BC Controlled Area, the sampling objective is focused on determination of current contaminant levels and distribution, and refinement of the preliminary CSM (Figure B-19). Radiological data will be collected to support assignment of MARSSIM Area Classifications (i.e., Area Classes 1, 2, and 3). The current BC Controlled Area CSM equates Zone A as being a Class 1 area, Zone B as a Class 2 area, and Zone C as a Class 3 area. Radiological survey reading will be taken and samples collected for gamma spectroscopy and radiochemical isotopic analyses.

Sample and survey locations will be selected to refine and reposition, as needed, the locations of CSM zone/MARSSIM survey class boundaries. Selected sampling locations used to define lateral variability in radionuclide concentrations throughout the BC Controlled Area also will be sampled to collect vertical profile information. Radionuclide vertical profile samples will be collected at two depth intervals: 0.0 to 0.5 ft below ground surface, and 0.5 to 1 ft below ground surface. A summary of the proposed scoping sampling and analyses is provided in Table B-16.

Analytical results also will be used to verify radionuclide ratios and validate the proposed use of surrogate (target) radionuclides (i.e., cesium-137) for conducting future MARSSIM surveys. A MARSSIM survey(s) may be proposed for site closure of CSM Zones C and B. MARSSIM radiological surveys focus on the demonstration of compliance for sites with residual radioactivity using a final status survey technique that integrates the remedial design/remedial action step of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* remedial process. Survey instrumentation will be used during the scoping phase with scan capabilities that are appropriate for minimum detectable concentration criteria and potential Derived Concentration Guideline Levels.

After evaluation of the initial radiological data set and refinement of the CSM, data collection requirements will be directed toward the remedial alternative assessment that will be conducted as part of the FS. Data collection as part of a treatability study for Zone A may be required before completing the FS for the BC Controlled Area. A separate DQO document will be prepared to address data collection requirements for the treatability study. Additional discussion of this phased approach is presented in the work plan.

### B3.14.1 Surface Radiation Measurement and Surveys

Static surface radiation measurements will be taken at all sample locations (Table B-16). In addition, 10 by 10 m survey plots will be established around hot spot locations identified for focused sample collection (Table B-16). A100 percent direct measurement scanning and static radiological survey will be conducted over the entire 100 $m^2$ area. The purpose of this surface radiation survey is to establish the local spatial density of radiological hot spots resulting from

biologic dissemination of radiological contaminants. Using a 2- by 2-in. NaI detector and approved beta-gamma detection instrumentation (e.g., SHP-38AB[1] detector or DP6BD detector), the entire area is to be surveyed. If portions cannot be readily surveyed because of obstructions or hazards, an equivalent area is to be added to the overall area. Each location within the survey area that indicates activity greater than twice background is to be documented. Qualified RCTs will conduct surface radiation surveys in accordance with applicable health and safety procedures. A survey report will be prepared for each area. Surveys will be performed according to HNF-IP-1277, Section 4.5.2, "Performance of Environmental Radiological Measurements" and associated Radiological Survey Task Instructions generated by the Radiological Control organization during the work planning process or other applicable approved procedures.

### B3.14.2 Soil Sampling

The surface soil samples designated within the each of the CSM zones that will be used to evaluate the lateral distribution of radionuclides will be collected from the interval from ground surface to a depth of 0.5 ft. The sampling specifications for collection of discrete samples, creation of sample composites, and analytical requirement are presented in Table B-16. Based on existing historical analytical data, this sampling interval should contain the majority of the radionuclide activity. This interval also would be the probable minimum depth of soil removal if heavy equipment were used for remediation. Samples collected for determination of vertical distribution of radionuclides in the soil profile will be collected from the depth intervals from 0.0 to 0.5 ft and 0.5 to 1.0 ft. Sample locations and analytical requirements are specified in Table B-16.

## B3.15 WASTE MANAGEMENT SAMPLING

A DQO process was conducted to identify additional sampling that may be required to support waste management of the soil or other materials generated during site remediation and sampling. The DQO process included review of the contaminants of potential concern identified for the 200-UR-1 OU and an analysis of any additional constituents that should be evaluated to complete the waste designation and profile. Based on the results of WMP-19920 (pending), samples for additional COCs are required as listed in Table B-17. Table B-18 details the additional sampling identified and the corresponding analytical requirements. Bottle requirements are presented in Table B-8. Figures B-20 and B-21 illustrate the decision processes related to waste designation characterization.

Modification of the waste sampling and analysis requirements determined during the DQO process may be required at some sites. Site-specific waste characterization sampling and analytical requirements will be developed as needed for waste acceptance at the Environmental Restoration Disposal Facility. Additional analytical data may be needed at some sites if no existing waste profiles correspond to the suspected waste streams.

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[1]SHP380-A/B is a trademark of Eberline Instruments, Waltham, Massachusetts.

### B3.15.1 Waste Designation Sampling Design

A judgmental sampling approach is used for waste designation determinations. Table B-19 presents the key features of the material/media waste sampling designs for the 200-UR-1 sites. Wastes that require characterization include material/media that cannot be designated without characterization and may require special handling for human exposure protection or waste acceptance. Uncontainerized, unknown material/media and unknown waste containers have been included in this category even though it is not anticipated that this type of waste will be encountered during the remediation of the 200-UR-1 sites. The sampling protocols for waste material/media and unknown waste forms are identified in Table 3-19.

### B3.15.2 Optimal Sample Size that Satisfies the Data Quality Objectives

Because judgmental sampling has been applied, a statistical design is not applicable. Sampling for waste profile/designation of the material/media will be focused in two areas. Sampling of herbicides and pesticides will be performed near the material/media surface, where these constituents are most likely to be present. Sampling of material/media also will be performed in the most highly contaminated areas as determined through field-screening techniques.

Periodic sampling for quick-turnaround laboratory analyses of nonradiological COCs may be performed to verify waste profiles as directed by the resident engineer.

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## B4.0 HEALTH AND SAFETY

All field operations will be performed in accordance with Fluor Hanford health and safety requirements and the appropriate Waste Disposal/Groundwater Remediation Project procedures. In addition, a work control package will be prepared in accordance with procedures that will further control site operations. This package will include an activity hazard analysis, a site-specific health and safety plan, and applicable radiological work permits. Work shall be performed in accordance with site-specific health and safety plans and applicable radiological work permits.

The sampling procedures and associated activities will take into consideration exposure reduction and contamination control techniques that will minimize the radiation exposure to the sampling team as required by the procedures mentioned earlier.

Health and safety personnel will use data collected during the response action as input to determine exposure levels to workers and to conduct health and safety assessments in accordance with the health and safety plan.

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## B5.0 MANAGEMENT OF REMEDIATION WASTE

The waste generated during excavation or characterization activities will be managed in accordance with the *Strategy for Management of Investigation Derived Waste* (Ecology et al. 1995) and as directed in BHI-EE-10, which identifies the requirements and responsibilities for containment, labeling, and tracking of investigation-derived waste. Management of investigation-derived waste, minimization practices, and waste types applicable to 200-UR-1 waste control is described in the waste control plan (to be prepared).

Unused samples and associated laboratory waste for the analysis will be dispositioned in accordance with the laboratory contract, which in most cases will require the laboratory to dispose this material. The approval of the remedial project manager is required before returning unused samples or waste from offsite laboratories.

Investigation-derived waste is defined as potentially contaminated waste materials that result from field investigation and characterization activities and may pose a risk to human health and the environment. This waste may include soil and other materials from the collection of samples; residues from the testing of treatment technologies; contaminated personal protective equipment; decontamination fluids (aqueous or otherwise); and disposable sampling equipment (*Guide to the Management of Investigation-Derived Wastes*, Publication 9345.3FS [EPA 1992]).

The highest levels (contamination and dose-rate information) indicated on the survey record will be used for waste verification purposes. This information then will be converted from the reported units (e.g., dose rate, disintegrations per minute) to an activity per unit mass. The basis for the conversion will be documented in a calculation performed in accordance with BHI-DE-01, *Design Engineering Procedures Manual*, Engineering Department Project Instruction 4.37-01, "Project Calculations." An example of this conversion can be found in the calculation used for the *233-S Determination of Step-Off Pad Waste Alpha Activity Concentration* (BHI 2001).

All radiological instruments used will be calibrated within the frequency specified in the instrument operating procedures. Daily instrument response checks for portable instruments will be performed in accordance with BHI-RC-05, Instruction 2.1.

The isotopic distribution for waste designation will be derived from the soil sampling analytical results. The waste generated during site operations will be handled according to the waste control plan for the 200-UR-1 OU (to be prepared).

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## B6.0 REFERENCES

40 CFR 268, "Land Disposal Restrictions," Title 40, *Code of Federal Regulations*, Part 268, as amended.

40 CFR 830.120, "Quality Assurance Requirements," Title 40, *Code of Federal Regulations*, Part 830.120, as amended.

49 CFR, "Transportation," Title 49, *Code of Federal Regulations*, as amended.

ANL, 2002, *RESRAD for Windows*, Version 6.21, Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.

BHI, 2001, *233-S Determination of Step-Off Pad Waste Alpha Activity Concentration*, Calculation 0200W-CA-N0032, Rev. 0, dated September 25, 2001, Bechtel Hanford, Inc., Richland, Washington.

BHI-00139, 1998, *Environmental Restoration Disposal Facility Waste Acceptance Criteria*, Rev. 3, Bechtel Hanford, Inc, Richland, Washington.

BHI-DE-01, *Design Engineering Procedures Manual*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-10, *Waste Management Plan,* Bechtel Hanford, Inc., Richland, Washington.

BHI-MA-02, *ERC Project Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-RC-01, *Radiation Protection Program Manual*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-01, *ERC Safety and Health Program*, Bechtel Hanford, Inc., Richland, Washington.

*Comprehensive Environmental Response, Compensation and Liability Act of 1980*, 42 USC 9601, et seq.

CP-GPP-EE-01-1.6, *Survey Requirements and Techniques*, Fluor Hanford, Inc., Richland, Washington.

CP-GPP-EE-01-2.0, *Sample Event Coordination*, Fluor Hanford, Inc., Richland, Washington.

CP-GPP-EE-01-2.1, *Sample Documentation Processing*, Fluor Hanford, Inc., Richland, Washington.

CP-GPP-EE-01-2.4, *Environmental Information Systems – Data Package Technical Verification*, Fluor Hanford, Inc., Richland, Washington.

CP-GPP-EE-01-2.5, *Environmental Information Systems – Data Package Validation Process*, Fluor Hanford, Inc., Richland, Washington.

CP-GPP-EE-01-5.2, *Test Pit Excavation in Contaminated Areas*, Fluor Hanford, Inc., Richland, Washington.

CP-MD-017, *Safety Communications*, Fluor Hanford, Inc., Richland, Washington.

DOE O 414.1A, *Quality Assurance*, as amended, U.S. Department of Energy, Washington, D.C.

DOE/EH-0624, 2000, *Multi-Agency Radiation Survey and Site Investigation Manual*, Rev. 1, U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Defense, and U.S. Nuclear Regulatory Commission, Washington, D.C. (also listed as NUREG-1575 and EPA 402/R-97/016)

DOE/RL-96-68, 1998, *Hanford Analytical Services Quality Assurance Requirements Document*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-98-28, 1999, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan – Environmental Restoration Program*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-STD-1153-2002, 2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*, DOE Technical Standard, U.S. Department of Energy, Washington, D.C.

Ecology, 1992, *Statistical Guidance for Ecology Site Managers*, Washington State Department of Ecology, Toxics Cleanup Program, Olympia, Washington.

Ecology, EPA, and DOE, 1995, *Strategy for Management of Investigation Derived Waste*, letter from R. Stanley, Washington State Department of Ecology, D. R. Sherwood, U.S. Environmental Protection Agency, and K. M. Thompson, U.S. Department of Energy, Richland Operations Office, to distribution, dated July 26, 1995, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement), 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

EPA, 1992, *Guide to the Management of Investigation-Derived Wastes*, Publication 9345.3FS (January), U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1997, OSWER Directive 9200.4-18, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 2001, *EPA Requirements for Quality Assurance Project Plans*, QA/R-5, U.S. Environmental Protection Agency, Quality Assurance Division, Washington, D.C.

EPA/240/B-01/003, 2001, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, U.S. Environmental Protection Agency, Quality Assurance Division, Washington, D.C.

EPA 402/R-97/016, 2000, *Multi-Agency Radiation Survey and Site Investigation Manual*, Rev. 1, U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Defense, and U.S. Nuclear Regulatory Commission, Washington, D.C. (also listed as NUREG-1575 and DOE/EH-0624)

EPA/600/R-96/055, 2000, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, U.S. Environmental Protection Agency, Washington, D.C.

EPA/600/4-79/020, 1983, *Methods of Chemical Analysis of Water and Wastes*, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

GRP-EE-01-3.0, *Chain of Custody*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-01-3.1, *Sample Packaging and Shipping*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-01-3.2, *Field Decontamination of Sampling Equipment*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-01-4.0, *Soil and Sediment Sampling*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-01-4.2, *Sample Storage and Shipping Facility*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-01-4.5, *Sample Compositing*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-05-1.0, *Routine Field Screening*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-05-3.2, *Field Screening Tedlar Bag Sampling*, Fluor Hanford, Inc., Richland, Washington.

GRP-EE-05-4.0, *Analysis of Volatile Organic Compounds in Vapor Samples Using the Brüel and Kjær 1302 and Innova 1312 Multi-Gas Analyzers*, Fluor Hanford, Inc., Richland, Washington.

GRP-PRO-8377, *Instrument Accuracy and Reliability (Calibration)*, Fluor Hanford, Inc., Richland, Washington.

HNF-5173, 2002, *PHMC Radiological Control Manual,* Rev. 1, Fluor Hanford, Inc., Richland, Washington.

HNF-12494, 2003, *Environmental Radiological Measurement Plan for the Central Plateau Remediation Project,* Rev. 0, Fluor Hanford, Inc., Richland, Washington.

HNF-13536, *PHMC Radiological Control Procedures,* Fluor Hanford, Inc., Richland, Washington.

HNF-20635, 2004, *Groundwater Remediation Project Quality Assurance Project Plan*, Fluor Hanford, Richland, Washington,

HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria,* Fluor Hanford, Inc., Richland, Washington.

HNF-IP-1277, *Central Plateau Remediation Project Radiological Control Procedures*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-052, *Corrective Action Management*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-121, *Heat Stress Control*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-123, *Requesting Materials and Services*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-175, *Training Program Descriptions*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-246, *Management Assessment*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-268, *Control of Purchased/Acquired Items and Services*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-298, *Noncomforming Items*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-459, *Environmental Training*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-462, *Pollution Prevention*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-490, *Calibration Management Program*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-1623, *Radiological Work Planning Process*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-10863, *Notebooks and Logbooks*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-15333, *Environmental Protection Processes*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-15334, *Effluent and Environmental Monitoring*, Fluor Hanford, Inc., Richland, Washington.

HNF-PRO-15335, *Environmental Permitting and Documentation Preparation*, Fluor Hanford, Inc., Richland, Washington.

HNF-RD-210, *Records Management Program*, Fluor Hanford, Inc., Richland, Washington.

HNF-RD-10743, *Safety Communications*, Fluor Hanford, Inc., Richland, Washington.

HNF-RD-10859, *Maintenance Management*, Fluor Hanford, Inc., Richland, Washington.

HNF-RD-11061, *Training Requirements*, Fluor Hanford, Inc., Richland, Washington.

HNF-RD-11812, *Occupational Noise Exposure and Hearing Conservation,* Fluor Hanford, Inc., Richland, Washington.

NUREG-1575, 2000, *Multi-Agency Radiation Survey and Site Investigation Manual*, Rev. 1, U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Defense, and U.S. Nuclear Regulatory Commission, Washington, D.C. (also listed as EPA 402/R-97/016 and DOE/EH-0624)

RL-TPA-90-0001, 1998, *Tri-Party Agreement Handbook Management Procedures,* Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)," U.S. Department of Energy, Richland Operations Office, Richland, Washington.

SW-846, 1999, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, as amended.

WAC 173-340-705, "Use of Method B," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-706, "Use of Method C," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC-173-340-900, "Tables," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340-7492, "Simplified Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

*Waste Information Data System Report*, Hanford Site database.

WCP-2002-0002, *Waste Control Plan for the 200-PW-1 Operable Unit*, Fluor Hanford, Inc., Richland, Washington.

WD/GRP RCP 4.5.1, *Portable Environmental Survey Instrument Operation*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WD/GRP RCP 4.5.2, *Performance of Environmental Radiological Measurements*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WD/GRP RCP 4.5.3, *MDA and Scan Speed Determination for Environmental Radiological Surveys*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WD/GRP RCP 4.5.7, *Preparation of Environmental Radiological Survey Task Instructions (ERSTIs)*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WD/GRP RCP 4.5.8, *Background Measurements for Environmental Radiological Surveys*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WD/GRP RCP 4.5.9, *Documenting Environmental Radiological Measurements*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WD/GRP RCP 5.6.15, *Operation of Mobile Surface Contamination Monitor II*, Waste Disposal/Groundwater Remediation Project Radiological Control Procedure.

WMP-19920, (pending), *Data Quality Objectives Summary Report for 200-UR-1 Operable Unit Unplanned Releases Waste Group*, Rev. 0, Fluor Hanford, Inc., Richland, Washington.

Figure B-1. 200-UR-1 Sites within the 200 East Admin Area.

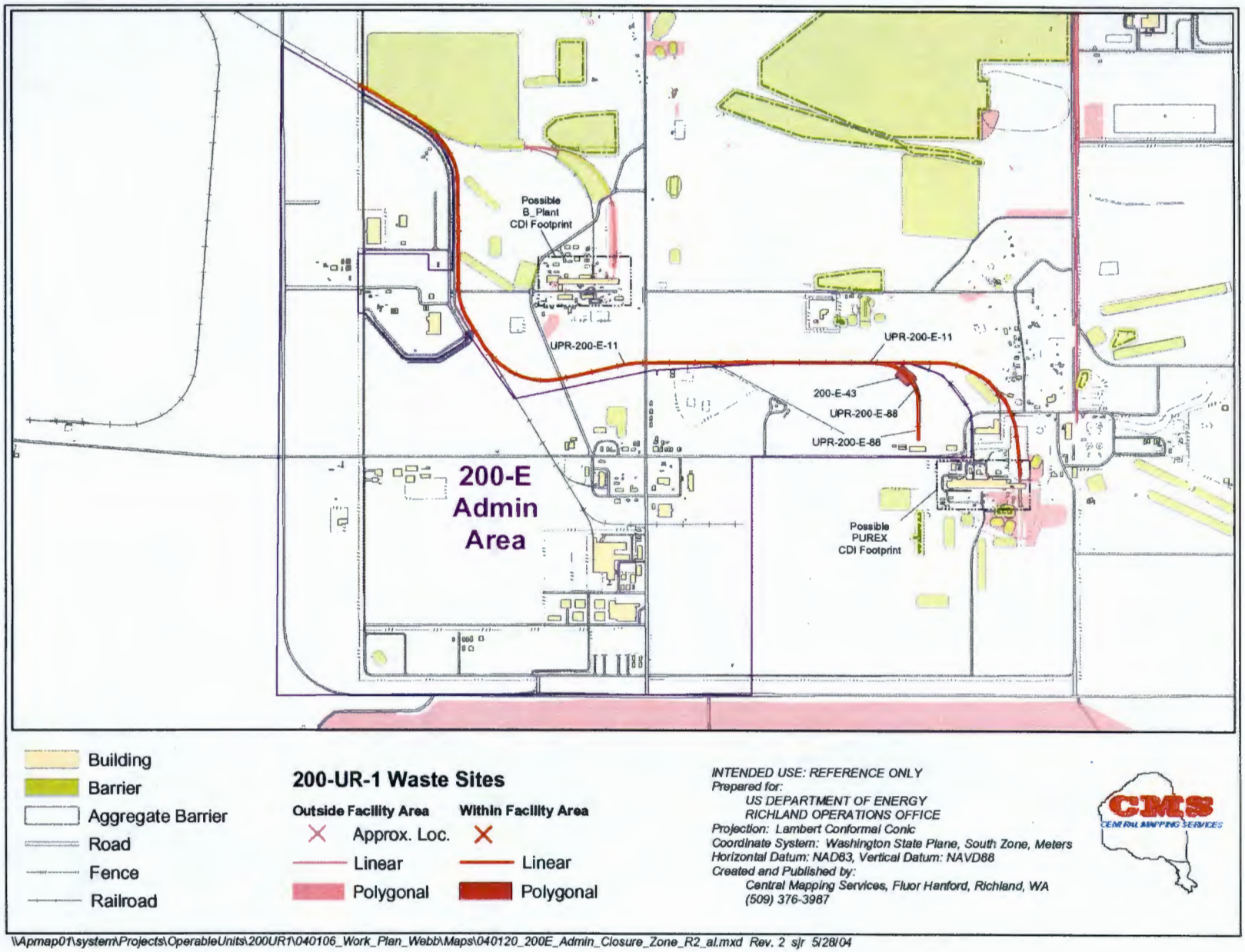

Figure B-2. 200-UR-1 Sites within the B Plant Area.

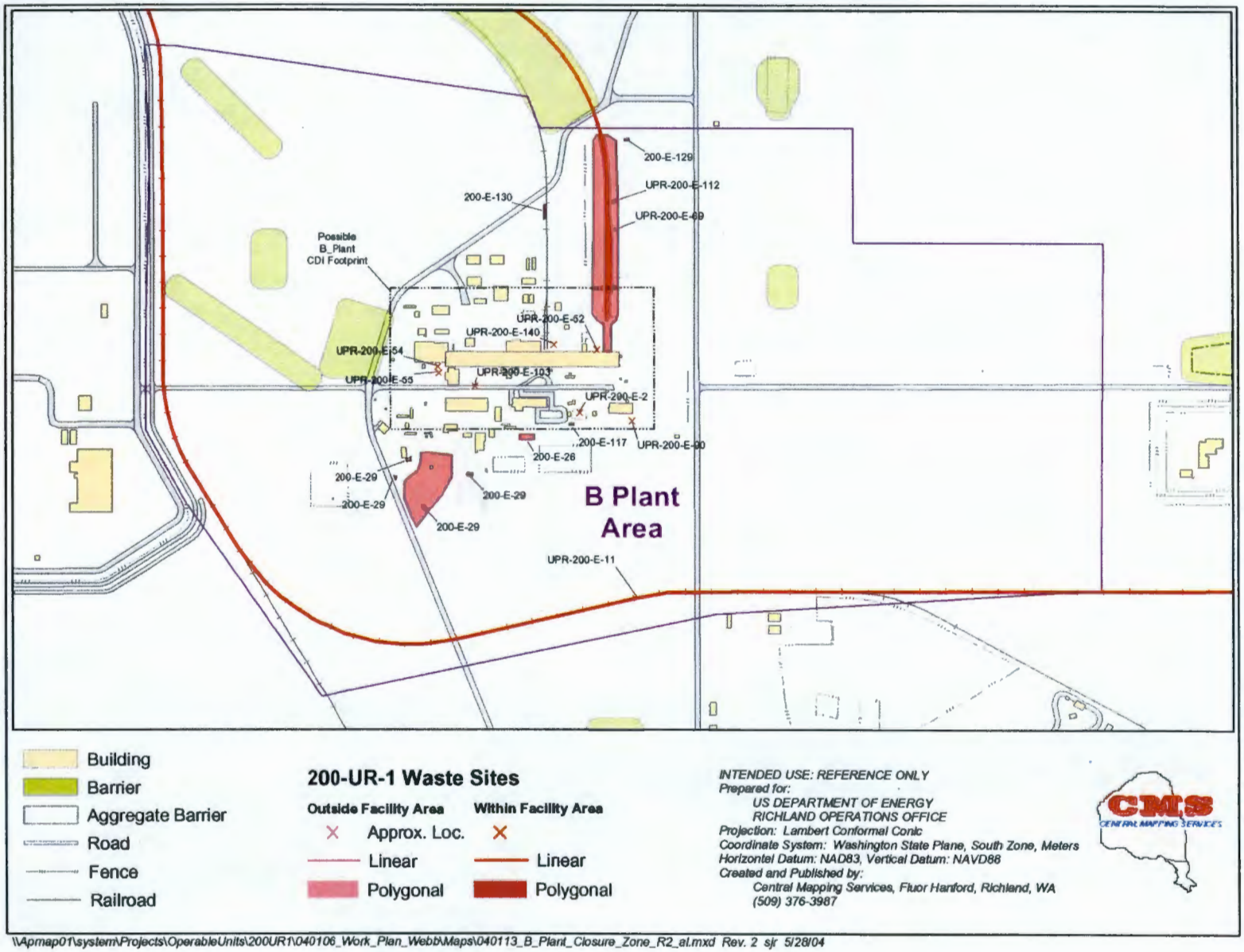

Figure B-3. 200-UR-1 Sites within the B Farm Area.

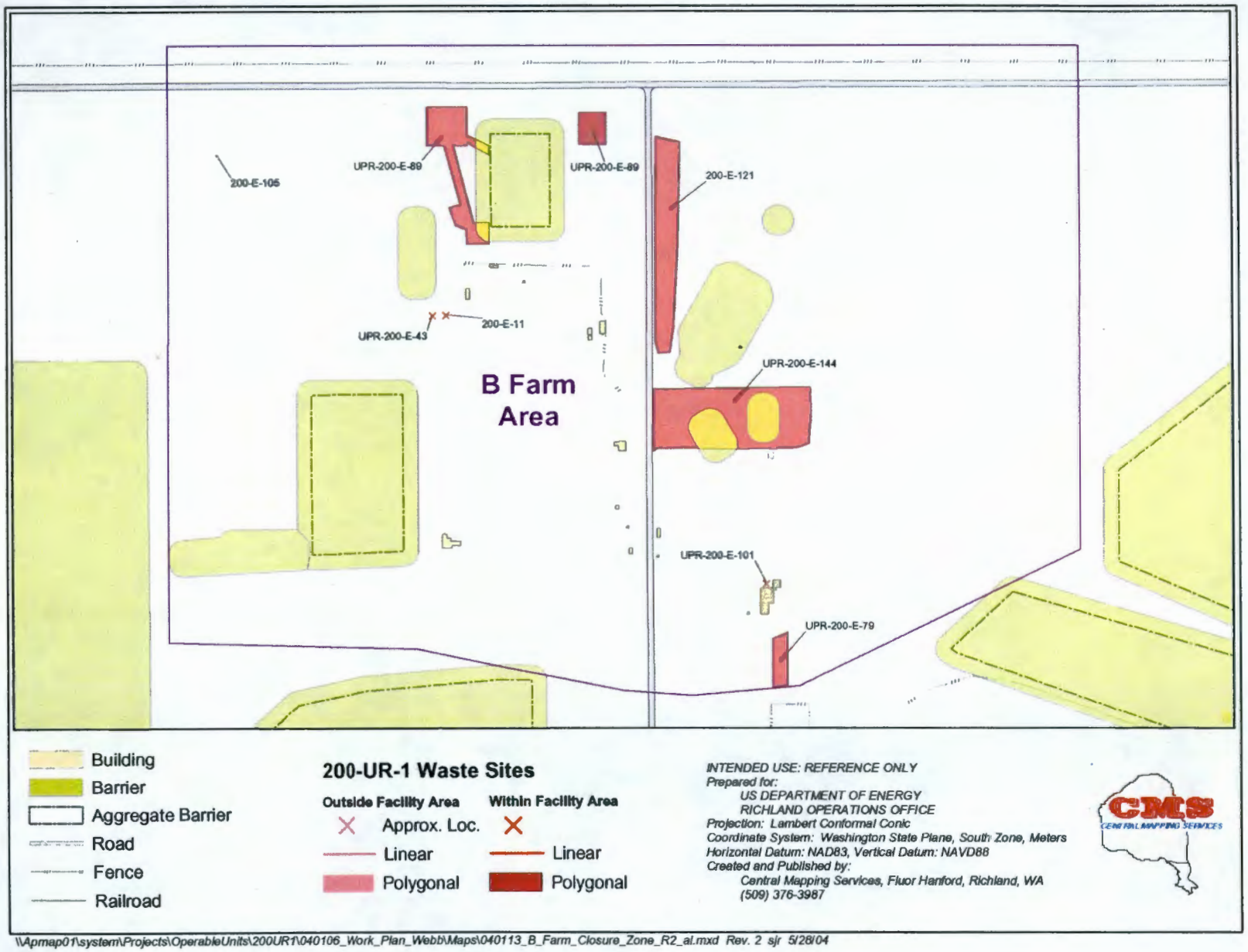

Figure B-4. 200-UR-1 Sites within the Plutonium-Uranium Extraction Area.

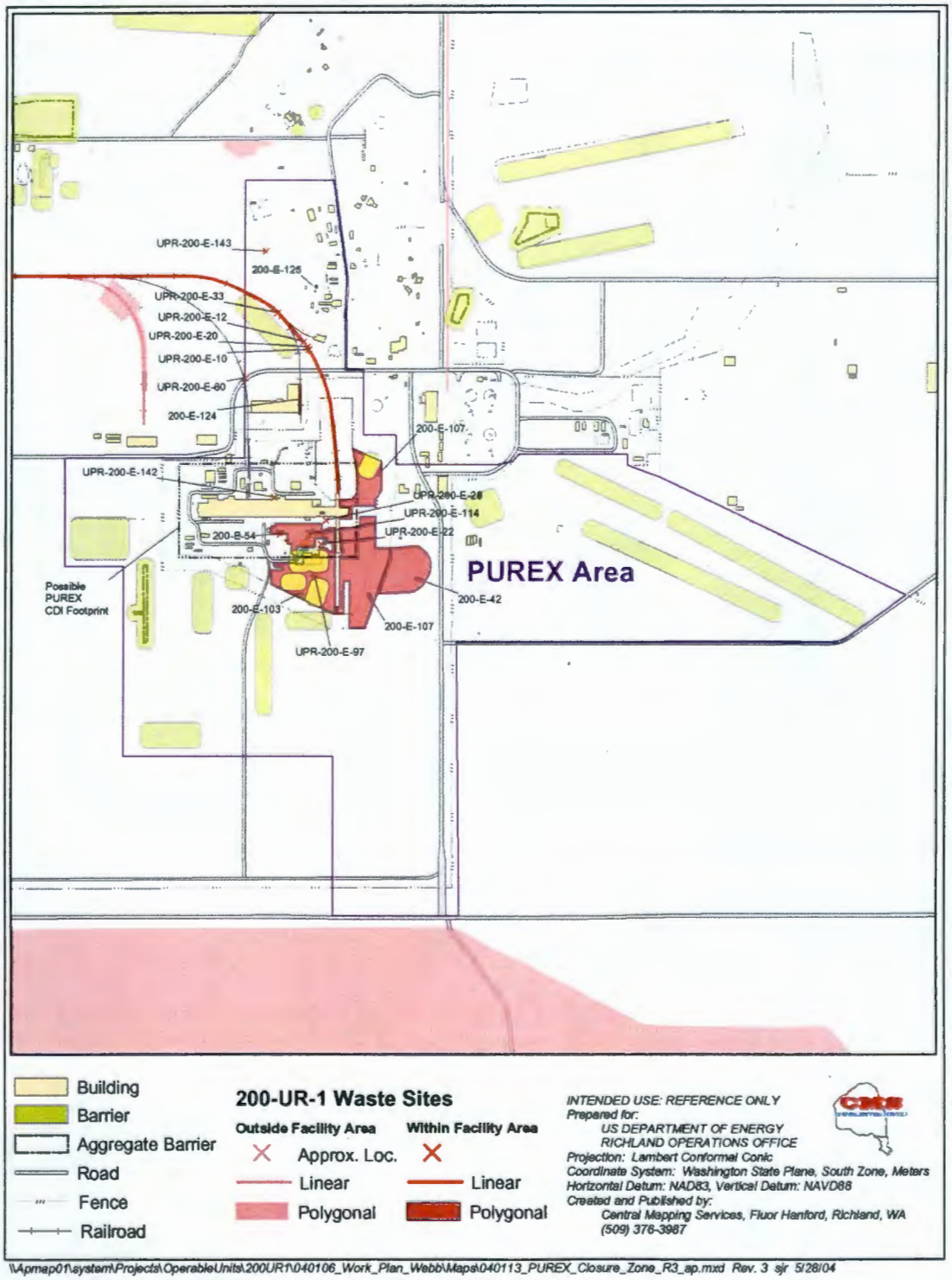

Figure B-5. 200-UR-1 Sites within the Semiworks Area.

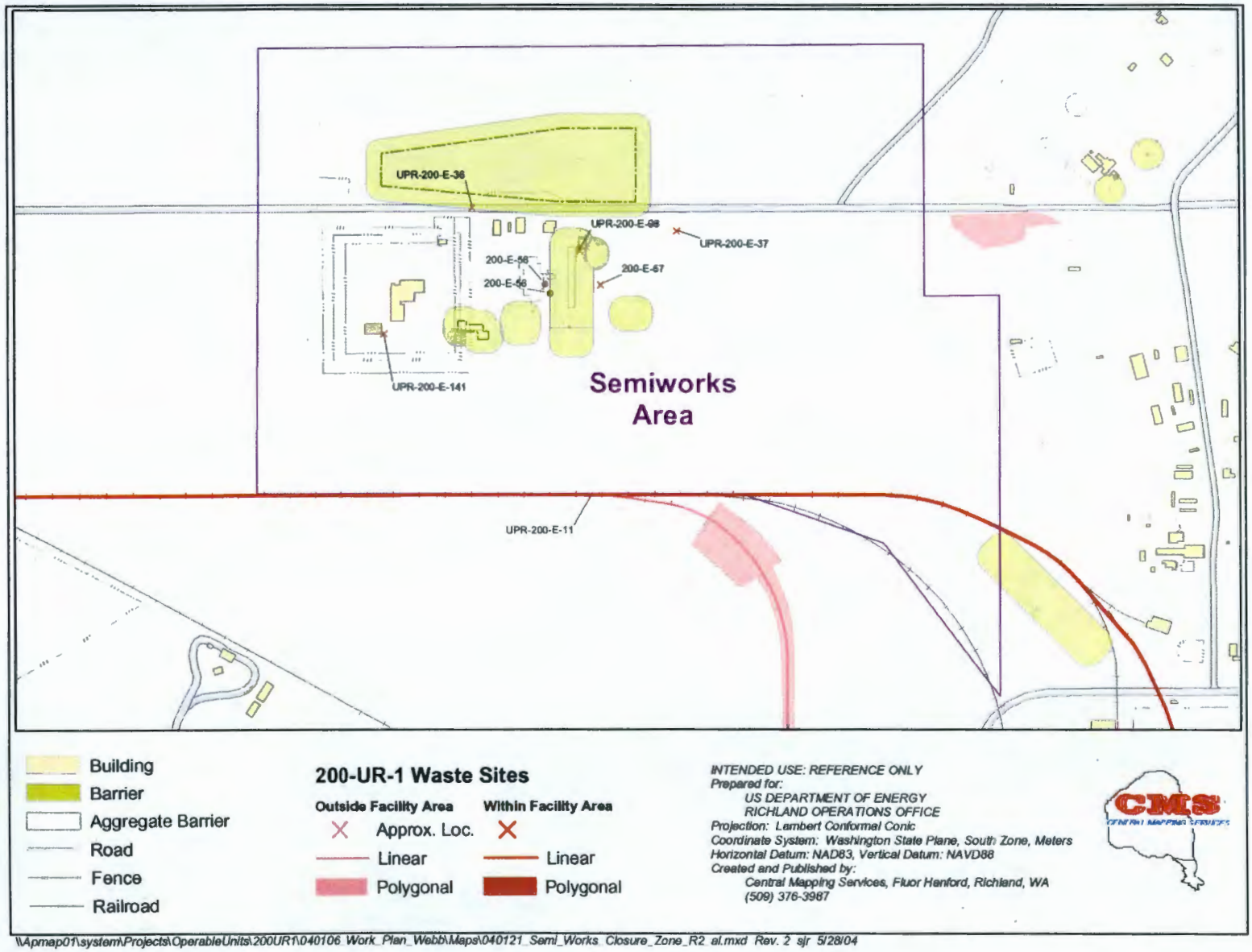

Figure B-6. 200-UR-1 Sites within the Waste Treatment Plant A Farm, C Farm, and Effluent Treatment Facility Farm Areas.

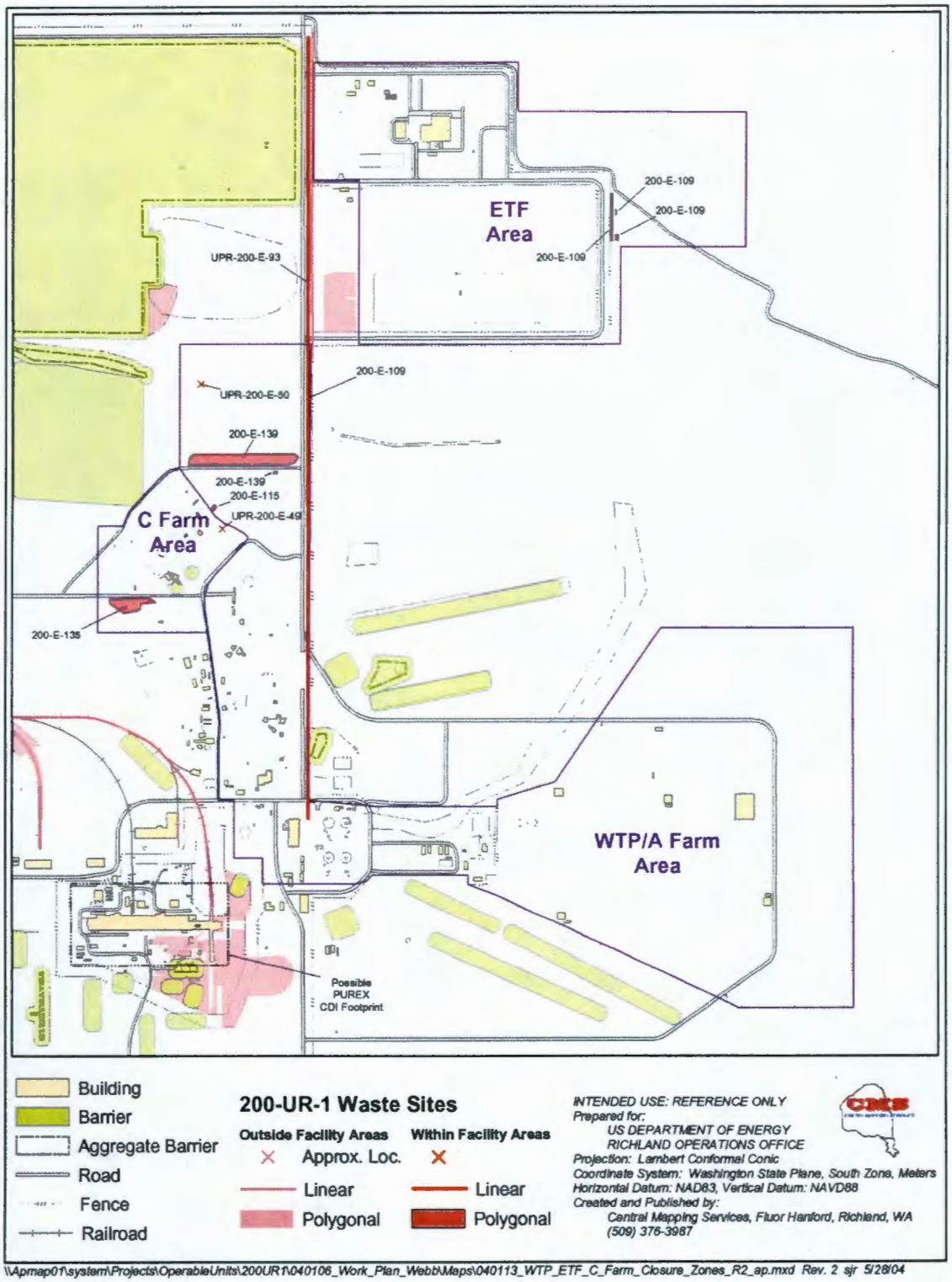

Figure B-7. 200-UR-1 Sites within the Solid Waste Area.

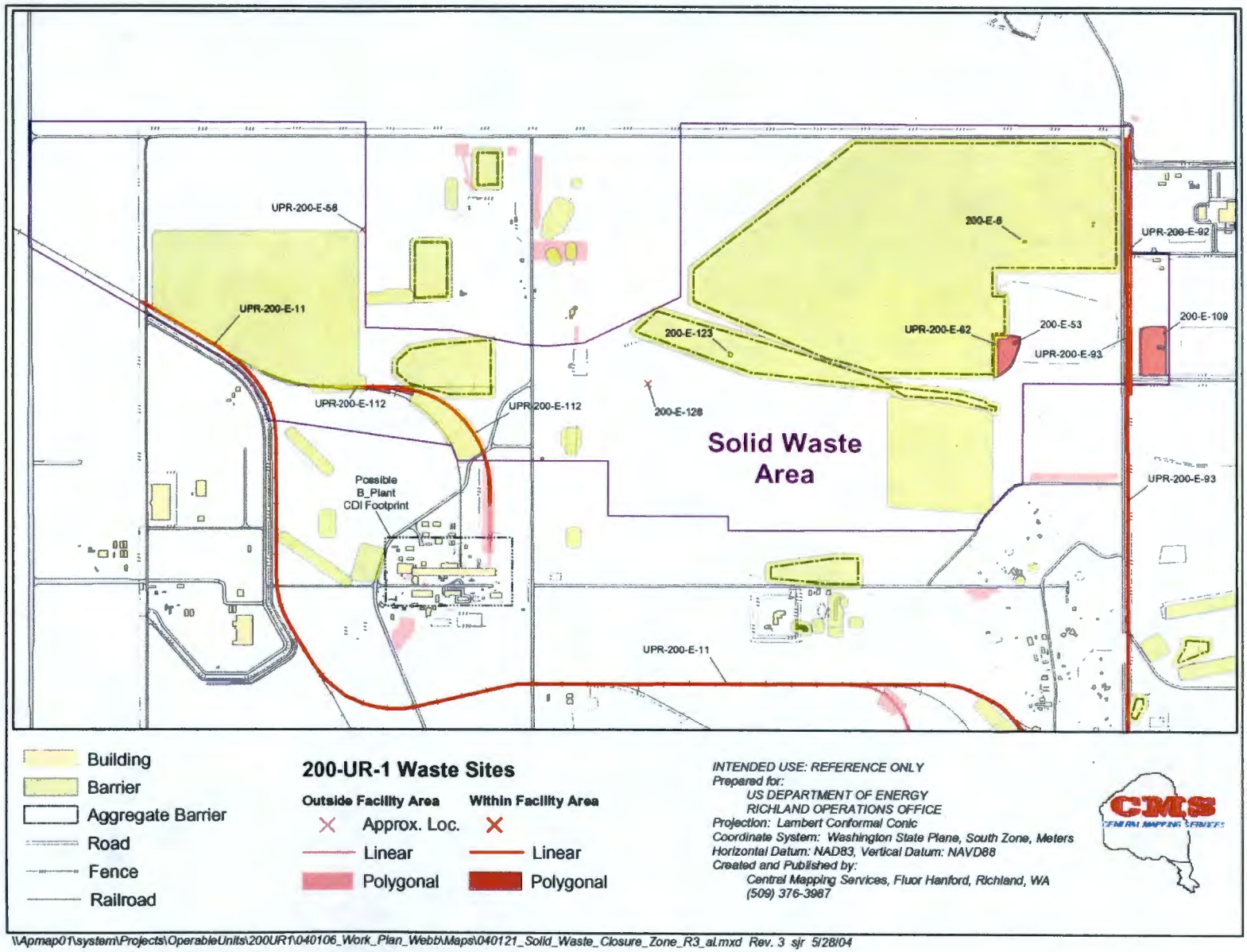

Figure B-8. 200-UR-1 Sites within the Reduction-Oxidation Plant Area.

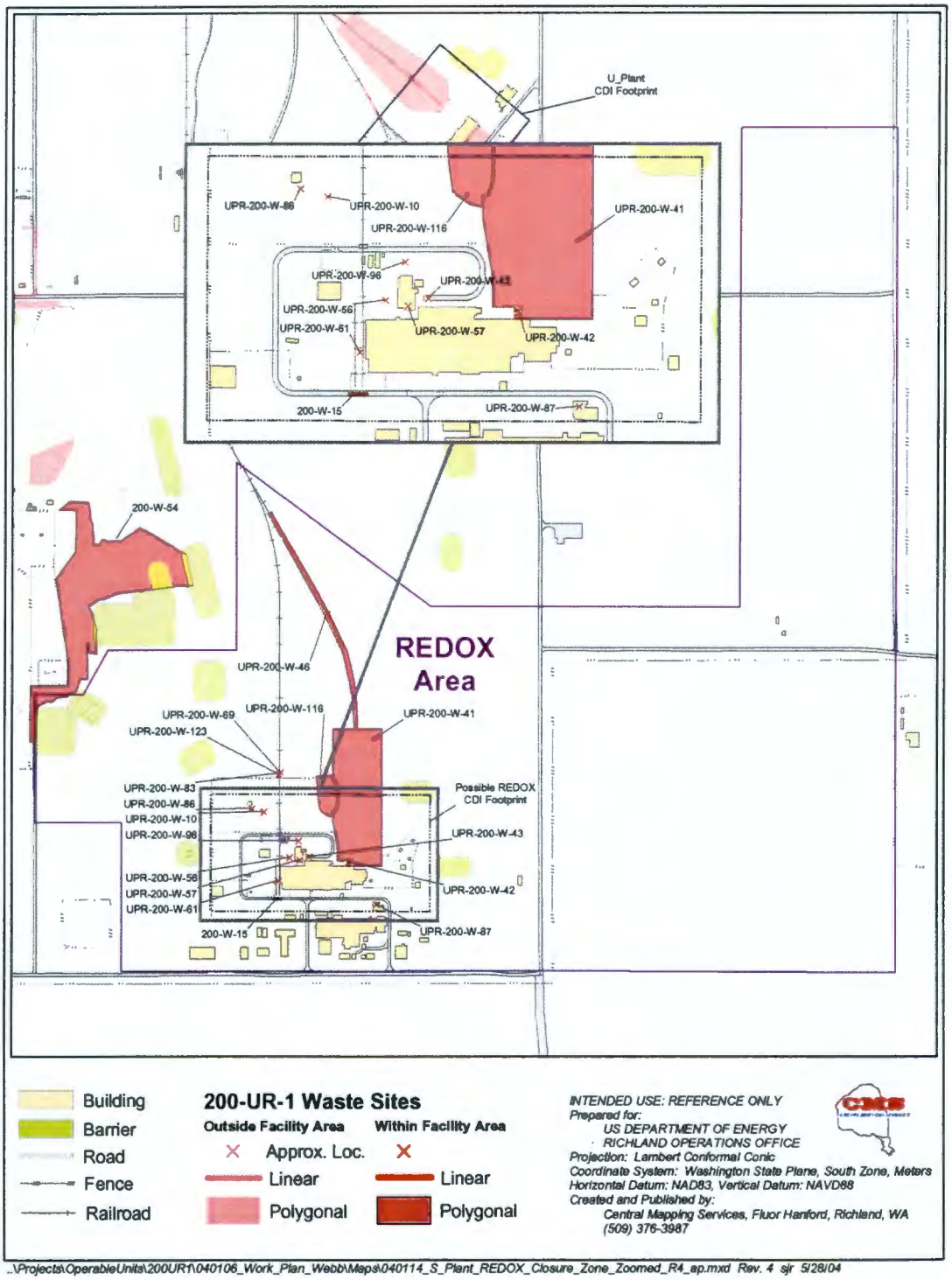

Figure B-9. 200-UR-1 Sites within the S/U Farm Area.

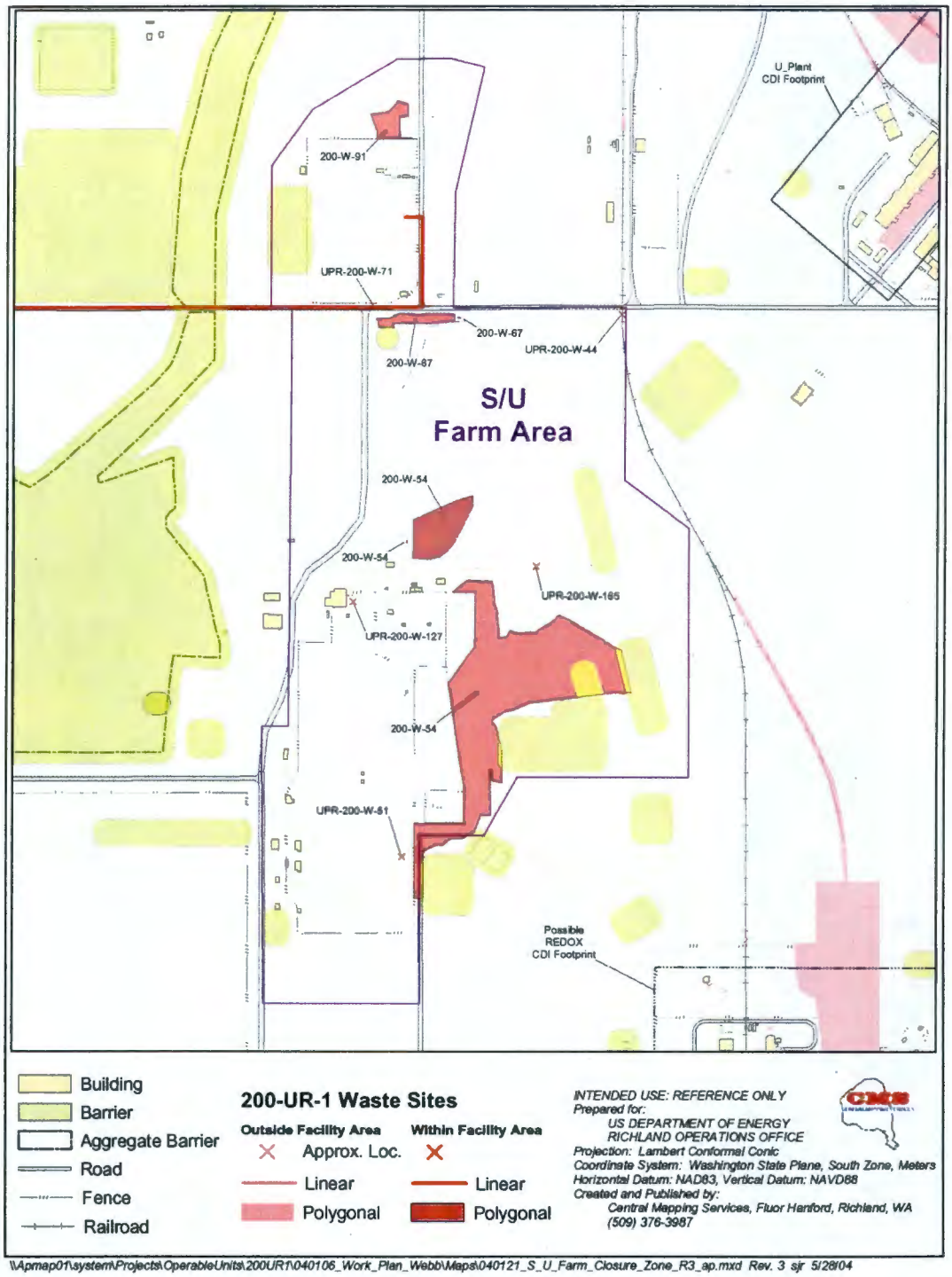

Figure B-10. 200-UR-1 Sites within the U Plant Area.

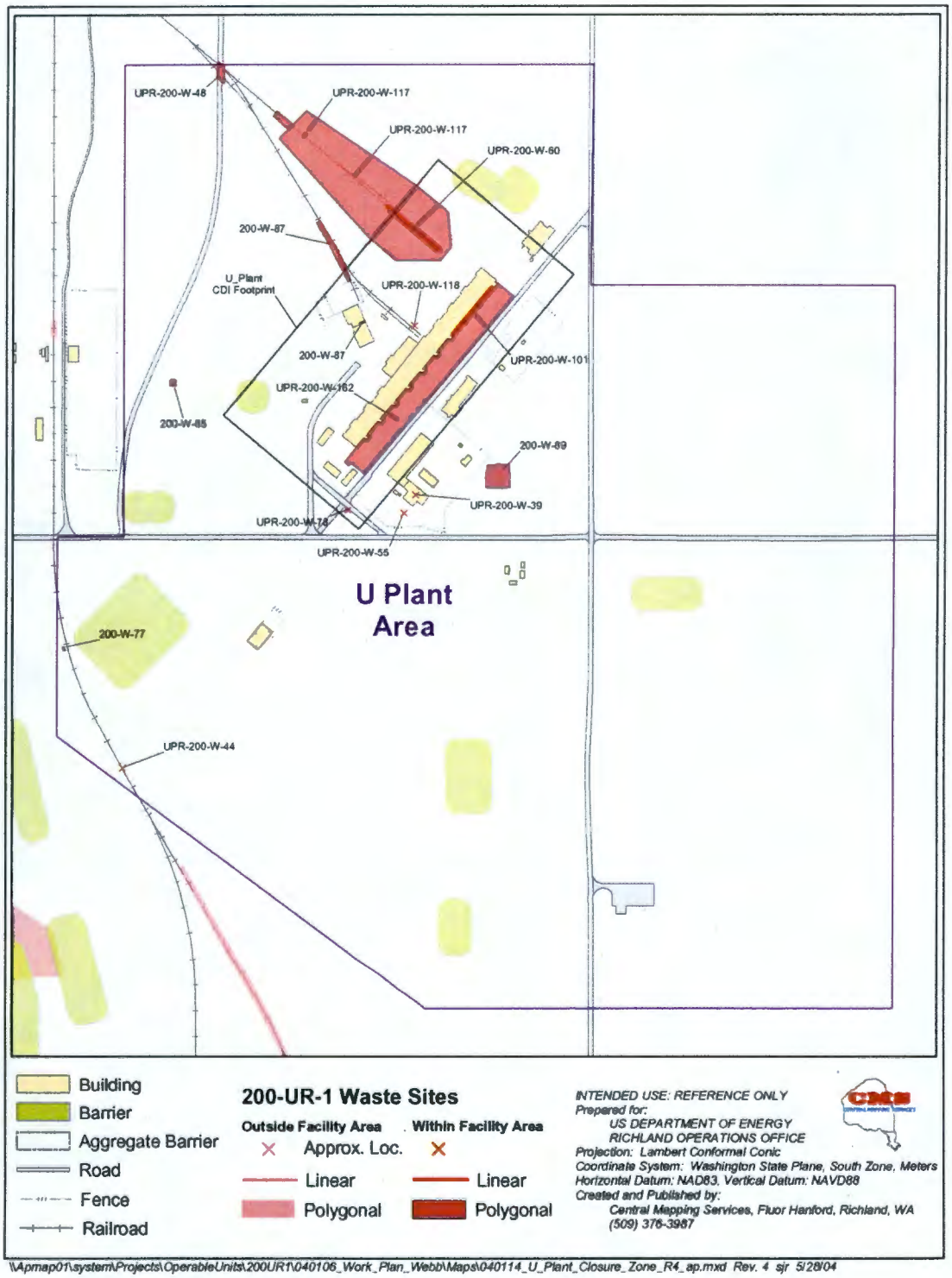

Figure B-11. 200-UR-1 Sites within the Plutonium Finishing Plant Area.

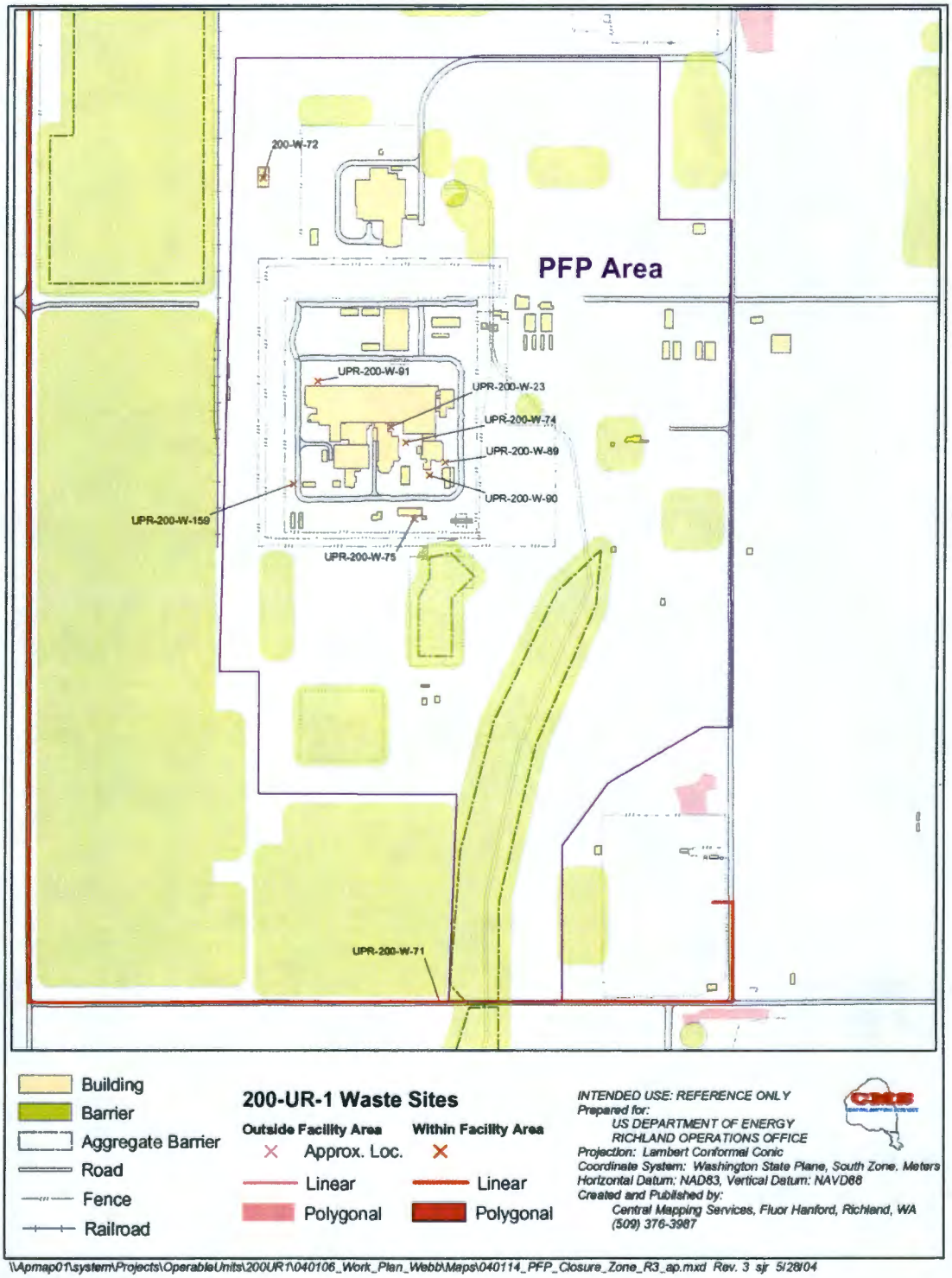

Figure B-12. 200-UR-1 Sites within the T Farm Area.

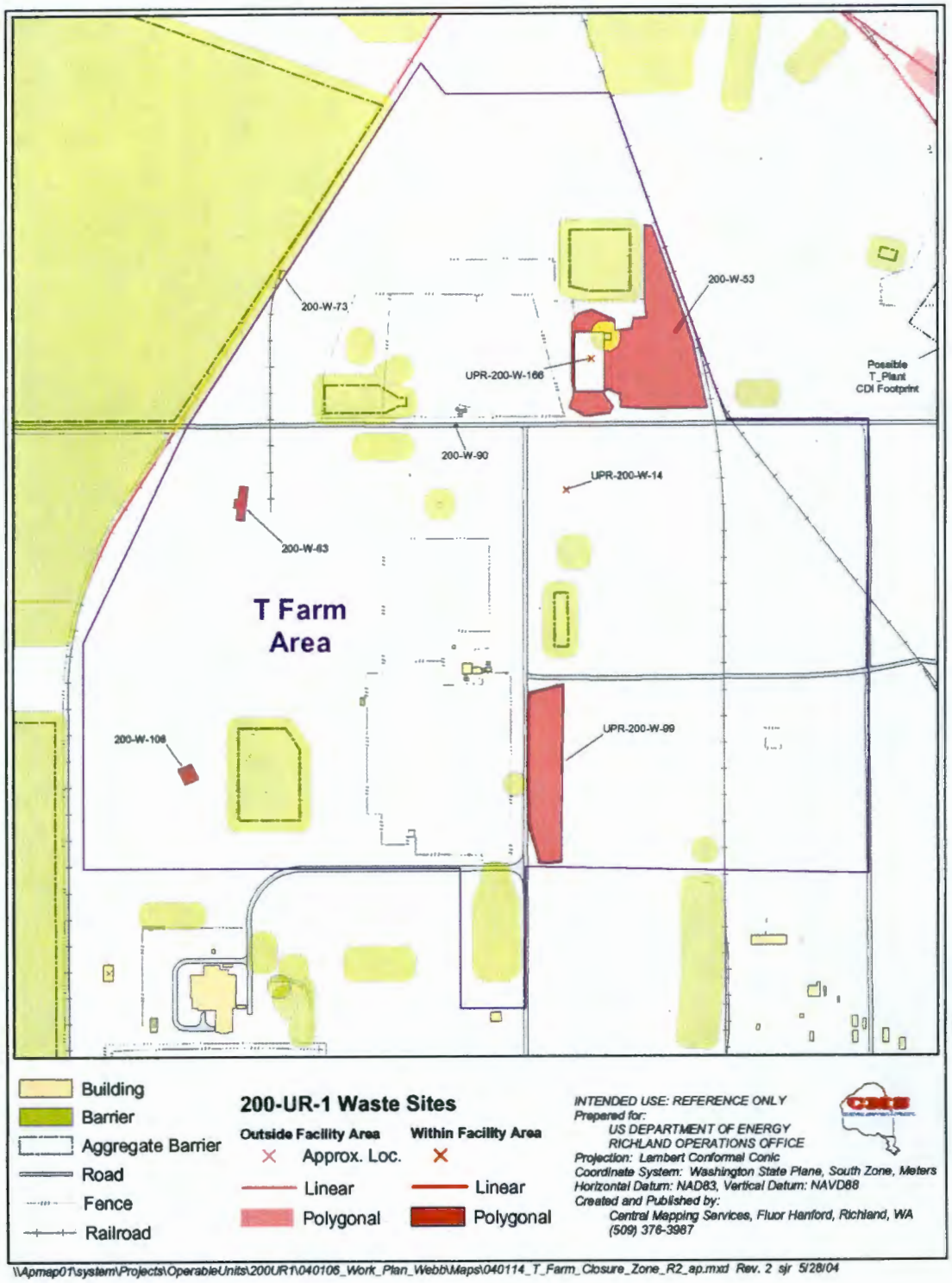

Figure B-13. 200-UR-1 Sites within the T Plant Area.

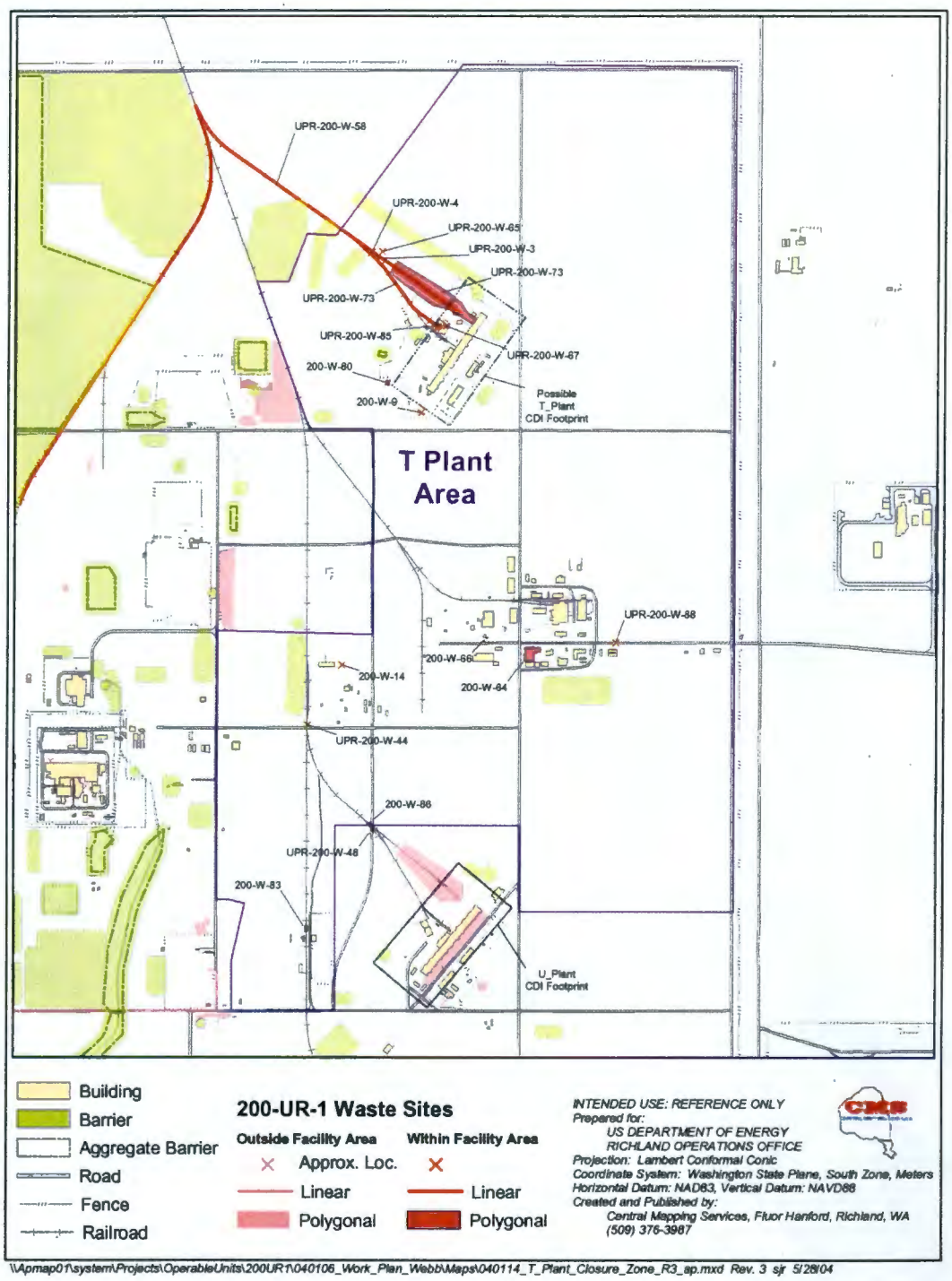

Figure B-14. 200-UR-1 Sites within the WM Area.

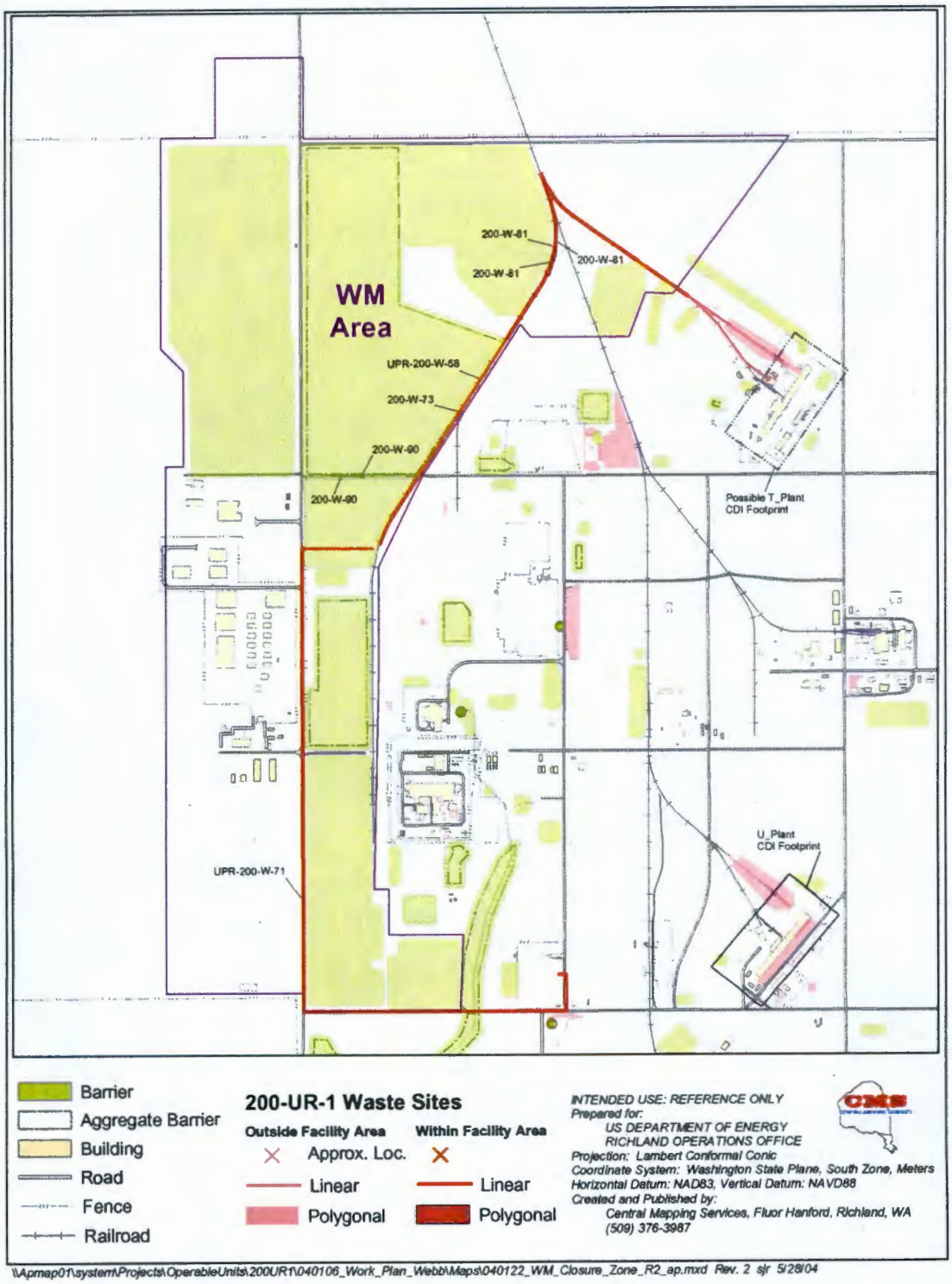

Figure B-15. Conceptual Contaminant Distribution Model for Animal Droppings, Vegetation Material and Windblown Particulate Waste Sites, 200 Area Unplanned Releases.

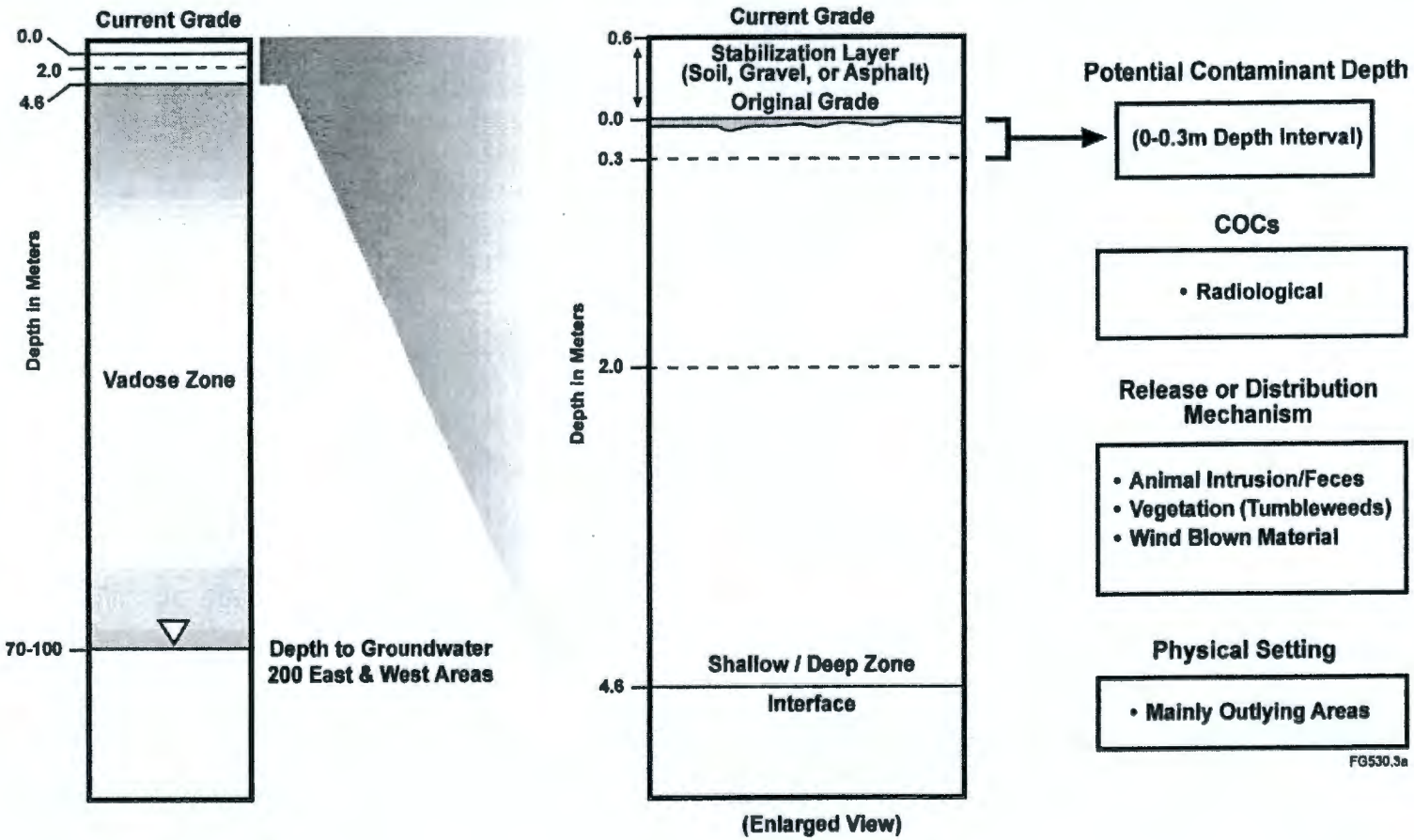

Figure B-16. Conceptual Contaminant Distribution Model for Small Leak/Spill Waste Sites, 200 Area Unplanned Releases.

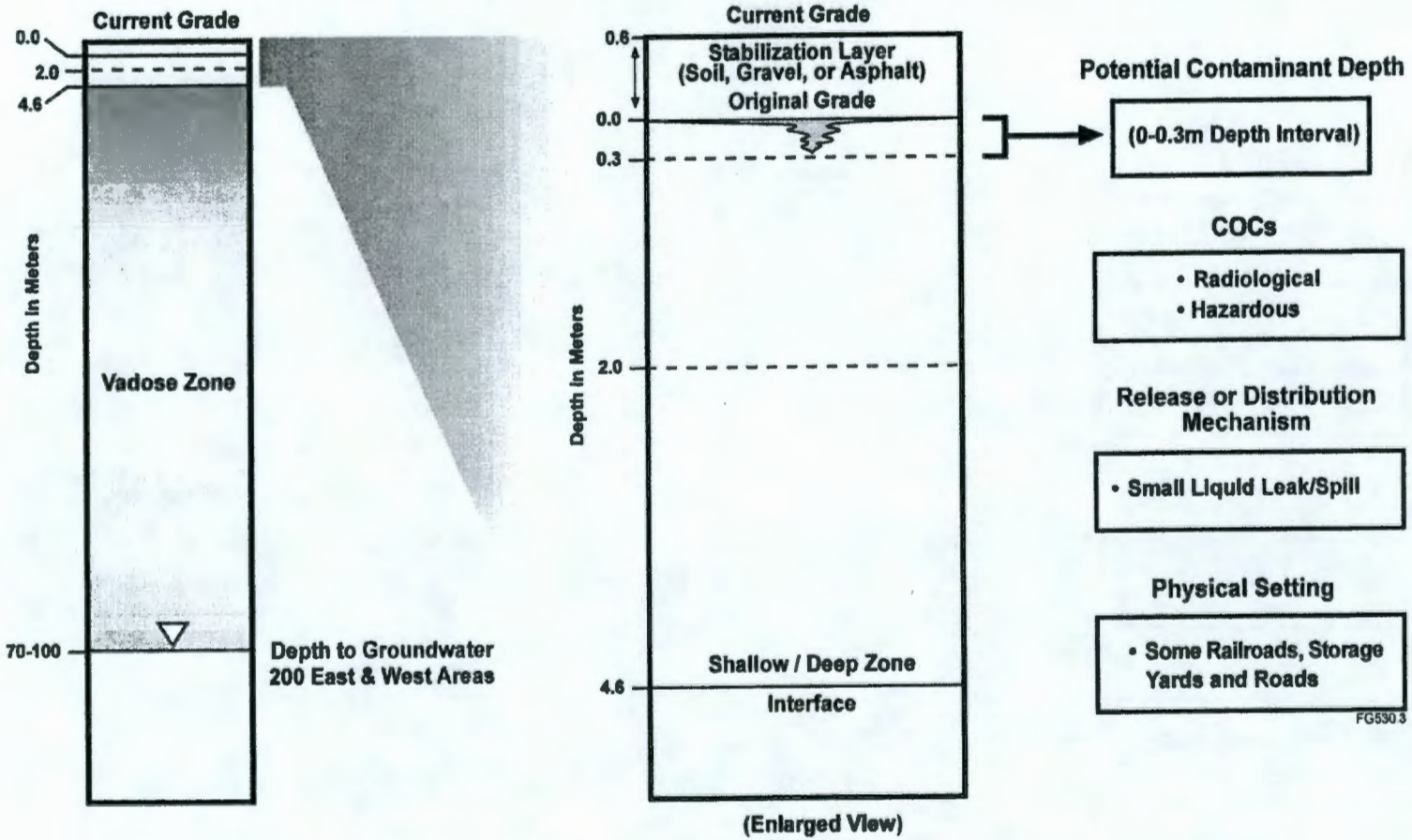

Figure B-17. Conceptual Contaminant Distribution Model for Moderate Leak/Spill Sites 200 Area Unplanned Releases.

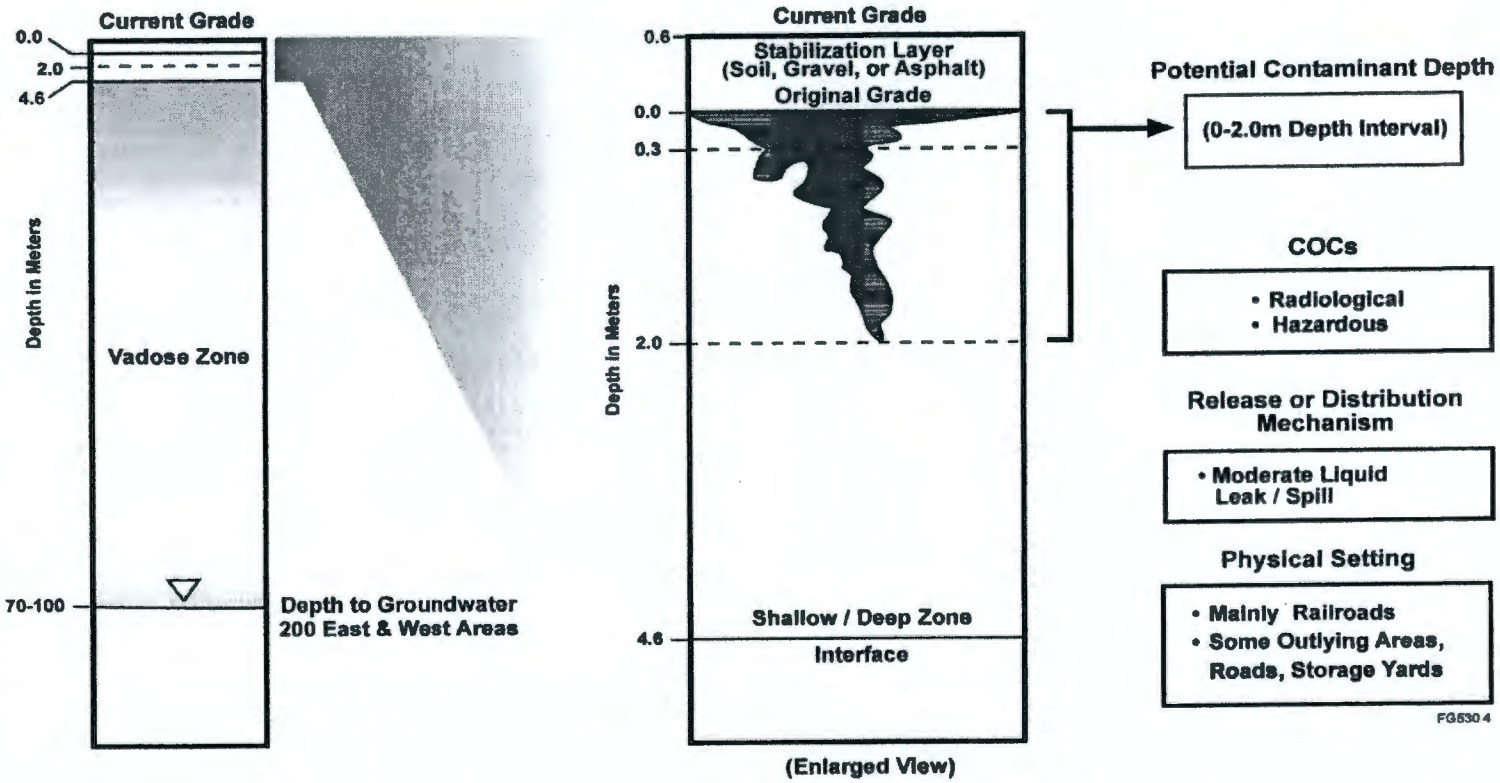

Figure B-18. Conceptual Contaminant Distribution Model for Larger Leak/Spill Sites 200 Area Unplanned Releases.

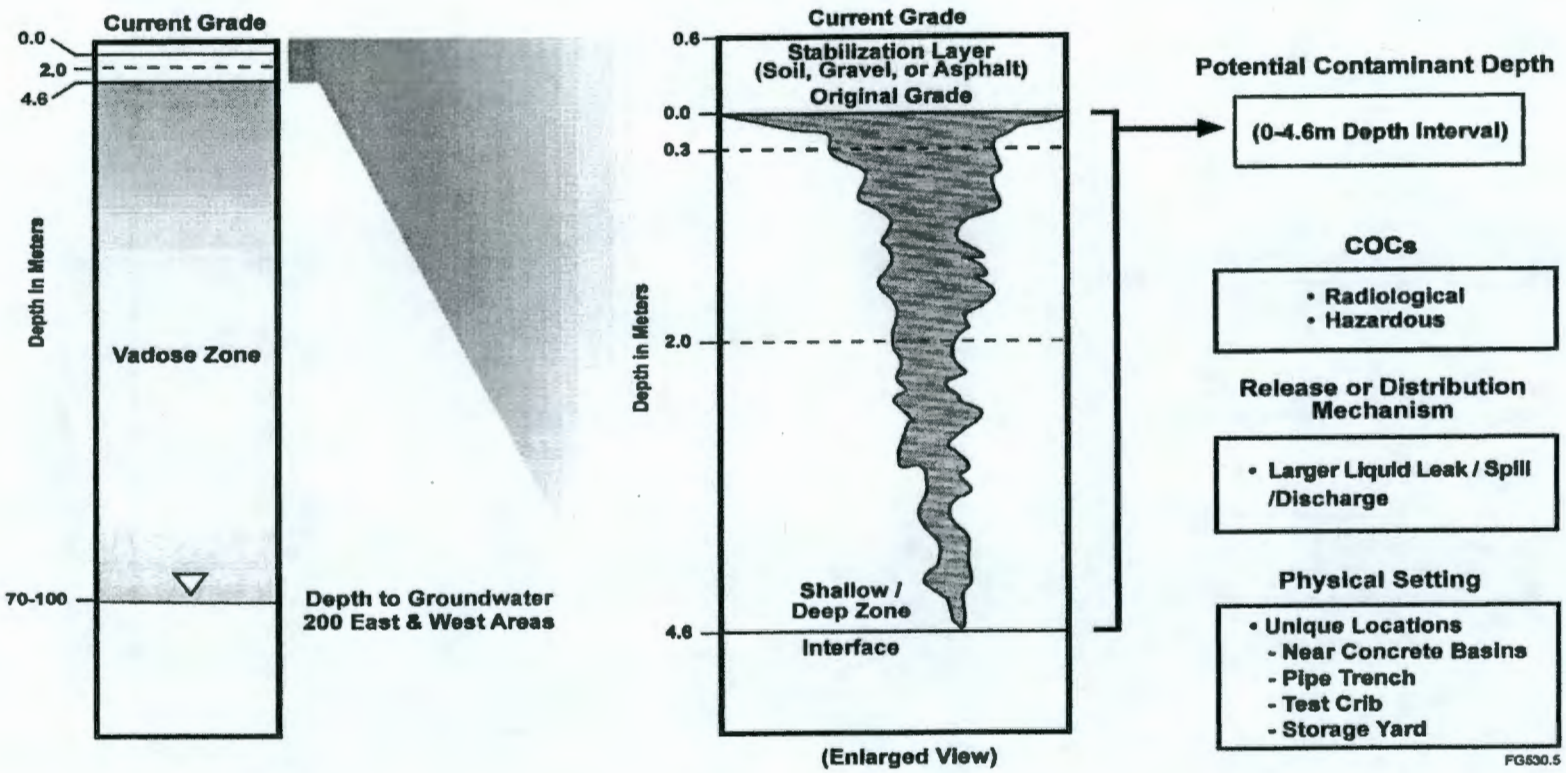

Figure B-19. Sample Design Process Flow for Remove/Treat/Dispose Sites.

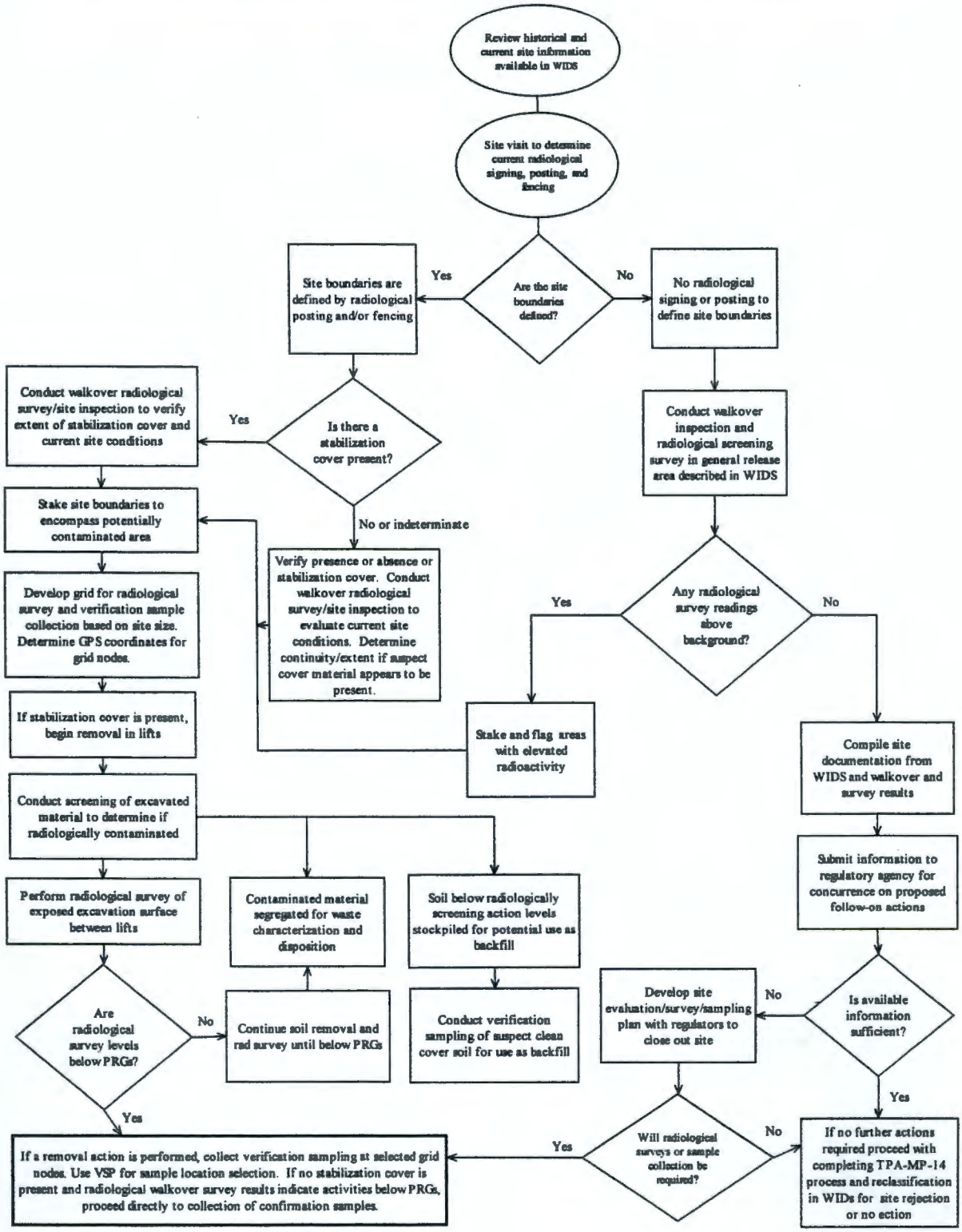

Figure B-20. Identification of Conceptual Site Model Zones within the BC Controlled Area.

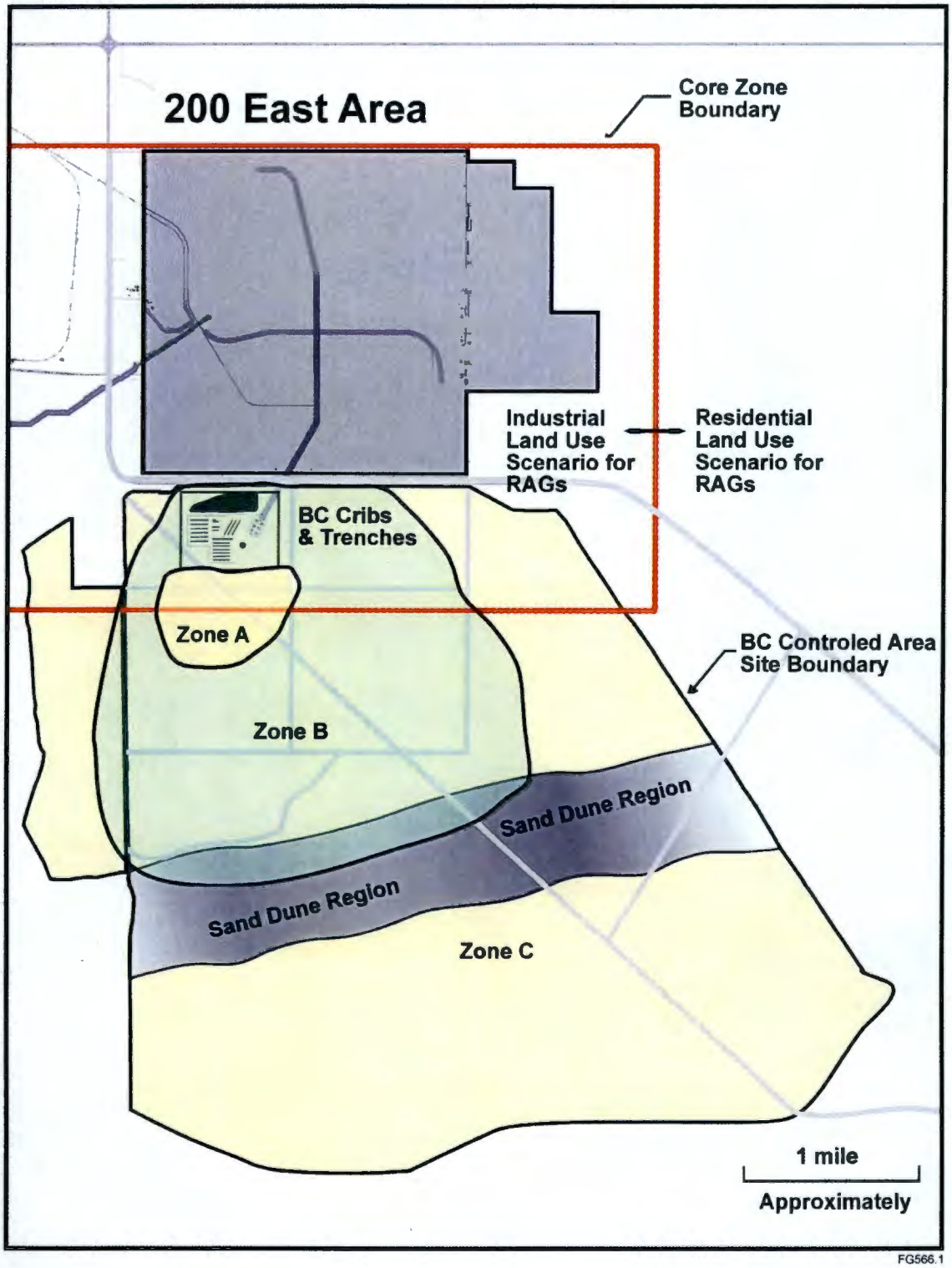

Figure B-21. Logic Flow Diagram for Disposition of Material/Media.

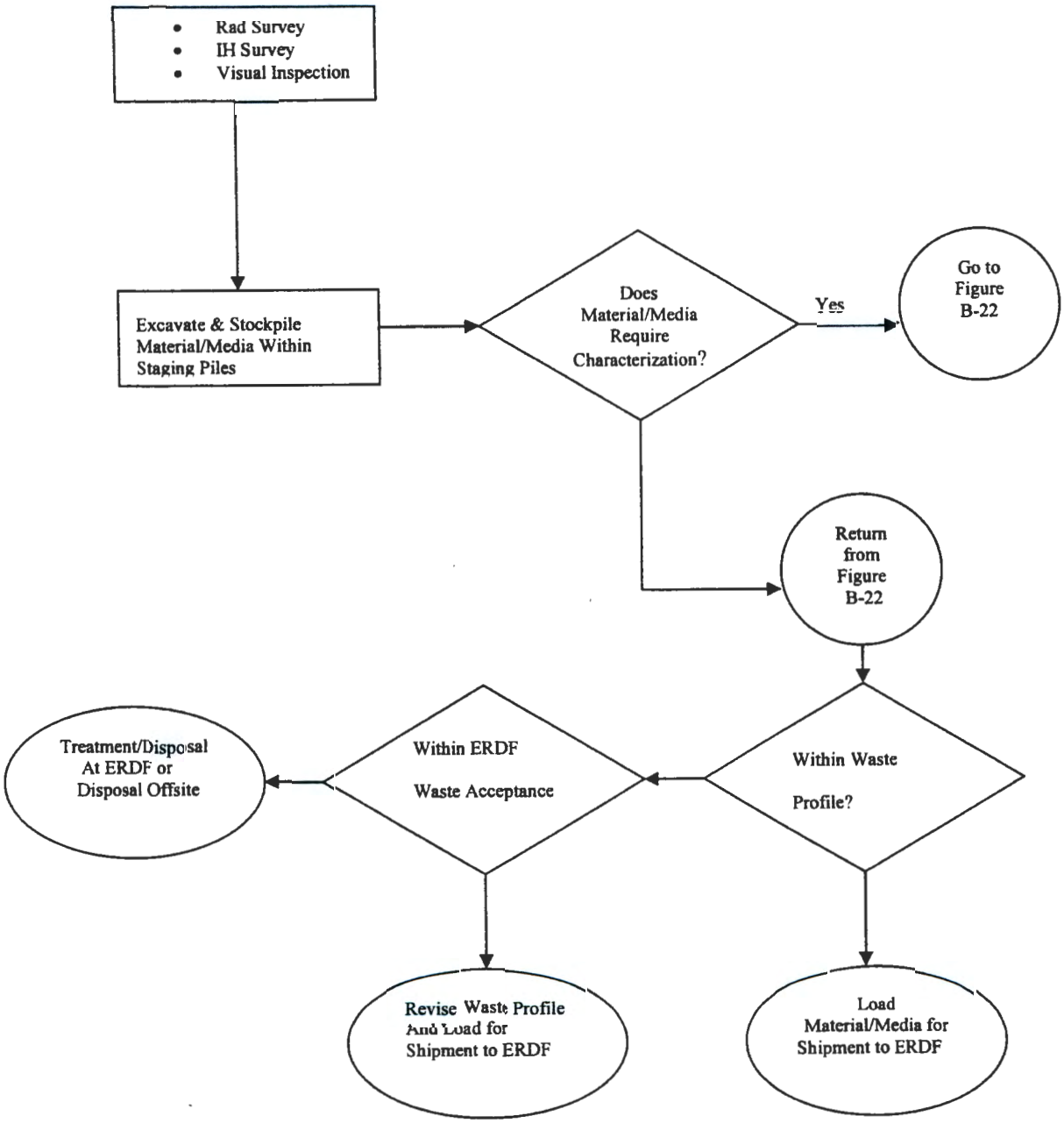

Figure B-22. Logic Flow Diagram for Characterization of Waste Materials/Media.

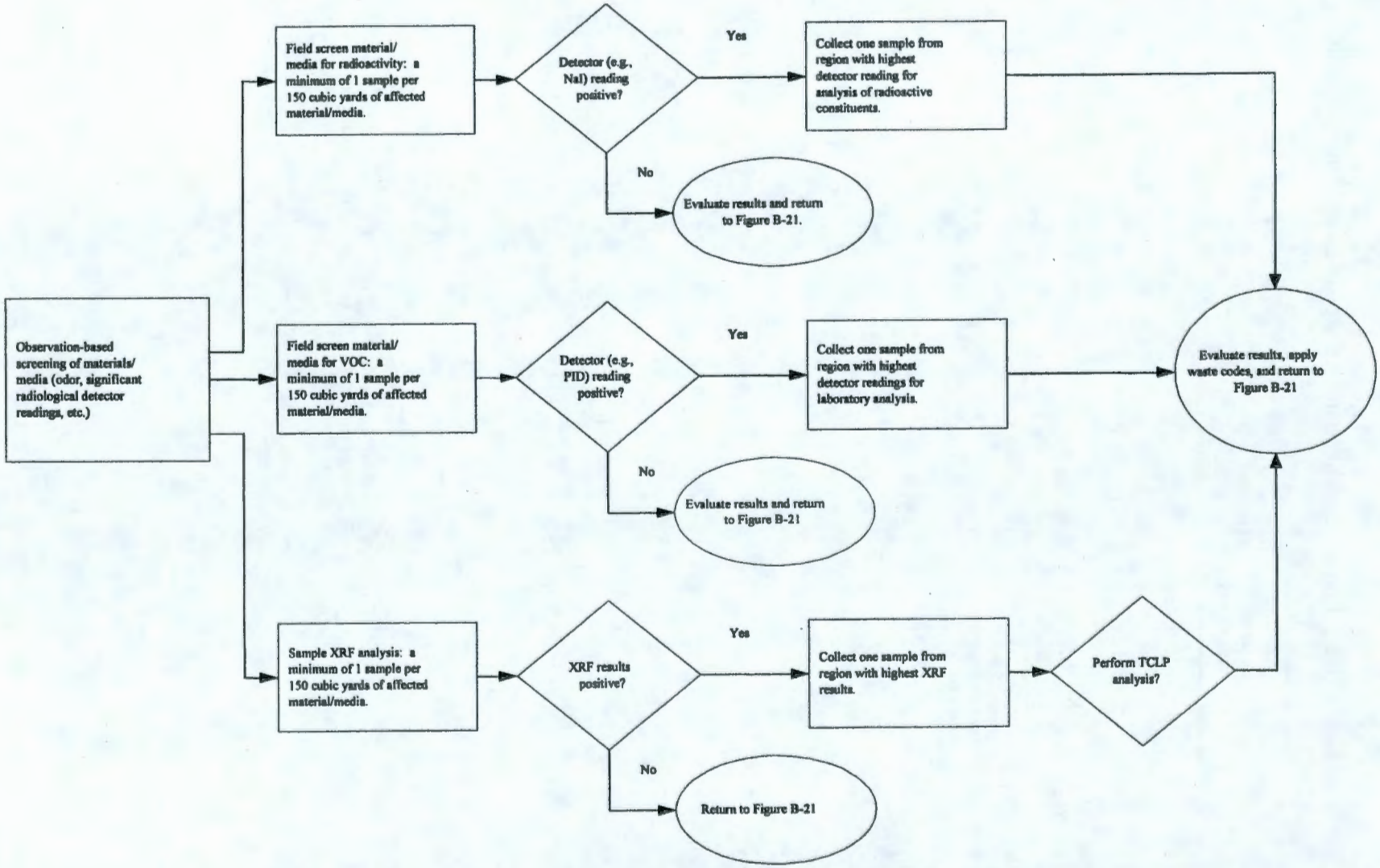

Table B-1. Sites Identified for Inclusion.

| | | | | | |
|---|---|---|---|---|---|
| 200-E-105 | 200-E-29 | 200-W-86 | UPR-200-E-36 | UPR-200-W-4 | 200-W-15 |
| 200-E-109 | 200-E-43 | 200-W-90 | UPR-200-E-43 | UPR-200-W-41 | 600-262 |
| 220-E-110 | 200-E-53 | 600-275 | UPR-200-E-69 | UPR-200-W-44 | UPR-600-21 |
| 220-E-115 | 200-W-106 | UPR-200-E-10 | UPR-200-E-88 | UPR-200-W-46 | UPR-200-E-50 |
| 200-E-117 | 200-W-14 | UPR-200-E-101 | UPR-200-E-89 | UPR-200-W-58 | UPR-200-E-62 |
| 200-E-121 | 200-W-53 | UPR-22-E-11 | UPR-200-N-1 | UPR-200-W-65 | |
| 200-E-124 | 200-W-63 | UPR-200-E-112 | UPR-200-N-2 | UPR-200-W-67 | |
| 200-E-125 | 200-W-64 | UPR-200-E-12 | UPR-200-W-116 | UPR-200-W-69 | |
| 200-E-128 | 200-W-67 | UPR-200-E-143 | UPR-200-W-123 | UPR-200-W-73 | |
| 200-E-129 | 200-W-80 | UPR-200-E-144 | UPR-200-W-166 | UPR-200-W-96 | |
| 200-E-130 | 200-W-81 | UPR-200-E-20 | UPR-200-W-23 | UPR-600-12 | |
| 200-E-139 | 200-W-83 | UPR-200-E-33 | UPR-200-W-3 | 200-E-26 | |

Table B-2. Contaminants of Concern for 200-UR-1 Operable Unit. (2 Pages)

| | | |
|---|---|---|
| **Radioactive Constituents** | | |
| Americium-241 | Neptunium-237 | Tritium[b] |
| Carbon-14 | Nickel-63 | Uranium-233/234 |
| Cesium-137 | Niobium-94[a] | Uranium-235/236 |
| Cobalt-60 | Plutonium-238 | Uranium-238 |
| Europium-152 | Plutonium-239/240 | |
| Europium-154 | Strontium-90 | |
| Europium-155 | Technetium-99 | |
| **Chemical Constituents – Metals** | | |
| Antimony | Copper | Silver |
| Arsenic | Hexavalent chromium | Vanadium |
| Barium | Lead | Zinc |
| Beryllium | Mercury | |
| Cadmium | Nickel | |
| Chromium | Selenium | |
| **Chemical Constituents – Other Inorganics** | | |
| Cyanide | Nitrate/Nitrite | |
| Fluoride | Sulfate | |
| **Chemical Constituents – Volatile Organics** | | |
| Acetone | 1,1-dichloroethane | Tetrahydrofuran |
| Acetonitrile | 1,2-dichloroethane | Toluene |
| Benzene | Dichloromethane (Methylene Chloride) | 1,1,1 Trichloroethane (TCA) |
| 1-Butanol (n-butyl alcohol) | Ethylbenzene Halogenated hydrocarbons | 1,1,2 Trichloroethane |
| 2-butanone (MEK) | Hexane | Trans-1,2-dichlorotheylene |
| Carbon tetrachloride | Methyl iso butyl ketone (MIBK) | Tetrachloroethylene (PCE) |
| Chlorobenzene | Perchloroethylene | Trichloroethylene (TCE) |
| Cis-1,2-dichloroethylene | | Vinyl chloride |
| Cyclohexane | | Xylenes |

Table B-2. Contaminants of Concern for 200-UR-1 Operable Unit. (2 Pages)

| **Semivolatile Organics** | | |
|---|---|---|
| AMSCO[c] Tributyl phosphate dilutant | Normal paraffin hydrocarbon | Tributyl phosphate and derivatives (mono, bi) |
| Cyclohexanone | Paint thinner | |
| Diesel fuel | Phenol | |
| Dodecane | Polychlorinated biphenyls (PCBs) | |
| Hydraulic Fluids (greases) | Shell E-2342 (napthalene and paraffin) | |
| Kerosene[d] | Soltrol-170 ($C_{10}H_{22}$ to $C_6$ to $H_{34}$; purified kerosene) | |
| Naphthylamine | | |

[a]Contaminant of concern applicable to Plutonium Finishing Plant Area only.
[b]Constituent will be retained only at liquid spill sites.
[c]Product of Allen Maintenance Supply Company Inc.
[d]Analyzed as kerosene total petroleum hydrocarbon.

Table B-3. Unplanned Release Decision Rules. (2 Pages)

| DR # | Application | Decision Rule |
|---|---|---|
| 1 | RTD | If the true mean (as estimated by the 95% UCL on sample mean) activity of radionuclides (Table B-4) within the cover[a] soil samples results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background (based on the site contaminant distribution model and RESRAD modeling [ANL 2002] or leach rate testing), remove the radiologically contaminated soils. Otherwise, use the cover soils as backfill. |
| 2 | RTD | If the true mean (as estimated by the 95% UCL on sample mean) concentrations of chemical constituents within the cover[a] soil samples are equal to or greater than the PRG values in Table B-5, remove the chemically contaminated soils. Otherwise, use the cover soils as backfill. |
| 3a | RI/FS | If the true mean (as estimated by the maximum detected value, mean, or 95% UCL on sample mean, as appropriate) activity of radionuclides (Table B-4) within the shallow zone soil samples results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above background (based on the site contaminant distribution model and RESRAD modeling [ANL 2002] or leach rate testing), evaluate remedial alternatives in an FS, or evaluate the site for closure with no remedial action. |
| 4a | RI/FS | If the true mean (as estimated by the maximum detected value, mean, or 95% UCL on sample mean, as appropriate) concentrations of chemical constituents within the shallow zone soil samples are equal to or greater than the PRG values in Table B-5, evaluate remedial alternatives in an FS, or evaluate the site for closure with no remedial action. |
| 5 | Verification | If the true mean (as estimated by the 95% UCL on sample mean) activity of radionuclides (Table B-4) within the shallow zone soil samples results in a direct radiological exposure dose greater than or equal to 15 mrem/yr above (based on the site contaminant distribution model and RESRAD modeling [ANL 2002] or leach rate testing), remove/dispose of the radiologically contaminated soils. Otherwise, initiate waste site closeout. |
| 6a | Verification | If the true mean (as estimated by the 95% UCL on sample mean) concentrations of chemical constituents within the shallow zone or cover[a] soil samples are equal to or greater than the PRG[b] values in Table B-5, remove/dispose of the chemically contaminated soils. Otherwise, initiate waste site closeout. |
| 6b | Verification | If the maximum detected sample concentrations of chemical constituents within the soil samples from the shallow zone, or cover[a] soil samples are equal to or greater than two times the PRG[b] values in Table B-5, remove the chemically contaminated soils. Otherwise, initiate waste site closeout. |

Table B-3. Unplanned Release Decision Rules. (2 Pages)

| DR # | Application | Decision Rule |
|---|---|---|
| 6c | Verification | If 10% of the detected sample concentrations of chemical constituents within the soil samples from the shallow zone, or cover[a] soil samples are equal to or greater than the limiting PRG[b] values in Table B-5, remove the chemically contaminated soils. Otherwise, initiate waste site closeout. |

[a]Decision unit definitions and sizes as stated in Table B-13.

[b]PRGs are applied to unplanned releases within the Core Zone via an industrial land-use scenario. PRGs are applied to unplanned releases outside the Core Zone using a rural-residential land-use scenario.

ANL, 2002, *RESRAD for Windows*, Version 6.21.

DR = decision rule.
DS = decision statement.
FS = feasibility study.
PRG = preliminary remediation goal.
RESRAD = RESidual RADioactivity (dose model).
RI/FS = remedial investigation/feasibility study.
RTD = remove/treat/dispose.
UCL = upper confidence limit.

Table B-4. Summary of Potential 200-UR-1 Operable Unit Radionuclide Soil Preliminary Remediation Goals.

| Contaminant | First Remedial Action Objective – Protection from Direct Exposure[a,b] | | Ecological Protection[c] |
|---|---|---|---|
| | Potential PRG for Radionuclides (pCi/g) 15 mrem/yr Industrial (Inside Core Zone) | Potential PRG for Radionuclides (pCi/g) 15 mrem/yr Residential (Outside Core Zone) | Ecological Soil Screening Values (pCi/g) |
| Americium-241 | 210 | 31.1 | 3,890 |
| Carbon-14 | 33,100 | 5.16 | -- |
| Cesium-137 | 25 | 6.2 | 20.8 |
| Cobalt-60 | 5.2 | 1.4 | 692 |
| Europium-152 | 12 | 3.3 | 1,520 |
| Europium-154 | 11 | 3.0 | 1,290 |
| Europium-155 | 518 | 125 | 15,800 |
| Neptunium-237 | 59.2 | 2.5 | -- |
| Nickel-63 | 3,070,000 | 4,026 | -- |
| Niobium-94[d] | 8.25 | 2.43 | -- |
| Plutonium-238 | 155 | 37.4 | -- |
| Plutonium-239/240 | 245 | 33.9 | 6,110[e] |
| Strontium-90 | 2,500 | 4.5 | 22.5 |
| Technetium-99 | 12,000 | 15 | 4,490 |
| Tritium[f] | 471 | 400 | 174,000 |
| Uranium-233/234 | 267 | 1.1 | 4,830 |
| Uranium-235/236 | 101 | 1.0 | 2,770[g] |
| Uranium-238 | 267 | 1.1 | 1,580 |

NOTE: Values in the table are PRGs based on the generic site model. Site-specific values will be calculated for site closeout verification using site-specific information.

[a]Direct exposure values represent soil activities for individual radionuclides that would meet the RAO for cumulative risk (i.e., $10^{-4}$ to $10^{-6}$ risk) from exposure to contaminated waste/soil. Values will be lower for multiple radionuclides to achieve the same risk endpoint. Listed values are calculated by RESRAD and apply to the top 4.6 m (15 ft).

[b]In the shallow zone, cleanup must achieve the direct exposure RAO.

[c]Based on DOE-STD-1153-2002 for use in U.S. Department of Energy compliance and risk assessment activities.

[d]Contaminant of concern applicable to Plutonium Finishing Plant Area only.

[e]Plutonium-239.

[f]Constituent will be retained only at liquid spill sites.

[g]Uranium-235.

ANL, 2002, *RESRAD for Windows*, Version 6.21.

DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota.*

PRG = preliminary remediation goal.
RAO = remedial action objective.
RESRAD = RESidual RADioactivity dose model.

Table B-5. Summary of 200-UR-1 Operable Unit Nonradionuclide Soil Preliminary Remediation Goals. (3 Pages)

| Contaminant | First Remedial Action – Protection from Direct Exposure | | Ecological Protection[a] | |
|---|---|---|---|---|
| | PRGs for Nonradionuclides (mg/kg) Industrial (Inside Core Zone) | PRGs for Nonradionuclides (mg/kg) Residential (Outside Core Zone) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) |
| **Inorganic Chemical Constituents (mg/kg)** | | | | |
| Antimony | 1,400 | 32 | [b] | [b] |
| Arsenic | 87.5 | 0.667 | 20[c] | 20[c] |
| Barium | 245,000 | 5,600 | 1,250 | 1,320 |
| Beryllium | 7,000 | 16 | 25 | [b] |
| Cadmium | 3,500 | 80 | 25 | 36 |
| Chromium (III) | No limit | 120,000 | 42[d] | 135[d] |
| Copper | 130,000 | 2,960 | 100 | 550 |
| Hexavalent chromium | 18.4[e] | 18.4[e] | -- | -- |
| Lead | No limit | 250 | 220 | 220 |
| Mercury | 1,050 | 24 | 9[f] | 9[f] |
| | | | 0.7[g] | 0.7[g] |
| Molybdenum | 17,500 | 400 | [b] | [b] |
| Nickel | 70,000 | 1,600 | 100 | 1,850 |
| Selenium | 17,500 | 400 | 0.8 | 0.8 |
| Silver | 17,500 | 400 | [b] | [b] |
| Thallium | 245 | 5.6 | -- | -- |
| Vanadium | 24,500 | 560 | 26 | [b] |
| Zinc | No limit | 24,000 | 270 | 570 |
| Cyanide | 70,000 | 1,600 | -- | -- |
| Nitrate/nitrite | 350,000 | 8,000 | -- | -- |
| **Organic Chemical Constituents (mg/kg)** | | | | |
| Acetone | No limit | 72,000 | -- | -- |
| Acetonitrile | 21,000 | 480 | -- | -- |
| Benzene | 2,390 | 18.2 | -- | -- |
| Benzyl alcohol | No limit | 24,000 | -- | -- |
| Bromodichloromethane | 2,120 | 16.1 | -- | -- |
| n-butyl alcohol (1-butanol) | 350,000 | 8,000 | -- | -- |
| Carbon tetrachloride | 1,010 | 7.69 | -- | -- |
| Chlorobenzene | 70,000 | 1,600 | -- | -- |
| Chloroform (trichloromethane) | 21,500 | 164 | -- | -- |
| Cis/Trans-1,2-Dichloroethylene | 35,000 | 80 | -- | -- |
| Cyclohexanone | No limit | 400,000 | -- | -- |
| 1,1-Dichloroethane | 350,000 | 8,000 | -- | -- |
| 1,2-Dichloroethane | 1,444 | 11 | -- | -- |
| 1,1-Dichloroethylene | 219 | 1.67 | -- | -- |
| Dichloromethane (methylene chloride) | 17,500 | 133 | -- | -- |

Table B-5. Summary of 200-UR-1 Operable Unit Nonradionuclide Soil Preliminary Remediation Goals. (3 Pages)

| Contaminant | First Remedial Action – Protection from Direct Exposure | | Ecological Protection[a] | |
|---|---|---|---|---|
| | PRGs for Nonradionuclides (mg/kg) Industrial (Inside Core Zone) | PRGs for Nonradionuclides (mg/kg) Residential (Outside Core Zone) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) |
| p-Dichlorobenzene | 5,470 | 41.7 | -- | -- |
| Ethyl benzene | 350,000 | 8,000 | -- | -- |
| Ethyl ether | 70,000 | 16,000 | -- | -- |
| Hexane | 210,000 | 4,800 | -- | -- |
| Hexone | 280,000 | 6,400 | -- | -- |
| Methyl ethyl ketone | No limit | 48,000 | -- | -- |
| Methyl isobutyl ketone (MIBK) | 280,000 | 6,400 | -- | -- |
| Perchloroethylene (tetrachloroethene) | 2,570 | 19.6 | -- | -- |
| Phenol | No limit | 24,000 | -- | -- |
| Pseudo cumenen (1,2,4-trimethyl benzene) | 175,000 | 4,000 | -- | -- |
| Tetrahydrofuran | 3,500 | 80 | -- | -- |
| Toluene | 700,000 | 16,000 | -- | -- |
| 1,1,1-Trichloroethane (TCA) | No limit | 72,000 | -- | -- |
| 1,1,2-Trichloroethane | 2,300 | 17.5 | -- | -- |
| Tetrachloroethylene (PCE) | 2,570 | 19.6 | -- | -- |
| Trichloroethylene (TCE) | 11,900 | 90.9 | -- | -- |
| Vinyl chloride | 87.5 | 0.667 | -- | -- |
| Xylenes | 700,000 | 16,000 | -- | -- |
| **Other Constituents (mg/kg)** | | | | |
| Polyaromatic hydrocarbons | Compound-specific | Compound-specific | -- | -- |
| Pesticides | Compound-specific | Compound-specific | -- | -- |
| Total petroleum hydrocarbon | 2,000 | 2,000 | 200[h] | 12,000[h] |
| | | | 460[i] | 15,000[i] |
| Polychlorinated biphenyls | 10[j] | 0.5[j] | 2[k] | 2[k] |
| Hydraulic fluids (greases) | 2,000 | 2,000 | -- | -- |
| Kerosene, normal paraffins, paint thinner | 2,000 | 2,000 | -- | -- |

Table B-5. Summary of 200-UR-1 Operable Unit Nonradionuclide Soil Preliminary Remediation Goals. (3 Pages)

| Contaminant | First Remedial Action – Protection from Direct Exposure | | Ecological Protection[a] | |
|---|---|---|---|---|
| | PRGs for Nonradionuclides (mg/kg) Industrial (Inside Core Zone) | PRGs for Nonradionuclides (mg/kg) Residential (Outside Core Zone) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) |

[a]From Table 749-2, WAC 173-340-900: "Priority Contaminants of Ecological Concern for Sites that Qualify for the Simplified Terrestrial Ecological Evaluation Procedure."

[b]Safe concentration has not yet been established. See WAC 173-340-7492(2)(c).

[c]The ecological screening in Table 749-2 provides different values for Arsenic III and Arsenic V. The laboratories used cannot make these isomer distinctions; therefore, the most conservative value has been adopted.

[d]Chromium (total) value from Table 749-2.

[e]Hexavalent chromium concentration that is protective of groundwater.

[f]Inorganic mercury.

[g]Organic mercury.

[h]Gasoline range organics.

[i]Diesel range organics.

[j]Compliance is based on the sum of all aroclors detected.

[k]Polychlorinated biphenyl mixtures (total).

WAC-173-340-900, "Tables."
WAC 173-340-7492, "Simplified Terrestrial Ecological Evaluation Procedures."

PRG = preliminary remediation goal.

Table B-6. Radiological Analytical Performance Requirements. (2 Pages)

| Chemical Abstracts Service # | Analyte | Survey or Analytical Method | Human Health Action Levels | | Ecological Protection | Required Detection Limits[a] (pCi/g) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|
| | | | 15 mrem/yr Residential (pCi/g) | 15 mrem/yr Industrial (pCi/g) | Ecological Soil Screening Values (pCi/g) | | | |
| 14596-10-2 | Americium-241 | AmAEA[b] | 31.1 | 210 | 3,890 | 1 | ±30%[c] | 70-130[c] |
| 14762-75-5 | Carbon-14 | Liquid scintillation | 5.16 | 33,100 | -- | 5 | ±30%[c] | 70-130[c] |
| 10045-97-3 | Cesium-137 | HPGe/GeLi | 6.2 | 25 | 20.8 | 0.1 | ±30%[c] | 70-130[c] |
| 10198-40-0 | Cobalt-60 | HPGe/GeLi | 1.4 | 5.2 | 692 | 0.05 | ±30%[c] | 70-130[c] |
| 14683-23-9 | Europium-152 | HPGe/GeLi | 3.3 | 12 | 1,520 | 0.1 | ±30%[c] | 70-130[c] |
| 15585-10-1 | Europium-154 | HPGe/GeLi | 3.0 | 11 | 1,290 | 0.1 | ±30%[c] | 70-130[c] |
| 14391-16-3 | Europium-155 | HPGe/GeLi | 125 | 518 | 15,800 | 0.1 | ±30%[c] | 70-130[c] |
| 13994-20-2 | Neptunium-237 | NpAEA[b] | 2.5 | 59.2 | -- | 1 | ±30%[c] | 70-130[c] |
| 13981-37-8 | Nickel-63 | Liquid scintillation | 4,026 | 3,070,000 | -- | 30 | ±30%[c] | 70-130[c] |
| 14681-63-1 | Niobium-94[d] | HPGe/GeLi | 2.43 | 8.25 | -- | 1 | ±30%[c] | 70-130[c] |
| 13981-16-3 | Plutonium-238 | PuAEA[b] | 37.4 | 155 | -- | 1 | ±30%[c] | 70-130[c] |
| Pu-239/240 | Plutonium-239/240 | PuAEA[b] | 33.9 | 245 | 6,110[e] | 1 | ±30%[c] | 70-130[c] |
| 13982-63-3 | Radium-226 | HPGe/GeLi | N/A | 7.9 | -- | 0.2 | ±30%[c] | 70-130[c] |
| Rad-Sr | Strontium-90 | Rad Sr | 4.5 | 2,500 | 22.5 | 1 | ±30%[c] | 70-130[c] |
| 14133-76-7 | Technetium-99 | Liquid scintillation | 15 | 12,000 | 4,490 | 15 | ±30%[c] | 70-130[c] |
| 10028-17-8 | Tritium | Liquid separation | 400 | 471 | 174,000 | 400 | ±30%[c] | 70-130[c] |
| 13966-29-5 | Uranium-233/234 | UAEA[b] | 1.1 | 267 | 4,830 | 1 | ±30%[c] | 70-130[c] |
| 15117-96-1 | Uranium-235/236 | | 1.0 | 101 | 2,770[f] | 1 | ±30%[c] | 70-130[c] |
| U-238 | Uranium-238 | | 1.1 | 267 | 1,580 | 1 | ±30%[c] | 70-130[c] |

Table B-6. Radiological Analytical Performance Requirements. (2 Pages)

| Chemical Abstracts Service # | Analyte | Survey or Analytical Method | Human Health Action Levels | | Ecological Protection | Required Detection Limits[a] (pCi/g) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|
| | | | 15 mrem/yr Residential (pCi/g) | 15 mrem/yr Industrial (pCi/g) | Ecological Soil Screening Values (pCi/g) | | | |
| N/A | Gross cesium-137 counts | Portable NaI detector | -- | -- | -- | 3.1 | N/A | N/A |
| N/A | Gross alpha | Portable contamination detector | -- | -- | -- | 100 d/min/ 100 $cm^2$ | N/A | N/A |
| N/A | Gross beta/gamma | Portable contamination detector | -- | -- | -- | 5,000 d/min/ 100 $cm^2$ | N/A | N/A |

[a]Units are in pCi/g (radioisotopes) unless otherwise specified.

[b]AmAEA, NpAEA, PuAEA, ThAEA, UAEA = chemical separation, electro/microprecipitation deposition, alpha energy analysis via Si barrier detector.

[c]Accuracy criteria for associated batch laboratory control sample percent recoveries. Except for gamma energy analysis, additional analysis-specific evaluations also performed for matrix spikes, tracers, and carriers as appropriate to the method. Precision criteria for batch laboratory replicate sample analyses.

[d]Contaminant of concern analysis only applicable to Plutonium Finishing Plant Area.

[e]Plutonium-239.

[f]Uranium-235.

AEA = alpha energy analysis.
GeLi = germanium-lithium.
HPGe = high-purity germanium.
N/A = not applicable.

Table B-7. Nonradiological Analytical Performance Requirements. (6 Pages)

| CAS # | Analyte | Survey or Analytical Method[a] | Human Health Action Levels | | Ecological Protection | | Required Detection Limits[b] (mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | Method B Residential (mg/kg) | Method C Industrial (mg/kg) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) | | | |
| 7440-36-0 | Antimony | EPA Method 6010 | 32 | 1,400 | [c] | [c] | 6 | ±30%[d] | 70-130[d] |
| 7440-38-2 | Arsenic | EPA Method 6010 (Trace ICP) | 0.667 | 87.5 | 20[e] | 20[e] | 1 | ±30%[d] | 70-130[d] |
| 7440-39-3 | Barium | EPA Method 6010 | 5,600 | 245,000 | 1,250 | 1,320 | 20 | ±30%[d] | 70-130[d] |
| 7440-41-7 | Beryllium | EPA Method 6010 | 16 | 7,000 | 25 | [c] | 0.5 | ±30%[d] | 70-130[d] |
| 7440-43-9 | Cadmium | EPA Method 6010 | 0.5 | 3,500 | 25 | 36 | 0.5 | ±30%[d] | 70-130[d] |
| 7440-47-3 | Chromium (III) | EPA Method 6010 | 120,000 | No limit | 42[f] | 135[f] | 1 | ±30%[d] | 70-130[d] |
| 7440-50-8 | Copper | EPA Method 6010 | 2,960 | 130,000 | 100 | 550 | 2.5 | ±30%[d] | 70-130[d] |
| 18540-29-9 | Hexavalent chromium | EPA Method 7196 | 18.4[g] | 18.4[g] | -- | -- | 0.5 | ±30%[d] | 70-130[d] |
| 7439-92-1 | Lead | EPA Method 6010 | 10.2 | 1000 | 220 | 220 | 10 | ±30%[d] | 70-130[d] |
| 7439-97-6 | Mercury | EPA Method 7471 | 0.33 | 1,050 | 9[h] | 9[h] | 0.2 | ±30%[d] | 70-130[d] |
| | | | | | 0.7[i] | 0.7[i] | | | |
| 7439-98-7 | Molybdenum | EPA Method 6010 | 400 | 17,500 | [c] | [c] | 2 | ±30%[d] | 70-130[d] |
| 7440-02-0 | Nickel | EPA Method 6010 | 1,600 | 70,000 | 100 | 1.850 | 4 | ±30%[d] | 70-130[d] |

Table B-7. Nonradiological Analytical Performance Requirements. (6 Pages)

| CAS # | Analyte | Survey or Analytical Method[a] | Human Health Action Levels | | Ecological Protection | | Required Detection Limits[b] (mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | Method B Residential (mg/kg) | Method C Industrial (mg/kg) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) | | | |
| 7782-49-2 | Selenium | EPA Method 6010 (Trace ICP) | 400 | 17,500 | 0.8 | 0.8 | 1[j] | ±30%[d] | 70-130[d] |
| 7440-22-4 | Silver | EPA Method 6010 | 400 | 17,500 | [c] | [c] | 2 | ±30%[d] | 70-130[d] |
| 7440-28-0 | Thallium | EPA Method 6010 | 5.6 | 245 | -- | -- | 5 | ±30%[d] | 70-130[d] |
| 7440-62-2 | Vanadium | EPA Method 6010 | 560 | 24,000 | 26 | [c] | 5 | ±30%[d] | 70-130[d] |
| 7440-66-6 | Zinc | EPA Method 6010 | 24,000 | No limit | 270 | 570 | 2 | ±30%[d] | 70-130[d] |
| 57-12-5 | Cyanide | EPA Method 9010 total cyanide | 1,600 | 70,000 | -- | -- | 2 | ±30%[d] | 70-130[d] |
| $NO_3/NO_2$-N | Nitrate/nitrite | IC 300 Modified and 353.1 | 8,000 | 350,000 | -- | -- | 0.75 | ±30%[d] | 70-130[d] |
| **Organic Chemical Constituents (mg/kg or as noted)** | | | | | | | | | |
| 67-64-1 | Acetone | EPA Method 8260 | 72,000 | No limit | -- | -- | 0.02 | ±30%[d] | 70-130[d] |
| 75-05-8 | Acetonitrile | EPA Method 8260 | 480 | 21,000 | -- | -- | 0.1 | ±30%[d] | 70-130[d] |
| 71-43-2 | Benzene | EPA Method 8260 | 18.2 | 2,390 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 100-51-6 | Benzyl alcohol | EPA Method 8260/8270 | 24,000 | No limit | -- | -- | 0.33 | ±30%[d] | 70-130[d] |

Table B-7. Nonradiological Analytical Performance Requirements. (6 Pages)

| CAS # | Analyte | Survey or Analytical Method[a] | Human Health Action Levels | | Ecological Protection | | Required Detection Limits[b] (mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | Method B Residential (mg/kg) | Method C Industrial (mg/kg) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) | | | |
| 75-27-4 | Bromodichloro-methane | EPA Method 8260 | 16.1 | 2,120 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 71-36-3 | n-butyl alcohol (1-butanol) | EPA Method 8015 | 8,000 | 350,000 | -- | -- | 5 | ±30%[d] | 70-130[d] |
| 56-23-5 | Carbon tetrachloride | EPA Method 8260 | 7.69 | 1,010 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 108-90-7 | Chlorobenzene | EPA Method 8260 | 1,600 | 70,000 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 67-66-3 | Chloroform (trichloromethane) | EPA Method 8260 | 164 | 21,500 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 156-59-2/ 156-60-5 | Cis/Trans-1,2-Dichloroethylene | EPA Method 8260 | 80 | 35,000 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 108-94-1 | Cyclohexanone | EPA Method 8270 | 400,000 | No limit | -- | -- | TIC[k] | N/A | N/A |
| 75-34-3 | 1,1-Dichloroethane | EPA Method 8260 | 8,000 | 350,000 | -- | -- | 0.01 | ±30%[d] | 70-130[d] |
| 107-06-2 | 1,2-Dichloroethane | EPA Method 8260 | 11 | 1,444 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 75-35-4 | 1,1-Dichloroethylene | EPA Method 8260 | 1.67 | 219 | -- | -- | 0.01 | ±30%[d] | 70-130[d] |
| 75-09-2 | Dichloromethane (methylene chloride) | EPA Method 8260 | 133 | 17,500 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 106-46-7 | p-Dichlorobenzene | EPA Method 8270 | 41.7 | 5,470 | -- | -- | 0.33 | ±30%[d] | 70-130[d] |
| 100-41-4 | Ethyl benzene | EPA Method 8260 | 8,000 | 350,000 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |

Table B-7. Nonradiological Analytical Performance Requirements. (6 Pages)

| CAS # | Analyte | Survey or Analytical Method[a] | Human Health Action Levels | | Ecological Protection | | Required Detection Limits[b] (mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | Method B Residential (mg/kg) | Method C Industrial (mg/kg) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) | | | |
| 60-29-7 | Ethyl ether | EPA Method 8015 | 16,000 | 70,000 | -- | -- | 5 | ±30%[d] | 70-130[d] |
| 10-54-3 | Hexane | EPA Method 8260 | 4,800 | 210,000 | -- | -- | TIC[k] | ±30%[d] | 70-130[d] |
| 108-10-1 | Hexone (Methyl isobutyl ketone - MIBK) | EPA Method 8260 | 6,400 | 280,000 | -- | -- | 0.01 | ±30%[d] | 70-130[d] |
| 78-93-3 | Methyl ethyl ketone (MEK) | EPA Method 8260 | 48,000 | No limit | -- | -- | 0.01 | ±30%[d] | 70-130[d] |
| 127-18-4 | Perchloroethylene (tetrachloroethene) | EPA Method 8260 | 19.6 | 2,570 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 108-95-2 | Phenol | EPA Method 8270 | 24,000 | No limit | -- | -- | 0.33 | ±30%[d] | 70-130[d] |
| 95-63-6 | Pseudocumene (1,2,4-trimethyl benzene) | EPA Method 8260 | 4,000 | 175,000 | -- | -- | TIC[k] | ±30%[d] | 70-130[d] |
| 109-99-9 | Tetrahydrofuran | EPA Method 8260 | 80 | 3,500 | -- | -- | 0.05 | ±30%[d] | 70-130[d] |
| 108-88-3 | Toluene | EPA Method 8260 | 16,000 | 700,000 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 71-55-6 | 1,1,1-Trichloroethane (TCA) | EPA Method 8260 | 72,000 | No limit | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 79-00-5 | 1,1,2-Trichloroethane | EPA Method 8260 | 17.5 | 2,300 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 127-18-4 | Tetrachloroethylene (PCE) | EPA Method 8260 | 19.6 | 2,570 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |

Table B-7. Nonradiological Analytical Performance Requirements. (6 Pages)

| CAS # | Analyte | Survey or Analytical Method[a] | Human Health Action Levels | | Ecological Protection | | Required Detection Limits[b] (mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | Method B Residential (mg/kg) | Method C Industrial (mg/kg) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) | | | |
| 79-01-6 | Trichloroethylene (TCE) | EPA Method 8260 | 90.9 | 11,900 | -- | -- | 0.005 | ±30%[d] | 70-130[d] |
| 75-04-1 | Vinyl chloride | EPA Method 8260 | 0.667 | 87.5 | -- | -- | 0.01 | ±30%[d] | 70-130[d] |
| 1330-20-7 | Xylenes | EPA Method 8260 | 16,000 | 700,000 | -- | -- | 0.01 | ±30%[d] | 70-130[d] |
| **Other Constituents (mg/kg or as noted)** | | | | | | | | | |
| N/A | Polyaromatic hydrocarbons | EPA Method 8310 | Compound Specific | Compound Specific | -- | -- | 0.015[l] | ±30%[d] | 70-130[d] |
| N/A | Pesticides | EPA Method 1311/8081 | Compound Specific | Compound Specific | -- | -- | Compound Specific | ±30%[d] | 70-130[d] |
| | | EPA Method 8081 | | | | | 0.005[m] | ±30%[d] | 70-130[d] |
| N/A | Total petroleum hydrocarbon | EPA Method 8015/418.1 | 2,000 | 2,000 | 200[n] | 12,000[n] | 5 | ±30%[d] | 70-130[d] |
| | | | | | 46[o] | 15,000[o] | | | |
| N/A | Polychlorinated biphenyls | EPA Method 8082 | 0.5 | 10 | 2[p] | 2[p] | 0.02 | ±30%[d] | 70-130[d] |
| N/A | Hydraulic fluids (greases) | Oil & Grease – 413.N | 2,000 | 2,000 | -- | -- | 200 | ±30%[d] | 70-130[d] |
| 8008-20-6 | Kerosene, normal paraffins, paint thinner | NWTPH-Dx modified for kerosene range | 2,000 | 2,000 | -- | -- | 5 | ±30%[d] | 70-130[d] |

Table B-7. Nonradiological Analytical Performance Requirements. (6 Pages)

| CAS # | Analyte | Survey or Analytical Method[a] | Human Health Action Levels | | Ecological Protection | | Required Detection Limits[b] (mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|---|---|---|
| | | | Method B Residential (mg/kg) | Method C Industrial (mg/kg) | Unrestricted Land Use (mg/kg) (Outside Core Zone) | Industrial or Commercial Site (mg/kg) (Inside Core Zone) | | | |

[a]For 4-digit EPA methods, see SW-846. For EPA Methods 300.0, 353.1, 413.N, and 418.1, see EPA/600/4-79/020.

[b]Detection limits are based on optimal conditions in a standard fixed laboratory. Interferences and matrix effects may degrade the values shown.

[c]Safe concentration has not yet been established. See WAC 173-340-7492(2)(c).

[d]Accuracy criteria is the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also performed for matrix spikes, and surrogates as appropriate to the method. Precision criteria for batch laboratory replicate matrix spike analyses.

[e]The ecological screening Table 749-2 provides different values for Arsenic III and Arsenic V. The laboratories used cannot make these isomer distinctions; therefore, the most conservative value has been adopted.

[f]Chromium (total) value from Table 749-2.

[g]Hexavalent chromium concentration that is protective of groundwater.

[h]Inorganic mercury.

[i]Organic mercury.

[j]Special arrangements will be made with the laboratory to achieve detection limit needed for ecological action level for selenium.

[k]This compound will be reported as a tentatively identified compound if present in detectable quantities. Analytical methodologies shown can be calibrated for these compounds at extra expense and may be required if significant quantities are discovered. Establishment of required detection limits is not appropriate for these compounds at this time.

[l]The calculated action level is below established analytical methodology capabilities. The analytical detection limits would be used for working action levels and would be periodically reviewed to establish if lower detection limit capabilities are available.

[m]Maximum detection limit for pesticides, except for chlordanes.

[n]Gasoline range organics.

[o]Diesel range organics.

[p]Polychlorinated biphenyl mixtures (total).

EPA/600/4-79/020, *Methods for Chemical Analysis of Water and Wastes.*
SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A.*
WAC 173-340-7492, "Simplified Terrestrial Ecological Evaluation Procedures."

CAS = Chemical Abstracts Service.
EPA = U.S. Environmental Protection Agency.
TIC = tentatively identified compound.
WAC = *Washington Administrative Code.*

Table B-8. Sample Preservation, Container, and Holding Time Guidelines.

| Analytes | Analytical Priority | Matrix | Bottle | | Volume* | Preservation | Packing Requirements | Holding Time |
|---|---|---|---|---|---|---|---|---|
| | | | Number | Type | | | | |
| **Radionuclides** | | | | | | | | |
| Americium AEA | 2 | Soil | 1 | G/P | 10 g | None | None | 6 months |
| Gamma spectroscopy | 4 | Soil | 1 | G/P | 1,500 g | None | None | 6 months |
| Carbon-14 | 10 | Soil | 1 | G/P | 10g | None | None | 6 months |
| Isotopic plutonium | 1 | Soil | 1 | G/P | 10 g | None | None | 6 months |
| Isotopic thorium | 8 | Soil | 1 | G/P | 6 g | None | None | 6 months |
| Isotopic uranium | 7 | Soil | 1 | G/P | 10 g | None | None | 6 months |
| Neptunium-237 | 4 | Soil | 1 | G/P | 10 g | None | None | 6 months |
| Nickel-63 | 10 | Soil | 1 | G/P | 6 g | None | None | 6 months |
| Radiogenic strontium | 6 | Soil | 1 | G/P | 10 g | None | None | 6 months |
| Technetium-99 | 10 | Soil | 1 | G/P | 6 g | None | None | 6 months |
| Tritium – H-3 | 15 | Soil | 1 | G | 100 g | None | None | 6 months |
| **Chemicals** | | | | | | | | |
| Alcohols, glycols, and ketones – 8015 | 11 | Soil | 3 | G | 40 mL | None | Cool 4°C | 14 days |
| IC anions – 300.0 | 17 | Soil | 1 | G/P | 250 g | None | Cool 4°C | 28 days/ 48 hours |
| ICP metals – 6010A (TAL + add-on) | 3 | Soil | 1 | G/P | 125 g | None | None | 6 months |
| Hexavalent chromium – 7196 | 13 | Soil | 1 | G/P | 60 g | None | Cool 4°C | 30 days |
| Mercury – 7471 – (CV) | 12 | Soil | 1 | G | 125 g | None | None | 28 days |
| PCBs – 8082 | 5 | Soil | 1 | G | 250 g | None | Cool 4°C | 14/40 days |
| SVOA – 8270A (TCL) | 10 | Soil | 1 | G | 250 g | None | Cool 4°C | 14/40 days |
| Sulfides – 9030 | 14 | Soil | 1 | G | 40 g | None | Cool 4°C | 7 days |
| Total petroleum hydrocarbons – kerosene range | 9 | Soil | 1 | G | 200 g | None | Cool 4°C | 14 days |
| Methanol – VOA-8015 | 19 | Soil | 1 | G | 50 g | None | Cool 4°C | 14 days |
| VOA – 8260A (TCL) | 16 | Soil | 1 | G | 50 g | None | Cool 4°C | 14 days |

*Optimal volumes, which may be adjusted downward to accommodate the possibility of small sample recoveries. Minimum sample size will be defined in the Sampling Authorization Form.

AEA = alpha energy analysis.
CV = cold vapor.
G = glass.
IC = ion chromatography.
ICP = inductively coupled plasma.
P = plastic.
PCB = polychlorinated biphenyl.
SVOA = semivolatile organic analyte.
TAL = target analytical list.
TCL = target compound list.
VOA = volatile organic analyte.

Table B-9. Conceptual Site Models for Sampling Design.

| Conceptual Site Model Category | Release Type and Contaminant Depth Interval | Physical Settings |
|---|---|---|
| 1 | Animal Droppings, Vegetation Material, and Windblown Particulates (0 to 0.3 m depth interval of suspected contamination) | Outlying areas |
| 2 | Small Spill/Leak Sites (0 to 0.3 m depth interval of suspected contamination) | Roadways |
| | | Railroads |
| | | Storage yards |
| 3 | Moderate Spill/Leak Sites (0 to 2 m depth interval of suspected contamination) | Roadways |
| | | Railroads |
| | | Storage yards |
| 4 | Larger Spill/Leak Sites (0 to 4.6 m depth interval of suspected contamination) | Unique locations/areas |

Table B-10. Potential Radiological Field-Screening Methods.

| COPC | Waste Site COPC Profiles | Potential Field Screening Method | Applications/Potential Limitations |
|---|---|---|---|
| Gross Cs-137 counts | Potentially all sites with radiological contamination | Portable NaI detector | Field surveys; very sensitive gamma detector. |
| Gross alpha | | Portable contamination detector | Health and safety uses/limited detection capability, alpha particles are readily shielded; contamination may be missed during surveys. |
| Gross beta/ gamma | | Portable contamination detector | Health and safety uses/limited detection capability, beta particles may be shielded by soil/concrete; contamination may be missed during surveys. |
| | | Laser-Assisted Ranging and Data System (LARADS) | Data logging system that allows use of multiple types of radiological detectors and stores both radiological and physical (geographic) location data. Requires establishment of two benchmarks to provide geographic position correlation. |

COPC = contaminant of potential concern.
LARADS = Laser-Assisted Ranging and Data System.
NaI = sodium iodide.

Table B-11. Potential Chemical Field-Screening Measurement Methods. (2 Pages)

| Variable | Potentially Appropriate Measurement Method[a] | Possible Limitations or Reservations |
|---|---|---|
| Arsenic | X-ray fluorescence[b] | DL (75 mg/kg) |
| Barium | X-ray fluorescence[b] | DL (300 mg/kg) |
| Cadmium | X-ray fluorescence[b] | DL (75 mg/kg) |
| Chlorine (chlorinated compounds) | X-ray fluorescence[b] | Calibration and correlation to compound of interest; DL is unknown |
| Chromium (total) | X-ray fluorescence[b] | DL (400 mg/kg) |
| Chromium (VI) | Water extraction and colorimetric analysis | Interferences (iron) and soil alkalinity. DL (2 to 5 mg/kg) |
| Lead | X-ray fluorescence[b] | DL (100 mg/kg) |
| Mercury | Mercury vapor monitor | DL associated with soil concentrations well above the remedial action goal |
| Mercury | Immunoassay | DL (0.5 mg/kg). Results reported within a prespecified range. Analysis takes 15 to 30 minutes. |
| Mercury | X-ray fluorescence[b] | DL (100 mg/kg) |
| Selenium | X-ray fluorescence[b] | DL (200 mg/kg) |
| Silver | X-ray fluorescence[b] | DL (100 mg/kg) |
| Zinc | X-ray fluorescence[b] | DL (400 mg/kg) |
| Sulfate | X-ray fluorescence[b] | Calibration and correlation to elemental sulfur required |
| Polyaromatic hydrocarbons | Immunoassay | DL (1 to 5 mg/kg). Results reported within a prespecified range. Analysis takes 15 to 30 minutes. |
| Polychlorinated biphenyls | Immunoassay | DL (0.1 to 0.3 mg/kg). Results reported within a prespecified range. Analysis takes 15 to 30 minutes. |
| Pesticides | Immunoassay | DL approximately 10 mg/kg. Need to know specific pesticide of interest. Results reported within a prespecified range. Analysis takes 15 to 30 minutes. |
| Total petroleum hydrocarbons | Immunoassay | DL (5 to 10 mg/kg). Results reported within a prespecified range. Need to know if gasoline or diesel products. Analysis takes 15 to 30 minutes. |
| VOCs | Colorimetric tube | Tube capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. |
| VOCs | Flame ionization detector (e.g., Foxboro OVA 128)[c] | DL (1 to 5 mg/kg, methane-equivalent). Instrument capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. Limited to hydrogen containing compounds. |

Table B-11. Potential Chemical Field-Screening Measurement Methods. (2 Pages)

| Variable | Potentially Appropriate Measurement Method[a] | Possible Limitations or Reservations |
|---|---|---|
| VOCs | Photoacoustic infrared analyzer (e.g., B&K 1302)[d] | Instrument capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. |
| VOCs | Photo-ionization detector (e.g., thermo analytical organic vapor monitor) | DL (1 to 5 mg/kg, isobutylene-equivalent). Instrument capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. Limited to photo-ionizing compounds at 10.6 eV. |
| VOCs | Portable gas chromatograph with photo-ionization detector (e.g., Photovac 10S Plus)[e] | DL (sub-mL/m$^3$ levels depending on VOC of interest). Instrument capability must be compared to the site-specific need to determine if field detection limits would be sufficient for the VOC of interest. Need to know specific VOCs of interest. Limited to photo-ionizing compounds at 11.7 eV. |
| VOCs | Transportable mass spectrometer | Instrument use requires extensive training. Capital cost and setup are high; operational cost is moderate. |

[a]Other methods may be identified and implemented in conjunction with technology development.

[b]Metals by X-ray fluorescence require calibration to site-specific soils. Detection of chromium, aluminum, and sulfur could be greatly enhanced (50 to 100 mg/kg) with the purchase of a SiLi detector with Fe-55 source at a cost of about $20,000. Requires management of radioactive source (i.e., Am-241, Cm-244, or Fe-55).

[c]Foxboro and OVA 128 are trademarks of The Foxboro Company, Foxboro, Massachusetts.

[d]B&K 1302 is a trademark of Brüel and Kjær, Nærum, Denmark.

[e]Photovac 10S Plus is a trademark of Photovac, Inc., Waltham, Massachusetts.

DL = detection limit.
VOC = volatile organic compound.

Table B-12. Sampling Objectives Frequencies, and Basis for Remove/Treat/Dispose Sites.

| Sampling Objectives | Physical Samples | |
|---|---|---|
| | Number of Samples | Basis |
| Soil stabilization cover | Divide pile into decision units,[a] collect representative samples per decision unit. Collect four discrete aliquots per representative sample.[b] | Overburden pile sampling for statistical evaluation. |
| Site verification (shallow) (0 to 4.6 m [15 ft]) | Divide area into decision units[a] and collect representative samples per decision unit. Collect four discrete aliquots per representative sample.[b] | Shallow zone cleanup verification samples for statistical evaluation. |
| Backfill | No samples. | Radiation survey. |

[a]Based on the size of the waste site. Refer to Table B-13.
[b]Refer to Table B-14.

DS = decision statement.
N/A = not applicable.

Table B-13. Number of Decision Subunits Based on Exposed Waste Site Area.

| Decision Units | Waste Site Area | Number of Decision Subunits |
|---|---|---|
| Soil stabilization cover stockpiles | Very small area of exposed cover (<100 $m^2$ [1,076 $ft^2$]) | 1 |
| | Small area of exposed cover (>100 $m^2$ [1,076 $ft^2$] but <500 $m^2$ [5,380 $ft^2$]) | 2 |
| | Small-medium area of exposed cover (>500 $m^2$ [5,380 $ft^2$] but <1000 $m^2$ [10,760 $ft^2$]) | 4 |
| | Medium-large area of exposed cover (>1000 $m^2$ [10,760 $ft^2$] area of exposed overburden]) but <10,000 $m^2$ [107,600 $ft^2$]) | 6 |
| | Large area of exposed cover ( > 10,000 $m^2$ [107,600 $ft^2$]) | 8 |
| Site verification (shallow zone) (0 to 4.6 m [15 ft]) | Very small area of exposed surface after excavation (<100 $m^2$ [1,076 $ft^2$) | 1 |
| | Small area of exposed surface after excavation (>100 $m^2$ [1,076 $ft^2$] but <500 $m^2$ [5,380 $ft^2$]) | 2 |
| | Small-medium area of exposed surface after excavation (>500 $m^2$ [5,380 $ft^2$] but <1000 $m^2$ [10,760 $ft^2$]) | 4 |
| | Medium-large area of exposed surface after excavation (>1000 $m^2$ [10,760 $ft^2$]) but <10,000 $m^2$ [32,800 $ft^2$]) | 6 |
| | Large area of exposed surface after excavation (>10,000 $m^2$ [107,600 $ft^2$]) | 8 |

Table B-14. Sampling Frequency Based on Size of Remediated Waste Site.

| Exposed Surface Area After Excavation | Number of Decision Subunits | Number of Aliquots | Number of Representative Samples |
|---|---|---|---|
| Very small area of exposed surface after excavation (<100 $m^2$ [1,076 $ft^2$]) | 1 | 4 | 1 |
| Small area of exposed surface after excavation (>100 $m^2$ [1,076 $ft^2$] but <500 $m^2$ [5,380 $ft^2$]) | 2 | 8 | 2 |
| Small-medium area of exposed surface after excavation (>500 $m^2$ [5,380 $ft^2$] but <1000 $m^2$ [10,760 $ft^2$]) | 4 | 16 | 4 |
| Medium-large area of exposed surface after excavation (>1000 $m^2$ [10,760 $ft^2$]) but <10,000 $m^2$ [32,800 $ft^2$]) | 6 | 24 | 6 |
| Large area of exposed surface after excavation (>10,000 $m^2$ [107,600 $ft^2$]) | 8 | 32 | 8 |

Table B-15. Confirmatory or Verification Sampling Requirements for Candidate Remove/Treat/Dispose Sites. (3 Pages)

| Site Code | CSM | Physical State of Waste Released Defined in WIDS | Estimated Waste Site Area Defined in WIDS ($m^2$) | Samples | | | Laboratory Analyses (R=radiological COCs[a] C=Chemical COCs [b]) |
|---|---|---|---|---|---|---|---|
| | | | | Number of Decision Units | Number of Aliquots | Number of Representative Samples | |
| 200-E-105 | 1 | Solid | 1,716 | 6 | 24 | 6 | R |
| 200-E-109 | 1 | Solid | N/A | -- | -- | -- | R |
| 220-E-110 | 1 | Solid | 469 | 2 | 8 | 2 | R |
| 220-E-115 | 1 | Solid | 84 | 1 | 4 | 1 | R |
| 200-E-117 | 1 | Solid | 9 | 1 | 4 | 1 | R |
| 200-E-121 | 1 | Solid | 4,876 | 6 | 24 | 6 | R |
| 200-E-124 | 1 | Solid | 294 | 2 | 8 | 2 | R |
| 200-E-125 | 2 | Unknown | 30 | 1 | 4 | 1 | R,C |
| 200-E-128 | 3 | Unknown | 2 | 1 | 4 | 1 | R,C |
| 200-E-129 | 2 | Unknown | 22 | 1 | 4 | 1 | R,C |
| 200-E-130 | 2 | Unknown | 60 | 1 | 4 | 1 | R,C |
| 200-E-139 | 2 | Unknown | 7,880 | 6 | 24 | 6 | R,C |
| 200-E-29 | 1 | Solid | 4,609 | 6 | 24 | 6 | R |
| 200-E-43 | 3 | Liquid | 3,276 | 6 | 24 | 6 | R,C |
| 200-E-53 | 1 | Solid | 10,000 | 6 | 24 | 6 | R |
| 200-W-106 | 2 | Unknown | 330 | 2 | 8 | 2 | R,C |
| 200-W-14 | 3 | Liquid | 360 | 2 | 8 | 2 | C |
| 200-W-53 | 4 | Solid | 144,708 | 8 | 32 | 8 | R |
| 200-W-63 | 2 | Liquid | 585 | 4 | 16 | 4 | R,C |
| 200-W-64 | 2 | Liquid | 14 | 1 | 4 | 1 | R,C |
| 200-W-67 | 1 | Solid | 1,800 | 6 | 24 | 6 | R |
| 200-W-80 | 1 | Solid | 218 | 2 | 8 | 2 | R |
| 200-W-81 | 1 | Solid | 394 | 2 | 8 | 2 | R |
| 200-W-83 | 2 | Unknown | 139 | 2 | 8 | 2 | R,C |

Table B-15. Confirmatory or Verification Sampling Requirements for Candidate Remove/Treat/Dispose Sites. (3 Pages)

| Site Code | CSM | Physical State of Waste Released Defined in WIDS | Estimated Waste Site Area Defined in WIDS ($m^2$) | Samples | | | Laboratory Analyses (R=radiological COCs[a] C=Chemical COCs [b]) |
|---|---|---|---|---|---|---|---|
| | | | | Number of Decision Units | Number of Aliquots | Number of Representative Samples | |
| 200-W-86 | 2 | Unknown | 9 | 1 | 4 | 1 | R,C |
| 200-W-90 | 2 | Unknown | 56 | 1 | 4 | 1 | R,C |
| 600-275 | 3 | Liquid/Solid | 15,750 | 8 | 32 | 8 | R,C |
| UPR-200-E-10 | 3 | Liquid/Solid | N/A | -- | -- | -- | R,C |
| UPR-200-E-101 | 1 | Solid | 312 | 2 | 8 | 2 | R |
| UPR-22-E-11 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-E-112 | 3 | Liquid | N/A | -- | - | -- | R,C |
| UPR-200-E-12 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-E-143 | 1 | Solid | 4,645 | 6 | 24 | 6 | R |
| UPR-200-E-144 | 1 | Solid | 12,150 | 8 | 32 | 8 | R |
| UPR-200-E-20 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-33 | 2 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-E-36 | 3 | Liquid | 37,626 | 8 | 32 | 8 | R,C |
| UPR-200-E-43 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-E-69 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-E-88 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200E-89 | 1 | Solid | 12,150 | 8 | 32 | 8 | R |
| UPR-200-N-1 | 3 | Liquid | 223 | 2 | 8 | 2 | R,C |
| UPR-200-N-2 | 2 | Unknown | 37 | 1 | 4 | 1 | R,C |
| UPR-200-W-116 | 1 | Solid | 8,100 | 6 | 24 | 6 | R |
| UPR-200-W-123 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-W-166 | 1 | Solid | 14,569 | 8 | 32 | 8 | R |
| UPR-200-W-23 | 3 | Solid | 28 | 1 | 4 | 1 | R |
| UPR-200-W-3 | 3 | Unknown | 3 | 1 | 4 | 1 | R,C |

Table B-15. Confirmatory or Verification Sampling Requirements for Candidate Remove/Treat/Dispose Sites. (3 Pages)

| Site Code | CSM | Physical State of Waste Released Defined in WIDS | Estimated Waste Site Area Defined in WIDS ($m^2$) | Samples | | | Laboratory Analyses (R=radiological COCs[a] C=Chemical COCs [b]) |
|---|---|---|---|---|---|---|---|
| | | | | Number of Decision Units | Number of Aliquots | Number of Representative Samples | |
| UPR-200-W-4 | 2 | Unknown | N/A | -- | -- | -- | R,C |
| UPR-200-W-41 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-W-44 | 3 | Solid | 46 | 1 | 4 | 1 | R,C |
| UPR-200-W-46 | 1 | Solid | N/A | -- | -- | -- | R,C |
| UPR-200-W-58 | 1 | Solid | N/A | -- | -- | -- | R,C |
| UPR-200-W-65 | 1 | Solid | 114 | 2 | 8 | 2 | R,C |
| UPR-200-W-67 | 1 | Solid | 7 | 1 | 4 | 1 | R |
| UPR-200-W-69 | 2 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-200-W-73 | 3 | Liquid | 2,231 | 6 | 24 | 6 | R,C |
| UPR-200-W-96 | 3 | Liquid | N/A | -- | -- | -- | R,C |
| UPR-600-12 | 3 | Liquid | 16 | 1 | 4 | 1 | R,C |
| 200-E-26 | 4 | Liquid | 334 | 2 | 8 | 2 | R,C |
| 200-W-15 | 4 | Liquid | 30 | 1 | 4 | 1 | R,C |
| 600-262 | 4 | Liquid | 59 | 1 | 4 | 1 | R,C |
| UPR-600-21 | 1 | Solid | 121,406 | 8 | 32 | 8 | R |
| UPR-200-E-50 | 1 | Solid | 3,135 | 6 | 24 | 6 | R |
| UPR-200-E-62 | 3 | Liquid | 2 | 1 | 4 | 1 | R,C |

[a]See Table B-6.
[b]See Table B-7.

COC = contaminant of concern.
CSM = conceptual site model.
N/A = not applicable.
WIDS = *Waste Information Data System*.

Table B-16. BC Controlled Area Remedial Investigation Radiological Scoping Surveys and Sampling Requirements. (2 Pages)

| BC Controlled Area CSM Zone | Contaminant Lateral Distribution | | | | | | Contaminant Vertical Distribution | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Survey/Sample Locations | Radiological Surveying | Number of Discrete Samples | Laboratory Analyses | Compositing | Number of Composite Samples* | Number of Sample Locations | Soil Sample Depth Intervals | Number of Samples* |
| A | 20 locations. 16 locations systematically distributed throughout the zone (locations determined using VSP). 4 focused discrete sample locations selected with highest survey instrument readings. Use historical radiometric survey data to target potential hot spot areas. | NaI detector measurements recorded at each sample location. In addition, a 10 m by 10 m survey plot will be established around each of the focused sample locations identified with the highest survey instrument readings in each zone. A 100 % survey will be performed over the entire survey plot. | 20 (Sampling depth from 0.0-0.5 ft) | Gamma spectroscopy samples are retained after analysis for use in creating composites samples for radio isotopic laboratory analyses. | Create 5 composites composed of 4 discrete samples. One composite should represent the 4 discrete samples with the highest gamma spectroscopy results. | 5 | Samples collected at the 3 survey locations with the highest readings. | Collect samples from 0.0-0.5 ft depth interval and 0.5-1 ft depth interval. | 6 |
| B | 32 locations. 24 locations systematically distributed throughout the zone (locations determined using VSP). 8 focused discrete sample locations selected with highest survey instrument readings. Use historical radiometric survey data to target potential hot spot areas. | | 32 (Sampling depth from 0.0-0.5 ft) | | 6 composites composed of 4 discrete samples. Two of the composites should represent the 8 discrete samples with the highest survey readings. | 8 | Samples collected at the 3 survey locations with the highest readings. | Collect samples from 0.0-0.5 ft depth interval and 0.5-1 ft depth interval. | 6 |

Table B-16. BC Controlled Area Remedial Investigation Radiological Scoping Surveys and Sampling Requirements. (2 Pages)

| BC Controlled Area CSM Zone | Contaminant Lateral Distribution | | | | | | Contaminant Vertical Distribution | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number of Survey/Sample Locations | Radiological Surveying | Number of Discrete Samples | Laboratory Analyses | Compositing | Number of Composite Samples* | Number of Sample Locations | Soil Sample Depth Intervals | Number of Samples* |
| C | 32 locations. 24 locations systematically distributed throughout the zone. (Locations determined using VSP). 8 focused sample locations selected with highest survey instrument readings. | | 32 (Sampling depth from 0.0-0.5 ft) | | 8 composites composed of 4 discrete samples. Two of the composites should represent the 8 discrete samples with the highest survey readings | 8 | Samples collected at the 3 survey locations with the highest readings. | Collect samples from 0.0-0.5 ft depth interval and 0.5-1 ft depth interval. | 6 |

*Analyzed by laboratory using gamma spectroscopy and isotopic radiochemistry. Laboratory analytical requirements specified on Table B-6.

CSM = conceptual site model.
NaI = sodium iodide.
VSP = Visual Sample Plan (statistical software).

Table B-17. Final Waste Designation Contaminants of Concern List.

| Contaminants of Concern |
|---|
| ***Radiological Constituents to be Determined by Analysis:*** Curium-242, Tin-126. |
| ***Radiological Constituents to be Determined by Calculation:*** Actinium-227, Americium-242, Americium-243, Barium-137-m, Bismuth-210, Cadmium-113m, Cesium-135, Curium-244, Curium-245, Curium-246, Curium-247, Curium-248, Europium-150, Iron-55, Lead-210, Molybdenum-93, Nickel-59, Niobium-93m, Palladium-107, Plutonium-241, Plutonium-242, Plutonium-244, Promethium-147, Protactinium-231, Protactinium-233, Radium-224, Samarium-147, Samarium-151, Selenium-79, Thallium-204, Thorium-228, Thorium-229, Thorium-230, Tin-121, Uranium-232, Uranium-233, Uranium-236, Yttrium-90 |
| ***Inorganic Chemical Constituents:*** Boron, Thallium |
| ***Organic Chemical Constituents:*** Benzyl alcohol, Bromodichloromethane, 1,1-Dichloroethylene, Ethyl ether, Freon-11 (trichloromonofluoromethane), Hexone, 1,2,3,4-Tetra-hydroquinoline, Isopropyl Alcohol, Methanol, p-dichlorobenzene |
| ***Herbicides:*** 2,4-D, 2,4-DB, 2,4,5-T, 2,4,5-TP (silvex), Dicamba, Dichloroprop, DNBP |
| ***Pesticides:*** 4,4-DDD, 4,4'-DDE, 4,4'-DDT, Aldrin, Alpha-BHC, Alpha-chlordane, Beta-BHC, Delta-BHC, Dieldrin, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin aldehyde, Endrin ketone, Gamma-BHC (lindane), Heptachlor, Heptachlor epoxide, Methoxychlor, Toxaphene |

Table B-18. Waste Management Analytical Requirements. (3 Pages)

| Chemical Abstracts Service # | Analyte | Survey or Analytical Method[d] | Waste Designation Action Level (pCi/g or mg/kg or as noted) | Required Detection Limits[a] (pCi/g or mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|
| **Radiological Constituents (pCi/g)** | | | | | | |
| 15510-73-3 | Curium-242 | AmAEA[b] | 1 | 1 | ±30%[c] | 70-130[c] |
| 15832-50-5 | Tin-136 | HPGe/GeLi | | 1 | ±30%[c] | 70-130[c] |
| **Inorganic Chemical Constituents (mg/kg or as noted)** | | | | | | |
| 7440-42-8 | Boron | EPA Method 6010 | [e] | 2 | ±30%[c] | 70-130[c] |
| 7440-28-0 | Thallium | EPA Method 6010 | 5.6E+3 | 5 | ±30%[c] | 70-130[c] |
| **Organic Chemical Constituents (mg/kg or as noted)** | | | | | | |
| 67-56-1 | Methanol | EPA Method 8015 | 0.75 mg/L TCLP | 1 | ±30%[c] | 70-130[c] |
| **Herbicides (mg/kg)** | | | | | | |
| 94-75-7 | 2,4-D | EPA Method 8151 | [e]<br>10 mg/L TCLP[f]<br>10 mg/kg[g] | 400 | ±30%[c] | 70-130[c] |
| 94-82-6 | 2,4-DB | EPA Method 8151 | [e] | 100 | ±30%[c] | 70-130[c] |
| 93-76-5 | 2,4,5-T | EPA Method 8151 | [e]<br>7.9 mg/kg[g] | 20 | ±30%[c] | 70-130[c] |
| 93-72-1 | 2,4,5-TP (silvex) | EPA Method 8151 | [e]<br>1 mg/L TCLP[f]<br>7.9 mg/kg[g] | 20 | ±30%[c] | 70-130[c] |

Table B-18. Waste Management Analytical Requirements. (3 Pages)

| Chemical Abstracts Service # | Analyte | Survey or Analytical Method[d] | Waste Designation Action Level (pCi/g or mg/kg or as noted) | Required Detection Limits[a] (pCi/g or mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|
| 1918-00-9 | Dicamba | EPA Method 8151 | [e] | 100 | ±30%[c] | 70-130[c] |
| 120-36-5 | Dichloroprop | EPA Method 8151 | [e] | 100 | ±30%[c] | 70-130[c] |
| 88-85-7 | Dinitro-o-sec-butyl phenol | EPA Method 8151 | [e]<br>2.5 mg/kg[g] | 12 | ±30%[c] | 70-130[c] |
| **Pesticides (mg/kg)** | | | | | | |
| 72-54-8 | 4,4'-DDD | EPA Method 8081 | [e]<br>0.087 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 72-55-9 | 4,4'-DDE | EPA Method 8081 | [e]<br>0.087 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 50-29-3 | 4,4'-DDT | EPA Method 8081 | [e]<br>0.087 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 309-00-2 | Aldrin | EPA Method 8081 | [e]<br>0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 319-84-6 | Alpha-BHC | EPA Method 8081 | [e]<br>0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 5103-71-9 | Alpha-chlordane | EPA Method 8081 | [e] | 16.5 | ±30%[c] | 70-130[c] |
| 319-85-7 | Beta-BHC | EPA Method 8081 | 0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 319-86-8 | Delta-BHC | EPA Method 8081 | [e]<br>0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 60-57-1 | Dieldrin | EPA Method 8081 | [e]<br>0.13 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 959-98-8 | Endosulfan I | EPA Method 8081 | [e]<br>0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 33213-65-9 | Endosulfan II | EPA Method 8081 | [e]<br>0.13 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 1031-07-8 | Endosulfan sulfate | EPA Method 8081 | [e]<br>0.13 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 72-20-8 | Endrin | EPA Method 8081 | [e]<br>0.02 mg/L TCLP[f]<br>0.13 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 7421-93-4 | Endrin aldehyde | EPA Method 8081 | 0.13 mg/kg[g] | 3.3 | ±30%[c] | 70-130[c] |
| 53494-70-5 | Endrin ketone | EPA Method 8081 | [e] | 3.3 | ±30%[c] | 70-130[c] |
| 58-89-9 | Gamma-BHC (lindane) | EPA Method 8081 | [e]<br>0.4 mg/L TCLP[f]<br>0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 76-44-8 | Heptachlor | EPA Method 8081 | [e]<br>0.008 mg/L TCLP[f]<br>0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |

Table B-18. Waste Management Analytical Requirements. (3 Pages)

| Chemical Abstracts Service # | Analyte | Survey or Analytical Method[d] | Waste Designation Action Level (pCi/g or mg/kg or as noted) | Required Detection Limits[a] (pCi/g or mg/kg) | Precision Required | Accuracy Required |
|---|---|---|---|---|---|---|
| 1024-57-3 | Heptachlor epoxide | EPA Method 8081 | [e] 0.066 mg/kg[g] | 1.65 | ±30%[c] | 70-130[c] |
| 72-43-5 | Methoxychlor | EPA Method 8081 | [e] 10 mg/L TCLP[f] 0.18 mg/kg[g] | 16.5 | ±30%[c] | 70-130[c] |
| 8001-35-2 | Toxaphene | EPA Method 8081 | [e] 0.5 mg/L TCLP[f] 2.6 mg/kg[g] | 165 | ±30%[c] | 70-130[c] |

[a]Detection limits are based on optimal conditions in a standard fixed laboratory. Interferences and matrix effects may degrade the values shown.

[b]AmAEA, NpAEA, PuAEA, ThAEA, UAEA = chemical separation, electro/microprecipitation deposition, alpha energy analysis via Si barrier detector.

[c]Accuracy criteria for associated batch laboratory control sample percent recoveries. Except for gamma energy analysis, additional analysis-specific evaluations also performed for matrix spikes, tracers, and carriers as appropriate to the method. Precision criteria for batch laboratory replicate sample analyses.

[d]4-digit EPA Methods are found in SW-846.

[e]There is no action level for this constituent; it contributes to the Washington State equivalent concentration calculation.

[f]Federal toxic hazardous waste (TCLP).

[g]Treatment standard as an underlying hazardous constituent in accordance with 40 CFR 268.48 for non-waste waters (applicable value for soils).

40 CFR 268.48, "Land Disposal Restrictions."

SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A*.

AEA = alpha energy analysis.
EPA = U.S. Environmental Protection Agency.
GeLi = germanium-lithium (drifted).
HPGe = high-purity germanium.
TCLP = toxicity characteristic leaching procedure.

Table B-19. Waste Material/Media Sampling Design.

| Material/Media | Sample Collection Methodology | Key Features/Sampling Frequency | Basis for Sampling Design |
|---|---|---|---|
| Observational-based sampling of waste material/media | Waste material/media sampling for offsite analysis. | One sample collected from the location with high field screening results or one sample per media type per 200-UR-1 Operable Unit site. | Dangerous/hazardous waste designation. Analyses could include metals totals, toxicity characteristic leaching procedure, or volatile organic analysis/ semivolatile organic analysis, herbicide, and pesticide suite. |
| Anomalous media | Sampling and analytical requirements to be determined by the Fluor Hanford, Inc., Waste Management representative; the project safety engineer; the project environmental lead; and the analytical lead (or task lead, as appropriate). | | |

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# APPENDIX C

# COST ESTIMATE SUPPORTING DOCUMENTATION

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## TERMS

| | |
|---|---|
| CERCLA | *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* |
| DQO | data quality objective |
| EE/CA | engineering evaluation/cost analysis |
| ERDF | Environmental Restoration Disposal Facility |
| FH | Fluor Hanford |
| FY | fiscal year |
| OMB | Office of Management and Budget |
| RCRA | *Resource Conservation and Recovery Act of 1976* |

# APPENDIX C

# COST ESTIMATE SUPPORTING DOCUMENTATION

## C1.0 INTRODUCTION

Cost estimates for this engineering evaluation/cost analysis (EE/CA) are +50 percent, -30 percent. They were prepared to the accuracy specified in the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) guidance for remedial investigations/feasibility study (FS) (EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final*). The costs provide a discriminator for deciding between similar protective and implementable alternatives for a specific unplanned release site. Therefore, the costs are not absolute costs, but rather relational costs for the evaluation of the alternatives. Cost estimates were made based on the site conceptual model contaminant depth intervals that were designated for each unplanned release site as described in WMP-19920, *Data Quality Objectives Summary Report for 200-UR-1 Operable Unit Unplanned Releases Waste Group* (pending). In addition, combinations of sites for remedial actions were considered in areas where it is difficult to designate individual unplanned releases (i.e., the railroad sites). The economies associated with implementing multiple unplanned release sites with a common alternative are evaluated in this cost analysis. Potential areas of cost sharing to reduce overall remediation costs include the following:

- All unplanned release sites located within the same operable unit, within the same closure zone and within close proximity could be remediated at the same time.
- Shared mobilization/demobilization costs.
- Shared surveillance and maintenance costs.

## C2.0 ALTERNATIVE COST ESTIMATES

This section describes the cost estimates based on the remedial alternatives developed in Chapter 5.0 of this work plan. Table C-1 provides a summary of alternatives considered by unplanned release sites within a conceptual site model and the total present worth costs. Sections C2.1 through C2.3 provide summaries of the alternatives and backup information for costs by site.

Present net worth costs were estimated using the real discount rate published in Appendix C of the Office of Management and Budget (OMB) Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, which is effective through the end of January 2005. Programs with durations longer than 30 years use the 30-year interest rate of

3.5 percent. A discussion of present net worth costs is provided in each of the following sections.

## C2.1 ALTERNATIVE 1: NO ACTION

The no-action alternative represents a situation where no legal restrictions, access controls, or active remedial measures are applied to the site. No action implies "walking away from the site" and allowing the site to remain in its current configuration, affected only by natural processes. No maintenance or other activities would be instituted or continued. Section 5.3.1 of this work plan provides a description of the no-action alternative.

Because the no-action alternative assumes no further actions will be taken at an unplanned release site, costs are assumed to be zero. The costs for conducting a walkover inspection of the site and radiological screening have not been included in this estimate, but may constitute some costs for the sites without existing data in an effort to locate the site boundaries and to verify that preliminary remediation goals are met.

## C2.2 ALTERNATIVE 2: MAINTAIN EXISTING SOIL COVER, INSTITUTIONAL CONTROLS, AND MONITORED NATURAL ATTENUATION

Section 5.3.2 of this work plan provides a description of the Maintain the Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation alternative. This alternative includes the cost of maintaining the existing soil cover, if present. The costs for these controls were estimated based on the area of the unplanned release sites and a unit cost per area. Details of the cost estimates are provided in Table C-2.

The primary costs associated with this alternative are surveillance and cover maintenance and monitored natural attenuation costs.

The unit cost for surveillance and maintenance was assumed to be the same as the current unit cost for surveillance and maintenance activities done annually on the sites. These costs account for such activities as site radiation surveys, control of deeply burrowing animals and deep-rooted plants through herbicide or physical removal, maintenance of signs and markers, and repair of the existing soil cover on the sites where it is present. It is assumed that, because the existing soil cover is maintained on an annual basis, there is no need to include costs for replacing all or large portions of the existing cover at specified intervals (i.e., every 20 years).

The cost associated with natural attenuation monitoring includes radiological surveys of surface soils. The costs to perform radiological surveys of surface soils at waste sites are assumed to be similar to current survey practices at the site and are included in the surveillance and maintenance costs.

The cost model used for this alternative consisted of a simple spreadsheet. Because the unplanned release sites do not have data to support the time needed to reach preliminary

remediation goals, costs for institutional controls at these sites were estimated based on the degradation rate for the contaminants of concern (COC).

The real discount rate of 3.5 percent is used for discounting real (constant-dollar) flows for the duration until all preliminary remediation goals are reached at each site.

## C2.3 ALTERNATIVE 3: REMOVE AND DISPOSE

Section 5.3.3 of this work plan provides a description of the remove and dispose alternative. Three cost models were used to estimate costs for the remove and dispose alternative. These cost models are the "Trench Template," the "Retention Basin/Concrete Structures Template," and the "Rail Siding Template." These cost models are discussed in detail in Chapter C3.0. Cost estimate inputs for the remove and dispose alternative are included in Table C-3. A breakdown of costs developed in the remove and dispose estimate is provided in Table C-4.

Institutional control costs were not added to the remove and dispose alternative because the contaminants are assumed to be removed to concentrations at or below the preliminary remediation goals. If some contaminants remain after excavation, then institutional controls may be needed. All costs associated with the remove-and-dispose alternative are present net worth costs.

# C3.0 COST MODELS

The Maestro[1] software was used to develop estimates for Alternative 3: Remove and Dispose. Three cost templates were used for this estimate:

- Trench Cost Model Template: based on Maestro Model, Bechtel Hanford, Inc. (BHI) Maestro fiscal year (FY) 2002 Trench
- Retention Basin Cost Model Template: based on Maestro Model, BHI Maestro FY 2002 Trench and Retention Basin
- Rail Siding Cost Model Template: based on Maestro Model, BHI Maestro FY 2000.

The trench template was used for sites where the engineered structures can be removed with standard excavation equipment. The retention basis template was used for sites where engineered structures contained reinforced concrete where specialized demolition equipment may be required to break up and remove the structure. The rail siding template was used to develop costs for all sites where railroad ties, rails and switches would be removed.

The following sections summarize the assumptions for each Maestro model.

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[1]Maestro is a trademark of Explorer Software Inc., West Vancouver, British Columbia.

## C3.1 TRENCH TEMPLATE

This section summarizes cost inputs, assumptions, and backup used in the Maestro Trench template.

### C3.1.1 Remediation Work Scope

The template covers the construction work to excavate and remediate contaminated material/media from unplanned release sites within the 200 East Area, 200 West Area, and 600 Area Operable Units using conventional construction equipment. Contaminated material/media will be characterized for disposal and transported to the Environmental Restoration Disposal Facility (ERDF) for disposal. The template is based on the use of a fixed-price contractor to do the construction work with Fluor Hanford (FH) managing the work.

Major assumptions that have been made in the preparation of this estimate are as follows:

A. All borrow material needed to backfill the excavation or restore the site comes from Pit 30.

B. The following work process is used to restore the site:

1) Mobilization includes setting up a decontamination area, installing a temporary fence around the site, a site survey, setting up temporary office/change trailers, providing temporary utilities, constructing a staging area, and improvement/maintenance of the site haul road.

2) Environment monitoring and sampling and analysis of low-level- waste material/media, non-contaminated material/media, and the bottom of the excavation area during the excavation process.

3) Solids (contaminated material/media) collection and containment includes the following:

a) Excavation of clean overburden soil, hauling, and stockpiling near the waste site, including dust control.

b) Excavation of contaminated material/media and loading into containers to be hauled to a queue area. The work also includes site dust control.

4) Disposal of contaminated material/media includes the following:

a) Processing at the queue area for transport to ERDF.

b) Other work at the queue area includes decontaminating and surveying the containers, along with adding disposal liners.

c) Transportation of the waste to ERDF, ERDF dumping charges and fees.

5) Site restoration includes the following:

   a) Loading and hauling backfill from the overburden stockpile and Pit 30 borrow site.

   b) Backfill and compaction of the waste site. Compaction is limited to equipment compaction. Site dust control is included.

6) Revegetation includes planting dry land grass seed and native bushes with fertilizer and initial irrigation, as needed.

7) Demobilization includes removing the temporary fence, temporary trailers, decontamination site, staging area, haul road, and miscellaneous cleanup.

8) Project management includes part-time staff to manage the work and provide technical support. Fixed priced contractor staff manages the site work.

C. Mobilization and demobilization of construction equipment are calculated separately and added to the model specific mobilization and demobilization costs.

## C3.2 RETENTION BASIN/CONCRETE STRUCTURE

This section summarizes cost inputs, assumptions, and backup used in the Maestro Retention Basin/Concrete Structure template.

### C3.2.1 Remediation Work Scope

The template covers the construction work to excavate and remediate contaminated material/media from unplanned release sites within the 200 East Area, 200 West Area, and 600 Area operable units. Contaminated material/media will be characterized for disposal and transported to the ERDF for disposal. The template is based on the use of a fixed-price contractor to do the construction work with FH managing the work.

Major assumptions that have been made in the preparation of this estimate are as follows:

A. All borrow material needed to backfill the excavation or restore the site comes from Pit 30.

B. The following work process is used to restore the site:

   1) Mobilization includes setting up a decontamination area, installing a temporary fence around the site, a site survey, setting up temporary office/change trailers, providing temporary utilities, constructing a staging area, and improvement/maintenance of the site haul road.

2) Environment monitoring and sampling and analysis of low-level waste material/media, non-contaminated material/media, and the bottom of the excavation area during the excavation process.

3) Solids (contaminated material/media) collection and containment includes the following:

   a) Excavation of clean overburden soil, hauling, and stockpiling near the site, including dust control.

   b) Excavation of contaminated material/media and loading into containers to be hauled to a queue area. The work also includes site dust control.

   c) Demolishing, excavating, and loading small contaminated concrete structures to be hauled to a queue area.

4) Disposal of contaminated material/media includes the following:

   a) Processing at the queue area for transport to ERDF.

   b) Other work at the queue area includes decontaminating and surveying the containers, along with adding disposal liners.

   c) Transportation of waste to ERDF, ERDF dumping charges and fees.

5) Site restoration includes the following:

   a) Loading and hauling backfill from the overburden stockpile and Pit 30 borrow site.

   b) Backfill and compaction of the site. Compaction is limited to equipment compaction. Site dust control is included.

6) Revegetation includes planting dry land grass seed and native bushes with fertilizer and initial irrigation as needed.

7) Demobilization includes removing the temporary fence, temporary trailers, decontamination site, staging area, haul road, and miscellaneous cleanup.

8) Project management includes part-time staff to manage the work and provide technical support. Fixed price contractor staff manages the site work.

C. Mobilization and demobilization of construction equipment is calculated separately and added to the model-specific mobilization and demobilization costs.

## C3.3 RAIL SIDING TEMPLATE

This section summarizes cost inputs, assumptions, and backup used in the Maestro Rail Siding template.

### C3.3.1 Remediation Work Scope

The template covers the construction work to excavate and remediate contaminated material/media from unplanned release sites within the 200 East Area, 200 West Area, and 600 Area Operable Units. Contaminated material/media will be characterized for disposal and transported to the ERDF for disposal. The template is based on the use of a fixed-price contractor to do the construction work with FH managing the work.

Major assumptions that have been made in the preparation of this estimate are as follows:

A. All borrow material needed to backfill the excavation or restore the site comes from Pit 30.

B. The following work process is used to restore the site:

1) Mobilization includes setting up a decontamination area, installing a temporary fence around the site, a site survey, setting up temporary office/changing trailers, providing temporary utilities, construction of a staging area, and improvement/maintenance of the site haul road.

2) Environment monitoring and sampling and analysis of low-level waste material/media, non-contaminated material/media, and the excavation bottom during the excavation process.

3) Solids (contaminated material/media) collection and containment includes the following:

a) Excavation of clean overburden soil, hauling, and stockpiling near the site, including dust control.

b) Excavation of contaminated soil and loading into containers to be hauled to a queue area. The work also includes site dust control.

c) Removing ties/rails, cutting rails into short sections, and loading of rails and ties to be hauled to a queue area.

4) Disposal of contaminated soil includes the following:

a) Processing at the queue area for transport to ERDF.

b) Other work at the queue area includes decontaminating and surveying the containers, along with adding disposal liners.

c) Transportation of waste to ERDF, ERDF dumping charges and fees.

5) Site restoration includes the following:

a) Loading and hauling backfill from the overburden stockpile and Pit 30 borrow site.

b) Backfill and compaction of the waste site. Compaction is limited to equipment compaction. Site dust control is included.

6) Revegetation includes planting dry land grass seed and native bushes with fertilizer and initial irrigation as needed.

7) Demobilization includes removing the temporary fence, temporary trailers, staging area and decontamination site, haul road, and miscellaneous cleanup.

8) Project management includes part-time staff to manage the work and provide technical support. Fixed price contractor staff manages the site work.

C. Mobilization and demobilization of construction equipment is calculated separately and added to the model-specific mobilization and demobilization costs.

## C4.0 REFERENCES

*Comprehensive Environmental Response, Compensation and Liability Act of 1980*, 42 USC 9601, et seq.

EPA/540/G-89/004, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final,* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

OMB Circular No. A-94, 1992, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,* Office of Management and Budget, Washington, D.C.

WMP-19920, (pending), *Data Quality Objectives Summary Report for 200-UR-1 Operable Unit Unplanned Releases Waste Group*, Fluor Hanford, Richland, Washington.

Table C-1. Cost Estimate Summary by Conceptual Site Model/Alternative. (2 Pages)

| Conceptual Site Model/Unplanned Release Site | Alternative 1: No Action | Alternative 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation | Alternative 3: Remove and Dispose* |
|---|---|---|---|
| **Conceptual Site Model (0 – 0.3 m contaminant depth interval)** | | | |
| 200-E-29 | -- | $169,400 | $576,700 |
| 200-E-53 | -- | $169,400 | $869,900 |
| 200-E-105 | -- | $42,350 | $305,500 |
| 200-E-109 | -- | $413,300 | $3,014,400 |
| 200-E-110 | -- | $42,350 | $226,200 |
| 200-E-115 | -- | $42,350 | $207,100 |
| 200-E-117 | -- | $42,350 | $204,300 |
| 200-E-121 | -- | $169,400 | $517,600 |
| 200-E-124 | -- | $42,350 | $617,800 |
| 200-E-125 | -- | $42,350 | $204,600 |
| 200-E-129 | -- | $42,350 | $204,400 |
| 200-E-130 | -- | $42,350 | $203,500 |
| 200-E-139 | -- | $42,350 | $904,400 |
| UPR-200-E-50 | -- | $42,350 | $381,600 |
| UPR-200-E-62 | -- | $42,350 | $205,000 |
| UPR-200-E-89 | -- | $169,400 | $1,491,400 |
| UPR-200-E-101 | -- | $42,350 | $219,600 |
| UPR-200-E-143 | -- | $42,350 | $499,100 |
| UPR-200-E-144 | -- | $169,400 | $1,032,800 |
| 200-W-53 | -- | $169,400 | $869,900 |
| 200-W-63 | -- | $42,350 | $353,000 |
| 200-W-64 | -- | $42,350 | $564,300 |
| 200-W-67 | -- | $42,350 | $329,200 |
| 200-W-80 | -- | $42,350 | $215,000 |
| 200-W-81; UPR-200-W-58 | -- | $169,400 | $1,925,100 |
| 200-W-83 | -- | $42,350 | $471,800 |
| 200-W-86 | -- | $42,350 | $204,300 |
| 200-W-90 | -- | $42,350 | $211,400 |
| 200-W-106 | -- | $42,350 | $219,800 |
| UPR-200-W-46 | -- | $42,350 | $767,400 |
| UPR-200-W-67 | -- | $42,350 | $204,300 |
| UPR-200-W-69 | -- | $169,400 | $1,048,200 |
| UPR-200-W-116 | -- | $169,400 | $598,100 |
| UPR-200-W-166 | -- | $169,400 | $563,600 |
| UPR-600-21 | -- | $1,286,000 | $9,086,700 |
| UPR-200-N-2 | -- | $42,350 | $205,600 |

Table C-1. Cost Estimate Summary by Conceptual Site Model/Alternative. (2 Pages)

| Conceptual Site Model/Unplanned Release Site | Alternative 1: No Action | Alternative 2: Maintain Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation | Alternative 3: Remove and Dispose* |
|---|---|---|---|
| **Conceptual Site Model (0 – 2 m contaminant depth interval)** | | | |
| 200-E-43 | -- | $42,350 | $1,595,000 |
| 200-E-128 | -- | $42,350 | $207,800 |
| UPR-200-E-10; UPR-200-E-11; UPR-200-E-12; UPR-200-E-20; UPR-200-E-33 | -- | $225,000 | $12,854,700 |
| UPR-200-E-36 | -- | $393,750 | $15,655,400 |
| UPR-200-E-43 | -- | $42,350 | $958,500 |
| UPR-200-E-69 | -- | $169,400 | $6,727,900 |
| UPR-200-E-88 | -- | $169,400 | $3,351,000 |
| UPR-200-E-112 | -- | $293,600 | $8,814,400 |
| 200-W-14 | -- | $42,350 | $348,600 |
| UPR-200-W-3; UPR-200-W-4; UPR-200-W-65; UPR-200-W-73 | -- | $506,050 | $21,233,700 |
| UPR-200-W-23 | -- | $42,350 | $199,300 |
| UPR-200-W-41 | -- | $229,060 | $9,507,800 |
| UPR-200-W-44 | -- | $42,350 | $278,100 |
| UPR-200-W-96 | -- | $42,350 | $207,300 |
| UPR-200-W-123 | -- | $42,350 | $204,200 |
| 600-275 | -- | $169,400 | $941,200 |
| UPR-600-12 | -- | $42,350 | $220,900 |
| UPR-200-N-1 | -- | $42,350 | $423,500 |
| **Conceptual Site Model (0 – 4.6 m contaminant depth interval)** | | | |
| 200-E-26 | -- | $42,350 | $524,700 |
| 200-W-15 | -- | $42,350 | $240,700 |
| 600-262 | -- | $42,350 | $211,700 |

*Costs are rounded to the nearest $100.

Table C-2. Alternative 2: Maintain Existing Soil Cover and Institutional Controls. (2 Pages)

| Conceptual Site Model/Unplanned Release Site | Site Area ($ft^2$) | Duration[a] (years) | Institutional Controls | | Miscellaneous Cost | Total Present Net Worth[c] |
|---|---|---|---|---|---|---|
| | | | Annual Surveillance and Maintenance Costs[b] | Present Net Worth of Surveillance and Maintenance[c] | | |
| **Conceptual Site Model (0 – 0.3 m contaminant depth interval)** | | | | | | |
| 200-E-29 | 62,000 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-53 | 170,642 | 130 | $6,000 | $169,400 | -- | $169,400 |
| 200-E-105 | 18,471 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-109 | 425,104 | 130 | $14,639 | $413,300 | -- | $413,300 |
| 200-E-110 | 5,046 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-115 | 900 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-117 | 100 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-121 | 52,494 | 130 | $6,000 | $169,400 | -- | $169,400 |
| 200-E-124 | 3,168 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-125 | 326 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-129 | 240 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-130 | 650 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-139 | 110,445 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-E-50 | 33,750 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-E-62 | 100 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-E-89 | 163,800 | 130 | $6,000 | $169,400 | -- | $169,400 |
| UPR-200-E-101 | 3,360 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-E-143 | 50,176 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-E-144 | 131,644 | 130 | $6,000 | $169,400 | -- | $169,400 |
| 200-W-53 | 156,025 | 130 | $6,000 | $169,400 | -- | $169,400 |
| 200-W-63 | 6,300 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-64 | 15,400 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-67 | 19,391 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-80 | 2,346 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-81; UPR-200-W-58 | 86,000 | 130 | $6,000 | $169,400 | -- | $169,400 |
| 200-W-83 | 2,000 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-86 | 100 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-90 | 1,800 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-106 | 3,551 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-46 | 13,200 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-67 | 72 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-69 | 122,850 | 130 | $6,000 | $169,400 | -- | $169,400 |
| UPR-200-W-116 | 57,960 | 130 | $6,000 | $169,400 | -- | $169,400 |
| UPR-200-W-166 | 156,816 | 130 | $6,000 | $169,400 | -- | $169,400 |

Table C-2. Alternative 2: Maintain Existing Soil Cover and Institutional Controls. (2 Pages)

| Conceptual Site Model/Unplanned Release Site | Site Area ($ft^2$) | Duration[a] (years) | Institutional Controls | | Miscellaneous Cost | Total Present Net Worth[c] |
|---|---|---|---|---|---|---|
| | | | Annual Surveillance and Maintenance Costs[b] | Present Net Worth of Surveillance and Maintenance[c] | | |
| UPR-600-21 | 1,322,500 | 130 | $45,541 | $1,285,778 | -- | $1,285,778 |
| UPR-200-N-2 | 400 | 130 | $1,500 | $42,350 | -- | $42,350 |
| **Conceptual Site Model (0 – 2 m contaminant depth interval)** | | | | | | |
| 200-E-43 | 35,260 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-E-128 | 72 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-E-10; UPR-200-E-11; UPR-200-E-12; UPR-200-E-20; UPR-200-E-33 | 231,440 | 130 | $7,790 | $225,014 | -- | $225,014 |
| UPR-200-E-36 | 405,000 | 130 | $13,946 | $393,754 | -- | -- |
| UPR-200-E-43 | 1,300 | 130 | $1,500 | $42,350 | -- | $42,3500 |
| UPR-200-E-69 | 167,700 | 130 | $6,000 | $169,400 | -- | $169,400 |
| UPR-200-E-88 | 65,360 | 130 | $6,000 | $169,400 | -- | $169,400 |
| UPR-200-E-112 | 175,750 | 130 | $10,402 | $293,692 | -- | $293,692 |
| 200-W-14 | 4,320 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-3; UPR-200-W-4; UPR-200-W-65; UPR-200-W-73 | 520,500 | 130 | $17,924 | $506,047 | -- | $506,047 |
| UPR-200-W-23 | 289 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-41 | 235,600 | 130 | $8,113 | $229,058 | -- | $229,058 |
| UPR-200-W-44 | 800 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-96 | 1,369 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-W-123 | 25 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 600-275 | 331,250 | 130 | $6,000 | $169,400 | -- | $169,400 |
| UPR-600-12 | 504 | 130 | $1,500 | $42,350 | -- | $42,350 |
| UPR-200-N-1 | 3,200 | 130 | $1,500 | $42,350 | -- | $42,350 |
| **Conceptual Site Model (0 – 4.6 m contaminant depth interval)** | | | | | | |
| 200-E-26 | 3,600 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 200-W-15 | 320 | 130 | $1,500 | $42,350 | -- | $42,350 |
| 600-262 | 25 | 130 | $1,500 | $42,350 | -- | $42,350 |

[a]Duration corresponds to time required to meet preliminary remediation goals.

[b]Surveillance and maintenance costs are $1,500/site for sites less than 1 acre; $6,000/site for sites 1 to 4 acres; and $1,500 x acreage for sites larger than 4 acres and include maintenance of existing stabilization cover, vegetation control, and radiological surveys.

[c]Real discount rate used for present net worth calculation of 3.5 percent was from Appendix C of the Office of Management and Budget (OMB) Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, which is effective through the end of January 2005.

Table C-3. Alternative 3: Remove and Dispose – Cost Input Parameters. (3 Pages)

| Unplanned Release Site | Site-Specific Required Inputs | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Noncontaminated Soil Volume (Bank $ft^3$) | Contaminated Soil Volume (Bank $ft^3$) | Top Excavation Length (Linear ft) | Top Excavation Width (Linear ft) | Bottom Area ($ft^2$) | Total Depth of Excavation/Depth of Contamination (Linear ft) | Demolition Waste (Bank $ft^3$) | Railroad Ties (Each) | Rail (Linear ft) | Rail Switches (Each) |
| **Conceptual Site Model (0 – 0.3 m contaminant depth interval)** | | | | | | | | | | |
| 200-E-29 | 771 | 62,000 | 318 | 200 | 62,000 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-53 | 1,012 | 170,642 | 413 | 265 | 170,642 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-105 | 455 | 18,471 | 220 | 88 | 18,471 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-109 | 1,959 | 425,104 | 655 | 655 | 425,104 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-110 | 220 | 5,046 | 90 | 61 | 5,046 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-115 | 93 | 900 | 33 | 33 | 900 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-117 | 33 | 100 | 13 | 13 | 100 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-121 | 1,105 | 52,494 | 659 | 83 | 52,494 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-124 | 3,487 | 3,168 | 213 | 18 | 3,168 | 2/1 | 0 | 142 | 426 | 0 |
| 200-E-125 | 58 | 326 | 25 | 18 | 326 | 1/1 | 0 | 0 | 0 | 0 |
| 200-E-129 | 291 | 240 | 23 | 15 | 240 | 2/1 | 0 | 0 | 0 | 0 |
| 200-E-130 | 764 | 650 | 68 | 13 | 650 | 2/1 | 0 | 0 | 0 | 0 |
| 200-E-139 | 11,962 | 110,445 | 889 | 128 | 110,445 | 2/1 | 0 | 0 | 0 | 0 |
| UPR-200-E-50 | 789 | 33,750 | 453 | 78 | 33,750 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-E-62 | 138 | 100 | 103 | 4 | 100 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-E-89 | 247,000 | 163,800 | 588 | 283 | 163,800 | 2.5/1 | 5,725 | 0 | 0 | 0 |
| UPR-200-E-101 | 189 | 3,360 | 87 | 43 | 3,360 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-E-143 | 675 | 50,176 | 227 | 227 | 50,176 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-E-144 | 1,245 | 131,644 | 617 | 217 | 131,644 | 1/1 | 0 | 0 | 0 | 0 |
| 200-W-53 | 1,188 | 156,025 | 398 | 398 | 156,025 | 1/1 | 0 | 0 | 0 | 0 |
| 200-W-63 | 1,300 | 12,600 | 146 | 51 | 6,300 | 1/1 | 12,600 | 0 | 0 | 0 |
| 200-W-64 | 0 | 15,400 | 140 | 110 | 15,400 | 2/1 | 15,400 | 0 | 0 | 0 |
| 200-W-67 | 29,610 | 19,391 | 331 | 62 | 19,391 | 2.5/1 | 0 | 0 | 0 | 0 |

Table C-3. Alternative 3: Remove and Dispose – Cost Input Parameters. (3 Pages)

| Unplanned Release Site | Site-Specific Required Inputs | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Noncontaminated Soil Volume (Bank $ft^3$) | Contaminated Soil Volume (Bank $ft^3$) | Top Excavation Length (Linear ft) | Top Excavation Width (Linear ft) | Bottom Area ($ft^2$) | Total Depth of Excavation/Depth of Contamination (Linear ft) | Demolition Waste (Bank $ft^3$) | Railroad Ties (Each) | Rail (Linear ft) | Rail Switches (Each) |
| 200-W-80 | 2,346 | 2,346 | 54 | 49 | 2,346 | 2/1 | 0 | 0 | 0 | 0 |
| 200-W-81; UPR-200-W-58 | 6,409 | 86,000 | 4,300 | 20 | 86,000 | 1/1 | 0 | 2,667 | 8,000 | 3 |
| 200-W-83 | 160 | 2,000 | 83 | 28 | 2,000 | 1/1 | 0 | 53 | 160 | 0 |
| 200-W-86 | 33 | 100 | 13 | 13 | 100 | 1/1 | 0 | 0 | 0 | 0 |
| 200-W-90 | 138 | 1,800 | 63 | 33 | 1,800 | 1/1 | 0 | 0 | 0 | 0 |
| 200-W-106 | 183 | 3,551 | 70 | 56 | 3,551 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-W-46 | 2,400 | 13,200 | 1,320 | 10 | 13,200 | 1/1 | 0 | 1,980 | 2,640 | 0 |
| UPR-200-W-67 | 0 | 72 | 24 | 3 | 72 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-W-69 | 122,850 | 1,613 | 951 | 136 | 122,850 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-W-116 | 87,666 | 57,960 | 255 | 233 | 57,960 | 2.5/1 | 0 | 0 | 0 | 0 |
| UPR-200-W-166 | 0 | 156,816 | 396 | 396 | 156,816 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-600-21 | 3,453 | 1,322,500 | 1,153 | 1,153 | 1,322,500 | 1/1 | 0 | 0 | 0 | 0 |
| UPR-200-N-2 | 0 | 400 | 20 | 20 | 400 | 1/1 | 0 | 0 | 0 | 0 |
| **Conceptual Site Model (0 – 2 m contaminant depth interval)** | | | | | | | | | | |
| 200-E-43 | 78,509 | 232,716 | 235 | 184 | 35,260 | 8/6.6 | 0 | 157 | 470 | 0 |
| 200-E-128 | 2,800 | 1,320 | 30 | 40 | 200 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-E-10; UPR-200-E-11; UPR-200-E-12; UPR-200-E-20; UPR-200-E-33 | 715,526 | 1,527,504 | 11,592 | 40 | 231,440 | 6.6/6.6 | 0 | 7,528 | 22,584 | 6 |
| UPR-200-E-36 | 89,019 | 2,673,000 | 920 | 470 | 405,000 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-E-43 | 5,798 | 8,580 | 70 | 46 | 1,300 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-E-69 | 383,096 | 1,106,820 | 1,310 | 150 | 167,700 | 8/6.6 | 0 | 727 | 2,180 | 2 |
| UPR-200-E-88 | 153,515 | 431,376 | 780 | 106 | 65,360 | 8/6.6 | 0 | 520 | 1,560 | 0 |

Table C-3. Alternative 3: Remove and Dispose – Cost Input Parameters. (3 Pages)

| Unplanned Release Site | Site-Specific Required Inputs | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Noncontaminated Soil Volume (Bank $ft^3$) | Contaminated Soil Volume (Bank $ft^3$) | Top Excavation Length (Linear ft) | Top Excavation Width (Linear ft) | Bottom Area ($ft^2$) | Total Depth of Excavation/Depth of Contamination (Linear ft) | Demolition Waste (Bank $ft^3$) | Railroad Ties (Each) | Rail (Linear ft) | Rail Switches (Each) |
| UPR-200-E-112 | 227,625 | 1,159,950 | 3,535 | 70 | 175,750 | 6.6/6.6 | 0 | 2,077 | 6,230 | 4 |
| 200-W-14 | 10,585 | 28,080 | 140 | 56 | 4,320 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-W-3; UPR-200-W-4; UPR-200-W-65; UPR-200-W-73 | 342,578 | 3,435,300 | 5,205 | 100 | 520,500 | 6.6/6.6 | 0 | 3,070 | 9,210 | 6 |
| UPR-200-W-23 | 3,084 | 1,907 | 20 | 37 | 289 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-W-41 | 541,888 | 1,554,960 | 780 | 330 | 235,600 | 8/6.6 | 0 | 520 | 1,560 | 0 |
| UPR-200-W-44 | 4,752 | 5,280 | 60 | 40 | 800 | 6.6/6.6 | 0 | 40 | 120 | 0 |
| UPR-200-W-96 | 8,436 | 9,035 | 57 | 57 | 1,369 | 8.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-W-123 | 1,516 | 165 | 25 | 25 | 25 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| 600-275 | 68,727 | 1,665,625 | 220 | 1,640 | 333,125 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-600-12 | 4,893 | 3,326 | 76 | 29 | 504 | 6.6/6.6 | 0 | 0 | 0 | 0 |
| UPR-200-N-1 | 20,721 | 21,120 | 340 | 30 | 3,200 | 6.6/6.6 | 0 | 227 | 680 | 0 |
| **Conceptual Site Model (0 – 4.6 m contaminant depth interval)** | | | | | | | | | | |
| 200-E-26 | 59,248 | 54,000 | 165 | 75 | 3,600 | 15/15 | 0 | 0 | 0 | 0 |
| 200-W-15 | 25,328 | 4,800 | 85 | 53 | 320 | 15/15 | 0 | 0 | 0 | 0 |
| 600-262 | 13,500 | 375 | 50 | 50 | 25 | 15/15 | 0 | 0 | 0 | 0 |

Table C-4. Alternative 3: Remove and Dispose – Cost Summary. (3 Pages)

| Waste Site/Group | Mobilization | Monitoring and Sampling | Solids Collection | Queue Area Operations | ERDF Disposal | Site Restoration | Revegetation | Demobilization | Construction Staff | Project Management | Misc. Costs* | Total Present Net Worth Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Conceptual Site Model (0 – 0.3 m contaminant depth interval)** | | | | | | | | | | | | |
| 200-E-29 | $39,990 | $125,414 | $21,138 | $45,503 | $234,935 | $15,718 | $14,716 | $8,894 | $14,787 | $47,313 | $8,299 | $576,707 |
| 200-E-53 | $41,531 | $167,772 | $70,984 | $44,604 | $404,831 | $29,802 | $21,617 | $7,967 | $17,851 | $54,636 | $8,299 | $869,909 |
| 200-E-105 | $37,968 | $94,705 | $6,356 | $13,579 | $72,915 | $4,716 | $6,204 | $8,588 | $11,846 | $40,283 | $8,299 | $305,459 |
| 200-E-109 | $47,558 | $579,076 | $144,059 | $311,794 | $1,586,226 | $107,280 | $75,915 | $10,036 | $38,997 | $105,182 | $8,299 | $3,014,422 |
| 200-E-110 | $36,456 | $94,256 | $2,193 | $4,501 | $22,284 | $5,193 | $6,521 | $8,360 | $7,710 | $30,398 | $8,299 | $226,171 |
| 200-E-115 | $35,773 | $94,258 | $938 | $2,642 | $6,532 | $5,183 | $6,521 | $8,257 | $7,888 | $30,823 | $8,299 | $207,114 |
| 200-E-117 | $35,773 | $94,258 | $686 | $2,309 | $4,282 | $5,177 | $6,521 | $8,257 | $7,887 | $30,819 | $8,299 | $204,268 |
| 200-E-121 | $42,147 | $113,466 | $34,778 | $21,748 | $198,931 | $13,375 | $15,396 | $9,219 | $14,230 | $45,982 | $8,299 | $517,571 |
| 200-E-124 | $46,875 | $94,356 | $13,410 | $6,349 | $24,534 | $1,921 | $3,221 | $7,895 | $23,132 | $387,927 | $8,299 | $617,919 |
| 200-E-125 | $35,773 | $94,256 | $862 | $1,951 | $5,407 | $5,179 | $6,521 | $8,257 | $7,710 | $30,398 | $8,299 | $204,613 |
| 200-E-129 | $35,773 | $94,257 | $733 | $2,354 | $4,282 | $5,179 | $6,521 | $8,257 | $7,887 | $30,820 | $8,299 | $204,362 |
| 200-E-130 | $35,783 | $93,980 | $627 | $300 | $6,532 | $276 | $1,397 | $8,259 | $10,625 | $37,364 | $8,299 | $203,442 |
| 200-E-139 | $44,794 | $173,926 | $40,452 | $81,021 | $414,957 | $29,591 | $26,716 | $9,619 | $18,590 | $56,404 | $8,299 | $904,369 |
| UPR-200-E-50 | $40,115 | $95,341 | $22,687 | $13,987 | $129,172 | $8,611 | $10,600 | $8,912 | $9,421 | $34,486 | $8,299 | $381,631 |
| UPR-200-E-62 | $36,380 | $94,259 | $743 | $2,278 | $4,282 | $5,187 | $6,521 | $8,349 | $7,889 | $30,825 | $8,299 | $205,012 |
| UPR-200-E-89 | $52,979 | $250,872 | $191,565 | $72,617 | $648,986 | $80,498 | $32,630 | $9,321 | $38,831 | $104,785 | $8,299 | $1,491,383 |
| UPR-200-E-101 | $36,197 | $94,260 | $2,761 | $2,699 | $16,658 | $5,191 | $6,521 | $8,321 | $7,890 | $30,828 | $8,299 | $219,625 |
| UPR-200-E-143 | $36,023 | $94,259 | $1,425 | $3,382 | $16,803 | $5,188 | $6,521 | $8,295 | $7,890 | $30,826 | $8,299 | $218,911 |
| UPR-200-E-144 | $43,033 | $197,635 | $86,816 | $54,528 | $493,717 | $33,316 | $28,081 | $9,353 | $19,485 | $58,542 | $8,299 | $1,032,805 |
| 200-W-53 | $41,531 | $167,772 | $70,984 | $44,604 | $404,831 | $27,241 | $23,019 | $9,126 | $17,851 | $54,636 | $8,299 | $869,894 |
| 200-W-63 | $43,510 | $94,194 | $44,197 | $7,836 | $65,039 | $3,992 | $3,123 | $8,333 | $18,422 | $56,002 | $8,299 | $352,947 |
| 200-W-64 | $44,136 | $94,568 | $108,041 | $19,140 | $153,925 | $9,757 | $5,058 | $8,427 | $29,774 | $83,138 | $8,299 | $564,263 |
| 200-W-67 | $38,787 | $95,424 | $20,561 | $8,060 | $76,291 | $9,326 | $7,142 | $8,712 | $13,170 | $43,448 | $8,299 | $329,220 |
| 200-W-80 | $35,937 | $94,311 | $2,657 | $2,546 | $12,158 | $5,380 | $6,521 | $8,282 | $7,946 | $30,960 | $8,299 | $214,997 |

Table C-4. Alternative 3: Remove and Dispose – Cost Summary. (3 Pages)

| Waste Site/Group | Mobilization | Monitoring and Sampling | Solids Collection | Queue Area Operations | ERDF Disposal | Site Restoration | Revegetation | Demobilization | Construction Staff | Project Management | Misc. Costs* | Total Present Net Worth Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 200-W-81; UPR-200-W-58 | $86,244 | $155,123 | $259,484 | $76,291 | $468,964 | $29,673 | $51,864 | $14,341 | $225,018 | $549,828 | $8,299 | $1,925,129 |
| 200-W-83 | $45,691 | $94,016 | $7,558 | $2,202 | $15,533 | $1,307 | $1,916 | $8,221 | $16,122 | $270,963 | $8,299 | $471,828 |
| 200-W-86 | $35,773 | $94,257 | $722 | $2,278 | $4,282 | $5,179 | $6,521 | $8,257 | $7,887 | $30,820 | $8,299 | $204,275 |
| 200-W-90 | $35,995 | $94,259 | $1,789 | $2,469 | $9,908 | $5,187 | $6,521 | $8,291 | $7,889 | $30,825 | $8,299 | $211,432 |
| 200-W-106 | $36,216 | $94,260 | $2,877 | $2,699 | $16,658 | $5,191 | $6,521 | $8,324 | $7,890 | $30,828 | $8,299 | $219,763 |
| UPR-200-W-46 | $57,456 | $94,416 | $86,750 | $26,181 | $159,133 | $6,680 | $14,258 | $9,997 | $96,035 | $241,521 | $8,299 | $800,742 |
| UPR-200-W-67 | $35,773 | $94,256 | $693 | $2,278 | $4,282 | $5,175 | $6,521 | $8,257 | $7,886 | $30,817 | $8,299 | $204,237 |
| UPR-200-W-69 | $42,224 | $197,743 | $88,691 | $55,913 | $506,093 | $33,975 | $27,493 | $9,231 | $19,624 | $58,875 | $8,299 | $1,048,161 |
| UPR-200-W-116 | $39,701 | $121,495 | $61,239 | $24,008 | $219,183 | $27,750 | $13,819 | $8,850 | $18,215 | $55,506 | $8,299 | $598,065 |
| UPR-200-W-166 | $39,644 | $120,124 | $45,734 | $24,008 | $219,183 | $18,937 | $13,548 | $8,841 | $15,707 | $49,512 | $8,299 | $563,537 |
| UPR-600-21 | $57,205 | $1,764,392 | $447,472 | $969,988 | $4,927,886 | $333,356 | $220,340 | $11,492 | $98,585 | $247,617 | $8,299 | $9,086,632 |
| UPR-200-N-2 | $35,773 | $94,256 | $895 | $2,316 | $5,407 | $5,175 | $6,521 | $8,257 | $7,886 | $30,817 | $8,299 | $205,602 |
| **Conceptual Site Model (0 – 2 m contaminant depth interval)** | | | | | | | | | | | | |
| 200-E-43 | $48,685 | $151,313 | $112,612 | $148,236 | $880,764 | $71,227 | $10,709 | $8,673 | $42,059 | $112,501 | $8,299 | $1,595,078 |
| 200-E-128 | $35,677 | $94,055 | $1,605 | $570 | $8,782 | $751 | $1,346 | $8,243 | $10,752 | $37,668 | $8,299 | $207,748 |
| UPR-200-E-10; UPR-200-E-11; UPR-200-E-12; UPR-200-E-20; UPR-200-E-33 | $156,643 | $990,327 | $1,304,338 | $1,148,682 | $6,109,281 | $510,157 | $173,059 | $24,966 | $712,908 | $1,716,034 | $8,299 | $12,854,694 |
| UPR-200-E-36 | $48,001 | $1,356,591 | $1,779,648 | $1,106,974 | $9,957,253 | $686,088 | $73,317 | $10,103 | $182,022 | $447,055 | $8,299 | $15,655,351 |
| UPR-200-E-43 | $60,831 | $107,302 | $32,178 | $11,751 | $1,125 | $945 | $373,724 | $146,924 | $7,710 | $207,673 | $8,299 | $958,462 |
| UPR-200-E-69 | $55,386 | $584,645 | $448,497 | $690,246 | $4,148,165 | $294,729 | $31,826 | $9,684 | $131,085 | $324,300 | $8,299 | $6,726,862 |
| UPR-200-E-88 | $53,181 | $253,342 | $224,504 | $276,854 | $2,072,048 | $133,089 | $20,741 | $9,351 | $84,820 | $214,712 | $8,299 | $3,350,941 |
| UPR-200-E-112 | $78,974 | $659,072 | $592,787 | $740,294 | $5,552,015 | $331,721 | $58,379 | $13,244 | $226,420 | $553,180 | $8,299 | $8,814,385 |
| 200-W-14 | $36,890 | $95,337 | $21,317 | $11,630 | $107,795 | $8,654 | $6,521 | $8,436 | $9,377 | $34,381 | $8,299 | $348,637 |

Table C-4. Alternative 3: Remove and Dispose – Cost Summary. (3 Pages)

| Waste Site/Group | Mobilization | Monitoring and Sampling | Solids Collection | Queue Area Operations | ERDF Disposal | Site Restoration | Revegetation | Demobilization | Construction Staff | Project Management | Misc. Costs* | Total Present Net Worth Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UPR-200-W-3; UPR-200-W-4; UPR-200-W-65; UPR-200-W-73 | $95,726 | $1,808,026 | $2,181,522 | $1,469,629 | $12,962,496 | $924,714 | $125,157 | $15,773 | $480,880 | $1,161,416 | $8,299 | $21,233,657 |
| UPR-200-W-23 | $35,388 | $93,949 | $202 | $120 | $4,282 | $79 | $957 | $8,199 | $10,560 | $37,210 | $8,299 | $199,245 |
| UPR-200-W-41 | $55,338 | $820,670 | $1,021,611 | $652,349 | $5,822,371 | $474,629 | $48,644 | $9,677 | $171,743 | $422,484 | $8,299 | $9,507,815 |
| UPR-200-W-44 | $45,614 | $94,256 | $8,890 | $3,430 | $26,785 | $3,326 | $15,017 | $8,209 | $15,421 | $48,829 | $8,299 | $278,076 |
| UPR-200-W-96 | $36,043 | $94,258 | $1,076 | $2,355 | $6,532 | $5,184 | $6,521 | $8,298 | $7,889 | $30,824 | $8,299 | $207,279 |
| UPR-200-W-123 | $35,773 | $94,257 | $676 | $2,278 | $4,282 | $5,179 | $6,521 | $8,257 | $7,887 | $30,820 | $8,299 | $204,229 |
| 600-275 | $40,173 | $126,772 | $40,014 | $24,979 | $286,393 | $9,289 | $14,349 | $8,921 | $16,122 | $50,505 | $8,299 | $625,816 |
| UPR-600-12 | $36,014 | $94,186 | $3,476 | $1,414 | $16,658 | $1,570 | $1,811 | $8,293 | $10,978 | $38,208 | $8,299 | $220,907 |
| UPR-200-N-1 | $48,213 | $95,297 | $35,083 | $12,810 | $90,918 | $9,571 | $5,227 | $8,602 | $28,740 | $80,665 | $8,299 | $423,425 |
| **Conceptual Site Model (0 – 4.6 m contaminant depth interval)** | | | | | | | | | | | | |
| 200-E-26 | $37,314 | $97,538 | $33,885 | $39,617 | $204,556 | $22,485 | $4,547 | $8,490 | $16,509 | $37,314 | $8,299 | $524,670 |
| 200-W-15 | $36,332 | $94,724 | $9,843 | $1,991 | $21,159 | $5,010 | $2,451 | $8,341 | $11,957 | $36,332 | $8,299 | $240,656 |
| 600-262 | $35,966 | $94,571 | $4,125 | $2,316 | $5,407 | $6,356 | $6,521 | $8,286 | $8,231 | $35,966 | $8,299 | $211,720 |

*Miscellaneous cost includes personnel training cost.

ERDF = Environmental Restoration Disposal Facility.

# APPENDIX D

# POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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## TERMS

| | |
|---|---|
| AOC | area of contamination |
| ARAR | applicable or relevant and appropriate requirement |
| CERCLA | *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* |
| DOE | U.S. Department of Energy |
| EPA | U.S. Environmental Protection Agency |
| OU | operable unit |
| PCB | polychlorinated biphenyl |
| TBC | to be considered |
| TSD | treatment, storage, and disposal |

# APPENDIX D

# POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

## D1.0 POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This appendix identifies and evaluates potential applicable or relevant and appropriate requirements (ARAR) for waste site remediation in the 200-UR-1 Operable Unit (OU). The potential ARARs identified in this document have been used to form the basis for the levels to which contaminants must be remediated to protect human health and the environment. The *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) provides for the identification of to-be-considered (TBC) nonpromulgated advisories, criteria, guidance, or proposed standards that may be consulted to interpret ARAR to-be-determined remediation goals when ARARs do not exist or are insufficient. Independent of the TBC and ARARs identification process at the Hanford Site, the requirements of U.S. Department of Energy orders must be met.

Because the waste sites in the 200-UR-1 OU will be remediated under a CERCLA decision document, response actions at the sites will be required to meet ARARs. This appendix identifies and evaluates potential ARARs for these sites. Final ARARs for remediation will be established in the record of decision. In many cases, the ARARs form the basis for the preliminary remediation goals to which contaminants must be remediated to protect human health and the environment. In other cases, the ARARs define or restrict how specific response measures can be implemented.

The ARARs identification process is based on CERCLA guidance (EPA/540/G-89/006, *CERCLA Compliance with Other Laws Manual: Interim Final* and EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*). Section 121 of CERCLA, as amended, requires, in part, that any applicable or relevant and appropriate standard, requirement, criterion, or limitation promulgated under any Federal environmental law, or any more stringent state requirement promulgated pursuant to a state environmental statute, be met (or a waiver justified) for any hazardous substance, pollutant, or contaminant that will remain onsite after completion of the response action.

Under this process, potential ARARs are classified into one of three categories: chemical-specific, location-specific, or action-specific. These categories are defined as follows.

- Chemical-specific requirements are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of public and worker safety levels and site cleanup levels.

- Location-specific requirements are restrictions placed on the concentration of dangerous substances or the conduct of activities solely because they occur in special geographic areas.

- Action-specific requirements are usually technology- or activity-based requirements or limitations triggered by the response actions performed at the site.

When requirements in each of these categories are identified, a determination must be made as to whether those requirements are ARARs. A requirement is applicable if the specific terms or jurisdictional prerequisites of the law or regulations directly address the circumstances at a site. If not applicable, a requirement may nevertheless be relevant and appropriate if (1) circumstances at the site are, based on best professional judgment, sufficiently similar to the problems or situations regulated by the requirement and (2) the requirement's use is well suited to the site. Only the substantive requirements (e.g., use of control/containment equipment, compliance with numerical standards) associated with ARARs apply to CERCLA onsite activities. ARARs associated with administrative requirements, such as permitting, are not applicable to CERCLA onsite activities (CERCLA, Section 121[e][1]). In general, this CERCLA permitting exemption will be extended to all response action activities conducted at the 200-UR-1 OU waste sites, with the exception of the *Resource Conservation and Recovery Act of 1976* units, which will be incorporated into WA7890008967, *Hanford Facility RCRA Permit*.

TBC information is nonpromulgated advisories or guidance issued by Federal or state governments that is not legally binding and does not have the status of potential ARARs. In some circumstances, TBCs will be considered along with ARARs in determining the response action necessary for protection of human health and the environment. The TBCs complement the ARARs in determining protectiveness at a site or implementation of certain actions. For example, because soil cleanup standards do not exist for all contaminants, health advisories, which would be TBCs, may be helpful in defining appropriate response action goals.

## D1.1 WAIVERS FROM APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The U.S. Environmental Protection Agency may waive ARARs and select a response action that does not attain the same level of site cleanup as that identified by the ARARs. Section 121 of the *Superfund Amendments and Reauthorization Act of 1986* identifies six circumstances in which the U.S. Environmental Protection Agency may waive ARARs for onsite response actions. The six circumstances are as follows:

- The action selected is only a part of a total remedial action (such as an interim action), and the final remedy will attain the ARAR upon its completion
- Compliance with the ARAR will result in a greater risk to human health and the environment than alternative options
- Compliance with the ARAR is technically impracticable from an engineering perspective
- An alternative response action will attain an equivalent standard of performance through the use of another method or approach

- The ARAR is a state requirement that the state has not consistently applied (or demonstrated the intent to apply consistently) in similar circumstances
- In the case of Section 104 (Superfund-financed remedial actions), compliance with the ARAR will not provide a balance between protecting human health and the environment and the availability of Superfund money for response at other facilities.

## D1.2 POTENTIAL ARARS FOR RESPONSE ACTIONS AT THE 200-UR-1 OPERABLE UNIT WASTE SITES

Potential Federal and state ARARs are presented in Tables D-1 and D-2, respectively. The chemical-specific ARARs likely to be most relevant to remediation of the 200-UR-1 OU waste sites are elements of the Washington State regulations that implement WAC 173-340, "Model Toxics Control Act -- Cleanup," specifically associated with developing risk-based concentrations for cleanup (WAC 173-340-745, "Soil Cleanup Standards for Industrial Properties"). The requirements of WAC 173-340-745 risk-based concentrations help establish soil cleanup standards for nonradioactive contaminants at waste sites. The air emission standards are likely to be important in identifying air emission limits and control requirements for any response actions that produce air emissions. *Resource Conservation and Recovery Act of 1976* land-disposal restrictions will be important standards during the management of wastes generated during response actions.

No location-specific ARARs have been identified for the waste sites considered in the engineering evaluation/cost analysis.

Action-specific ARARs that could be pertinent to remediation are state solid and dangerous waste regulations (for management of characterization and remediation wastes and performance standards for waste left in place) and regulations related to air emissions.

## D2.0 REFERENCES

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Title 40, *Code of Federal Regulations*, Part 61, as amended.

40 CFR 268, "Land Disposal Restrictions," Title 40, *Code of Federal Regulations*, Part 268, as amended.

40 CFR 761, "Polychorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," *Code of Federal Regulations*, Title 40, *Code of Federal Regulations*, Part 761, as amended.

*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq.

EPA/540/G-89/004, 1989, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*, U.S. Environmental Protection Agency, Washington, D.C.

EPA/540/G-89/006, 1988, *CERCLA Compliance with Other Laws Manual: Interim Final*, U.S. Environmental Protection Agency, Washington, D.C.

*Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq.

*Superfund Amendments and Reauthorization Act of 1986*, 42 USC 103, et seq.

WA7890008967, 1994, *Hanford Facility RCRA Permit*, Washington State Department of Ecology, Olympia, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-304, "Minimum Functional Standards for Solid Waste Handling," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-340, "Model Toxics Control Act -- Cleanup," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-350, "Solid Waste Handling Standards," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

Table D-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements for the 200-UR-1 Operable Unit Engineering Evaluation/Cost Analysis.

| ARAR Citation | ARAR or TBC | Requirement | Rationale for Use |
|---|---|---|---|
| "Polychlorinated Biphenyls (PCB) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," 40 CFR 761 | | | |
| "PCB Remediation Waste," 40 CFR 761.61 | ARAR | Establishes the cleanup and disposal options for PCB remediation waste. | This requirement is relevant and appropriate because PCB remediation waste may be encountered during the remediation of the 200-UR-1 OU. |
| "National Emission Standards for Hazardous Air Pollutants," 40 CFR 61 | | | |
| "Lists of Pollutants and applicability of Part 61," 40 CFR 61.01 | ARAR | Establishes the list of hazardous air pollutants. | This requirement applies to response actions that release air emissions into unrestricted areas. Therefore, this regulation is applicable to response action activities in the 200-UR-1 OU. |
| "Monitoring Requirements," 40 CFR 61.14 | ARAR | Requires the owner/operator to maintain and operate each monitoring system in a manner consistent with air pollution control practices for minimizing emissions. The regulation also establishes the requirements for installing monitoring systems. | This requirement applies to response actions that release air emissions into unrestricted areas. Therefore, this regulation is applicable to response action activities in the 200-UR-1 OU. |
| "Standard," 40 CFR 61.92 | ARAR | Requires that emissions of radionuclides to the ambient air from DOE facilities shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. | This requirement applies to response actions that release air emissions into unrestricted areas. Therefore, this regulation is applicable to response action activities in the 200-UR-1 OU. |
| "Emission Monitoring and Test Procedures," 40 CFR 61.93(e) | ARAR | Establishes the methods for monitoring emissions rates. | This requirement applies to response actions that release air emissions into unrestricted areas. Therefore, this regulation is applicable to response action activities in the 200-UR-1 OU. |
| Regulations pursuant to the *Resource Conservation and Recovery Act of 1976* and implemented through WAC 173-303, "Dangerous Waste Regulations" (see Table D-2). | | | |

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants."

40 CFR 761, "Polychorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions."

*Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq.

WAC 173-303, "Dangerous Waste Regulations."

ARAR = applicable or relevant and appropriate requirement.
DOE = U.S. Department of Energy.
OU = operable unit.
PCB = polychlorinated biphenyl.
TBC = to be considered.

Table D-2. Identification of Potential State Applicable and Relevant or Appropriate Requirements for the 200-UR-1 Operable Unit Engineering Evaluation/Cost Analysis. (3 Pages)

| ARAR Citation | ARAR or TBC | Requirement | Rationale for Use |
|---|---|---|---|
| "Dangerous Waste Regulations," WAC 173-303 | | | |
| "Identifying Solid Waste," WAC 173-303-016 | ARAR | Identifies those materials that are and are not solid wastes. | The requirements of this section are applicable to the on-site generation of wastes within the 200-UR-1 OU because they identify those materials that are subject to the dangerous waste regulations. These regulations may be relevant and applicable to waste sites within the AOC. |
| "Designation of Dangerous Waste," WAC 173-303-070 | ARAR | Establishes the method for determining whether a solid waste is, or is not, a dangerous waste or an extremely hazardous waste. | The requirements of this section are applicable because dangerous wastes may be generated during response action activities in the 200-UR-1 OU. |
| "Excluded Categories of Waste," WAC 173-303-071 | ARAR | Describes those categories of wastes that are excluded from the requirements of WAC 173-303 (excluding WAC 173-303-050). | The conditions of this requirement are applicable to response actions in the 200-UR-1 OU should wastes identified in WAC 173-303-071 be encountered. |
| "Conditional Exclusion of Special Wastes," WAC 173-303-073 | ARAR | Establishes the conditional exclusion and the management requirements of special wastes, as defined in WAC 173-303-040. | The conditions of this requirement are applicable to response action activities in the 200-UR-1 OU, should special wastes be encountered. |
| "Discarded Chemical Products," WAC 173-303-081 | ARAR | Identifies when discarded products are to be designated as dangerous wastes. | The requirements of this section are applicable to remediation activities in the 200-UR-1 OU that may use a commercial chemical product. |
| "Dangerous Waste Sources," WAC 173-303-082 | ARAR | Identifies the requirements for dangerous waste sources identified in WAC 173-303-9904. | This requirement is applicable to any waste or residue that is listed in WAC 173-303-9904, that was generated through remediation activities in the 200-UR-1 OU. |
| "Dangerous Waste Characteristics," WAC 173-303-090 | ARAR | Identifies the characteristics that a solid waste may exhibit, causing it to be a dangerous waste. | The requirements of this section are applicable because the wastes in the 216-U-12 TSD unit exhibit characteristics of corrosivity. |
| "Dangerous Waste Criteria," WAC 173-303-100 | ARAR | Establishes criteria for determining if a solid waste is a dangerous waste. | The criteria established in this section are applicable to wastes generated through the remediation activities of the 200-UR-1 OU. |
| "Sampling and Testing Methods," WAC 173-303-110 | ARAR | Establishes the testing method to be used to comply with the requirements of this chapter. This section also requires the use of control procedures for the analytical results. | The requirements of this section are applicable to sampling and testing methods used during sampling activities at the response action waste sites in the 200-UR-1 OU. |

Table D-2. Identification of Potential State Applicable and Relevant or Appropriate Requirements for the 200-UR-1 Operable Unit Engineering Evaluation/Cost Analysis. (3 Pages)

| ARAR Citation | ARAR or TBC | Requirement | Rationale for Use |
|---|---|---|---|
| "Recycled, Reclaimed, and Recovered Wastes," WAC 173-303-120 | ARAR | Describes the requirements for recycling materials that are solid wastes and dangerous wastes. | Materials generated during site characterization or response action may be recyclable and not subject to all applicable dangerous waste requirements. Therefore, this regulation is applicable to recyclable wastes that meet the criteria of WAC 173-303-120 in the 200-UR-1 OU. |
| "Land Disposal Restrictions," WAC 173-303-140 | ARAR | Incorporates by reference, EPA land disposal requirements in 40 CFR 268 that are applicable to wastes designated in accordance with WAC 173-303-070. | Incorporates by reference, land disposal restrictions applicable to dangerous waste that the EPA cannot delegate to the states. Therefore, this regulation is applicable to the waste sites containing dangerous wastes within the 200-UR-1 OU. |
| "Spills and Discharges into the Environment," WAC 173-303-145 | ARAR | Sets forth the requirements that apply when any dangerous waste or hazardous substance is intentionally or accidentally spilled or discharged into the environment such that human health and the environment are threatened, regardless of the quantity of dangerous waste or hazardous substance. | This regulation is applicable to on-site response activities in the 200-UR-1 OU, should dangerous waste or hazardous substances be spilled or discharged into the environment. This regulation may be relevant and appropriate, should a dangerous waste be spilled or discharged within the AOC. |
| "Requirements for Generators of Dangerous Waste," WAC 173-303-170 | ARAR | Establishes the requirements for dangerous waste generators. | The requirements of this section are applicable to actions performed at the site if dangerous waste is generated in the 200-UR-1 OU. However, if wastes are generated within an AOC, then the requirements of WAC 173-303-170 are relevant and appropriate. |
| "Accumulating Dangerous Waste On-Site," WAC 173-303-200 | ARAR | Establishes the requirements for accumulating wastes on-site. | Applicable to wastes generated on site at the 216-U-12 Crib TSD Unit. The requirements of WAC 173-303-200 may be relevant and appropriate for wastes generated within the AOC. |
| "Model Toxics Control Act -- Cleanup," WAC 173-340 | | | |
| "Soil Cleanup Standards for Industrial Properties," WAC 173-340-745 | ARAR | Identifies the methods used to identify risk-based concentrations and their use in the selection of a cleanup action. Cleanup and remediation levels are based on protection of human health and the environment, the location of the site, and other regulations that apply to the site. The standard specifies cleanup goals that implement the strictest Federal or state cleanup criteria. | The risk-based concentrations for soils and protection of groundwater are relevant and appropriate to the 200-UR-1 OU waste site actions. |

Table D-2. Identification of Potential State Applicable and Relevant or Appropriate Requirements for the 200-UR-1 Operable Unit Engineering Evaluation/Cost Analysis. (3 Pages)

| ARAR Citation | ARAR or TBC | Requirement | Rationale for Use |
|---|---|---|---|
| "Minimum Functional Standards for Solid Waste Handling," WAC 173-304 | | | |
| "On-Site Containerized Storage, Collection and Transportation Standards for Solid Waste," WAC 173-304-200 | ARAR | Establishes the standards for the storage of containerized solid wastes generated on site. | This section is applicable to the on-site containerized storage, collection, and transportation of solid wastes that may be generated during remediation activities in the 200-UR-1 OU. |
| "Solid Waste Handling Standards," WAC 173-350 | | | |
| "On-Site Storage, Collection and Transportation Standards," WAC 173-350-300 | ARAR | Establishes the requirements for the temporary storage of solid waste in a container on site and the collecting and transporting of the solid waste. | This newly promulgated rule is relevant and appropriate to the on-site collection and temporary storage of solid wastes at the 200-UR-1 OU remediation waste sites because compliance with this regulation is phased for existing facilities. |
| "General Regulations for Air Pollution Sources," WAC 173-400 | | | |
| "General Standards for Maximum Emissions," WAC 173-400-040 | ARAR | Establishes the general emission standards for emission units. Emission standards identified in other chapters for specific emission units will take precedence over the general emission standards of this section. | Requirements of this standard are applicable to response actions performed at the site that could result in the emission of hazardous air pollutants. Substantive standards established for the control and prevention of air pollution under this regulation are applicable to response actions that may be proposed at a site. |
| "Controls for New Sources of Toxic Air Pollutants," WAC 173-460 | | | |
| "Control Technology Requirements," WAC 173-460-060 | ARAR | Requires that new sources of air emissions provide the emission estimates identified in this regulation. | The standard is relevant and appropriate to response actions in the 200-UR-1 OU because nonradioactive operable unit contaminants of concern are identified in the regulation as toxic air contaminants. |
| "Ambient Air Quality Standards and Emission Limits for Radionuclides," WAC 173-480 | | | |
| "Emission Monitoring and Compliance Procedures," WAC 173-480-070 | ARAR | Establishes requirements for determining compliance with dose standards. | Requirements of this standard are applicable to response actions that may emit radionuclides to the air. |

40 CFR 268, "Land Disposal Restrictions."
WAC 173-303, "Dangerous Waste Regulations."
WAC 173-304, "Minimum Functional Standards for Solid Waste Handling."
WAC 173-340, "Model Toxics Control Act -- Cleanup."
WAC 173-350, "Solid Waste Handling Standards."
WAC 173-400, "General Regulations for Air Pollution Sources."
WAC 173-460, "Controls for New Sources of Toxic Air Pollutants."
WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides."

AOC = area of contamination.
ARAR = applicable or relevant and appropriate requirement.
EPA = U.S. Environmental Protection Agency.
OU = operable unit.
TBC = to be considered.
TSD = treatment, storage, and disposal.

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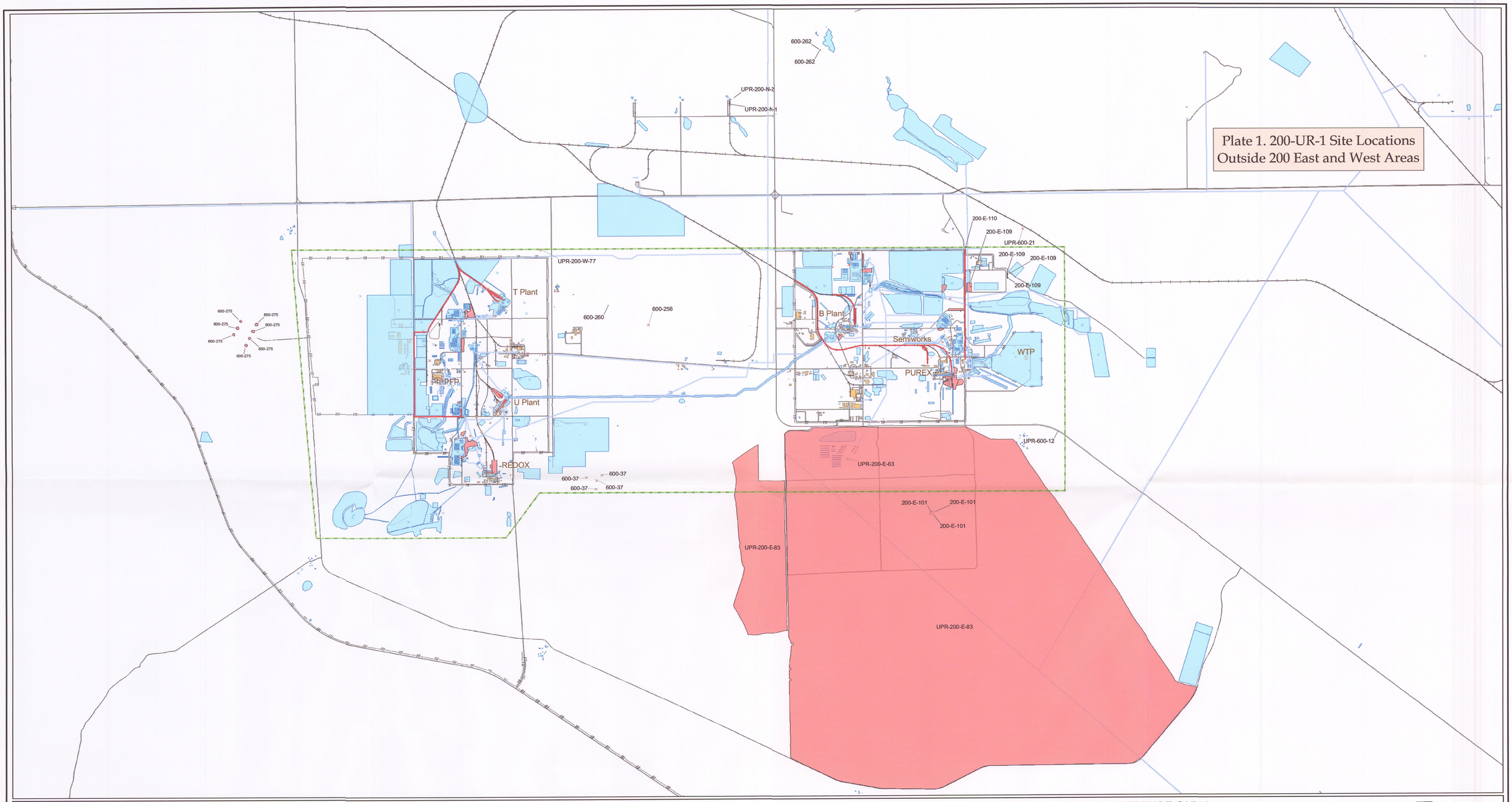


Building

Core Zone

Road

Fence

Railroad

**200-UR-1 Sites**

Polygonal

Linear

**Other Waste Sites**

Polygonal

Linear

Approximate Location

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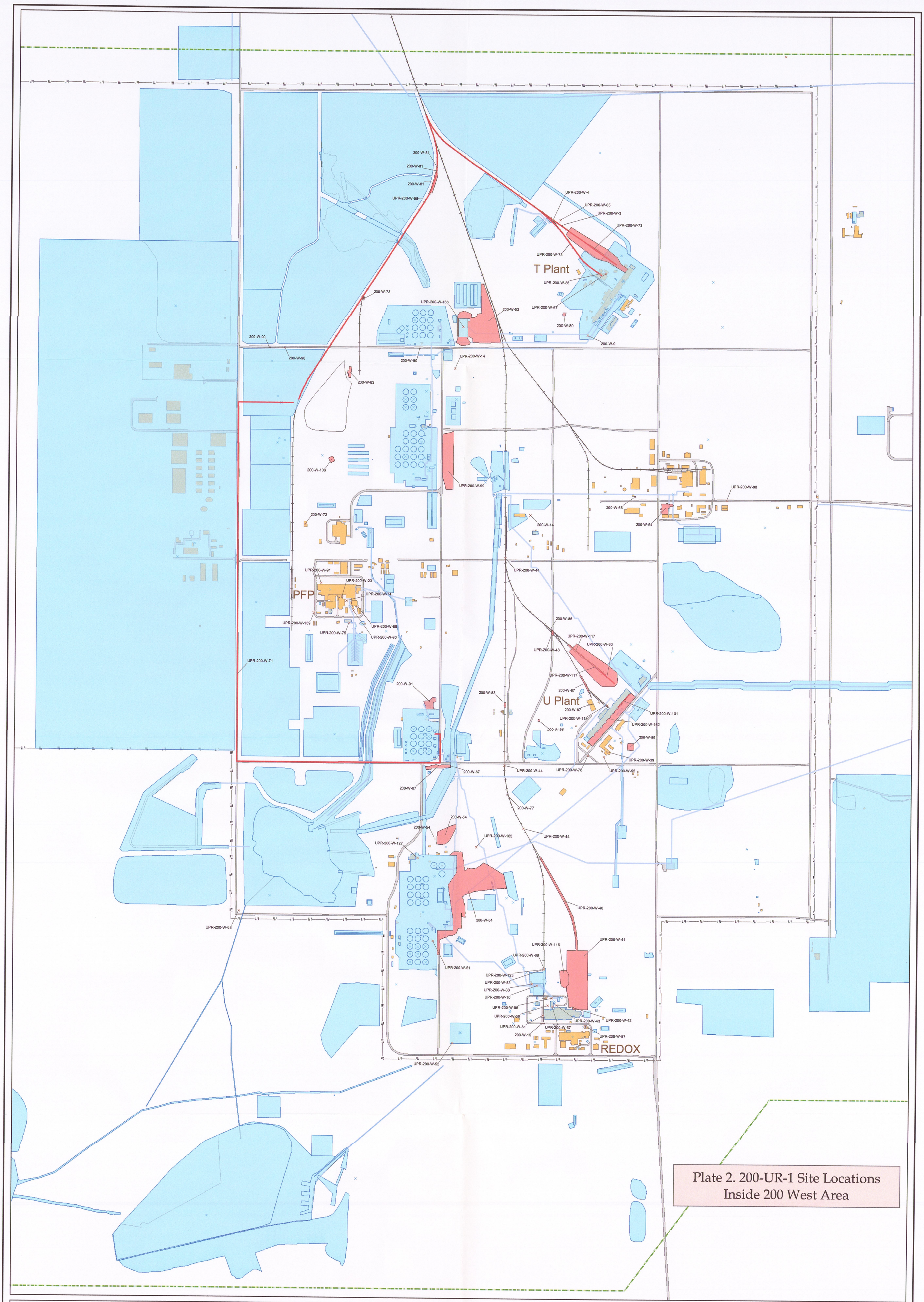


Plate 2. 200-UR-1 Site Locations
Inside 200 West Area

Core Zone
Building
Road
Fence
Railroad

**200-UR-1 Sites**
Polygonal
Linear
Approx. Loc.

**Other Waste Sites**
Polygonal
Linear
Approx. Loc.

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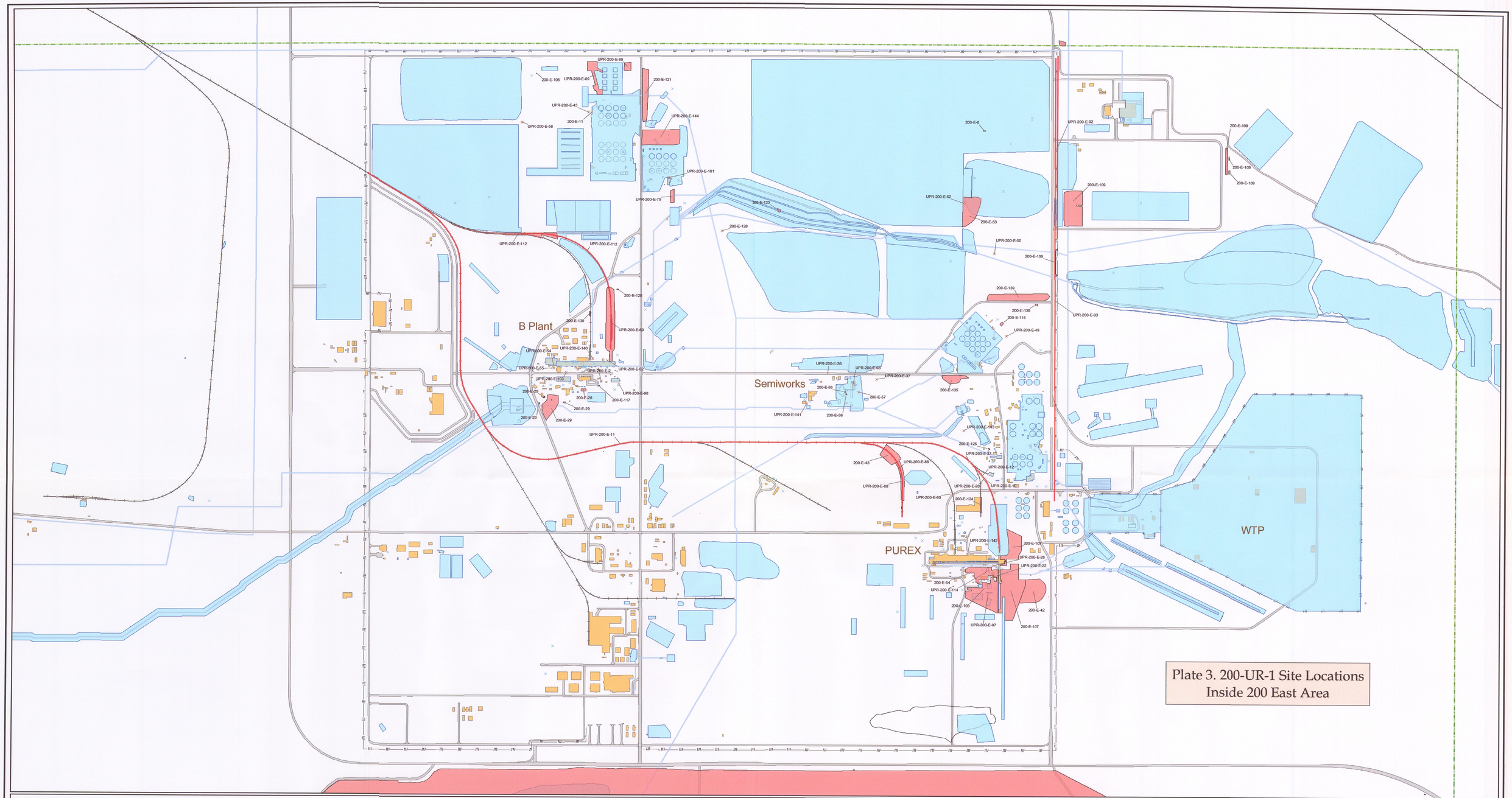


Plate 3. 200-UR-1 Site Locations
Inside 200 East Area

Building
Core Zone
Road
Fence
Railroad

**200-UR-1 Sites**
Polygonal
Linear

**Other Waste Sites**
Polygonal
Linear

Approximate Location

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