

I-10018-0041

DOE/OR/01-2399&D0

**Fiscal Year 2009 Phased Construction
Completion Report for EU Z2-36 in Zone 2,
East Tennessee Technology Park,
Oak Ridge, Tennessee**



This document is approved for public
release per review by:

A. Z. Mc Bride/dw 2/6/2009
BJC ETTP Classification & Information Control Office Date

RECEIVED FEB 18 2009

**Fiscal Year 2009 Phased Construction
Completion Report for EU Z2-36,
East Tennessee Technology Park,
Oak Ridge, Tennessee**

Date Issued—February 2009

Prepared for the
U.S. Department of Energy
Office of Environmental Management

BECHTEL JACOBS COMPANY LLC
managing the
Accelerated Cleanup Activities at the
East Tennessee Technology Park
under contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

Reference to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

CONTENTS

EXECUTIVE SUMMARY	ES-1
1. INTRODUCTION AND PURPOSE.....	1
2. PROJECT DESCRIPTION	5
2.1 SCOPE.....	5
2.1.1 Exposure Unit Groups	5
2.1.2 Excluded Acreage.....	7
2.1.3 Data Quality Objectives and Soil Unit Classifications.....	7
2.1.4 Federal Facility Agreement Sites	7
2.2 DVS CHARACTERIZATION APPROACH	7
2.2.1 Planning.....	9
2.2.1.1 SU classification	9
2.2.1.2 DQO scoping	9
2.2.2 Class 2 SU Characterization Approach	9
2.2.3 Class 3 SU Characterization Approach	12
2.2.4 Program Execution	14
2.2.5 Action/No Further Action Decision/Communication.....	16
2.2.6 Documentation and Records.....	17
3. PROJECT REQUIREMENTS	19
3.1 ZONE 2 RECORD OF DECISION	19
3.2 DYNAMIC VERIFICATION STRATEGY	23
3.3 FINAL STATUS EVALUATION PROCESS.....	24
3.3.1 Action/No Further Action Decision	24
3.3.2 Special Data Uses and Considerations	27
3.3.3 Qualitative Risk Screening for Unrestricted Use	28
4. FINAL STATUS ASSESSMENTS	29
4.1 EXPOSURE UNIT EVALUATION.....	32
4.1.1 Exposure Unit Z2-36.....	32
5. REMEDIATION ACTIVITIES	35
5.1 END STATE.....	35
6. DEVIATIONS FROM GOVERNING DOCUMENTS	37
7. COSTS AND SCHEDULE FOR REMEDIAL ACTION(S).....	39
8. WASTE MANAGEMENT ACTIVITIES FOR REMEDIAL ACTION(S)	41
9. OPERATIONS AND MAINTENANCE	43
10. MONITORING SCHEDULE AND/OR EXPECTATIONS.....	45

11.	LAND USE CONTROLS	47
11.1	POSSIBLE LIFTING OF LAND USE CONTROLS	47
11.2	DEFINITIONS	47
11.3	INDUSTRIAL CONTROLS AT DEPTH	47
11.4	POTENTIAL UNRESTRICTED USE	48
11.5	REMAINING ACTIVITIES	48
12.	REFERENCES	53
APPENDIX A. EXPOSURE UNIT Z2-33 SOUTH PARK AREA		
	TECHNICAL MEMORANDUM	A-1

FIGURES

1.	ETTP site map with Zone 2 DQO scoping EU groups and EUs.	2
2.	EU Z2-36 location map.	6
3.	Zone 2 DVS Class 1 and Class 2 SU sampling and analysis decision process flow.	11
4.	Zone 2 DVS Class 3 and Class 4 SU sampling and analysis decision process flow.	13
5.	Risk evaluation process.	25
6.	EUs Included in EU Z2-36 PCCR.	51

TABLES

1.	Zone 2 EU groups and acreages	5
2.	FFA sites in EU Z2-36	8
3.	RAO and protection goals for Zone 2	19
4.	Chemicals and radionuclides required for analysis in Zone 2 DVS samples and their evaluation criteria.....	20
5.	DVS decision rules for Zone 2 soils.....	24
6.	DVS evaluation summary for EU Z2-36.....	29
7.	Final status assessment summary for EU Z2-36	31
8.	Summary of conclusions for EU Z2-36 Zone 2 ROD Appendix A FFA sites	32
9.	EU Z2-36 FCNs and concurrences.....	37

ACRONYMS

AP	assessment point
ARL	average remediation level
BAR	biased area remediation
BOS	Balance of Site
CD	compact disc
COC	contaminant of concern
D&D	deactivation and demolition
DOE	U.S. Department of Energy
DQO	data quality objective
DVS	Dynamic Verification Strategy
DWP	Dynamic Work Plan
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
EU	exposure unit
FCN	Field Change Notice
FFA	Federal Facility Agreement
FY	fiscal year
FIDLER	field instrument for the detection of low energy radiation
HI	hazard index
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCL	maximum contaminant level
MP	mid-point
NFA	no further action
OREIS	Oak Ridge Environmental Information System
PCB	polychlorinated biphenyl
PCCR	Phased Construction Completion Report
PRG	preliminary remediation goal
QAPP	Quality Assurance Program Plan
QC	quality control
RA	remedial action
RAO	remedial action objective
RAR	Remedial Action Report
RDR/RAWP	Remedial Design Report/Remedial Action Work Plan
RCW	recirculating cooling water
RL	remediation level
ROD	Record of Decision
SL	screening level
SOP	standard operating procedure
SU	soil unit
SVOC	semivolatile organic compound
TAL	target analyte list
TDEC	Tennessee Department of Environment and Conservation
TM	technical memorandum
UST	underground storage tank
VOC	volatile organic compound

EXECUTIVE SUMMARY

The *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2161&D2) (Zone 2 ROD) acknowledged that most of the 800 acres in Zone 2 were contaminated, but that sufficient data to confirm the levels of contamination were lacking. The Zone 2 ROD further specified that a sampling strategy for filling the data gaps would be developed. The *Remedial Design Report/Remedial Action Work Plan for Zone 2 Soils, Slabs, and Subsurface Structures, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2224&D3) (Zone 2 RDR/RAWP) defined the sampling strategy as the Dynamic Verification Strategy (DVS), generally following the approach used for characterization of the Zone 1 exposure units (EUs).

The Zone 2 ROD divided the Zone 2 area into seven geographic areas and 44 EUs. To facilitate the data quality objectives (DQOs) of the DVS process, the Zone 2 RDR/RAWP regrouped the 44 EUs into 12 DQO scoping EU groups. These groups facilitated the DQO process by placing similar facilities and their support facilities together and allowing identification of data gaps. The EU groups were no longer pertinent after DQO planning was completed and characterization was conducted as areas became accessible. As the opportunity to complete characterization became available, the planned DVS program was completed for the EU addressed in this document (EU Z2-36). The purpose of this PCCR is to address the following:

- Document DVS characterization results for EU Z2-36,
- Describe and document the risk evaluation and determine if the EU meets the Zone 2 ROD requirements for unrestricted industrial use to 10 ft bgs, and
- Identify additional areas not defined in the Zone 2 ROD that require remediation based on the DVS evaluation results.

Approximately 15 acres are included in the EU addressed in this PCCR. Based on the results of the DVS evaluation, approximately 15 acres are recommended for unrestricted industrial use to 10 ft bgs. Two Federal Facility Agreement sites as listed below are included in Appendix A of the Zone 2 ROD as being in EU Z2-36. The K-1423 Grease Burial FFA Site is included in the Main Plant DQO Scoping Package as being in EU Z2-36, but it is actually located east of K-1423 in EU Z2-25 and will be addressed in the technical memorandum for that EU. The DOE recommends NFA for the two FFA sites here.

- K-1098-C Asphalt Plant,
- K-1503 Neutralization Pit, and

The Zone 2 ROD required land use controls to prevent disturbance of soils below 10 ft deep and to restrict future land use to industrial/commercial activities. In response to stakeholder comments, the U.S. Department of Energy agreed to re-evaluate the need for such land use restrictions. This document includes a screening evaluation to determine the likelihood of land use controls in EU Z2-36 being modified to: (1) eliminate the restriction on disturbance of soils below 10 ft bgs where data indicate the absence of residual contamination at any depth that would result in an unacceptable risk to the future industrial worker, and (2) permit alternative land uses that would be protective of future site occupants. Results of this screening evaluation indicate a low probability that restrictions on disturbing soil below 10 ft bgs could be safely eliminated for EU Z2-36. A qualitative screening evaluation considered the likelihood of unrestricted land use being protective of future site occupants. Based on this qualitative assessment, all 15 acres addressed in this PCCR were assigned a low probability for consideration of release for unrestricted land use.

This document contains the main text (Sects. 1 through 13) and one appendix. The main text addresses the purposes for this PCCR. Additional supporting detail (e.g., field work summaries, maps, survey results, and data summaries) is provided in the EU Z2-36 technical memorandum (Appendix A). Historical and DVS analytical data used in this PCCR are provided on a compact disc attached to this document and can be accessed through the Oak Ridge Environmental Information System.

1. INTRODUCTION AND PURPOSE

The purpose of this Phased Construction Completion Report (PCCR) is to present fiscal year (FY) 2009 results of Dynamic Verification Strategy (DVS) characterization activities for exposure unit (EU) Z2-36 in Zone 2 at the East Tennessee Technology Park (ETTP). The ETTP is located in the northwest corner of the U.S. Department of Energy (DOE) Oak Ridge Reservation in Oak Ridge, Tennessee and encompasses approximately 5000 acres that have been subdivided into three zones—Zone 1 (~1400 acres), Zone 2 (~800 acres), and the Boundary Area (~2800 acres).

Zone 2 comprises the highly industrialized portion of ETTP (Fig. 1) and consists of all formerly secured areas of the facility, including the large processing buildings and direct support facilities; experimental laboratories and chemical and materials handling facilities; materials storage and waste disposal facilities; secure document records libraries; and shipping and receiving warehouses. The *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2005) (Zone 2 ROD) specifies the future end use for Zone 2 acreage as uncontrolled industrial for the upper 10 ft of soils.

Characterization activities in these areas were conducted in compliance with the Zone 2 ROD and the DVS and data quality objectives (DQOs) presented in the *Main Plant Group DQO Scoping Package* (July 2006) and the *Remedial Design Report/Remedial Action Work Plan for Zone 2 Soils, Slabs, and Subsurface Structures, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2007a) (Zone 2 RDR/RAWP). The purpose of this PCCR is to address the following:

- Document EU Z2-36 DVS characterization results;
- Describe and document the risk evaluation and determine if the EU meets the Zone 2 ROD requirements for unrestricted industrial use to 10 ft bgs, and
- Identify additional areas not defined in the Zone 2 ROD that require remediation based on the DVS evaluation results

The Zone 2 ROD divided the area into 7 geographic areas and 44 EUs. To facilitate DQOs of the DVS process, the Zone 2 RDR/RAWP regrouped the 44 EUs into 12 DQO scoping EU groups. These groups facilitated the DQO process by placing similar facilities and their support facilities together and allowing identification of data gaps. The EU groups were no longer pertinent after DQO planning was completed, and characterization was conducted as EUs became accessible. As the opportunity to complete characterization became available, the planned DVS program was completed in FY 2009 for EU Z2-36.

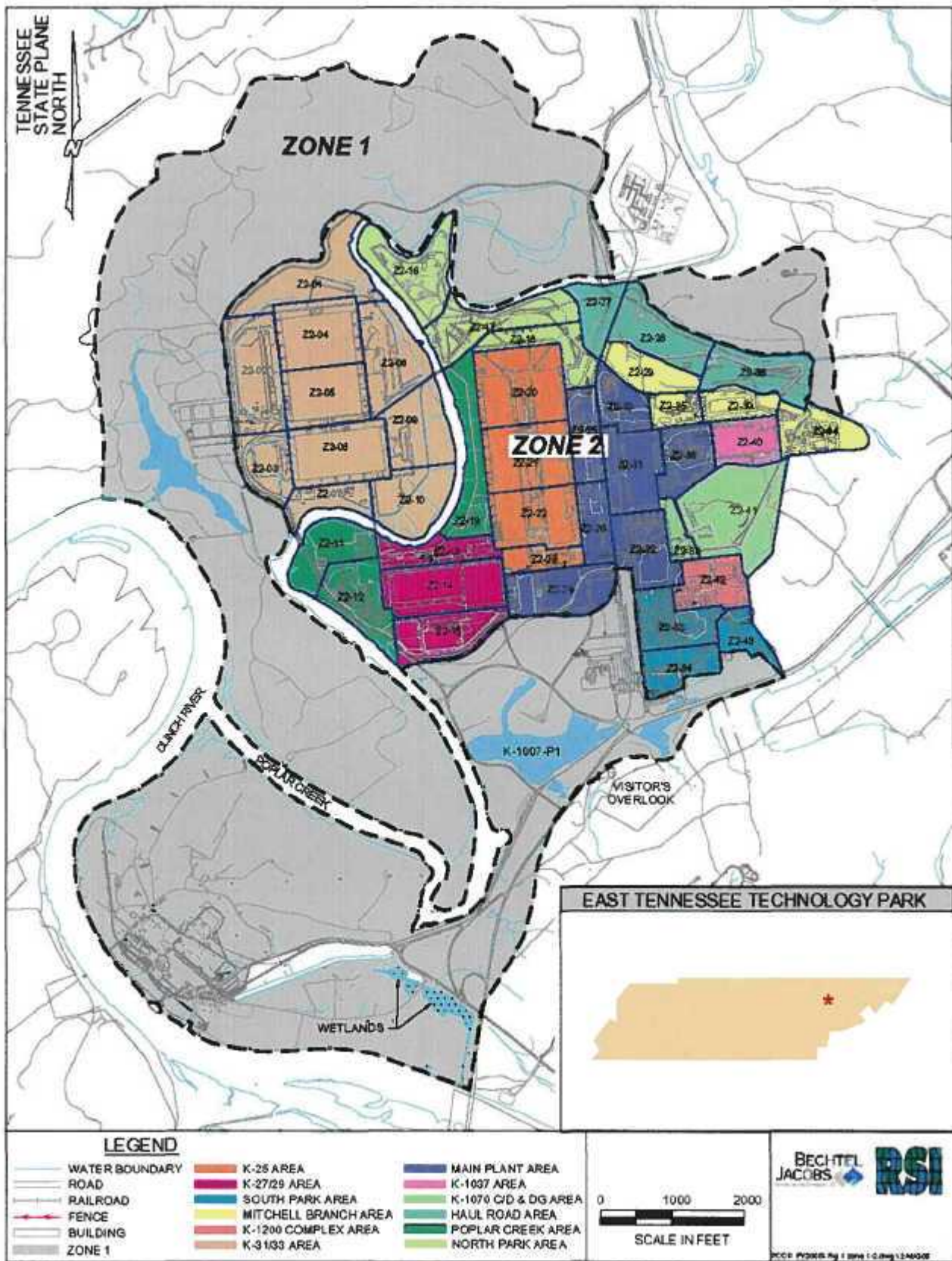


Fig. 1. ETTP site map with Zone 2 DQO scoping EU groups and EUs.

The main body of this report describes the DVS process and the scope of work performed. The scope and approach for performing DVS activities that lead to action/no further action decisions are presented in Sects. 2 through 4. The remedial action of backfilling the building K-1501 basement and two small adjacent pits, normally described in Sects. 5 through 10, was described in *Fiscal Year 2007 Phased Construction Completion Report for the Zone 2 Soils, Slabs, and Subsurface Structures at East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2007b). Future land use is described in Sect. 11, and the status of all Zone 2 EUs as of this PCCR is presented in Sect. 12.

7

2. PROJECT DESCRIPTION

2.1 SCOPE

2.1.1 Exposure Unit Groups

The Zone 2 ROD specified the division of Zone 2 into 44 EUs that range in size from 5.9 acres (EU Z2-37) to 38 acres (EU Z2-41). The location of EU Z2-36 in the Main Plant Area is shown in Fig. 2. An EU represents a hypothetical area over which an industrial worker could be exposed to contaminated soil in the interval 0-10 ft bgs. The acreage of each EU was calculated based on the estimated EU boundaries defined in the Zone 2 ROD. For the Zone 2 DVS characterization program, EU boundaries and acreage calculations were refined. Acreages presented in this document have been rounded to one decimal place.

To facilitate DQO development and planning, the 44 EUs within Zone 2 were divided into 12 EU Groups (DOE 2007a). Field activities were conducted as the opportunity for access to the various areas arose. Coordination between deactivation and demolition (D&D) activities and assets utilization priorities were the primary drivers in executing the Zone 2 DVS characterization program and RAs. Therefore, EU groups were not completed in their entirety. Evaluation and discussion of the DVS program completed in EU Z2-36 is provided in the technical memorandum (TM) (see Appendix A). The Zone 2 EU groups, EUs, and associated total EU group acreages are shown in Table 1.

Table 1. Zone 2 EU groups and acreages

EU Group	EUs	Acreage
K-31/K-33 Area	Z2-01, Z2-02, Z2-03, Z2-04, Z2-05, Z2-06, Z2-07, Z2-08, Z2-09, Z2-10	223.6
Poplar Creek Area	Z2-11, Z2-12, Z2-19	58.5
K-27/K-29 Area	Z2-13, Z2-14, Z2-15	60.5
North Park Area	Z2-16, Z2-17, Z2-18	62.9
K-25 Area	Z2-20, Z2-21, Z2-22, Z2-23	87.6
Main Plant Area	Z2-24, Z2-25, Z2-26, Z2-31, Z2-32, Z2-36	100.9
Haul Road Area	Z2-27, Z2-28, Z2-38	52.3
Mitchell Branch Area	Z2-29, Z2-30, Z2-35, Z2-39, Z2-44	59.7
K-1037 Area	Z2-40	13.8
K-1070-C/D and Downgradient Area	Z2-37, Z2-41	44.0
K-1200 Complex Area	Z2-42	15.5
South Park Area	Z2-33, Z2-34, Z2-43	39.7
Total acreage		819.0

EU = exposure unit

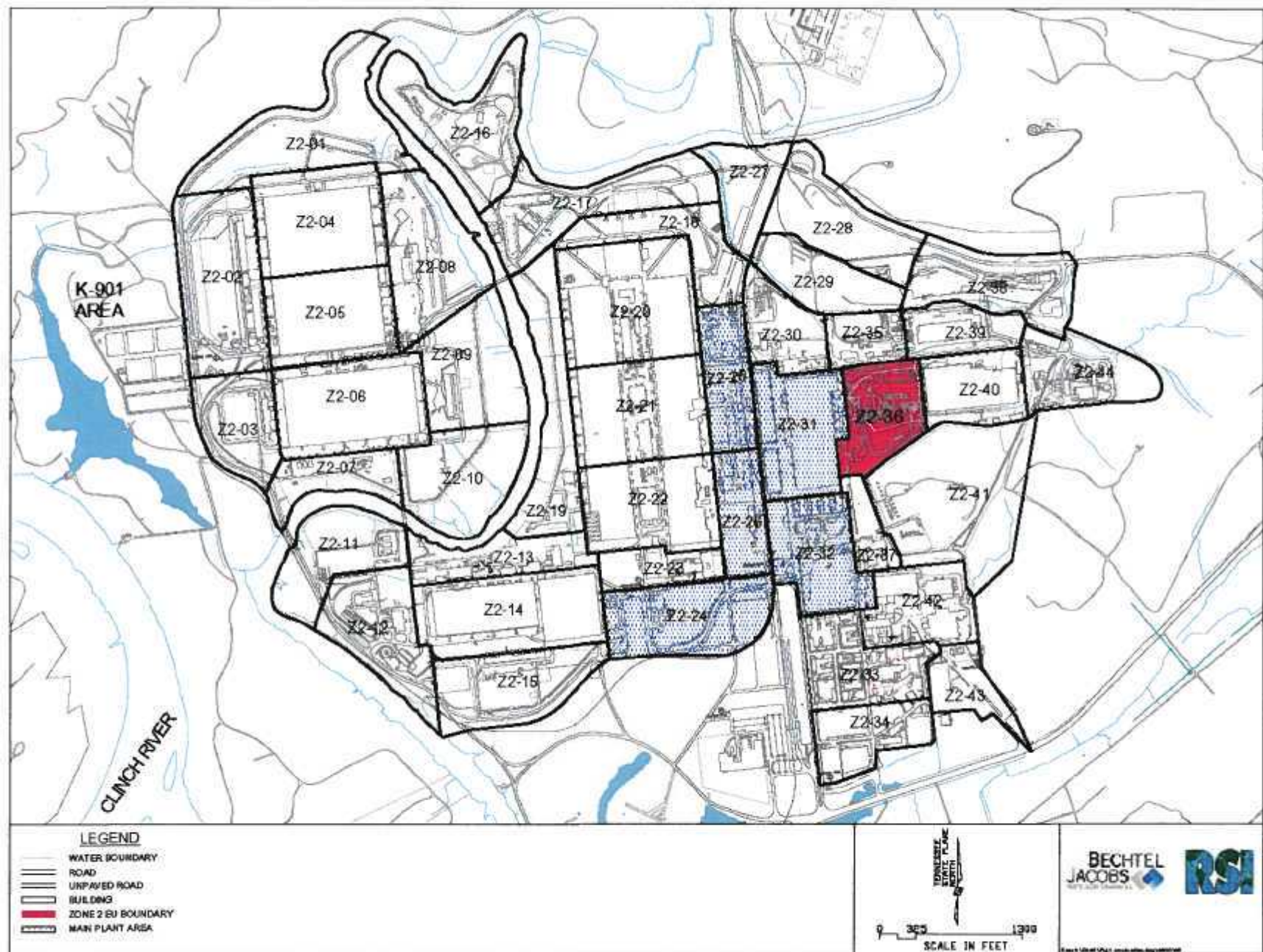


Fig. 2. EU Z2-36 location map.

2.1.2 Excluded Acreage

No EU Z2-36 acreage is excluded. All acreage in EU Z2-36 discussed in this document is included in its entirety.

2.1.3 Data Quality Objectives and Soil Unit Classifications

The first action taken under the DVS characterization program was to assemble the DQO scoping packages, which are Core Team documents that give a compilation and evaluation of facility records and present the results of previous sampling that provided the bases for soil unit (SU) classification and determination of additional sampling needs. The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), which describes the probability that an area has been impacted and the extent to which the impact forms the basis for classification, was generally followed for SU classification. The SU classification was used to develop a graded approach to the level of scrutiny so that soils with the highest probability of contamination received the highest level of scrutiny and those with the lowest probability of contamination received the lowest level of scrutiny. The SUs were classified as follows:

- Class 1—high to moderate probability that contaminants exceed remedial action objectives (RAOs),
- Class 2—moderate to low probability that contaminants exceed RAOs,
- Class 3—impacted areas with low probability of contamination above RAOs, or
- Class 4—no impact from anthropogenic activities (no Class 4 SU areas were identified in Zone 2).

The soil classification breakdown for acreage in EU Z2-36 included the following:

- 0 acres in Class 1 SUs,
- 2 acres in Class 2 SUs,
- 13 acres in Class 3 SUs, and
- 0 acres in Class 4 SUs.

In each case, the probability of contamination was based on a thorough review of historical data, aerial photographs, records, and personnel interviews. Soil sampling activities under the DVS included both the Class 2 and Class 3 SUs. The SUs were evaluated by walkover assessments, which included historic photograph analysis, records research, visual inspection, limited radiological survey, and selected biased sampling based on walkover assessment observations and measurements.

2.1.4 Federal Facility Agreement Sites

There are two Federal Facility Agreement (FFA) sites (DOE 1992) in EU Z2-36 that are assessed in this PCCR. Final status assessments for these sites are summarized in Table 2.

2.2 DVS CHARACTERIZATION APPROACH

The DVS approach to soils characterization and the rationale to support conclusions drawn from the characterization results are presented in this section. Through characterization activities, DVS provides the necessary information to support decisions on whether an action is required. Additionally, DVS supports decisions on the extent of an action and, through confirmation sampling, whether the action is

Table 2. FFA sites in EU Z2-36

FFA site	EU	Final status assessed in this PCCR?	Explanation, if not assessed
K-1098-C Asphalt Plant	Z2-36	Yes	
K-1503 Neutralization Pit	Z2-36	Yes	

EU = exposure unit
FFA = Federal Facility Agreement

PCCR = Phased Construction Completion Report
RCW = recirculating cooling water

complete. In this section, the characterization approach and communications necessary to make key decisions throughout the DVS process are discussed. Decisions and communications required during remediation also are discussed. The DVS process was further defined in the Zone 2 RDR/RAWP (DOE 2007b).

The DVS process was designed to provide sufficient data to determine if a RA is needed. To meet this goal, a sampling strategy was developed based on the likelihood of RA being required. The DVS characterization approach has six key components, which include the following:

- Planning (Sect. 2.2.1), including acreage classification (Sect. 2.2.1.1) and DQO scoping (Sect. 2.2.1.2);
- Class 1 and Class 2 SU characterization approach (Sect. 2.2.2);
- Class 3 and Class 4 SU characterization approach (Sect. 2.2.3);
- Program execution (Sect. 2.2.4);
- Action/no further action (NFA) decision/communication (Sect. 2.2.5); and
- Documentation and records (Sect. 2.2.6).

During the planning stage (first component), the acres of interest were classified into SUs according to their potential level of contamination as described in Sect. 2.1.3, and the DQOs were applied to develop a sampling plan. Because of different probabilities for the presence of contamination, SU classifications had different characterization strategies (second and third component). However, a base survey and sampling program was developed for all SU classifications and presented during DQO scoping. This base program was modified during field implementation as work was conducted and additional characterization needs were identified. The Class 1 and Class 2 SU base program consisted of radiological walkover and geophysical surveys, where appropriate, and systematic sampling supplemented by biased sampling. The Class 3 and Class 4 SU base program primarily consisted of visual inspections and radiological screening surveys with biased sampling conducted based on inspection and survey observations. Execution techniques to accomplish SU characterization were carried out in the field (fourth component). The final stage included RA Core Team decision making and communication, which was associated with all sampling programs (fifth component).

The RA Core Team was created to streamline planning and accelerate the completion of all actions at ETTP to accelerate site closure. The RA Core Team approach is a formalized, consensus-based process where members reach agreement on key closure issues and strategies. The RA Team consists of representatives from parties to the FFA—DOE, U.S. Environmental Protection Agency (EPA), and Tennessee Department of Environment and Conservation (TDEC) as well as DOE's accelerated closure contractor. The primary function of the RA Core Team is to make programmatic decisions that facilitate and guide specific projects as ETTP progresses toward closure.

The following subsections provide an overview of the first four DVS characterization process components.

2.2.1 Planning

The two key parts of the planning component included soil unit classification and DQO scoping for sampling plan development, both of which required RA Core Team concurrence.

2.2.1.1 SU classification

To begin planning, the land area within each EU Group was classified as either impacted or non-impacted by ETTP plant activities. This initial classification included compilation and review of existing information from historic aerial photographs, maps, drawings, and other facility records. After classification as impacted/non-impacted, land areas were assigned SU classifications as defined in Sect. 2.1.3. (FFA sites were typically designated as Class 1 or Class 2 SUs.)

2.2.1.2 DQO scoping

Once the area under consideration was classified into a SU, the quantity and quality of existing data and other information was evaluated against the DQO requirements for sufficiency and quality, and a DQO scoping plan for base program surveying, sampling, and analysis was developed. Some of the work described below (e.g., field survey results) was used to design the DQO scoping plan and was considered part of the planning process. A DQO scoping plan, including the SU classifications, was presented to the RA Core Team for concurrence and documented in the Dynamic Work Plan (DWP), which identified sample locations and analysis requirements, and included the use of real-time field measurements where applicable. Any additional sampling and analysis was added to the program with RA Core Team concurrence. The DQO scoping meeting for work described in this PCCR was conducted on January 19, 2005, and the applicable DWP is the *Zone 2 Dynamic Work Plan, East Tennessee Technology Park, Oak Ridge, Tennessee* (BJC 2007).

Per the DVS process, a portion of characterization samples were analyzed for an extensive list of potential contaminants. Fixed laboratory analyses were performed for a suite of analytes [volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, polychlorinated biphenyls (PCBs), and a radiological analytical suite that included gamma spectroscopy, alpha spectroscopy, thorium-isotopic, uranium-isotopic, technetium-99, and radium-specific analyses].

All identified contamination was evaluated to determine if action was needed for the EU, including the following:

- Primary and secondary contaminants of concern (COCs), which are identified in the Zone 2 ROD;
- Contaminants of potential concern, which are identified during the risk evaluation process; and
- EU-specific COCs, which are contaminants identified during characterization that result in an unacceptable EU risk.

The documentation included a summary of existing data, assessment of data gaps in DQO scoping packages, and documentation of the base survey and sampling program in the Zone 2 DWP. Concurrence on the base program was reached by the Core Team and documented on concurrence forms.

2.2.2 Class 2 SU Characterization Approach

Implementation of the Class 2 SU characterization program included the steps listed below. Details on each step are provided in Sect. A.8 of the *Quality Assurance Project Plan for Soil Characterization Activities under the Dynamic Verification Strategy at the East Tennessee Technology Park, Oak Ridge, Tennessee* (QAPP), which is included as Appendix A in the Zone 2 RDR/RAWP (DOE 2007a).

- Step 1 (not applicable in Zone 2)—Complete an ecological impact assessment prior to significant disturbance.
- Step 2 (not applicable in Zone 2)—Clear to provide access (as required).
- Step 3—Perform radiological walkover surveys (where historic surveys are unavailable) and geophysical surveys [burial sites and underground storage tank (UST) sites].
- Step 4—Select systematic sampling locations and additional biased sampling locations based on survey results.
- Step 5—Perform base program and initial biased sampling.
- Step 6—Evaluate field and laboratory data.
- Step 7—Select additional biased sampling locations based on field measurements and laboratory results.

A flow diagram outlining the details of this characterization approach and associated decisions made for Class 2 SUs is shown in Fig. 3. Along with the planning component (acreage classification and DQOs) defined in Sects. 2.2.1.1 and 2.2.1.2, Steps 1 through 4 above constitute the base program for characterizing Class 2 SUs.

Field radiological and geophysical surveys (Step 3) were performed prior to the actual sampling activity. A lead time of several weeks to months allowed for the evaluation of survey data and supported selection of a set of biased sampling locations to evaluate the results. Geophysical surveys were used to define the boundaries of buried waste at landfill disposal sites or the presence of other buried objects (USTs) and materials.

Radiological walkover surveys were used to define the limits of radiological contamination in surface soils. The decision to have biased sampling locations where elevated radiological readings or geophysical anomalies were encountered (Step 4) was made after reviewing results of the radiological walkover and geophysical surveys. (These survey results were used later during the confirmation sampling phase to assist in identifying potential excavation boundaries.) After concurrence from the RA Core Team, any biased sampling locations identified from these survey results were included in the base sampling program.

Characterization field work began (Step 5) after the base program was defined and agreed to by the RA Core Team. Each EU Group was characterized according to the specific details presented during DQO scoping and finalized in the DWP. Soil sampling was performed using standard field methods and following EPA Region IV standard operating procedures (SOPs).

The predominant method of sample acquisition for subsurface soil to depths up to 30 ft was Geoprobe® sampling. Surface and shallow interval soil sampling was performed predominantly using hand augers. The standard DVS sampling methodology calls for composite samples to be taken from the 0- to 6-in. interval, 6-in. to 2-ft interval, and 2- to 10-ft interval. The sample composite protocol is presented in Attachment C to the QAPP [Appendix A in the Zone 2 RDR/RAWP (DOE 2007a)]. Discrete interval samples were collected based on the following two criteria (Steps 5, 6, and 7):

- Field screening method showed an elevated level for a COC in a segment of a core; or
- Initial analytical results from samples submitted to a laboratory showed an action level [25% of an average remediation level (ARL)] for one or more COCs was exceeded in the composited sample (Steps 6 and 7).

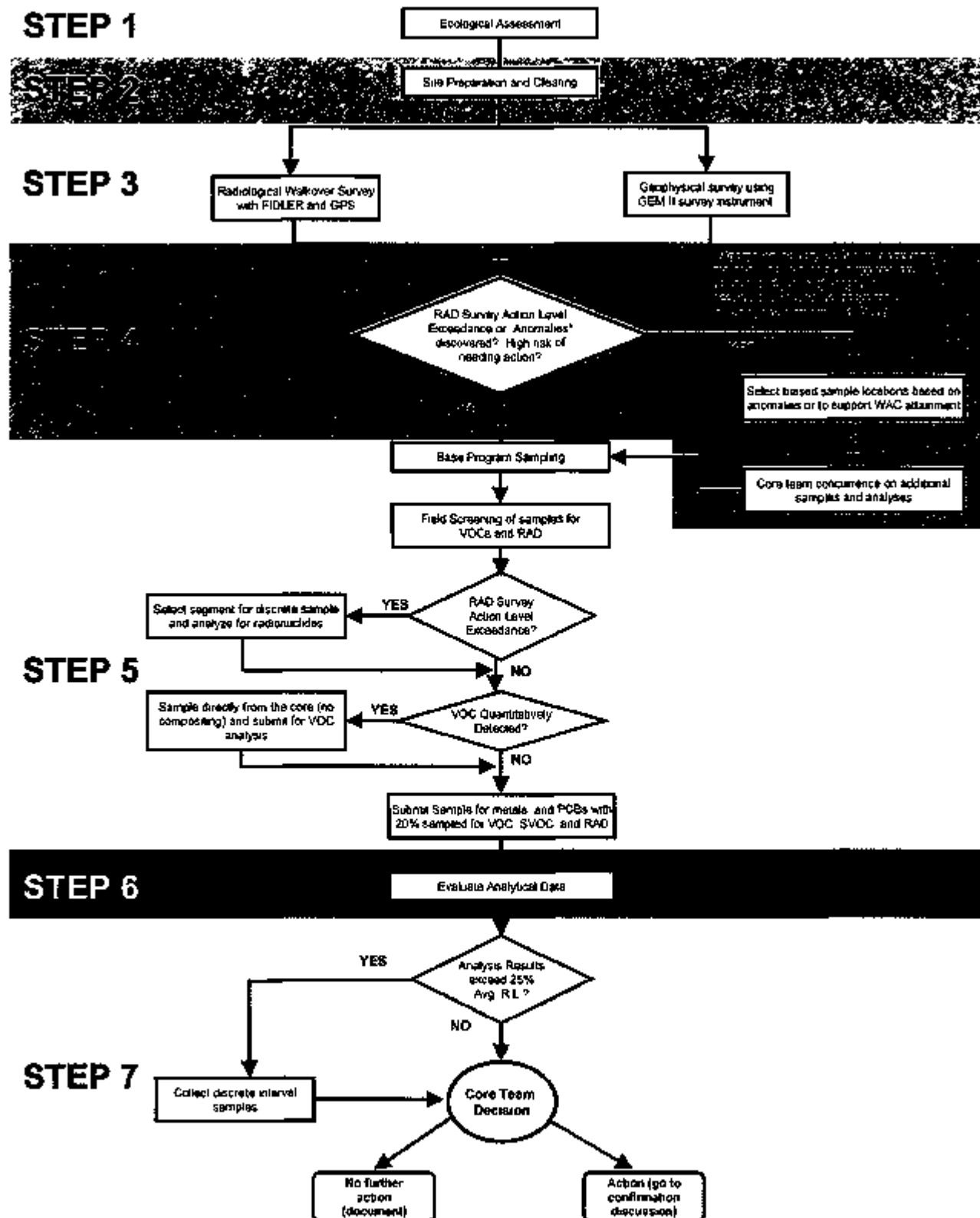


Fig. 3. Zone 2 DVS Class 1 and Class 2 SU sampling and analysis decision process flow.

For the first criterion, field screening methods were used as part of the field characterization activity (Step 5). Two field screening methods used on soil cores included (1) VOC screening using hand-held meters, and (2) radiological screening using core-scanning devices developed specifically for the DVS program. Field screening allowed sample collection for laboratory analysis of the core intervals most likely to have contamination in addition to collection of the composited sample. Collection of the most-likely contaminated segment of the core ensured existing contamination was represented in the analytical results. Recognition of potential VOC contamination also allowed the segment of the core to be collected for VOC analysis prior to compositing. VOCs were not analyzed for in composite samples.

The second criterion was based on analysis of laboratory results. The base program required all samples to be analyzed for TAL metals and PCBs. To support the risk assessment, a randomly selected 20% of all samples also were analyzed for VOC (discrete interval), SVOC, and radiological analyses (Step 5). If laboratory-reported results indicated action levels were exceeded in any of the randomly selected samples, the location with elevated results was resampled for the specific parameters of concern and three discrete intervals [0-6 in., 6 in.-2 ft, and a selected interval in the 2-10 ft interval (Steps 6 and 7)] were sent for analysis.

Current EPA laboratory analytical methods were used to provide risk assessment quality data as required by the DQO process and as stipulated in the DWP for all composite samples, discrete samples, and samples sent for full-suite analysis. All of the information collected is documented in the EU Z2-36 TM (Appendix A).

2.2.3 Class 3 SU Characterization Approach

A flow diagram outlining the characterization approach taken and the associated decisions made for Class 3 and Class 4 SUs is presented in Fig. 4. Note that no Class 4 SUs are present in EU Z2-36. The following statements were considered during decision making:

- Are there anthropogenic features, areas of elevated radiation, or sediment accumulation areas that require biased sampling and analysis?
- Does the EU exceed RAOs stated in the Zone 2 ROD and, therefore, require action? (Results from Class 1 and 2 SU evaluations, if applicable, are needed to make this final EU-level assessment.)

Assessment of the Class 3 and Class 4 SU acreage proceeded independently of the Class 2 SU investigations and were performed during the winter, when possible, to facilitate inspection of those portions of Zone 2 with heavy vegetation. These assessments were conducted in accordance with the *Class 3 and Class 4 Soil Unit Walkover Assessment Protocol* (DOE 2007a, Attachment C). The approach began with visual walkover inspections conducted to systematically inspect Class 3 SUs along transects to established systematic grid assessment locations, map observed features, and collect radiological screening data to support the action/NFA decision.

These assessments focused on identifying anthropogenic features, delineating boundaries of the features, and determining if sampling of the features was warranted. Anthropogenic features identified in the Class 3 SU were broadly inclusive of anything present as the result of any human activity. Identifying any unnatural conditions in the remote areas of the site where little to no industrial activity occurred was a very conservative approach to the site assessment protocol for clearing large tracts of peripheral lands in Zone 2. Anthropogenic features as defined in the Class 3 and Class 4 SU walkover assessment protocol were to include areas of radiation survey anomalous readings (above two times area background), visible anthropogenic materials (such as concrete, asphalt, metal debris, rubble, and rubbish), soil staining or discoloration, and/or stressed vegetation. In addition, crews were instructed to identify areas of unusual topographic relief, low areas where sediment would accumulate, and mounds of soil that appeared to be unusual for the local topographic conditions. This very broad definition of anthropogenic features provided a thorough assessment of the Class 3 SU in EU Z2-36.

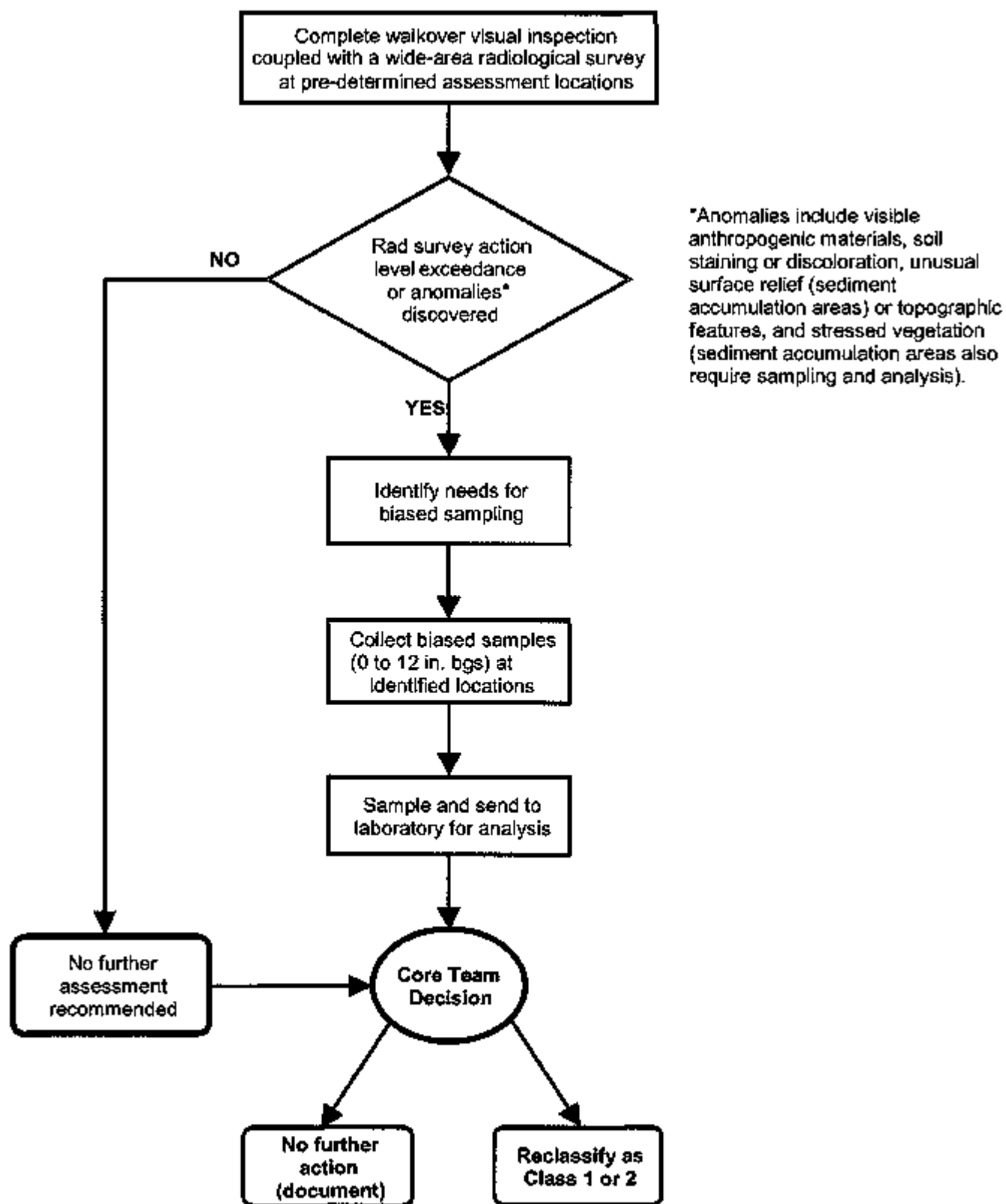


Fig. 4. Zone 2 DVS Class 3 and Class 4 SU sampling and analysis decision process flow.

A systematic grid with a random starting point was used to establish each assessment point (AP), with approximately one point per acre. A field instrument for detection of low-energy radiation (FIDLER) (Ludlum® 44-17 detector, 2 in. × 2 mm) was used by the survey crews. Background conditions were established for the EU group based on the *Class 3 and Class 4 Soil Unit Walkover Assessment Protocol* (DOE 2007a, Attachment C). The screening level (SL), which determined the need for further consideration and detailed evaluation, was twice the group mean background value. Approximately halfway to each AP, a mid-point (MP) was counted and surface features described. A Class 3 SU radiological survey was conducted at APs, MPs, and discretionary points during the SU walkover assessments. Anthropogenic features or areas of elevated activity away from APs and MPs were also characterized with 30-second counts of the FIDLER as a discretionary survey point.

Biased soil samples from identified anomalies were collected and analyzed for metals, radionuclides, and PCBs. Approximately 20% of the biased samples were analyzed for a larger suite of analytes to aid in identifying potentially unrecognized, site-related soil contaminants.

Biased sampling locations also were identified in sediment accumulation areas, which are defined as areas where runoff from large portions of the SU and surrounding areas converge and have the potential for sediment deposition. The chemical and radiological composition of sediment accumulation area soils or sediments is representative of the upstream conditions, and elevated levels of contamination are indicative of an upgradient source. Biased samples collected from sediment accumulation areas were sent to a laboratory for radionuclide, metal, VOC, SVOC, and PCB analysis to identify previously unrecognized site-related soil contaminants.

2.2.4 Program Execution

Soil sample collection was performed following EPA Region IV standard sampling methods and SOPs. The DVS base program sampling was tailored to site-specific conditions and samples were collected in the 0- to 10-ft depth in all Class 1 and Class 2 SUs. There were several conceptual site models in Zone 2 that included surface and subsurface models describing the potential contaminant source and potential release to the environment.

The DVS program for the Class 1 and 2 SUs required at least 20% of all sample locations be drilled and sampled to a depth of 10 ft bgs. Sample borings were completed using Geoprobe® direct-push equipment (Models 54DT and 54LT) and were collected in acetate liners and capped upon recovery. All boreholes were logged and described according to EPA Region IV guidance (EPA 2002), and all soil cores were scanned in the field for the presence of radioactive contaminants using the Model T Radiological Soil Core Screening System. The core screening action level was set to correspond with approximately 80% of the ARL for U-238 (40 pCi/g). The SL for the core scanner was based on a background soil core for which a daily baseline value was determined. The SL varied slightly from day to day in response to local ambient radiological conditions and natural activity of the background soils specific for the EU Group. Screening levels were set at the observed daily baseline (commonly in the range of 135-150 cpm), plus 65 cpm, and were in the range of 200 cpm (±20 cpm), which provided 100% accuracy for identifying gamma-emitting radioactive contamination in soils in excess of 40 pCi/g.

Results of field activities completed in this PCCR indicate the SLs of baseline plus 65 cpm were consistently identifying radiological constituents at 10 pCi/g or greater in soil cores. When the SL was exceeded, a discrete interval soil sample was collected for radiological analysis.

The acetate liners were split in the field and the core was screened for the presence of VOCs. If VOCs were detected above 5 ppm using a hand-held photoionization detector, a discrete interval soil sample was collected for VOC analyses using EnCore® samplers. Approved sample containers were used at these sites and managed according to EPA Region IV protocols (EPA 2002).

At base program sampling locations, three intervals of the soil core were composited according to the protocol described in the QAPP (DOE 2007a, Appendix C). The compositing procedure stipulates that

equal volumes of soil from the surface to 0.5-ft interval, 0.5- to 2-ft interval, and a selected section of core in the 2- to 10-ft interval be collected and thoroughly mixed to form a composite soil sample. The interval selected for inclusion in the soil composite was based on visual observation of the sample and targeted to select the most contaminated portion of the soil core. Selection was made based on visual observations such as staining, odor, soil contacts, obvious waste, or the presence of unnatural materials. This compositing methodology provided a physical composite that represented the average contaminant profile for the entire 0- to 10-ft interval. All base program composite samples were analyzed for PCBs and TAL metals and screened in the field for the presence of VOCs (> 5 ppm) and radioactivity (in excess of two times background). Discrete interval samples were collected for VOC and radiological analyses if field SLs were exceeded [refer to the Zone 2 QAPP (DOE 2007a) for specific procedures].

The DVS program requires 20% of all sample locations be drilled and sampled to 10 ft bgs. At surface contamination sites, the base program focused on the 0- to 2-ft interval where contaminant releases would have occurred. However, 20% of the locations were drilled and sampled to 10 ft bgs. At the UST sites and buried utilities and infrastructure sites, all borings were drilled and sampled to 10 ft bgs or to native material, whichever was deeper. The program also requires at least 20% of all samples be analyzed for a full suite of COCs, including VOCs, SVOCs, metals, PCBs, and radioisotopes. Locations to be drilled to depth and samples for full suite analyses are randomly selected. This selection process results in full suite analyses being performed on both surface and shallow interval samples as well as on some deep soil samples.

Changes to the base program plan included dropping inaccessible sample locations (e.g., areas of steep slopes or obstructions such as roads or heavy dead fall areas) and moving locations due to shallow refusal (e.g., buried concrete and metallic debris and rubble). These changes were documented on concurrence forms and presented to the Core Team for concurrence. Drops and moves occurred at < 5% of the planned locations. Locations moved more than 5 ft from the planned grid node were identified by the inclusion of an "M" character in the location ID (e.g. Z2-EU36M-200).

At surface contamination sites, the base program plan stipulated sampling the 0- to 2-ft interval to focus in the interval where contamination levels were assumed to be the highest. Sampling in these areas was performed using the Geoprobe® equipment and 0- to 2-ft, two-interval composite samples using the standard sampling method. In these areas, 20% of the base program sample locations were drilled to 10 ft at randomly selected locations and 20% of all locations (0 to 2 ft and to depth) were analyzed for a full suite of constituents. Soil cores at these sites also were screened in the field for VOC and radiological contamination.

Biased sampling was performed in addition to base program sampling. These locations were selected based on the results of geophysical surveys, radiological walkover surveys, and "step-out" locations to base program samples that indicated significant concentrations of contamination occurred. Biased samples drilled to 10 ft were collected in three discrete intervals (from the 0.5-ft interval, 0.5- to 2-ft interval, and a selected section of core in the 2- to 10-ft interval). Surface soil samples were generally collected as five-point composite samples to provide area coverage of radiological surface anomalies, surface-distributed mounds of soils, or small waste piles. The intent of surface compositing was to provide an average contaminant profile for a localized surface area.

Sampling procedures and methods were complied using EPA Region IV guidance. Sampling equipment, shipping containers, and quality assurance/quality control (QC) requirements also followed EPA Region IV guidance. Standard laboratory analytical methods were used, and data management and QC procedures were complied with EPA criteria. Detailed discussion of field and laboratory requirements is included in the Zone 2 RDR/RAWP (DOE 2007a).

2.2.5 Action/No Further Action Decision/Communication

Once results of field and analytical work were received, the RA Core Team evaluated the data and decided on an appropriate action. The action/NFA decision was based on one or more of the following criteria:

- Exceedance of a maximum remediation level (RL) at any location,
- Exceedance of an average RL across the EU,
- Unacceptable future threat to groundwater, and/or
- Unacceptable cumulative excess lifetime cancer risk (ELCR) of $> 1 \times 10^{-4}$ and hazard index (HI) of > 1 across the EU.

Sample results were evaluated for the 0- to 10-ft soil interval and were not depth dependent. Contamination anywhere within the 0- to 10-ft interval had equal weighting in the risk assessment and was presumed equally accessible to an industrial worker. Soil sample compositing provided data representative of the 0- to 10-ft interval. Discrete interval sampling was selected based on the field screening for VOCs and radioactivity identified by soil core screening. This approach provided a very conservative evaluation of soil conditions and had an equivalent consideration in the risk assessment methodology. Selection of intervals for inclusion in soil core composite samples was based on visual observation and included the portion of the soil core with the highest probability of contamination. Visual cues included but were not limited to bedding contacts, porous and permeable intervals, staining, and odor. Discrete sample interval depth information is included in the data set on the compact disc provided with this document. Major stratigraphic differences (i.e., 2 ft of cover material over fill) are referenced in the text where appropriate.

An area-weighted mean of the data in each EU was used to compare the average composition of the EU to the average RLs. Risk was evaluated by area-weighting the results. Because data within an EU was unevenly distributed across the SUs (i.e., SUs with greater probability of contamination had a higher density of samples), weighting was based on the areal extent of the SUs. For SUs with little probability of contamination and, therefore, few, if any, sample results (i.e., Class 3 SUs), background concentrations of COCs as defined in the *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2003) were used in the weighted average calculations for the EU risk assessments and comparison to average RLs.

Data collected for the original background data set for ETP (DOE 1993a) was not representative of ETP site soils, nor were the associated statistical calculations performed in accordance with then current EPA guidance. To resolve the issues, additional samples were collected and statistics were recalculated to comply with EPA guidance. Samples were collected from the B soil horizon of the Rome and Upper Knox formations to supplement the original data set. These samples were collected from approximately 12-24 in. bgs and analyzed only for radiological constituents and inorganic elements. The comparison of site data versus background data was made using methods from *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (EPA 2002). Soil background data used in this report was presented in the document *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2003) and not from the earlier report.

If elevated concentrations (i.e., above background) were found, sample results were used (even if sparse) after the SU was reclassified as a Class 1 or Class 2 SU. Results of the action/NFA evaluation were documented in the EU Z2-36 TM, which were provided to the RA Core Team for early review but formally submitted for approval as an appendix to this PCCR. Data, maps, cross sections, and other useful information also were provided on the project webpage to facilitate decision making.

The risk RAO was developed in the Zone 2 ROD to identify new COCs because of the uncertainty that all COCs had been identified in the historical data sets. If the risk assessment identified contaminants

requiring remediation that did not have associated RLs, remediation was recommended if the risk was found to be unacceptable.

2.2.6 Documentation and Records

All information, data, documents, and records necessary to support the decisions presented in this PCCR will be transferred to the post-decision document file upon approval of the PCCR. A list of referenced documents that becomes part of the file is provided in Sect. 12. Additional records contained within the file but not listed in Sect. 12 include but are not limited to FCNs, Core Team concurrence forms, and analytical data packages. FCNs and Core Team concurrences pertinent to EU Z2-36 are listed in Section 6. The post-decision document file is available to the public through the DOE Oak Ridge Office Information Center. Analytical data, field data, and sample location maps are archived in and made available to the public through the Oak Ridge Environmental Information System (OREIS).

3. PROJECT REQUIREMENTS

Requirements for the characterization activities, final status assessments, and RAs originated in the Zone 2 ROD, which presents specific soil RAs required in Zone 2 and provides general guidelines for addressing the remainder of the soils. In response to the guidelines for addressing Zone 2 soils, DVS was developed to present specific requirements for addressing soils and making action/NFA decisions. It is further stated in Sect. 1.5 of the Zone 2 ROD that additional contaminants could be identified during remedy implementation or confirmation.

3.1 ZONE 2 RECORD OF DECISION

The Zone 2 ROD presents the selected remedy for environmental remediation of contaminated areas within Zone 2 at ETTP. An evaluation of existing data performed in the Zone 2 ROD determined the following sites either had sufficient characterization data to demonstrate unacceptable risk, warrant additional characterization, and/or selection of an action for soil:

- K-1070-B Old Burial Ground,
- K-1420 Facility Area,
- K-1004-J Lab Complex Area,
- K-1401 Facility Area,
- K-1070-C/D Area, and
- Zone 2 miscellaneous soils.

In addition, the ROD specifies that a DVS should be developed to address the characterization of soils in other areas in the Zone with insufficient data to determine if an action is required. As discussed in the ROD, the key criterion for an action/NFA decision and a successful RA is the RAO, which is presented in Table 3.

Table 3. RAO and protection goals for Zone 2

Remediation issue	Protection goal
Future land use	Protect human health under an unrestricted industrial land use to a risk level not to exceed 1×10^{-4}
Groundwater resources	Control leaching and migration from contaminated soil to help minimize further impacts to groundwater

RAO = remedial action objective

Other key parts of the ROD include determining future land use as unrestricted industrial to 10 ft bgs, protecting the industrial worker from soil exposure identified as the primary risk driver, developing a risk assessment methodology based on EUs, and defining soil COCs with corresponding soil RLs (two RLs were established for each COC in the ROD). The maximum RL is the concentration that a COC may not exceed at any location within an EU. The average RL is the average COC concentration within an EU that, when exceeded, means the RAO risk protection goal has not been met. The Zone 2 ROD COCs, chemicals, and radionuclides required for analysis and associated RLs are presented in Table 4.

**Table 4. Chemicals and radionuclides required for analysis in
Zone 2 DVS samples and their evaluation criteria^a**

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10⁻⁵)	Background	Groundwater SL^b	Residential PRG (10⁻⁶)
<i>Metals (mg/kg) (mg/L for groundwater)</i>						
Aluminum			100,000	40,300		7,614
Antimony			410	1.52	144	3.1
Arsenic ^c	900	300	16	14.95	66.3	0.39
Barium			67,000	124.93	9,150	537
Beryllium	6,000	2,000	1,900	2.20		15
Boron			100,000			1,600
Cadmium			450	0.22U		3.7
Calcium				2400		
Chromium			640	44.88	172	22
Cobalt			130,000	42.00		138
Copper			41,000	22.48		313
Iron			100,000	58,600		2,346
Lead			800	37.91	3,370	400
Lithium			20,000	48.94		156
Magnesium				3,300		
Manganese			19,000	2,200		176
Mercury ^f	1,800	600	310	0.17		2.35
Molybdenum			5,100			39
Nickel			20,000	26.07		156
Potassium				5,074.69		
Selenium			5,100	1.47		39
Silver			5,100	0.6U		39
Sodium				497		
Thallium			67	0.4U	10.8	0.52
Uranium			200			1.56
Vanadium			1,000	65.47		7.8
Zinc			100,000	89.70		2,346
<i>Radionuclides (pCi/g) (ug/L for groundwater)</i>						
Cesium-137 ^e	20	2	1.1			0.06
Cobalt-60			0.6			0.04
Gross alpha activity						
Gross beta activity						
Neptunium-237 ^e	50	5	2.7			0.13
Potassium-40			2.7	32.12		0.11
Radium-226 ^{c,d}	15	5	0.26	1.25		0.01
Technetium-99			9,000			0.25
Thorium-230 ^{c,d}	15	5	210	1.20		3.5
Thorium-232 ^{c,d}	15	5	0.176	1.95		0.01
Uranium-234 ^{c,d}	7,000	700	330	1.47	61.1	4.02
Uranium-235 ^{c,d}	80	8	4.0		61.1	0.2
Uranium-238 ^{c,d}	500	50	18	1.47	61.1	0.74
<i>Pesticides and PCBs (ug/kg)</i>						
PCB-1016 ^e	100,000	10,000	37,000			393
PCB-1221 ^e	100,000	10,000	7,436			112
PCB-1232 ^e	100,000	10,000	7,436			112
PCB-1242 ^e	100,000	10,000	7,436			112
PCB-1248 ^e	100,000	10,000	7,436			112
PCB-1254 ^e	100,000	10,000	7,436			112
PCB-1260 ^e	100,000	10,000	7,436			112
Polychlorinated biphenyl ^e	100,000	10,000	7,436			112

**Table 4. Chemicals and radionuclides required for analysis in
Zone 2 DVS samples and their evaluation criteria^a (continued)**

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10⁻⁵)	Background	Groundwater SL^b	Residential PRG (10⁻⁶)
<i>Semivolatile Organic Compounds (ug/kg) (ug/L for groundwater)</i>						
1,2,4-Trichlorobenzene			220,000			6,216
1,2-Dichlorobenzene			600,000			110,330
1,3-Dichlorobenzene			600,000			53,135
1,4-Dichlorobenzene			79,000			3,447
2,3,4,6-Tetrachlorophenol			18,000,000			183,309
2,4,5-Trichlorophenol			62,000,000			611,031
2,4,6-Trichlorophenol			62,000			611
2,4-Dichlorophenol			1,800,000			18,331
2,4-Dimethylphenol			12,000,000			122,206
2,4-Dinitrophenol			1,200,000			12,221
2,4-Dinitrotoluene			25,000			715
2,6-Dinitrotoluene			25,000			715
2-Chloronaphthalene			23,000,000			493,664
2-Chlorophenol			240,000			6,340
2-Methyl-4,6-dinitrophenol			62,000			611
2-Methylnaphthalene			190,000			5,592
2-Methylphenol			31,000,000			305,515
2-Nitrobenzenamine			1,800,000			18,277
2-Nitrophenol						
3,3'-Dichlorobenzidine			38,000			1,081
3-Nitrobenzenamine			18,000			1,833
4-Bromophenyl phenyl ether						
4-Chloro-3-methylphenol						
4-Chlorobenzenamine			2,500,000			24,441
4-Chlorophenyl phenyl ether						
4-Methylphenol			3,100,000			310,000
4-Nitrobenzenamine			180,000			18,330
4-Nitrophenol						
Acenaphthene			29,000,000			370,000
Acenaphthylene			29,000,000			370,000
Aniline			3,000,000			42,742
Anthracene			100,000,000			2,200,000
Benz(a)anthracene			21,000			621
Benzenemethanol			100,000,000			1,833
Benzo(a)pyrene			2,100			62
Benzo(b)fluoranthene			21,000			621
Benzo(ghi)perylene			29,000,000			231,595
Benzo(k)fluoranthene			210,000			6,215
Benzoic acid			100,000,000			24,000,000
Bis(2-chloroethoxy) methane						
Bis(2-chloroethyl) ether			5,800			218
Bis(2-chloroisopropyl) ether			74,000			2,884
Bis(2-ethylhexyl)phthalate			1,200,000		2,350,000	34,741
Butyl benzyl phthalate			100,000,000			1,200,000
Carbazole			860,000			24,319
Chrysene			2,100,000			62,146
Di-n-butyl phthalate			62,000,000			611,000

**Table 4. Chemicals and radionuclides required for analysis in
Zone 2 DVS samples and their evaluation criteria^a (continued)**

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10⁻⁵)	Background	Groundwater SL^b	Residential PRG (10⁻⁵)
Di-n-octylphthalate			25,000,000			244,000
Dibenz(a,h)anthracene			2,100			62
Dibenzofuran			1,600,000			14,526
Diethyl phthalate			100,000,000			4,900,000
Dimethyl phthalate			100,000,000			61,000,000
Diphenyldiazene			160,000			4,422
Fluoranthene			22,000,000			230,000
Fluorene			26,000,000			275,000
Hexachlorobenzene			11,000			304
Hexachlorobutadiene			180,000			1,833
Hexachloro- cyclopentadiene			3,700,000			36,550
Hexachloroethane			620,000			6,110
Indeno(1,2,3-cd)pyrene			21,000			621
Isophorone			5,100,000			512,000
N-Nitroso-di-n- propylamine			2,500			69.5
N-Nitrosodimethylamine			340			9.54
N-Nitrosodiphenylamine			3,500,000			99,261
Naphthalene			190,000			5,592
Nitrobenzene			100,000			1,964
Pentachlorophenol			90,000			2,979
Phenanthrene			29,000,000			23,160
Phenol			100,000,000			1,800,000
Pyrene			29,000,000			231,600
Pyridine			620,000			6,110
<i>Volatile Organic Compounds (ug/kg) (ug/L for groundwater)</i>						
1,1,1-Trichloroethane			1,200,000		97,900	198,200
1,1,2,2-Tetrachloroethane			9,300			408
1,1,2-Trichloroethane			16,000		1,370	729
1,1-Dichloroethane			1,700,000			50,640
1,1-Dichloroethene			410,000		1,750	12,350
1,2-Dichloroethane			6,000		729	278
1,2-Dichloropropane			7,000			342
2-Butanone			110,000,000			2,230,000
2-Hexanone						
4-Methyl-2-pentanone			47,000,000			528,100
Acetone			54,000,000			1,413,000
Benzene			14,000		1,150	643
Bromodichloromethane			18,000			824
Bromoform			2,200,000			61,570
Bromomethane			13,000			390
Carbon disulfide			720,000			35,530
Carbon tetrachloride			5,500		2,770	217
Chlorobenzene			530,000			15,070
Chloroethane			65,000			3,026
Chloroform			4,700		1230	221
Chloromethane			160,000			4,685
Dibromochloromethane			26,000			1,109
Ethylbenzene			400,000			186,400
Methylene chloride			210,000		241	9,107
Styrene			1,700,000			438,210

Table 4. Chemicals and radionuclides required for analysis in Zone 2 DVS samples and their evaluation criteria^a (continued)

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10 ⁻⁵)	Background	Groundwater SL ^b	Residential PRG (10 ⁻⁶)
Tetrachloroethene			13,000		4,720	484
Toluene			520,000		502,000	65,600
Total Xylene			420,000			27,000
Trichloroethene			1,100		1,720	53
Vinyl chloride			7,500		176	79
cis-1,2-Dichloroethene			150,000			4,294
cis-1,3-Dichloropropene			18,000			777
trans-1,2-Dichloroethene			230,000			6,949
trans-1,3-Dichloropropene			18,000			777
Diesel Range Organics ^c					100 mg/kg	
Gasoline Range Organics ^d					100 mg/kg	

^aChemicals and radionuclides listed include all of the Zone 2 soils COCs and other chemical and radionuclides considered to be potential contaminants at ETTP. Analytical laboratories for DVS samples often report the results for chemicals and radionuclides not listed here and historical data may include analyses for chemicals and radionuclides not reported in DVS samples. When there is a detection in either a DVS or historical sample of a chemical or radionuclide not listed here, the concentration is compared to its 1×10^{-5} industrial PRG and 1×10^{-6} residential PRG, which can be found in the Zone 2 RDR/RAWP (DOE 2007a).

^bReferred to as soil exposure concentrations in the Zone 2 ROD.

^cZone 2 ROD contaminant of concern.

^dRadium-226, Thorium-230, and Thorium-232 are evaluated by a computational method that determines the primary RAD constituent and the daughters of the primary radionuclide; the total activity of the primary plus daughters is then compared to established Zone 2 RLs that are listed in the Zone 2 RDR/RAWP (DOE 2007a).

^eDiesel-range organics and gasoline-range organics apply when there is an UST under investigation. The 100-mg/kg limit for protection of groundwater is based on State of Tennessee UST regulations.

COC = contaminant of concern

RAD = radiological

DVS = Dynamic Verification Strategy

RL = remediation level

ETTP = East Tennessee Technology Park

ROD = Record of Decision

PRG = preliminary remediation goal

UST = underground storage tank

As specified in the Zone 2 ROD, all of Zone 2 should be evaluated for unrestricted use with data from the industrial use scenario. In areas where information indicates there is little chance for unacceptable contamination, restrictions will not be imposed (see Sect. 11).

3.2 DYNAMIC VERIFICATION STRATEGY

The DVS was developed as required by the Zone 2 ROD and designed to provide sufficient data to fill data gaps, conduct final status assessments for all of Zone 2, and to facilitate real-time decision making. This strategy focused on the soil characterization portion of the Zone 2 ROD to determine where action was needed. Acreage classification was used to progressively focus the investigation efforts in areas with a moderate to high probability of soil contamination (see Sect. 2.1.3). The DVS also helped verify information from previous investigations to incorporate flexibility to facilitate rapid collection of additional data based on data results. The strategy was to gather adequate data with minimal iterations of site investigation planning and mobilization.

The DVS addressed requirements of the Zone 2 ROD RAO with the DQO process. Step 5 of the DVS DQOs presented four decision rules whereby any particular land area in Zone 2 was deemed to have met the RAO requirements (see Table 5).

Table 5. DVS decision rules for Zone 2 soils

Decision Rule	If	Then	Otherwise
1	Concentration of any COC in a localized area ("hot spot" nominally 50-ft radius) within an EU to a depth of 10 ft exceeds the maximum RL	Remediate localized area of elevated contamination until the COC concentration is less than the maximum RL	NFA for protection of industrial worker
2	Mean concentration value of any soil COC to a depth of 10 ft exceeds the average RL within an EU	Remediate elevated areas of contamination until the mean COC concentration over the EU is less than the respective RL	NFA for protection of industrial worker
3	Industrial risk across the EU to a depth of 10 ft is $> 1 \times 10^{-4}$ ELCR or target organ HIs exceed 1	Remediate elevated areas of contamination until residual risk over the EU is below the risk levels. Evaluate the need for action if target HIs exceed 1	NFA for protection of industrial worker
4	Site-specific contaminants in groundwater exceed MCL or site-specific, mass-based soil SLs ^a calculated for a site for the protection of groundwater are exceeded above the water table or bedrock surface (whichever is shallower)	Evaluate the impacts of remediating the site	NFA for the protection of groundwater

^aSoil SLs for the protection of groundwater are presented in the *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2161&D2, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN.

COC = contaminant of concern

DVS = Dynamic Verification Strategy

ELCR = excess lifetime cancer risk

EU = exposure unit

HI = hazard index

MCL = maximum contaminant level

NFA = no further action

RL = remediation level

SL = screening level

3.3 FINAL STATUS EVALUATION PROCESS

The final status recommendation for action/NFA of EU Z2-36 as presented in this PCCR was determined by evaluating the EU in terms of the four decision rules. Descriptions of the action/NFA evaluation processes for each decision rule are presented in Sect. 3.3.1. A discussion of special data uses and considerations in the action/NFA evaluations is included in Sect. 3.3.2. As defined in the Zone 2 ROD, a risk screening was performed to evaluate the industrial land use of each EU. A qualitative risk screening also was conducted against 1×10^{-6} residential preliminary remediation goals (PRGs) to evaluate the unrestricted use of each EU. A description of this evaluation is presented in Sect. 3.3.3.

3.3.1 Action/No Further Action Decision

The process whereby EUs are evaluated against the four DVS decision rules (see Sect. 3.2) is described in the following text and presented graphically in Fig. 5 as Steps 1 through 4.

Decision Rule 1—Maximum RL Evaluation. Zone 2 soils chemical and radionuclide COC concentrations are screened against their maximum (not to exceed) RLs as defined in the Zone 2 ROD. If any compound is detected at a concentration above its maximum RL, an action is required. Maximum RLs and the COCs they are applied to are presented in Table 4.

Decision Rule 2—Average RL Evaluation. The mean value of the detected concentrations for each Zone 2 soil COC across an EU is screened against the respective average RL. If the average detected concentration of any COC across an EU is less than the average RL for that COC, then the overall average concentration of the COC (which includes non-detected results and area weighting) must also be below the average RL.

If the EU average detected concentration of soils COC exceeds the average RL for that COC, then the EU average is calculated using the detected values and half the detection limit for all the non-detect results. If the EU average for this calculation is still in excess of the Zone 2 average RLs, then an area-weighted mean for the EU is calculated (see Sect. 3.3.2). If the area-weighted mean concentration of the COC is above the Zone 2 average RL for the COC, then an action is required. Average RLs and the COCs they are applied to are presented in Table 4.

Decision Rule 3^a—Cumulative Risk Assessment. The first step in evaluating the cumulative risk associated with an EU is to perform a risk screen to determine if further assessment in the form of a risk calculation is required. The risk screen consists of comparing the data to average RLs and an EPA Region IX ELCR $< 1 \times 10^{-5}$ or HI of 1. If the concentration of any chemical or radionuclide exceeds either an average RL or an industrial PRG (except as described in Sect. 3.3.2), then the complete EU data set is evaluated to determine if the cumulative effect of all chemicals and radionuclides in the EU would cause the EU to fail the 1×10^{-4} risk criterion established in the Zone 2 ROD. If such a determination is made, a risk calculation^b is conducted as described below. Additional detail on the risk calculation is documented in *Supporting Documentation for Preliminary Remediation Goals Used in the Dynamic Verification Strategy Sampling Program, East Tennessee Technology Park, Oak Ridge, TN* (BJC 2006). U.S. Environmental Protection Agency Region IX 1×10^{-5} industrial PRGs for chemicals and radionuclides analyzed under the DVS are presented in Table 4.

If it is determined by the risk screen that a risk calculation is required, then the risk is calculated in accordance with the Zone 2 ROD by first calculating the risk based on the available EU data. If the calculated risk is below an industrial 1×10^{-4} ELCR or target organ HI of 1, then NFA is appropriate. If not, EU area-weighted calculations are performed.

Because data collection is focused on areas of potential contamination, the resultant data population is more representative of specific portions of an EU than the total EU, and it is the total EU over which risk is to be evaluated according to the Zone 2 ROD. To account for this over emphasis of potentially contaminated areas, an area-weighted risk calculation is performed for the EU. An area-weighted average is calculated for each chemical and radionuclide in the EU according to the area-weighted averaging method described in Sect. 3.3.2, and the cumulative risk is calculated on the area-weighted averages according to the guidelines in the Zone 2 RDR/RAWP (DOE 2007).

If the area-weighted calculation results in an acceptable ELCR ($< 1 \times 10^{-4}$) and HI (< 1), a NFA determination can be made. However, if the area-weighted calculation results in an unacceptable ELCR ($> 1 \times 10^{-4}$), the EU cannot be cleared for industrial land use and an action determination is made. If the area-weighted approach results in an unacceptable HI (> 1), an individual target organ HI review is conducted. If individual target organ HIs exceed 1, an assessment on the need for action is conducted in accordance with the Zone 2 RDR/RAWP (DOE 2007a).

Decision Rule 4—Threat to groundwater. A threat to groundwater by Zone 2 soils is evaluated by reviewing existing area groundwater data for maximum contaminant level (MCL) exceedances that occur on a regular basis. If the groundwater data are sufficient and there are no consistent MCL exceedances, then NFA is appropriate. If the groundwater data are insufficient to discern regular MCL exceedances, or the data are sufficient and regular MCL exceedances are observed, then soil concentrations are screened

^aRadium and thorium isotopes are excluded from the risk evaluation (see Sect. 3.3.2 for further discussion).

^bNumber of samples to adequately characterize the EU and evaluate risk is determined in the DQO scoping process with the Core Team. Available DVS and historical data are used when risk calculations are performed.

against the SLs for the protection of groundwater as defined in the Zone 2 ROD (DOE 2005). Based on the screening, site-specific modeling may be conducted if additional evaluation is required. Consideration of an action is required if modeling results indicate a site may be a potential source of contamination to groundwater. The sitewide ROD evaluates available site data for threats to groundwater. Data generated from the DVS process will be included in this ROD. Groundwater SLs for chemicals and radionuclides analyzed under the DVS are presented in Table 4.

The Zone 2 ROD specifically addresses USTs at ETTP, including those in Zone 1 and Zone 2. State UST regulations are applicable or relevant and appropriate regulations for all ETTP tanks according to the Zone 2 ROD. Therefore, closure will be performed according to State of Tennessee regulations. Tanks that are demonstrated to be clean (i.e., containing no fluids that could adversely effect groundwater) and have no soil contamination present to indicate a leak will be closed in place by filling. Tanks that contain residual fluid and/or where soil contamination indicates a leak will be removed according to state UST regulations.

3.3.2 Special Data Uses and Considerations

Circumstances requiring special data uses and considerations during EU action/NFA evaluations fall into three categories: (1) evaluation of Class 3 and Class 4 SUs that may not have any analytical data, (2) area-weighted averages, and (3) chemicals and radionuclides with regulatory limit concentrations less than or similar in value to background concentrations.

Class 3 and Class 4 SU Evaluations—Some EUs have historical information and the Class 3 and Class 4 SU walkover assessments provide sufficient information to support the NFA determination. Class 3 and Class 4 SU walkover assessments include visual observations of the SU acreage, collection of radiological survey data, and selected biased sampling where survey results or observations indicate the presence of impacted soils.

Area-weighted Averages—Area-weighted averaging is accomplished by calculating the fraction of the total area of the EU that contains contaminated soil (called a contaminant area fraction). The remaining area of the EU constitutes a remaining acreage area fraction. The average concentration of soil constituents in the area of contamination is calculated and then multiplied by the contaminant area fraction. Average soil concentrations are calculated for the remaining acreage area of the EU using all available sample results or, if no sample data are available, background concentrations. These average concentrations are multiplied by the remaining acreage area fraction. The area-weighted EU average then is calculated as the sum-of-the-fractions.

Regulatory Limit versus Background Concentrations—The industrial PRGs for arsenic, Cs-137, K-40, Ra-226, Th-228, and Th-232 are less than or similar in value to their respective background concentrations, which results in the industrial PRGs exceeding all or most instances where the chemical or radionuclide is detected. It was concluded in the Zone 2 ROD that data for Ra-226, Th-228, and Th-232 will not be used for risk calculations. Instead, health hazards associated with the presence of these radionuclides in Zone 2 soils will be evaluated by comparison to the RLs for Ra-226 and Th-232 (which contains Th-228 in its decay chain).

When a risk screen is conducted as part of the Decision Rule 3 evaluation (Sect. 3.3.1), secondary concentration comparisons are made in response to PRG exceedances by arsenic, Cs-137, and K-40 before proceeding with the cumulative effects evaluation, which may lead to performing risk calculations for the EU. The industrial PRG for arsenic (15.9 mg/kg) was very close in value to the arsenic background concentration (14.95 mg/kg). Although no local background value exists, the industrial PRG for Cs-137 (1.13 pCi/g) was low enough that this ubiquitous nuclear fallout radionuclide exceeded its PRG in most instances where detected, and the industrial PRG for K-40 (2.73 pCi/g) was less than the background concentration for K-40 (32.12 pCi/g). Secondary concentration comparisons that were

performed included arsenic concentrations to the arsenic Zone 2 soils average RL, Cs-137 concentrations to the Cs-137 Zone 2 soils average RL, and K-40 concentrations to the K-40 background value. If any of these secondary concentration comparisons resulted in an exceedance, then the complete EU dataset was evaluated for cumulative effects as described in Sect. 3.3.1.

Ra/Th Decay Series Calculation. Because the carcinogenic risk associated with the concentrations of radium and thorium isotopes in the natural background at ETTP exceed the cumulative risk goal of 1×10^{-4} , RL values for these radionuclides were based on alternative concentration levels rather than risk. The alternative concentration levels of 5 pCi/g above background (average RL) and 15 pCi/g above background (maximum RL) were set as low as reasonably achievable under the site-specific conditions. Concentrations of these radionuclides and their decay series were not considered in the risk estimates because site-specific background concentrations of the radionuclides exceeded the target risk range.

The Zone 2 ROD states that average RL and maximum RL exceedances by Ra-226, Th-230, and Th-232 are to be evaluated by summing above-background concentrations of the greater of Ra-226 or Th-230 with the above-background concentrations of Th-232, and comparing the results to 5 pCi/g (average RL) and 15 pCi/g (maximum RL). These calculations were performed by subtracting the background values of Ra-226, Th-230, and Th-232 from the analytical result. A Ra/Th decay series value then was calculated for each sample by selecting the larger of the Ra-226 or Th-230 value and summing the selected value with the Th-232 value.

The Ra/Th decay series was considered to be analyzed in a sample if one or more of the three radionuclides it comprised were analyzed for in the sample. Also, this decay series was considered to be detected in a sample if one or more of the three radionuclides it comprised were detected in a sample. It is possible that a Ra/Th decay series detected value could equal zero.

3.3.3 Qualitative Risk Screening for Unrestricted Use

While not required by the Zone 2 ROD, a qualitative risk screening for unrestricted use was conducted to determine the possibility of releasing the EUs without institutional controls. These results are provided for information only and do not form the basis for action (see Sect. 11). For this screening, average concentrations were compared to 1×10^{-6} residential PRGs and ETTP soils background values from Table 4 in *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2003). EPA Region IX residential PRGs 1×10^{-6} and ETTP soil background values for the chemicals and radionuclides analyzed for under the DVS are presented in Table 4.

4. FINAL STATUS ASSESSMENTS

This section presents the DVS evaluation results for EU Z2-36 and the final status assessment based on that evaluation. Guidelines for the evaluation are presented in Sect. 2 and for preparing the final status assessment are presented in Sect. 3. A high-level summary of the DVS evaluation is presented in Table 6.

The final status assessment conclusions for EU Z2-36 are presented in Table 7, which is followed by a summary of the evaluation and conclusions. The conclusions and summaries presented in Table 8 were based on the evaluation of existing information in terms of the four DVS decision rules described in Sect. 3. Table 7 provides the information by EU and includes the EU acreage, Class 1 and Class 2 SU acreage, Class 3 SU acreage, and FFA sites in each EU.

Because all samples within the 0- to 10-ft soil interval were considered equally in the risk assessment, there was no differentiation of the contamination information by depth. Any contamination in the 0- to 10-ft interval was considered to be equally accessible to an industrial worker. Depth information for discrete interval samples, including all VOC samples and the majority of the radiological samples, is provided in the accompanying compact disc (CD). Because there is no depth differentiation of the potential impact of contamination, details regarding sample intervals were not included in the EU evaluation presented in the following text.

Details of the material presented in Tables 6 and 7 and the associated summaries are presented in the EU Z2-36 TM (see Appendix A). Analytical data summary tables are also presented in the TM. The complete set of analytical data used to generate the summary data tables is provided in the CD attached to this PCCR. Data are also available in the OREIS database, which can be accessed by contacting DOE.

Recommendations for the Zone 2 ROD Appendix A FFA sites are summarized in Table 8. Characterization, evaluation, and remediation of these sites will be used as a metric for the closure of ETTP. If the evaluation of all available data for an EU supported a NFA determination at the EU level, then all FFA sites within that EU were considered NFA by inclusion. If a limited set of data resulted in an action being required within an EU, then the final status of the EU and all included FFA sites was deferred until the action was complete and an EU-level NFA determination was made.

Table 6. DVS evaluation summary for EU Z2-36

Bulk acreage summary	
Total acreage in Zone 2	819
Acreage included in this PCCR	15
Acreage for NFA – no RA	15
Acreage for NFA – post RA ^a	0
Acreage of RAs conducted	< 1
Acreage of RAs to be conducted	0
SU classification summary for acreage in the PCCR	
Class 1 SU acreage	0
Class 2 SU acreage	2
Class 3 SU acreage	13
Class 4 SU acreage	0

Table 6. DVS evaluation summary for EU Z2-36 (continued)

EU summary		
Number of EUs in Zone 2	44	
Number of EUs addressed in this PCCR	1	
Number of EUs for NFA	1	
Number of EUs for NFA – post RA	0	
Characterization summary		
Sample analyses DVS and historical	Metal: 32 PCB: 27 Radionuclide: 24 SVOC: 27	VOC: 18 Other: 8 TCLP SVOC: 0 TCLP Metals: 0
Radiological walkover survey acreage	0	
Geophysical survey acreage	0	
Linear feet of soil core obtained	Approximately 128 ft	
Class 3 and Class 4 SU walkover assessments	Assessment point locations: 16 Mid-point locations: 15 Discretionary point locations: 15 Total locations assessed: 46	
FFA Sites Addressed – NFA		
K-1098-C Asphalt Plant		
K-1503 Neutralization Pit		
FFA Sites – Additional Action		
None		

"The need for RA anywhere in an EU indicated the NFA decision could not be made for the whole EU until the action was complete. Final status of FFA sites within an EU where an action was planned was contingent on completion of the RA. "Acreage for NFA-post RA" indicates the sum of acreages in which a RA was to be conducted. "Acreages of RAs to be conducted" indicates the sum of acreages of the actions themselves.

DVS = Dynamic Verification Strategy

EU = exposure unit

FFA = Federal Facility Agreement

NFA = no further action

PCB = polychlorinated biphenyl

PCCR = Phased Construction Completion Report

RA = remedial action

SU = soil unit

SVOC = semivolatile organic compound

TCLP = toxicity characteristic leaching procedure

VOC = volatile organic compound

Table 7. Final status assessment summary for EU Z2-36

EU size (acres)	EU Group	Zone 2 ROD Appendix A FFA sites	Class 1 and 2 SU area (acres)	Class 3 and 4 SU area (acres)	Risk evaluation	Decision rule evaluation	Final status decision
15	Main Plant	K-1098-C Asphalt Plant	--	—	Passes risk screen	Max RL: NFA Avg RL: NFA Risk: NFA GW: NFA	NFA for soils
		K-1503 Neutralization Pit			Passes risk screen	Max RL: NFA Avg RL: NFA Risk: NFA GW: NFA	NFA for soils

Avg = average
EU = exposure unit
GW = groundwater
Max = maximum

NFA = no further action
RL = remediation level
ROD = Record of Decision
SU = soil unit

Table 8. Summary of conclusions for EU Z2-36 Zone 2 ROD Appendix A FFA sites

Zone 2 ROD Appendix A FFA Site	Recommendation
K-1098-C Asphalt Plant	NFA
K-1503 Neutralization Plant	NFA

EU = exposure unit
 FFA = Federal Facility Agreement

NFA = no further action
 ROD = Record of Decision

4.1 EXPOSURE UNIT EVALUATION

The following section summarizes the evaluation and conclusions for EU Z2-36. Details of the material presented in Tables 6, 7, and 8, and the following section, are presented in Appendix A. The evaluation is performed and presented from a post-RA perspective by removing from the analysis data from all locations where RA was performed.

4.1.1 Exposure Unit Z2-36

EU Z2-36 is located in the east central portion of Zone 2 in the Main Plant EU Group (Fig. 1), and is bounded on the north by EU Z2-35 and EU Z2-39, on the east by EU Z2-40 and Zone 1, on the south by EU Z2-41, and on the west by EU Z2-31. All of the land area in this EU has been impacted by site operations. Impacts to the EU included construction of buildings, roads, parking lots, and sidewalks.

Exposure unit Z2-36 has two FFA sites that are listed in Appendix A of the Zone 2 ROD (Fig. 2):

- K-1098-C Asphalt Plant,
- K-1503 Neutralization Pit, and

One conceptual model applies to EU Z2-36. The conceptual site model is a surface release model related to fuel storage facilities in the EU. There was a known spill from the K-1501 Diesel Storage Tank in the 2000.

EU Z2-36 contains only Class 2 and Class 3 SUs. The Class 2 SUs include K-1501-A/B and K-1501-J which comprise an area of approximately 2 acres. Sampling but no radiological surveys were performed in these SUs.

The remainder of EU Z2-36 is a Class 3 SU where walkover assessments and biased sampling was performed.

The following is a summary of the data evaluation for EU Z2-36.

EU #	Max RL exceeded?	Average RL over EU exceeded?	Industrial risk above 1×10^{-4}?	Potential source to groundwater?	Action required?
Z2-36	No	No	No	No	No

- There are no Max RL exceedances in EU Z2-36.
- No average COC concentration across EU Z2-36 exceeded its Avg RL.
- The industrial risk for EU Z2-36 was calculated to be $< 1 \times 10^{-4}$ ELCR, with a target organ HI of 1.

- Despite the presence of VOC groundwater contaminant plumes beneath EU Z2-36, the source areas are located to the south in EU Z2-41. The EU Z2-36 soils do not contribute to those plumes and do not pose a threat to groundwater.
- No further action is necessary to meet industrial land use.

There is a low probability that the acreage of EU Z2-36 could be released with no land use restrictions. There is one location with two PCB Avg RL exceedances that will remain because the exceedances do not cause the average concentrations across the EU to exceed the Avg RL and there are widespread Ind PrG exceedances and residential PRG exceedances. There have also been a substantial number of historical VOC MCL exceedances across the EU associated with known groundwater contaminant plumes beneath the EU.

5. REMEDIATION ACTIVITIES

The remedial action of backfilling the building K-1501 basement and two small adjacent pits, normally described in this section, was described in *Fiscal Year 2007 Phased Construction Completion Report for the Zone 2 Soils, Slabs, and Subsurface Structures at East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE 2007b). There were no other completed RAs in EU Z2-36 to be addressed in this PCCR.

5.1 END STATE

The building 1501 basement was planted in domestic grass that will require mowing, and the two small adjacent pits were covered with gravel.

6. DEVIATIONS FROM GOVERNING DOCUMENTS

Zone 2 was divided into 7 geographic areas and 44 EUs in the ROD (DOE 2005). To facilitate the DQOs, the Zone 2 RDR/RAWP (DOE 2007a) regrouped the 44 EUs into 12 DQO scoping EU groups, which facilitated the DQO process by placing similar facilities and their support facilities together and allowing identification of data gaps.

It is not uncommon for EU acreages reported in PCCRs to differ from that reported in the ROD because of boundary refinement and an increased level of accuracy. In the case of EU Z2-36, however, the 15 acres used in this PCCR is the same as that reported in the ROD.

The RA Core Team concurrence process is an integral part of DVS implementation, which allows actions such as revising sampling locations or RA implementation based on field conditions encountered. Table 9 lists the FCNs and concurrences submitted to and reached by the RA Core Team pertaining to the DVS characterization and RAs assessed in this PCCR.

Table 9. EU Z2-36 FCNs and concurrences

Log number	FCN number	Title or description	Date issued	Date approved
94		Main Plant Group changes to DQO base program	3/1/2006	3/15/2006
	FCN-ETTP-Zone 2-026	Main Plan EU Group DQO Scoping Package Backfilling the K-1501 basement (Z2-EU36)	12/20/2006	1/5/2007
	FCN-ETTP-Zone 2-035	Main Plant EU Group DQO Scoping Package biased sampling in K-1501 sump (Z2-EU36)	3/7/2007	3/20/2007
	FCN-ETTP-Zone 2-037	Main Plant EU Group DQO Scoping Package backfill K-1501 basement in EU 36	3/12/2007	3/22/2007
	FCN-ETTP-Zone 2-038	Main Plant EU Group DQO Scoping Package biased sampling in K-1501 pit (Z2-EU36)	3/29/2007	4/12/2007
	FCN-ETTP-Zone 2-043	Main Plant EU Group DQO Scoping Package backfill the K-1501 pit (Z2-EU36)	5/15/2007	5/24/2007
	FCN-ETTP-Zone 2-088	Move Main Plant sample locations (EU Z2-36)	7/9/2008	7/17/2008
	FCN-ETTP-Zone 2-093	Delete samples in EUs 12, 32, and 36	8/21/2008 resubmitted 9/29/2008	10/14/2008
	FCN-ETTP-Zone 2-098	Revise DQO sampling at K-1501-J Class 2 SU (EU-Z2-36)	10/7/2008	10/9/2008

DQO = data quality objective

ETTP = East Tennessee Technology Park

EU = exposure unit

FCN = Field Change Notice

7. COSTS AND SCHEDULE FOR REMEDIAL ACTION(S)

Aside from the remedial action of backfilling the Bldg. K-1501 basement and two small adjacent pits described in Sect. 5, there were no other completed RAs in EU Z2-36 addressed in this PCCR.

8. WASTE MANAGEMENT ACTIVITIES FOR REMEDIAL ACTION(S)

Aside from the remedial action of backfilling the Bldg. K-1501 basement and two small adjacent pits described in Sect. 5, there were no other completed RAs in EU Z2-36 addressed in this PCCR.

9. OPERATIONS AND MAINTENANCE

Aside from mowing, no operations and maintenance is required for the Bldg. 1501 basement and adjacent pits backfill RA performed.

10. MONITORING SCHEDULE AND/OR EXPECTATIONS

There are no monitoring requirements for the RA performed in EU Z2-36.

11. LAND USE CONTROLS

This section discusses general land use controls for the EUs in Zone 2 at ETTP. Details of the controls will be presented in the Remedial Action Report. An assessment for possible unrestricted use of EU Z2-36 is presented in Sect. 11.4.

Dynamic Verification Strategy characterization of EU Z2-36 was conducted in accordance with the requirements of the Zone 2 ROD and RDR/RAWP. The goal of characterization was to gather sufficient information to evaluate the EU against the four decision rules developed in the DVS DQOs (Table 5) and arrive at an action/NFA decision. The decision rule evaluation process used in this PCCR is described in Sect. 3. Consistent with the Zone 2 ROD, a NFA decision means an EU is available for unrestricted industrial use to a depth of 10 ft bgs.

11.1 POSSIBLE LIFTING OF LAND USE CONTROLS

As required by the Zone 2 ROD, this section presents an evaluation of EU Z2-36 for the possible lifting of the following two land use controls:

- Industrial land use controls below 10 ft bgs, and
- Making the EU available for unrestricted land use.

The DVS process and EU status assessment presented in this PCCR for EU Z2-36 can assign a high, medium, or low qualitative probability of lifting land use controls.

11.2 DEFINITIONS

High probability—This designation indicates no identified areas of contaminated soils and there are no significant disposal or landfill operations observed in the EU. Dynamic Verification Strategy evaluations indicate no identified impact within the EU and a high probability the acreage could be released with no land use controls following appropriate evaluation.

Medium probability—This designation indicates an identifiable impact from facility operations to some portion of acreage in the EU. This impact may be visible rubbish and debris, concentrations of several metals and/or radionuclides above background levels, and/or the detection of organic compounds in a few samples within the EU. Based on the observations and sample results, the impact appears to be minor and limited in extent. There is a moderate probability the acreage could be released following appropriate evaluation.

Low Probability—This designation indicates a clearly identified impact to substantial portions of acreage within the EU. Metals and radionuclides are commonly above background levels and organic compounds may be present in several samples within the EU at levels above 1×10^{-6} residential PRGs. The probability of unrestricted use of the acreage is low.

11.3 INDUSTRIAL CONTROLS AT DEPTH

An evaluation was performed to determine if EU Z2-36 would require industrial controls below 10 ft bgs. The DVS program was designed to assure the top 10 ft of soil meet industrial criteria. However, sufficient information exists to make reasonable conclusions regarding the need for land use controls below 10 ft of soil. A VOC groundwater plume is known to exist in the central portion of EU Z2-36 at a

depth of +/- 25 ft below ground surface. Therefore, it is proposed to retain land use restrictions below 10 ft for EU Z2-36.

11.4 POTENTIAL UNRESTRICTED USE

To conduct the evaluation and determine the probability of lifting land use controls, EU Z2-36 analytical data were compared to background concentrations and 1×10^{-6} residential PRGs. A qualitative assessment of the comparison results applicability to the whole EU was made. DVS sampling is biased to areas with relatively high probabilities of contamination being present (i.e., DVS systematic sampling is focused on Class 1 and Class 2 SUs and DVS biased sampling is conducted in all SUs based on a determination from visual and screening assessments that there is a likelihood of contamination). As a result, the presence of background or 1×10^{-6} residential-use PRG concentration exceedances in the data set does not automatically preclude the possibility of lifting industrial land use controls. The probability of lifting land use controls for acreage in Zone 2 is generally low because it has been extensively impacted by the construction of ETTP facilities, infrastructure, and heavy industrial activities. Sample results consistently indicate impact to area soils above background levels and commonly above industrial use PRGs. Also, unrestricted use of Zone 2 acreage is an unlikely alternative because there are many small structures and abandoned infrastructures in the area.

Further evaluation is recommended before a final conclusion can be made concerning lifting industrial land use controls because the DVS process was designed around requirements of the Zone 2 ROD, which specifies an unrestricted industrial land use.

To evaluate for unrestricted use, appropriate DQOs were developed that considered but were not limited to the following:

- Calculated RLs consistent with the risk management requirements of an unrestricted land use scenario,
- Remediation levels for chemicals and radionuclides where background concentrations are greater than residential PRGs (i.e., aluminum, arsenic, iron, manganese, K-40, Ra-226, Th-228, and Th-232),
- Remediation levels for Cs-137, a ubiquitous fallout radionuclide that does not have a determined background concentration but typically exceeds its residential PRG when detected, and
- EU size.

Taking the above information into account, results of the evaluation process determined there is a low probability that land use controls can be lifted at EU Z2-36. There is one location with two PCB Avg RL exceedances that will remain because the exceedances do not cause the average concentrations across the EU to exceed the Avg RL and there are widespread Ind PrG exceedances and residential PRG exceedances.

11.5 REMAINING ACTIVITIES

This section summarizes activities remaining to be completed in Zone 2. The rationale for these activities falls into the following four categories:

- Remaining activity is an action to be performed,
- Remaining activity awaits a risk management decision,
- Remaining activity is part of a larger infrastructure investigation to be conducted at a later date, or
- Remaining activity awaits D&D to make soils accessible.

The status of each EU in Zone 2 is presented in Table 12. The status of Zone 2 RA characterization as of this PCCR is shown in Fig. 13. As shown in Fig. 13, characterization has been completed in 18 of 44 Zone 2 EUs (328 of 800 acres).

Table 10. Status of Zone 2 EUs

EU	Characterization complete?	NFA on soil appropriate?	NFA on infrastructure appropriate?^a	Action required?	Closure documentation?	Comment/explanation
Z2-01	✓	✓	✓		FY 2007 PCCR	
Z2-02	✓	✓	✓		FY 2006 PCCR	
Z2-03	✓	✓	✓		FY 2007 PCCR	
Z2-04					PCCR or Zone 2 RAR	
Z2-05					PCCR or Zone 2 RAR	
Z2-06					PCCR or Zone 2 RAR	
Z2-07	✓	✓	✓		FY 2006 PCCR	
Z2-08	✓	✓	✓		FY 2007 PCCR	
Z2-09	✓	✓	✓		FY 2006 PCCR	
Z2-10	✓	✓	✓		FY 2006 PCCR	
Z2-11					PCCR or Zone 2 RAR	
Z2-12					PCCR or Zone 2 RAR	
Z2-13					PCCR or Zone 2 RAR	
Z2-14					PCCR or Zone 2 RAR	
Z2-15					PCCR or Zone 2 RAR	
Z2-16					PCCR or Zone 2 RAR	
Z2-17					PCCR or Zone 2 RAR	
Z2-18					PCCR or Zone 2 RAR	
Z2-19					PCCR or Zone 2 RAR	
Z2-20					PCCR or Zone 2 RAR	
Z2-21					PCCR or Zone 2 RAR	
Z2-22					PCCR or Zone 2 RAR	
Z2-23	✓	✓	✓		FY 2007 PCCR	
Z2-24	✓	✓	✓		FY 2007 PCCR	
Z2-25					PCCR or Zone 2 RAR	
Z2-26					PCCR or Zone 2 RAR	

Table 10. Status of Zone 2 EUs (continued)

EU	Characterization complete?	NFA on soil appropriate?	NFA on infrastructure appropriate? ^a	Action required?	Closure documentation?	Comment/Explanation
Z2-27	✓	✓	✓		FY 2006 PCCR	
Z2-28	✓	✓	✓	✓	FY 2007 PCCR	
Z2-29					PCCR or Zone 2 RAR	
Z2-30					PCCR or Zone 2 RAR	
Z2-31					PCCR or Zone 2 RAR	
Z2-32					PCCR or Zone 2 RAR	
Z2-33	✓	✓	✓	✓	FY 2008 EU Z2-33 PCCR	Bldg. K-1006 north sump recommended RA will be performed when the facility is demolished; recommended action added to FFA Appendix J
Z2-34	✓	✓	✓		FY 2007 PCCR	
Z2-35					PCCR or Zone 2 RAR	
Z2-36	✓	✓	✓		FY 2009 EU Z2-36 PCCR	
Z2-37	✓	✓	✓		FY 2007 PCCR	
Z2-38					PCCR or Zone 2 RAR	
Z2-39					PCCR or Zone 2 RAR	
Z2-40					PCCR or Zone 2 RAR	
Z2-41	✓	✓	✓	✓	FY 2007 PCCR	
Z2-42	✓	✓	✓	✓	PCCR or Zone 2 RAR	Soil RA complete; K-1004-J Vaults FFA Site requires RA
Z2-43	✓	✓	✓		FY 2007 PCCR	
Z2-44	✓	✓	✓		FY 2007 PCCR	

^aThe check mark in this column indicates either the infrastructure has been evaluated or there is no infrastructure requiring evaluation.

EU = exposure unit

FFA = Federal Facility Agreement

FY = fiscal year

NFA = no further action

PCCR = Phased Construction Completion Report

RA = remedial action

RAR = Remedial Action Report

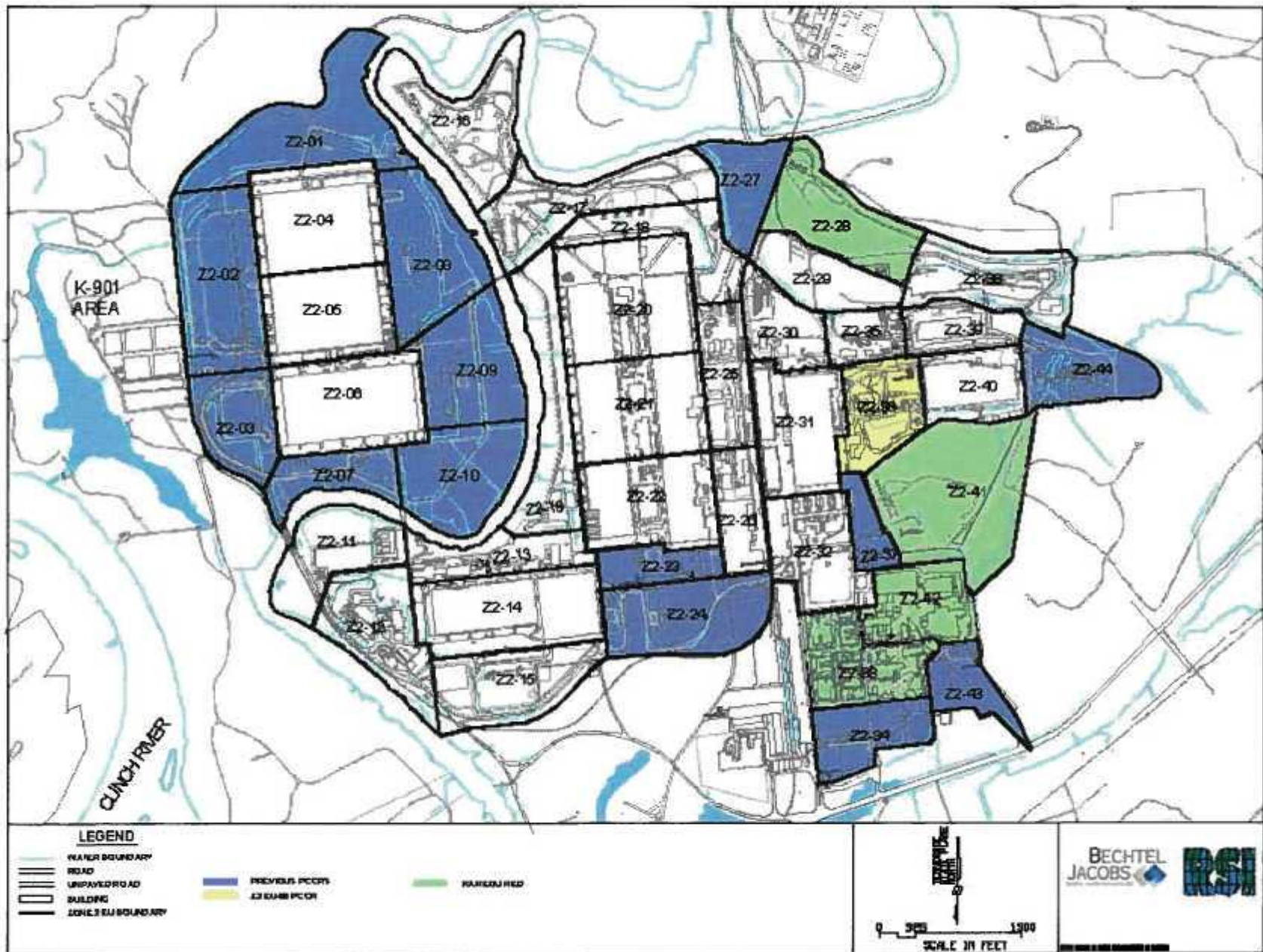


Fig. 6. EUs Included in EU Z2-36 PCCR.

12. REFERENCES

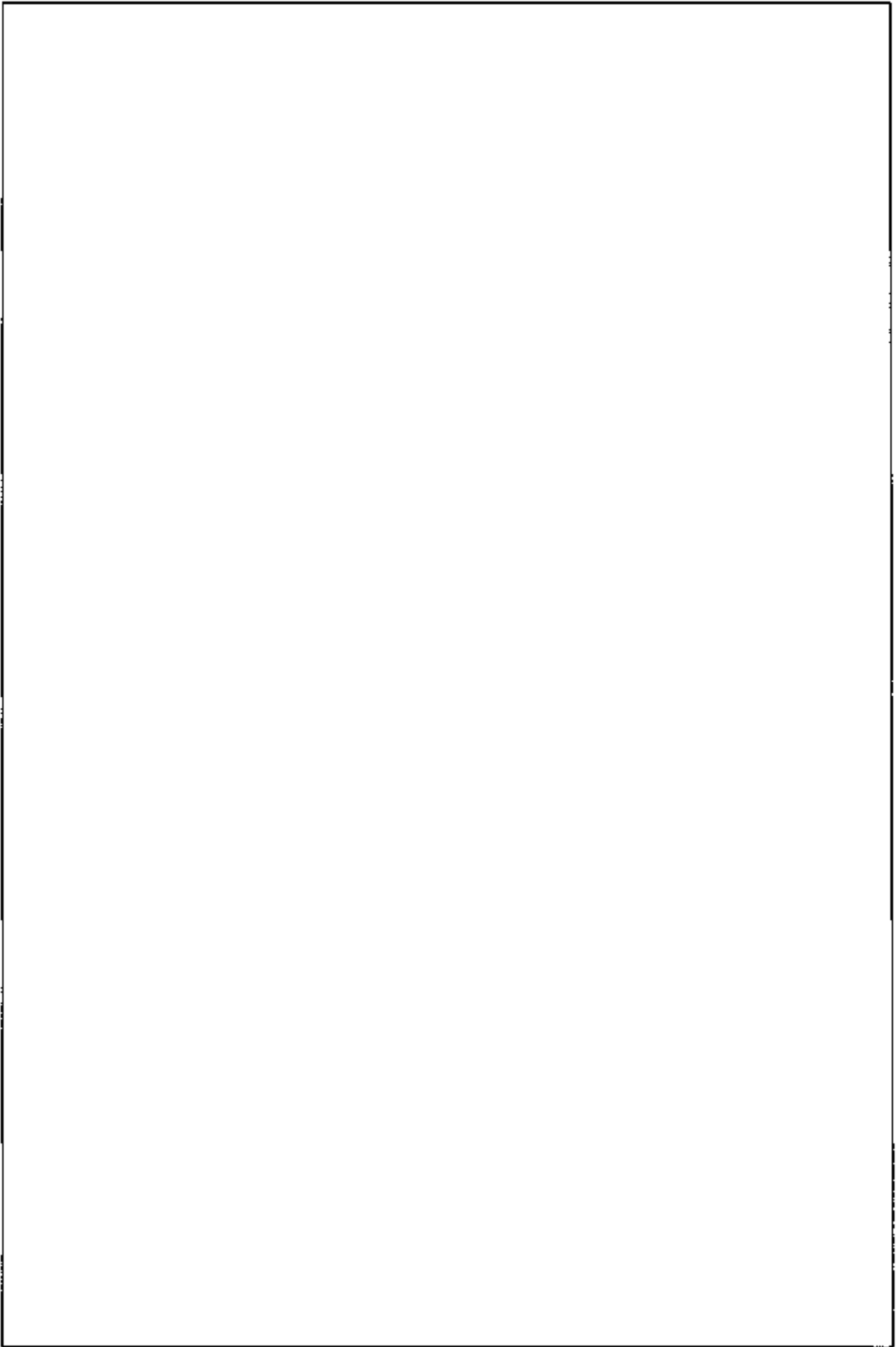
- BJC 2006. *Supporting Documentation for Preliminary Remediation Goals Used in the Dynamic Verification Strategy Sampling Program, East Tennessee Technology Park, Oak Ridge, TN*, BJC/OR-2383, Bechtel Jacobs Company LLC, Oak Ridge, TN.
- BJC 2007. *Zone 2 Dynamic Work Plan, East Tennessee Technology Park, Oak Ridge, Tennessee*, BJC/OR-2373/R1.
- DOE 1992. *Federal Facility Agreement for the Oak Ridge Reservation*, DOE/OR-1014, EPA-Region 4, DOE, and TDEC, Washington, D.C.
- DOE 1993a. *Final Report on the Background Soil Characterization Project at the Oak Ridge Reservation, Oak Ridge, Tennessee, Volume 1 – Results of Field Sampling Program*, DOE/OR/01-1175/V1, October.
- DOE 1993b. *Radiation Protection of the Public and the Environment*, DOE O 5400.5, Change 2, U.S. Department of Energy, Washington, D.C.
- DOE 2003. *Soil Background Supplemental Data Set for the East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2105&D1, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN.
- DOE 2005. *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2161&D2, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN.
- DOE 2006. *Fiscal Year 2006 Phased Construction Completion Report for the Zone 2 Soils, Slabs, and Subsurface Structures at East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2317&D2, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN.
- DOE 2007a. *Remedial Design Report/Remedial Action Work Plan for Zone 2 Soils, Slabs, and Subsurface Structures, East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2224&D3, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN.
- DOE 2007b. *Fiscal Year 2007 Phased Construction Completion Report for the Zone 2 Soils, Slabs, and Subsurface Structures at East Tennessee Technology Park, Oak Ridge, Tennessee*, DOE/OR/01-2723&D1, U.S. Department of Energy, Office of Environmental Management, Oak Ridge, TN, September.
- EPA 1989. *Risk Assessment for Superfund, Vol. I, Human Health Evaluation Manual (Part A)*, EPA/540/1-89/002, U.S. Environmental Protection Agency, Washington, D.C.
- EPA 2002. *Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites*, EPA-540-R-01-003, EPA Region IV, Washington, D.C.
- MMES 1994. *Cable Insulation PCB Analysis*, Internal Correspondence, Martin Marietta Energy Systems, Inc., February 28, 1994.

ORISE 2000. *Polychlorinated Biphenyl and Asbestos Sampling and Analysis Report for the K-762 and K-792 Switchyard Site, East Tennessee Technology Park, Oak Ridge, Tennessee* (Draft), Oak Ridge Institute for Science and Education, December 14, 2000.

Appendix A

Main Plant Exposure Unit Group Zone 2 EU 36

Technical Memorandum

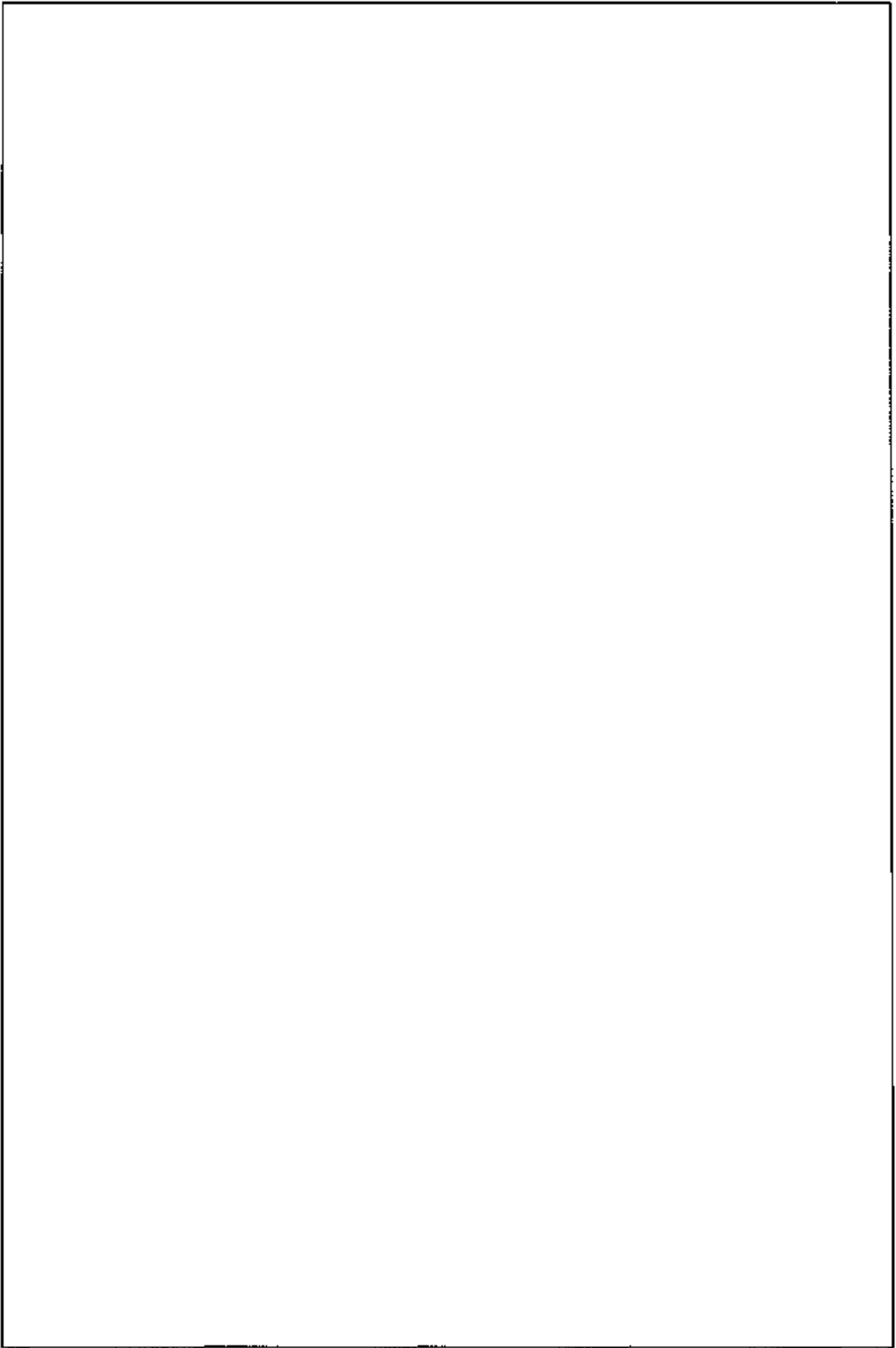


FIGURES

A.1. EU Z2-36 location map.	A-31
A.2. EU Z2-36 boundary location map.	A-32
A.3. EU Z2-36 area field map.	A-33
A.4. EU Z2-36 sample locations.	A-34

TABLES

A.1. EU Z2-36 facility and FFA site list	A-35
A.2. EU Z2-36 sample summary	A-36
A.3. EU Z2-36 data summary for soil samples collected from 0 to 10 ft below ground surface	A-38



DYNAMIC VERIFICATION STRATEGY (DVS) TECHNICAL MEMORANDUM

EXPOSURE UNIT (EU) GROUP: Zone 2 Main Plant Group EU 36

INTRODUCTION

The purpose of this Technical Memorandum (TM) is to document the recommendation for an action/no further action (NFA) decision for Zone 2 exposure unit 36 (EU Z2-36) in the Main Plant EU Group. The recommendation for this EU is based on existing historical data and DVS soil characterization activities. These data were used to determine the nature and extent of contamination in the EU and evaluate the need for an action. When it was determined that an action was necessary, the data were also used to calculate soil volumes for the proposed remedial alternative, as identified in the *Record of Decision for Soil, Buried Waste, and Subsurface Structure Actions in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2161&D2) (Zone 2 ROD).

1.0 BACKGROUND AND EU SUMMARY

1.1 LOCATION AT EAST TENNESSEE TECHNOLOGY PARK (ETTP)

EU Z2-36 is located in the east/central interior of Zone 2 in the Main Plant EU Group (Fig. A.1). It is bounded on the north by EUs Z2-37 and Z2-39, on the east by EUs Z2-40 and Z2-41, on the south by EUs Z2-37 and Z2-41, and on the west by EU Z2-31.

1.2 EU ACREAGE

EU Z2-36 has an area of approximately 15 acres (Fig. A.2).

1.3 SUMMARY DESCRIPTION

All of the land area in EU Z2-36 has been impacted by site operations. Impact to the EU includes the construction of buildings, roads, parking lots, and sidewalks.

The DQO Scoping Package for the Main Plant EU Group lists 42 facilities in EU Z2-36. Table A.1 presents an accounting of facilities in the EU.

1.4 SOIL UNITS (SUs)

Class 1 SU: None

Class 2 SU: 2 acres

Class 3 SU: 13 acres

Class 4 SU: None

The EU Z2-36 soil unit boundaries are shown on Fig. A.2.

1.5 ZONE 2 ROD APPENDIX A FEDERAL FACILITY AGREEMENT (FFA) SITES

There are two FFA sites listed in Appendix A of the Zone 2 ROD as being in EU Z2-36:

- K-1098-C Asphalt Plant FFA Site
- K-1503 Neutralization Pit FFA Site

The Main Plant DQO Scoping Document places the K-1098-C Asphalt Plant FFA Site in the northeast corner of EU Z2-36 and the K-1503 Neutralization Pit south of the K-1501 Steam Plant. The location of the K-1423 Grease Burial FFA Site is described in the scoping document as either east of K-1423 in EU Z2-25 or between K-1401 and the

K-1501 Steam Plant. Subsequent to DQO scoping, further investigation showed that the former K-1098-C Asphalt Plant was located in the central portion of EU Z2-36 in an area identified in this document as the K-1501-A/B Area Class 2 SU (Sect. 2.1.2), the K-1503 Neutralization Pit is located where it was identified during DQO scoping [which is also in the K-1501 Area Class 2 SU (Sect. 2.1.2)], and the K-1423 Grease Burial Site is located east of K-1423 in EU Z2-25 that will be addressed in the EU Z2-25 TM.

In addition to the two FFA sites identified in EU Z2-36, a portion of the K-1401 Acid Lines FFA site occurs in this EU. The K-1401 Acid Line FFA site will be addressed in the EU Z2-31 TM.

2.0	DVS INVESTIGATIONS AND RESULTS
2.1	DVS FIELD ACTIVITIES
Dynamic Verification Strategy activities were conducted in accordance with the <i>Remedial Design Report/Remedial Action Work Plan for Zone 2 Soils, Slabs, and Infrastructure, East Tennessee Technology Park, Oak Ridge, Tennessee</i> (DOE/OR/01-2224&D3) (Zone 2 RDR/RAWP).	
2.1.1	CLASS 1 SUs
None	
2.1.1.1	CLASS 1 SU RADIOLOGICAL WALKOVER SURVEY
None	
2.1.1.2	CLASS 1 SU GEOPHYSICAL SURVEY
None	
2.1.1.3	CLASS 1 SU SOIL SAMPLING
None	
2.1.2	CLASS 2 SUs
There are two Class 2 SUs in EU Z2-36:	
<u>K-1501-A/B Class 2 SU:</u> The 1.8-acre K-1501-A/B Class 2 SU is located in the central interior of the EU (Fig. A.2). The boundaries of this Class 2 SU were defined to encompass the land area around the K-1501-A and K-1501-B Oil Storage Tank Area. The K-1098-C Asphalt Plant FFA Site is located in the central portion of this SU.	
<u>K-1501-J Class 2 SU:</u> The <0.2-acre K-1501-J Class 2 SU is located due east of the southern end of the K-1501-A/B Class 2 SU and south of the K-1501 Steam Plant. The boundaries of this Class 2 SU were defined around the K-1501-J Fuel Storage Tank Area. The K-1503 Neutralization Pit FFA Site is located in this Class 2 SU.	
Soil unit boundaries in EU Z2-36 are shown on Fig. A.2.	
2.1.2.1	CLASS 2 SU RADIOLOGICAL WALKOVER SURVEY
With Core Team concurrence, no radiation walkover surveys were conducted in EU Z2-36.	
2.1.2.2	CLASS 2 SU GEOPHYSICAL SURVEY
None	
2.1.2.3	CLASS 2 SU SOIL SAMPLING
<u>K-1501-A/B Class 2 SU:</u> There are 10 DVS systematic grid sample locations in the K-1501-A/B Class 2 SU.	
<u>K-1501-J Class 2 SU:</u> There are two DVS systematic grid and one DVS biased sample location in the K-1501-J Class 2 SU. Soil from a third systematic grid location was screened for radiation and volatile organic compounds (VOCs) but was not sampled because the screening levels were not exceeded (Table A.2). The biased sample	

location was selected to investigate possible fuel spills at the K-1501-J Fuel Storage Tank. The Main Plant DQO Scoping Package describes 10 systematic grid sample locations in the K-1501-J Class 2 SU. However, Fig. 8 in the DQO Scoping Package shows three systematic grid sample locations. Based on the small size of the K-1501-J Class 2 SU, 10 systematic grid sample locations is incorrect. The error in the DQO Scoping Package was described to the RA Core Team and the current sampling approach in the SU was implemented with RA Core Team concurrence.

The details of actual sampling and analysis in the Class 2 SU, including sample depths, analytes, and deviations from planned sampling, are presented in Table A.2 and sample locations are shown on Fig. A.4.

2.1.3 CLASS 3 AND CLASS 4 SU WALKOVER ASSESSMENT

The protocol for addressing the Class 3 SUs in EU Z2-36 is the *Class 3 and Class 4 Soil Unit Walkover Inspection Protocol*, Rev. 1 (found in Appendix A of the Zone 2 RDR/RAWP). The purposes of the Class 3 SU walkover assessments are to systematically inspect Class 3 SUs by visual observation along transects to established grid assessment locations, map observed features, and collect radiological screening data at grid and discretionary locations. The details of the walkover assessment results for EU Z2-36 are presented in the document *FY 2009 Walkover Inspections and Radiological Surveys for Exposure Units in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee* (BJC/OR-3157) (Assessment Report). A summary of the report results is presented below in Sects. 2.1.3.1 and 2.1.3.2. Class 3 SU boundaries are shown on Fig. A.2. The assessment point (AP), mid-point (MP), and discretionary point (DP) locations are shown on Fig. A.3.

A total of 15 APs were identified in EU Z2-36 prior to the start of fieldwork and are documented in the DQO Scoping Package. There were 16 APs evaluated in EU Z2-36.

In addition to the APs, the field team made assessments at 15 MP locations (MPs are selected in the field and are points located approximately half way between APs) and conducted discretionary surveys at a total of 15 locations (see below). Mid-point and DP locations are not specified in planning documents. Assessment point, MP, and DP locations are shown on Fig. A.3.

	Number of APs	Number of MPs	Number of DPs
EU Z2-36	16	15	15
AP = assessment point EU = exposure unit DP = discretionary point MP = mid-point			

2.1.3.1 CLASS 3 AND CLASS 4 SU RADIOLOGICAL SURVEY SUMMARY

Screening level (SL): 4082 cpm

SL exceedances: None

2.1.3.2 CLASS 3 AND CLASS 4 SU ANTHROPOGENIC FEATURES

Number of identified anthropogenic features: 15

Exposure unit Z2-36 is located in an industrialized portion of ETTP. As such, there are numerous anthropogenic features that consist of facilities and associated constructed features such as roads, sidewalks, and paved areas. Plant facilities and their associated constructed features are assessed as part of the Class 3 and Class 4 SU Walkover Assessment protocol (Sect. 2.1.3.3). Other than plant facilities and associated constructed features, 15 anthropogenic features, corresponding to the 15 DPs, were identified in EU Z2-36 during the Class 3 SU walkover assessment.

The anthropogenic features identified in EU Z2-36 during the Class 3 SU assessment include the following:

- Gravel pad
- Sealand container
- Open lumber storage shed
- Sediment accumulation area at grated storm drain adjacent to loading ramp
- Document storage trailer

<ul style="list-style-type: none"> • Sediment accumulation area at diesel tank drain sump • Electrical supply building • Gas cylinder storage shed • Flammable materials storage shed • Metal storage building • Break trailer <ul style="list-style-type: none"> • Grated storm drain catch basin • Change house trailer • Concrete block storage area 	
2.1.3.3	CLASS 3 SU FACILITIES ASSESSMENTS
<p>Forty-two facilities are listed in the DQO Scoping Package as being located in EU Z2-36 and 45 facilities were assessed during the Class 3 SU walkover assessment (Table A 1). The facility assessments are reported in the Assessment Report. In summary, no facility was identified as a possible source for either chemical or radiological contamination.</p>	
2.1.3.4	CLASS 3 AND CLASS 4 SU BIASED SAMPLING
<p>Based on radiation surveys and visual assessment of each anthropogenic feature for evidence of possible contamination, no biased sample locations were selected during the Class 3 SU walkover assessment.</p> <p>There are nine DVS biased sample locations that will be addressed as Class 3 SU sample locations. Two of the locations are within the K-1501 Area Class 2 SU but because they address DQO scoping Class 3 SU sampling requirements, they will be addressed as Class 3 SU sample locations (see below).</p> <ul style="list-style-type: none"> • As required by DQO scoping, there are six biased sample locations associated with three storm drains in EU Z2-36. One sample location at each storm drain is for collection of sediment from the storm drain and the other location is for soil from outside the storm drain. The three storm drains addressed by DVS sampling are the storm drain junction located east of K-1401 along Avenue D, a storm drain southeast of K-1501, and a storm drain northwest of K-1501. The storm drain northwest of K-1501 is actually located in the K-1501 Area Class 2 SU (Sect 2.1.2) but sampling is addressed as Class 3 SU sampling to be consistent with DQO scoping. The DQO Scoping Package specifically identifies the K-1401 storm drain for sampling. This DQO scoping requirement is fulfilled by sampling at the three storm drains. • As required by DQO scoping, there are two biased sample locations in the former coal yards in EU Z2-36. A four-point composite sample was collected from the K-1501-N Coal Yard and another four-point composite sample was collected at the K-1501-S Coal Yard. • One biased sample location was identified at the sump located east of the K-1501 Steam Plant prior to a remedial action conducted at the sump. This sampling location was added with Core Team concurrence. <p>Data quality objective scoping specified that a sample of sediment or sludge would be collected from the K-1204-05 Sewage Ejector Station. During field work it was determined there was no sediment or sludge from the sewage ejector station. Because of the absence of materials that might pose a risk to the industrial worker, sampling at the proposed location was dropped with Core Team concurrence.</p> <p>The details of actual sampling and analysis in the Class 3 SU, including sample depths, analytes, and deviations from planned sampling, are presented in Table A 2 and sample locations are shown on Fig. A 4.</p>	
2.2	DVS AND HISTORICAL SAMPLE RESULTS
<p>Sample data for DVS and historical sampling in EU Z2-36 are summarized in Table A 3. The total number of samples referred to in the table is a combination of all sample results. The presentation of sample results in Sect 2.2.5 summarizes subsets of Table A 3 by presenting pertinent results for focused characterization within EU Z2-36. Sample locations are shown on Fig. A 4. A compact disc containing electronic files for the historical and</p>	

DVS analytical data used to generate the data tables is provided with this Phased Construction Completion Report (PCCR)

2.2.1 CLASS 1 SUS

None

2.2.2 CLASS 2 SUS

There are 13 DVS sample locations in the K-1501 Area Class 2 SU and no historical sample locations. Class 2 SU sample locations are shown on Fig. A 4 and summarized below:

DVS sample locations	Historical sample locations
K-1501-A/B Class 2 SU Systematic Grid	
Locations:	
Z2-EU36M-200, Z2-EU36-201, Z2-EU36-202, Z2-EU36-203, Z2-EU36-204, Z2-EU36-205, Z2-EU36-206, Z2-EU36M-207, Z2-EU36-208, Z2-EU36-209	
K-1501-J Class 2 SU Systematic Grid	
Locations:	
Z2-EU36-210, Z2-EU36-211	
K-1501-J Class 2 SU Biased Location:	
Z2-EU36-213	
DVS = Dynamic Verification Strategy SU = soil unit	

Sampling and analytical details for each sample location are presented in Table A 2. The analytical data are summarized in Table A 3 and evaluated in Sect. 2.2.5. The number of analyses conducted in the Class 2 SU is presented below by analyte group:

Metals	Other organics ^a	PPCBs	Radionuclides	SVOCs	VOCs
18	7	12	5	12	7

^aIncludes diesel range organics (DRO) and gasoline range organics (GRO)

PPCB = pesticide and polychlorinated biphenyl

SVOC = semivolatile organic compound

VOC = volatile organic compound

2.2.3 CLASS 3 AND CLASS 4 SUS

There are 23 DVS and historical Class 3 SU sample locations in EU Z2-36, including two sample locations that actually fall in the K-1501 Area Class 2 SU but are addressed as Class 3 SU sample location to maintain consistency with DQO scoping requirements. Historical sampling was conducted during compliance sampling and the ETTP Release Site Project. Class 3 SU sample locations are shown on Fig. A 4 and summarized below:

DVS sample locations	Historical sample locations
K-1401 Storm Drain: Z2-EU36B-301 (storm drain sediment), Z2-EU36B-302 (soil)	ETTP-REL05, ETTP-REL06, ETTP-REL07, S01, S02, S03, S04, S05, S06, S07, S08, S09, S10, S11
Storm Drain Northwest of K-1501-H: Z2-EU36B-307 (storm drain sediment), Z2-EU36B-308 (soil)	

Storm Drain Southeast of K-1501-H: Z2-EU36B-303
(storm drain sediment), Z2-EU36B-304 (soil)

K-1501-N Coal Yard: Z2-EU36B-305

K-1501-S Coal Yard: Z2-EU36B-306

Sump East of K-1501: Z2-EU36B-310

Sampling and analytical details for each sample location are presented in Table A 2. The analytical data are summarized in Table A 3 and evaluated in Sect 2.2.5. The number of analyses conducted in the Class 3 SU is presented below by analyte group.

Metals	Other organics ^a	PPCBs	Radionuclides	SVOCs	VOCs
14	1	15	19	15	11

^aIncludes DRO and GRO

PPCB = pesticide and polychlorinated biphenyl

SVOC = semivolatile organic compound

VOC = volatile organic compound

2.2.4 INFRASTRUCTURE SAMPLING

Dynamic Verification Strategy Class 3 SU biased sampling of storm drains was conducted.

2.2.5 EU EVALUATION

Characterization data and other information are evaluated for EU Z2-36 in this section. Analytical data in the following summaries are presented by analyte group and results for a particular analyte group are summarized only if that group was analyzed in the samples from the unit being summarized. Within each summary, the data are evaluated by comparing to certain criteria, including the Zone 2 soils maximum remediation level (Max RL), Zone 2 soils average remediation level (Avg RL), 1×10^{-5} industrial preliminary remediation goal (Ind PRG), ETTP soils background composition (Bkg), Zone 2 groundwater screening levels (GW SL), and 1×10^{-6} residential preliminary remediation goal (Res PRG). If a particular criterion does not apply to any member of an analyte group, it is not tabulated for that analyte group. If a particular criterion does not apply to all analytes within an analyte group, those analytes to which it does not apply were notated with NA (not applicable). Individual metals and radionuclides, which are naturally occurring, are reported in the summaries only if one or more criterion is exceeded. Organic chemicals, which are not naturally occurring, are reported if they are detected even if no criteria are exceeded. The Max RL, Avg RL, Ind PRG, Bkg, GW SL, and Res PRG criteria values are presented in Sect 3.1 of this PCCR as they pertain to the analytes listed in Appendix A of the RDR/RAWP (i.e., the QAPP).

Because the carcinogenic risk associated with the concentrations of radium and thorium isotopes in the natural background at ETTP exceeds the cumulative risk goal of 1×10^{-4} , RL values for these radionuclides are based on alternative concentration levels rather than risk. The alternative concentration levels of 5 pCi/g above background (Avg RL) and 15 pCi/g above background (Max RL) were set as low as reasonably achievable under the site-specific conditions. Because site-specific background concentrations of these radionuclides exceed the target risk range, residual concentrations of these radionuclides and their decay series are not considered in estimates of residual risk following any remedial action.

The Zone 2 ROD states that Avg RL and Max RL exceedances by Ra-226, Th-230, and Th-232 will be evaluated by summing above-background concentrations of the greater of Ra-226 or Th-230 with the above-background concentrations of Th-232 and comparing the results to 5 pCi/g (average RL) and 15 pCi/g (maximum RL). These required calculations have been performed. Average and Max RL exceedances for these radionuclides, if any, are reported in the TM data summaries below and in Table A 2 as "Ra/Th decay series", and individual RL exceedances

by Ra-226, Th-230, and Th-232 are reported as NA. The Ra/Th decay series data are summarized in the sections that follow only if an Avg or Max RL has been exceeded, consistent with the description in the preceding paragraph for reporting radionuclides. Discussion of the Ra/Th decay series calculation, including the manner in which the calculation is performed, is presented in Sect. 3.3 of this PCCR.

EU Z2-36 Conceptual Site Model (CSM)

The 15-acre EU Z2-36 is located in the eastern portion of the Main Plant EU Group north of the K-1070-C/D waste disposal area. Of the 15 acres, 1.8 acres were classified as a Class 2 SU encompassing the K-1501-A and K-1501-B Diesel Storage Tanks and a small Class 2 SU (less than a 0.2 acre) around the K-1501-J Fuel Storage Tank. The remaining 13 acres were classified as a Class 3 SU.

There are two FFA sites in EU Z2-36 (K-1098-C Asphalt Plant and K-1503 Neutralization Pit) and 42 facilities are listed in the DQO Scoping Package as occurring in the EU. The K-1098-C Asphalt Plant ceased operations in the 1950s and was removed from the site in the early 1960s. The K-1503 Neutralization Pit was filled with concrete in the 1980s when it was found to be leaking. This pit was backfilled as part of the K-1501 Demolition Project. Most of the facilities in the EU have been removed as part of ongoing decommissioning and demolition (D&D) projects. The K-1501 Steam Plant and all of the associated building structures and facilities that were formerly located in the eastern portion of the EU have been removed and the subsurface structures, including the K-1501 building basement, have been backfilled with clean soils. The only permanent structure that remains in EU Z2-36 is the K-1400 office building. Trailers and other temporary office structures have been removed and replaced with new trailers within the last several years as part of the ongoing site demolition program.

There is one CSM related to the possible release of contaminants in EU Z2-36. The CSM is a surface release model related to fuel storage facilities in the EU. There was a known spill from the K-1501 Diesel Storage Tank in 2000. The size of the spill was substantial but the spill was generally contained within the containment dike around this large aboveground storage tank and the fuel was pumped into temporary storage tanks to remove it from the area. Surface releases of fuels for the K-1501 Steam Plant also may have occurred at the K-1501-J Fuel Storage Tank, another aboveground tank. Sampling in the EU during DQO scoping focused on the potential for releases of diesel and other fuels to surface soils. Spilled fuels generally are known to have entered the storm drain system that discharges through the K-170 storm drain to the north into Mitchell Branch. Storm drain sediment and surrounding soil were sampled at three storm drains in EU Z2-36 and no contamination was identified. In addition, soil samples collected as part of the DVS sampling program did not identify any areas of substantially contaminated soils above Zone 2 RLs or above industrial use PRGs.

The Class 3 SU areas were evaluated according to the approved Class 3 SU walkover assessment protocol. No samples were added to the base program based on observations made during these assessments.

EU Z2-36 Groundwater Evaluation

There are seven groundwater monitoring wells in EU Z2-36 and two collection sumps where infiltrating water is monitored for the presence of contaminants. Groundwater flow in the area is from the topographic high ground to the south that underlies EU Z2-41 (K-1070-C/D) where waste storage yards and disposal trenches were located. Three monitoring wells are located along the south boundary of the EU. A bedrock/unconsolidated zone well pair, BRW-012/UNW-019, and a single unconsolidated zone well point, UNP-001, are located north of the Patrol Road on the north flank of the high ground. A single bedrock well, BRW-070, is located in the west central portion of the EU north of the former coal storage yard. A single unconsolidated zone monitoring well, UNW-056, is located immediately south of the former steam plant building location, and a bedrock/unconsolidated zone well pair, BRW-048/UNW-092, is located north of the Steam Plant and downgradient of the former diesel storage tank location. In addition to these groundwater monitoring wells, the water collected in the French drain system around the K-1400 building is monitored at location K-1400 FR-DRAIN and a collection sump east of Avenue D is monitored at location K-1070-TR-EF.

Location ID	Date drilled	Interval	Screen depth	Monitoring period
BRW-012	1987	Bedrock/abandoned	112-132 ft	1987-1998
BRW-048	1989	Bedrock	56-66 ft	1989-1995
BRW-070	1989	Bedrock/abandoned	Open hole to 83 ft	1989-1995
UNW-019	1987	Unconsolidated zone/ abandoned	25-35 ft	1989-1995
UNW-056	1987	Unconsolidated zone	5.5-10.5 ft	1989-1995
	1989	Unconsolidated zone	13.5-18.5 ft	1989-1998
UNW-092				
UNP-001	1985	Unconsolidated zone	22.5-27.5 ft	1986-2008
K-1400-FR-DRAIN	NA	Open catchment	NA	2006
K-1070-TR-EF	NA	Open catchment	NA	2002-2003

Depth to water varies in the unconsolidated zone wells located on the slope of the hill along the south EU boundary from approximately 12-20 ft bgs. Depth to water in wells further north in the flat ground around the K-1501 steam plant and the former diesel storage tank is near the ground surface, ranging from as little as 1.7-6.1 ft bgs. The potentiometric surface in the bedrock wells range from 13-20 ft bgs in BRW-012 located on the slope, 7-9 ft bgs in BRW-048 in the north portion of the EU, and from surface to artesian in BRW-070, which is located in the west central portion of the site. Vertical gradients vary seasonally both spatially and temporally over the EU. Horizontal gradients are toward the north and are presumed to be higher along the south boundary and flatten across the broad area to the north flowing toward Mitchell Branch. Three of the monitoring wells were closed and abandoned in 2002, including the well pair along the southern EU boundary and the bedrock well in the west central portion of the EU that exhibited artesian flow.

Substantial groundwater contamination in the EU is observed over the entire historic monitoring period in only one well, UNP-001, which is located along the southern EU boundary and downgradient of a former waste drum storage yard located in the northwestern portion of EU Z2-41. The source location was identified in the investigation work performed in EU Z2-41, however no localized source of soil contamination was identified in the former waste storage yard. Contaminants present in groundwater from UNP-001 include several VOCs (tetrachloroethene and its degradation products trichloroethene, dichloroethene, and vinyl chloride). Concentrations of these contaminants over the historic monitoring period (1989-2007) show minimal decline of the tetrachloride compound but show declining concentrations of the degradation products. This monitoring well location is near the EU boundary and historic records show the contaminant source area is to the south, outside of EU Z2-36 in EU Z2-41.

EU Z2-36 Sampling Results

The 15-acre EU Z2-36 has been classified into two Class 2 SUs covering 2 acres, with the remaining 13 acres classified as a Class 3 SU. The EU lies in a heavily industrialized portion of Zone 2 and the land area has been densely populated by buildings, other facilities, and paved areas such as sidewalks, roads, and parking lots. Many of the buildings and other facilities have been removed as part of the D&D Program at ETTP.

The K-1501-A/B Class 2 SU (1.8 acres) encompasses the land area around the former K-1501-A and K-1501-B Oil Storage Tanks. There are 10 DVS systematic grid sample locations in this Class 2 SU (Sect. 2.2.2). Two biased sample locations at a storm drain also occur in this Class 2 SU but the analytical data are evaluated as Class 3 SUs data because the sample locations were specified as part of the Class 3 SU sampling requirements during DQO scoping. The K-1098-C Asphalt Plant FFA Site is located within the boundaries of the K-1501-A/B Class 2 SU. The K-1501-J Class 2 SU (approximately 0.2 acre) is located to the east of the southern portion of the K-1501-A/B Class 2 SU and encompasses the land area around the former K-1501-J Oil Storage Tank. There are two DVS systematic grid sample locations and one DVS biased sample location in the K-1501-J Class 2 SU (Sect. 2.2.2). The K-1503 Neutralization Pit FFA Site is located within the boundaries of the K-1501-J Class 2 SU.

A Class 3 SU walkover assessment was conducted over the Class 3 SU in EU Z2-36. Because the EU is located in an industrialized portion of ETTP, anthropogenic features are common. However, many of the anthropogenic features are facilities or the remains of facilities that have been demolished. Forty-five facilities were evaluated as part of the Class 3 SU walkover assessment (Sect. 2.1.3.3) but no biased sampling was conducted based on radiation

surveys and visual observations. No other anthropogenic features were identified for biased sampling during the Class 3 SU walkover assessment (Sect 2.1.3.2). Three storm drain sample pairs (one sample of storm drain sediment and the other sample of soil from outside the storm drain) were specified during DQO scoping. All six sample locations were identified and sampled during DVS activities. One of the storm drains is located in the K-1501-A/B Class 2 SU but is evaluated as Class 3 SU sampling to be consistent with DQO scoping requirements. Two four-point composite DVS biased sample locations also were sampled in the Class 3 SU as specified during DQO scoping, one each in the K-1501-N and K-1501-S Coal Yards. A DVS biased sample also was collected at the sump located east of the K-1501 Steam Plant prior to a remedial action at the sump. Finally, there are 14 historical sample locations in the Class 3 SU that were sampled as part of the ETTP Release Site Project and compliance sampling. None of the historical sample locations are associated with features of interest identified during DQO scoping or with FFA sites.

Following are summaries of the focused investigation areas in EU Z2-36. Focused investigation areas include the K-1501-A/B Class 2 SU, K-1501-J Class 2 SU, K-1501-N and K-1501-S Coal Yards, K-1501 sump, storm drains in EU Z2-36, and other Class 3 SU sample locations not associated with any particular feature or FFA site in the EU. Following the focused investigation summaries is an EU Z2-36 summary, which includes both data summary tables and a written description of the nature and extent of the chemicals and radionuclides observed in the EU. The summary includes all data from the EU. Details of sampling and analysis at each sample location in EU Z2-36 are presented in Table A.2, a summary of all EU data is presented in Table A.3, and sample locations are shown on Fig. A.4.

K-1501-A/B Class 2 SU: There are 10 DVS systematic grid sample locations in the K-1501-A/B Class 2 SU (Sect 2.2.2). Analytical results from the DVS sampling in this Class 2 SU also serve to characterize the K-1098-C Asphalt Plant FFA Site. Analytical results from the 10 sample locations summarized below show radionuclide and one SVOC Ind PRG exceedances, metal and radionuclide Bkg exceedances, and detections of DRO, GRO, PCBs, SVOCs, and VOCs.

EU Z2-36 K-1501-A/B CLASS 2 SU METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Aluminum	10/10	4,900	24,000	Z2-EU36-202	15,490	NA	NA	0	0	NA	9
Arsenic	9/10	0.97	6	Z2-EU36-204	2.99	0	0	0	0	0	9
Barium	10/10	48	130	Z2-EU36-204 Z2-EU36-206	93.3	NA	NA	0	2	0	0
Cadmium	10/10	0.12	1.2	Z2-EU36-209	0.314	NA	NA	0	5	NA	0
Calcium	10/10	1,700	250,000	Z2-EU36-203	37,900	NA	NA	NA	9	NA	NA
Chromium	10/10	17	44	Z2-EU36-201	28.2	NA	NA	0	0	0	6
Copper	10/10	11	150	Z2-EU36-209	41.5	NA	NA	0	5	NA	0
Iron	10/10	8,800	39,000	Z2-EU36-205 Z2-EU36M-207	30,080	NA	NA	0	0	NA	10
Magnesium	10/10	1,900	43,000	Z2-EU36-203	10,670	NA	NA	NA	8	NA	NA
Manganese	10/10	180	2,000	Z2-EU36-204	774	NA	NA	0	0	NA	10
Nickel	10/10	15	94	Z2-EU36-209	42.6	NA	NA	0	7	NA	0
Selenium	2/10	1.1	1.8	Z2-EU36M-207	1.45	NA	NA	0	1	NA	0
Uranium	10/10	0.38	3	Z2-EU36-204	1.34	NA	NA	0	NA	NA	4
Vanadium	10/10	9	35	Z2-EU36-204	26.9	NA	NA	0	0	NA	10
Zinc	10/10	32	96	Z2-EU36-209	55.8	NA	NA	0	1	NA	0

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SU = soil unit

EU Z2-36 K-1501-A/B CLASS 2 SU OTHER ORGANICS DETECTS (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result
Diesel Range Organics	1/6	860J	860J	Z2-EU36-208	860
Gasoline Range Organics	3/6	0.16J	25	Z2-EU36-208	9.65

EU = exposure unit
J = analyte was identified and result is approximate concentration
Res = residential
SU = soil unit

EU Z2-36 K-1501-A/B CLASS 2 SU PPCB DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Max RL	Avg RL	Ind PRG	Res PRG
PCB-1254	1/10	8.1J	8.1J	Z2-EU36-206	8.1	0	0	0	0
PCB-1260	4/10	11J	78	Z2-EU36M-200	40	0	0	0	0
Polychlorinated biphenyl	5/10	8.1J	78	Z2-EU36M-200	33.6	0	0	0	0

Avg = average
EU = exposure unit
Ind = industrial
J = analyte was identified and result is approximate concentration
Max = maximum
PPCB = pesticide and polychlorinated biphenyl
PRG = preliminary remediation goal
Res = residential
RL = remediation level
SU = soil unit

EU Z2-36 K-1501-A/B CLASS 2 SU RADIONUCLIDES WITH BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Potassium-40	4/4	19.8	24	Z2-EU36-209	21.6	NA	NA	4	0	NA	4
Thorium-228	4/4	1.28	1.64	Z2-EU36-204	1.43	NA	NA	4	0	NA	4
Thorium-230	4/4	0.828J	1.51	Z2-EU36-206	1.07	NA	NA	0	1	NA	0
Thorium-232	4/4	1.12	1.87	Z2-EU36-201	1.43	NA	NA	4	0	NA	4
Uranium-238	4/4	0.955	1.88	Z2-EU36-209	1.41	0	0	0	2	0	4

Avg = average
Bkg = background
EU = exposure unit
GW = groundwater
Ind = industrial
J = analyte was identified and result is approximate concentration
Max = maximum
NA = not applicable
PRG = preliminary remediation goal
Res = residential
RL = remediation level
SL = screening level
SU = soil unit

EU Z2-36 K-1501-A/B CLASS 2 SU SVOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
2-Methylnaphthalene	4/10	91J	10,000	Z2-EU36-203	2,608	0	NA	1
Acenaphthene	1/10	520	520	Z2-EU36-203	520	0	NA	0
Acenaphthylene	2/10	84J	150J	Z2-EU36-203	117	0	NA	0
Anthracene	2/10	81J	680	Z2-EU36-203	381	0	NA	0
Benzo(a)anthracene	1/10	2700	2,700	Z2-EU36-209	2,700	0	NA	1
Benzo(a)pyrene	1/10	4,000J	4,000J	Z2-EU36-209	4,000	1	NA	1
Benzo(b)fluoranthene	2/10	120J	8,800J	Z2-EU36-209	4,460	0	NA	1
Benzo(ghi)perylene	1/10	3,200J	3,200J	Z2-EU36-209	3,200	0	NA	0
Benzo(k)fluoranthene	1/10	2,700J	2,700J	Z2-EU36-209	2,700	0	NA	0
Carbazole	1/10	120J	120J	Z2-EU36-203	120	0	NA	0
Chrysene	1/10	2,100	2100	Z2-EU36-209	2,100	0	NA	0
Dibenz(a,h)anthracene	1/10	780J	780J	Z2-EU36-209	780	0	NA	1
Dibenzofuran	1/10	270J	270J	Z2-EU36-203	270	0	NA	0
Fluoranthene	2/10	130J	2,600	Z2-EU36-209	1,365	0	NA	0
Fluorene	1/10	750	750	Z2-EU36-203	750	0	NA	0
Indeno(1,2,3-cd)pyrene	1/10	3,000J	3,000J	Z2-EU36-209	3,000	0	NA	1
Naphthalene	6/16	76J	7,400J	Z2-EU36-208	1,551	0	NA	1

EU Z2-36 K-1501-A/B CLASS 2 SU SVOC DETECTS (ug/kg) 0-10 ft (cont.)

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
Phenanthrene	2/10	97J	2400	Z2-EU36-203	1,249	0	NA	0
Pyrene	3/10	89J	6,600J	Z2-EU36-209	2,373	0	NA	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SU = soil unit

SVOC = semivolatile organic compound

EU Z2-36 K-1501-A/B CLASS 2 SU VOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
(1,1-Dimethylethyl)benzene	1/6	390	390	Z2-EU36-208	390	0	NA	0
(1-Methylpropyl)benzene	2/6	21	1,300	Z2-EU36-208	661	0	NA	0
1,2,4-Trimethylbenzene	2/6	4.5J	47,000	Z2-EU36-208	23,502	0	NA	1
1,2-Dichloropropane	1/6	250J	250J	Z2-EU36-208	250	0	NA	0
1,2-Dimethylbenzene	1/6	23,000	23,000	Z2-EU36-208	23,000	0	NA	0
1,3,5-Trimethylbenzene	1/6	20,000	20,000	Z2-EU36-208	20,000	0	NA	1
1-Methyl-4-(1-methylethyl)benzene	2/6	14	3,800	Z2-EU36-208	1,907	NA	NA	NA
2-Butanone	1/6	8.3J	8.3J	Z2-EU36-203	8.3	0	NA	0
Acetone	1/6	17J	17J	Z2-EU36-203	17	0	NA	0
Benzene	1/6	640	640	Z2-EU36-208	640	0	0	0
Butylbenzene	2/6	22	2,900	Z2-EU36-208	1,461	0	NA	0
Cumene	2/6	15	3,000	Z2-EU36-208	1,508	0	NA	0
Ethylbenzene	2/6	11	20,000	Z2-EU36-208	10,006	0	NA	0
M + P Xylene	2/6	2.1J	65,000	Z2-EU36-208	32,501	0	NA	1
Propylbenzene	2/6	25	6,500	Z2-EU36-208	3,263	0	NA	0
Toluene	1/6	4,400J	4,400J	Z2-EU36-208	4,400	0	0	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SU = soil unit

VOC = volatile organic compound

K-1501-J Class 2 SU: There are two DVS systematic grid sample locations and one DVS biased sample location in the K-1501-J Class 2 SU (Sect. 2.2.2). Analytical results from this Class 2 SU also serve to characterize the K-1503 Neutralization Pit FFA Site. Analytical results from the three sample locations summarized below show one metal and several radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and detections of DRO, GRO, and PCBs.

EU Z2-36 K-1501-J CLASS 2 SU METALS WITH BACKGROUND, PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Aluminum	2/2	12,000	16,000	Z2-EU36-211	14,000	NA	NA	0	0	NA	2
Arsenic	2/2	9.7	27	Z2-EU36-210	18.4	0	0	1	1	0	2
Cadmium	2/2	0.21	0.52	Z2-EU36-210	0.365	NA	NA	0	1	NA	0
Calcium	2/2	8,700	10,000J	Z2-EU36-211	9,350	NA	NA	NA	2	NA	NA
Chromium	2/2	25	33J	Z2-EU36-211	29	NA	NA	0	0	0	2
Copper	2/2	32	34	Z2-EU36-210	33	NA	NA	0	2	NA	0
Iron	2/2	34,000	37,000	Z2-EU36-211	35,500	NA	NA	0	0	NA	2
Lead	2/2	23	66	Z2-EU36-210	44.5	NA	NA	0	1	0	0

**EU Z2-36 K-1501-J CLASS 2 SU METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont.)**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Magnesium	2/2	1,500	9,400J	Z2-EU36-211	5,450	NA	NA	NA	1	NA	NA
Manganese	2/2	730J	1,100	Z2-EU36-210	915	NA	NA	0	0	NA	2
Mercury	2/2	0.036	0.17	Z2-EU36-210	0.103	0	0	0	1	NA	0
Nickel	2/2	21	44J	Z2-EU36-211	32.5	NA	NA	0	1	NA	0
Selenium	1/2	1.6	1.6	Z2-EU36-211	1.6	NA	NA	0	1	NA	0
Vanadium	2/2	37	56	Z2-EU36-210	46.5	NA	NA	0	0	NA	2
Zinc	2/2	89	140J	Z2-EU36-211	115	NA	NA	0	1	NA	0

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SU = soil unit

EU Z2-36 K-1501-J CLASS 2 SU OTHER ORGANICS DETECTS (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result
Diesel Range Organics	1/1	5.2J	5.2J	Z2-EU36-210	5.2
Gasoline Range Organics	1/1	0.46J	0.46J	Z2-EU36-210	0.46

EU = exposure unit

SU = soil unit

J = analyte was identified and result is approximate concentration

EU Z2-36 K-1501-J CLASS 2 SU PPCB DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Max RL	Avg RL	Ind PRG	Res PRG
PCB-1260	1/2	17J	17J	Z2-EU36-210	17	0	0	0	0
Polychlorinated biphenyl	1/2	17J	17J	Z2-EU36-210	17	0	0	0	0

Avg = average

EU = exposure unit

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

PPCB = pesticide and polychlorinated biphenyl

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SU = soil unit

**EU Z2-36 K-1501-J CLASS 2 SU RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Potassium-40	1/1	9.37	9.37	Z2-EU36-210	9.37	NA	NA	1	0	NA	1
Thorium-228	1/1	1.83	1.83	Z2-EU36-210	1.83	NA	NA	1	0	NA	1
Thorium-230	1/1	2.15	2.15	Z2-EU36-210	2.15	NA	NA	0	1	NA	0
Thorium-232	1/1	1.76	1.76	Z2-EU36-210	1.76	NA	NA	1	0	NA	1
Uranium-238	1/1	2.64	2.64	Z2-EU36-210	2.64	0	0	0	1	0	1

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SU = soil unit

SVOCs and VOCs were analyzed in two samples but were not detected.

Storm Drains: Three storm drains were identified for sampling under DVS and two sample locations were identified at each storm drain (one sediment sample location from inside the storm drain and one soil sample location from outside the storm drain) (Sect. 2.2.3). Analytical results summarized below show PCB-1254 and polychlorinated biphenyl Avg RL exceedances in the sediment sample from the K-1401 storm drain; metal, PCB, and radionuclide Ind PRG exceedances; metal and radionuclide Bkg exceedances, and PCB, SVOC, and VOC detections.

EU Z2-36 STORM DRAINS METALS WITH BACKGROUND, PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Aluminum	6/6	1,400	16,000	Z2-EU36B-302	9,567	NA	NA	0	0	NA	4
Antimony	6/6	0.028	2	Z2-EU36B-303	0.5	NA	NA	0	1	0	0
Arsenic	6/6	2.4	37	Z2-EU36B-303	10.7	0	0	1	1	0	6
Barium	6/6	71	260	Z2-EU36B-303	130	NA	NA	0	2	0	0
Cadmium	6/6	0.1	1.9	Z2-EU36B-301	0.5	NA	NA	0	4	NA	0
Calcium	6/6	3,600	210,000	Z2-EU36B-301	79,783	NA	NA	NA	6	NA	NA
Chromium	6/6	26	160	Z2-EU36B-301	65.3	NA	NA	0	2	0	6
Copper	6/6	28	110	Z2-EU36B-301	62.8	NA	NA	0	6	NA	0
Iron	6/6	17,000	140,000	Z2-EU36B-303	51,167	NA	NA	1	1	NA	6
Lead	6/6	11	340	Z2-EU36B-301	78.7	NA	NA	0	2	0	0
Magnesium	6/6	3,600	65,000	Z2-EU36B-301	24,167	NA	NA	NA	6	NA	NA
Manganese	6/6	180	4,200	Z2-EU36B-303	1,585	NA	NA	0	1	NA	6
Mercury	5/6	0.025	0.38	Z2-EU36B-301	0.1	0	0	0	1	NA	0
Nickel	6/6	17	210	Z2-EU36B-303	83.7	NA	NA	0	5	NA	1
Silver	3/6	0.21	0.65	Z2-EU36B-301	0.4	NA	NA	0	1	NA	0
Uranium	6/6	0.68	4.7	Z2-EU36B-308	1.7	NA	NA	0	NA	NA	2
Vanadium	6/6	6.6	31	Z2-EU36B-302	21.3	NA	NA	0	0	NA	5
Zinc	6/6	52	390	Z2-EU36B-301	143	NA	NA	0	3	NA	0

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 STORM DRAINS PPCB DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Max RL	Avg RL	Ind PRG	Res PRG
PCB-1254	3/6	27	16,000	Z2-EU36B-301	5,373	0	1	1	1
PCB-1260	1/6	18J	18J	Z2-EU36B-303	18	0	0	0	0
Polychlorinated biphenyl	4/6	18J	16,000	Z2-EU36B-301	4,035	0	1	1	1

Avg = average

EU = exposure unit

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

PPCB = pesticide and polychlorinated biphenyl

PRG = preliminary remediation goal

Res = residential

RL = remediation level

**EU Z2-36 STORM DRAINS RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analytes exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Potassium-40	2/3	3.94J	17.1	Z2-EU36B-307	10.5	NA	NA	2	0	NA	2
Technetium-99	1/3	13.1	13.1	Z2-EU36B-301	13.1	NA	NA	0	NA	NA	1
Thorium-228	2/3	0.81	0.873	Z2-EU36B-303	0.842	NA	NA	2	0	NA	2
Thorium-232	3/3	0.21	0.804	Z2-EU36B-307	0.501	NA	NA	3	0	NA	3
Uranium-238	3/3	0.632	1.21	Z2-EU36B-301	0.916	0	0	0	0	0	2

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 STORM DRAINS SVOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analytes exceeding criteria		
						Ind PRG	GW SL	Res PRG
1-Methylnaphthalene	1/3	99J	99J	Z2-EU36B-304	99	NA	NA	NA
2-Methylnaphthalene	2/6	100J	200J	Z2-EU36B-307	150	0	NA	0
Anthracene	3/6	110J	390J	Z2-EU36B-303	250	0	NA	0
Benzo(a)anthracene	4/6	360J	2,300J	Z2-EU36B-303	930	0	NA	1
Benzo(a)pyrene	4/6	370J	1,400J	Z2-EU36B-303	673	0	NA	4
Benzo(b)fluoranthene	4/6	490J	2,000J	Z2-EU36B-303	943	0	NA	2
Benzo(ghi)perylene	3/6	160J	1,300J	Z2-EU36B-303	563	0	NA	0
Benzo(k)fluoranthene	4/6	250J	1,200J	Z2-EU36B-303	500	0	NA	0
Bis(2-ethylhexyl)phthalate	2/6	300J	3,000J	Z2-EU36B-301	1,650	0	0	0
Carbazole	1/6	440J	440J	Z2-EU36B-303	440	0	NA	0
Chrysene	4/6	250J	2,000J	Z2-EU36B-303	755	0	NA	0
Dibenz(a,h)anthracene	1/6	390J	390J	Z2-EU36B-303	390	0	NA	1
Fluoranthene	4/6	810	5,000	Z2-EU36B-303	2,078	0	NA	0
Fluorene	1/6	280J	280J	Z2-EU36B-304	280	0	NA	0
Indeno(1,2,3-cd)pyrene	4/6	160J	1,100J	Z2-EU36B-303	418	0	NA	1
Phenanthrene	4/6	340J	2,400	Z2-EU36B-303	1,163	0	NA	0
Pyrene	5/6	400J	8,200J	Z2-EU36B-303	2,326	0	NA	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SVOC = semivolatile organic compound

EU Z2-36 STORM DRAINS VOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analytes exceeding criteria		
						Ind PRG	GW SL	Res PRG
Acetone	2/3	470J	490J	Z2-EU36B-303	480	0	NA	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

VOC = volatile organic compound

Coal Yards: There is one DVS biased sample location in the K-1501-N Coal Yard and the K-1501-S Coal Yard (Sect. 2.2.3). Each sample represents a four-point composite sample. Analytical results for the two sample locations summarized below show metal Bkg exceedances and PCB and SVOC detections.

**EU Z2-36 COAL YARDS METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Aluminum	2/2	12,000	16,000	Z2-EU36B-306	14,000	NA	NA	0	0	NA	2
Arsenic	2/2	4.1	8.9	Z2-EU36B-305	6.5	0	0	0	0	0	2
Cadmium	2/2	0.22	0.24	Z2-EU36B-305	0.23	NA	NA	0	2	NA	0
Calcium	2/2	15,000	22,000	Z2-EU36B-306	18,500	NA	NA	NA	2	NA	NA
Chromium	2/2	30	35	Z2-EU36B-306	32.5	NA	NA	0	0	0	2
Copper	2/2	13	47	Z2-EU36B-306	30	NA	NA	0	1	NA	0
Iron	2/2	28,000	38,000	Z2-EU36B-306	33,000	NA	NA	0	0	NA	2
Magnesium	2/2	7,700	17,000	Z2-EU36B-306	12,350	NA	NA	NA	2	NA	NA
Manganese	2/2	880	1,000	Z2-EU36B-306	940	NA	NA	0	0	NA	2
Nickel	2/2	18	75	Z2-EU36B-306	46.5	NA	NA	0	1	NA	0
Selenium	1/2	1.6	1.6	Z2-EU36B-305	1.6	NA	NA	0	1	NA	0
Uranium	2/2	1.2	2.3	Z2-EU36B-306	1.75	NA	NA	0	NA	NA	1
Vanadium	2/2	26	29	Z2-EU36B-306	27.5	NA	NA	0	0	NA	2

Avg = average
 Bkg = background
 EU = exposure unit
 GW = groundwater
 Ind = industrial
 Max = maximum
 NA = not applicable
 PRG = preliminary remediation goal
 Res = residential
 RL = remediation level
 SL = screening level

EU Z2-36 COAL YARDS PPCB DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Max RL	Avg RL	Ind PRG	Res PRG
PCB-1254	1/2	220	220	Z2-EU36B-306	220	0	0	0	1
Polychlorinated biphenyl	1/2	220	220	Z2-EU36B-306	220	0	0	0	1

Avg = average
 EU = exposure unit
 Ind = industrial
 Max = maximum
 PPCB = pesticide and polychlorinated biphenyl
 PRG = preliminary remediation goal
 Res = residential
 RL = remediation level

EU Z2-36 COAL YARDS SVOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
1-Methylnaphthalene	1/1	81J	81J	Z2-EU36B-306	81	NA	NA	NA
2-Methylnaphthalene	2/2	110J	440	Z2-EU36B-305	275	0	NA	0
Fluoranthene	1/2	79J	79J	Z2-EU36B-305	79	0	NA	0
Naphthalene	2/2	76J	280J	Z2-EU36B-305	178	0	NA	0
Phenanthrene	2/2	77J	110J	Z2-EU36B-305	93.5	0	NA	0

EU = exposure unit
 GW = groundwater
 Ind = industrial
 J = analyte was identified and result is approximate concentration
 NA = not applicable
 PRG = preliminary remediation goal
 Res = residential
 RL = remediation level
 SL = screening level
 SVOC = semivolatile organic compound

K-1501 Sump: Sediment from the sump located east of the K-1501 Steam Plant was sampled as part of DVS characterization prior to a remedial action being conducted (Sect. 2.2.3). Analytical results from the sump sediment sample summarized below show one metal and several radionuclide and SVOC Ind PRG exceedances, metal and radionuclide Bkg exceedances, and DRO and SVOC detections.

**EU Z2-36 K-1501 SUMP METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Antimony	1/1	2.4J	2.4J	Z2-EU36B-310	2.4	NA	NA	0	1	0	0
Arsenic	1/1	31	31	Z2-EU36B-310	31	0	0	1	1	0	1
Barium	1/1	140	140	Z2-EU36B-310	140	NA	NA	0	1	0	0
Cadmium	1/1	1.2J	1.2J	Z2-EU36B-310	1.2	NA	NA	0	1	NA	0
Calcium	1/1	150,000	150,000	Z2-EU36B-310	150,000	NA	NA	NA	1	NA	NA
Chromium	1/1	23J	23J	Z2-EU36B-310	23	NA	NA	0	0	0	1
Copper	1/1	110J	110J	Z2-EU36B-310	110	NA	NA	0	1	NA	0
Iron	1/1	27,000J	27,000J	Z2-EU36B-310	27,000	NA	NA	0	0	NA	1
Lead	1/1	49J	49J	Z2-EU36B-310	49	NA	NA	0	1	0	0
Magnesium	1/1	15,000J	15,000J	Z2-EU36B-310	15,000	NA	NA	NA	1	NA	NA
Manganese	1/1	270J	270J	Z2-EU36B-310	270	NA	NA	0	0	NA	1
Mercury	1/1	0.28J	0.28J	Z2-EU36B-310	0.28	0	0	0	1	NA	0
Nickel	1/1	32J	32J	Z2-EU36B-310	32	NA	NA	0	1	NA	0
Selenium	1/1	3	3	Z2-EU36B-310	3	NA	NA	0	1	NA	0
Thallium	1/1	0.54J	0.54J	Z2-EU36B-310	0.54	NA	NA	0	1	0	1
Uranium	1/1	1.6	1.6	Z2-EU36B-310	1.6	NA	NA	0	NA	NA	1
Vanadium	1/1	19	19	Z2-EU36B-310	19	NA	NA	0	0	NA	1
Zinc	1/1	220J	220J	Z2-EU36B-310	220	NA	NA	0	1	NA	0

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 K-1501 SUMP OTHER ORGANICS DETECTS (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result
Diesel Range Organics	1/1	160J	160J	Z2-EU36B-310	160

EU = exposure unit

J = analyte was identified and result is approximate concentration

PCBs were analyzed for but were not detected.

**EU Z2-36 K-1501 SUMP RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Potassium-40	1/1	8.02	8.02	Z2-EU36B-310	8.02	NA	NA	1	0	NA	1
Thorium-228	1/1	0.679J	0.679J	Z2-EU36B-310	0.679	NA	NA	1	0	NA	1
Thorium-232	1/1	0.59J	0.59J	Z2-EU36B-310	0.59	NA	NA	1	0	NA	1
Uranium-238	1/1	1.47	1.47	Z2-EU36B-310	1.47	0	0	0	1	0	1

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 K-1501 SUMP SVOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Ind PRG	GW SL	Res PRG	
2,4-Dimethylphenol	1/1	94J	94J	Z2-EU36B-310	94	0	NA	0	
2-Methylnaphthalene	1/1	4,400	4,400	Z2-EU36B-310	4,400	0	NA	0	
Acenaphthene	1/1	10,000	10,000	Z2-EU36B-310	10,000	0	NA	0	
Anthracene	1/1	28,000	28,000	Z2-EU36B-310	28,000	0	NA	0	
Benzo(a)anthracene	1/1	31,000	31,000	Z2-EU36B-310	31,000	1	NA	1	
Benzo(a)pyrene	1/1	25,000	25,000	Z2-EU36B-310	25,000	1	NA	1	
Benzo(b)fluoranthene	1/1	34,000	34,000	Z2-EU36B-310	34,000	1	NA	1	
Benzo(ghi)perylene	1/1	5,200	5,200	Z2-EU36B-310	5,200	0	NA	0	
Benzo(k)fluoranthene	1/1	15,000	15,000	Z2-EU36B-310	15,000	0	NA	1	
Bis(2-ethylhexyl)phthalate	1/1	990	990	Z2-EU36B-310	990	0	0	0	
Carbazole	1/1	8,500	8,500	Z2-EU36B-310	8,500	0	NA	0	
Dibenz(a,h)anthracene	1/1	1,700	1,700	Z2-EU36B-310	1,700	0	NA	1	
Dibenzofuran	1/1	7,200	7,200	Z2-EU36B-310	7,200	0	NA	0	
Fluoranthene	1/1	91,000	91,000	Z2-EU36B-310	91,000	0	NA	0	
Fluorene	1/1	11,000	11,000	Z2-EU36B-310	11,000	0	NA	0	
Indeno(1,2,3-cd)pyrene	1/1	10,000	10,000	Z2-EU36B-310	10,000	0	NA	1	
Naphthalene	2/2	140J	3,700	Z2-EU36B-310	1,920	0	NA	0	
Phenanthrene	1/1	85,000	85,000	Z2-EU36B-310	85,000	0	NA	1	
Pyrene	1/1	71,000	71,000	Z2-EU36B-310	71,000	0	NA	0	

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SVOC = semivolatile organic compound

VOCs were analyzed for but were not detected.

Other Class 3 SU Historical Sampling: There are 14 historical sample locations in the EU Z2-36 Class 3 SU (Sect. 2.2.3) that are not associated with any of the preceding features of interest. Analytical results summarized below show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and detections of PCBs, SVOCs, and VOCs.

**EU Z2-36 OTHER HISTORICAL METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Aluminum	5/5	6,430J	19,200	S01	11,648	NA	NA	0	0	NA	3
Arsenic	5/5	4.19	13.8	S01	8.39	0	0	0	0	0	5
Barium	5/5	99.1J	232J	S03	143	NA	NA	0	2	0	0
Cadmium	5/5	0.592	4.68	S01	1.59	NA	NA	0	5	NA	1
Calcium	5/5	1400	26,000	S01	7360	NA	NA	NA	2	NA	NA
Chromium	5/5	9.88J	40.6	S01	21.4	NA	NA	0	0	0	2
Copper	5/5	63	321	S01	210	NA	NA	0	5	NA	1
Iron	5/5	9,690	36,700	S01	18,418	NA	NA	0	0	NA	5
Lead	5/5	13.8J	185	S01	60.0	NA	NA	0	2	0	0
Magnesium	5/5	781J	6,420	S01	2,377	NA	NA	NA	1	NA	NA
Manganese	5/5	690	1,480	S03	1,007	NA	NA	0	0	NA	5
Mercury	5/5	0.065J	1.98J	S01	0.488	0	0	0	2	NA	0
Nickel	5/5	121	613	S01	397	NA	NA	0	5	NA	4
Selenium	2/5	0.323J	1.99	S01	1.16	NA	NA	0	1	NA	0

**EU Z2-36 OTHER HISTORICAL METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont.)**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Silver	1/5	0.819J	0.819J	S01	0.819	NA	NA	0	1	NA	0
Vanadium	5/5	12.5J	44.1	S01	24.7	NA	NA	0	0	NA	5
Zinc	5/5	59.2J	320J	S01	123	NA	NA	0	2	NA	0

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 OTHER HISTORICAL PPCB DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Max RL	Avg RL	Ind PRG	Res PRG
PCB-1254	3/6	19.9	873	S01	328	0	0	0	1
PCB-1260	5/6	20J	249	S01	89.9	0	0	0	1

Avg = average

EU = exposure unit

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

PPCB = pesticide and polychlorinated biphenyl

PRG = preliminary remediation goal

Res = residential

RL = remediation level

**EU Z2-36 OTHER HISTORICAL RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Cesium-137	12/15	0.11	1.24	S01	0.550	0	0	2	NA	NA	12
Potassium-40	3/3	27.6	29.9	ETTP-REL06	29	NA	NA	3	0	NA	3
Radium-226	3/3	0.757	1	ETTP-REL07	0.891	NA	NA	3	0	NA	3
Technetium-99	1/15	2.94	2.94	S01	2.94	NA	NA	0	NA	NA	1
Thorium-228	15/15	0.942J	1.81J	S09	1.24	NA	NA	15	0	NA	15
Thorium-230	15/15	0.228J	1.94J	S02	1.19	NA	NA	0	9	NA	0
Thorium-232	15/15	0.771J	1.4J	S02	1.08	NA	NA	15	0	NA	15
Uranium-234	15/15	0.276J	16.5	S01	3.83	0	0	0	NA	0	6

**EU Z2-36 OTHER HISTORICAL RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont.)**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Uranium-235	14/15	0.0239J	0.932	S01	0.231	0	0	0	NA	0	8
Uranium-238	15/15	0.162J	7.03	S01	1.99	0	0	0	10	0	12

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 OTHER HISTORICAL SVOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
2-Methylnaphthalene	4/6	27.6J	53.9J	S01	36.0	0	NA	0
Benzo(a)anthracene	3/6	376	1,840	S01	882	0	NA	1
Benzo(a)pyrene	2/6	358J	2,020	S01	1,189	0	NA	2
Benzo(b)fluoranthene	3/6	393	2,270	S01	1,183	0	NA	2
Benzo(g,h,i)perylene	3/6	218J	1,390J	S01	616	0	NA	0
Benzo(k)fluoranthene	3/6	192J	1,980	S01	842	0	NA	0
Bis(2-ethylhexyl)phthalate	2/6	215J	340J	S01	278	0	0	0
Chrysene	4/6	197J	2,280	S01	839	0	NA	0
Fluoranthene	4/6	399	4,430	S01	1,688	0	NA	0
Indeno(1,2,3-cd)pyrene	3/6	209J	1,230J	S01	554	0	NA	1
Pentachlorophenol	1/6	280J	280J	S08	280	0	NA	0
Phenanthrene	4/6	197J	3,420	S01	1,138	0	NA	0
Pyrene	4/6	378	4,400	S01	1,654	0	NA	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SVOC = semivolatile organic compound

EU Z2-36 OTHER HISTORICAL VOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
Methylene chloride	1/7	1.1J	1.1J	S01	1.1	0	0	0
Tetrachloroethene	3/7	0.76J	0.89J	S03	0.83	0	0	0
Toluene	3/7	0.32J	0.85J	S02	0.55	0	0	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

VOC = volatile organic compound

EU Z2-36 Summary: This section presents a summary of the nature and extent of chemicals and radionuclides in the EU by combining all of the analytical data presented in the focused investigation summaries above. The two Zone 2 ROD Appendix A FFA sites in EU Z2-36 are evaluated above as parts of the K-1501-A/B Class 2 SU and K-1501-J Class 2 SU.

There are 36 sample locations in EU Z2-36. PCB-1254 and polychlorinated biphenyl Avg RLs were exceeded at sample location Z2-EU36B-301, the sediment sample location from the K-1401 storm drain. There are also metal, PCB, radionuclide, and SVOC Ind PRG exceedances and metal and radionuclide Bkg exceedances. DRO was detected at one sample location in the K-1501-A/B Class 2 SU (Z2-EU36-208), one sample location in the K-1501-J Class 2 SU (Z2-EU36-210), and the sample location in the K-1501 sump (Z2-EU36B-310). GRO was detected at three sample locations in the K-1501-A/B Class 2 SU (Z2-EU36-206, Z2-EU36-208, and Z2-EU36-209) and one sample location in the K-1501-J Class 2 SU (Z2-EU36-210). Also detected were PCBs, SVOCs, and VOCs.

**EU Z2-36 METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Aluminum	26/26	1,400	24,000	Z2-EU36-202	12,802	NA	NA	0	0	NA	20
Antimony	21/26	0.016	2.4J	Z2-EU36B-310	0.338	NA	NA	0	2	0	0
Arsenic	25/26	0.97	37	Z2-EU36B-303	8.55	0	0	3	3	0	25
Barium	26/26	47	260	Z2-EU36B-303	113	NA	NA	0	7	0	0
Cadmium	26/26	0.1	4.68	S01	0.634	NA	NA	0	18	NA	1

**EU Z2-36 METALS WITH BACKGROUND,
PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont.)**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Calcium	26/26	1,400	250,000	Z2-EU36-203	42,315	NA	NA	NA	22	NA	NA
Chromium	26/26	9.88J	160	Z2-EU36B-301	35.6	NA	NA	0	2	0	19
Copper	26/26	11	321	S01	79.9	NA	NA	0	20	NA	1
Iron	26/26	8,800	140,000	Z2-EU36B-303	33,227	NA	NA	1	1	NA	26
Lead	26/26	7.7	340	Z2-EU36B-301	41.1	NA	NA	0	6	0	0
Magnesium	26/26	781J	65,000	Z2-EU36B-301	12,084	NA	NA	NA	19	NA	NA
Manganese	26/26	180	4,200	Z2-EU36B-303	1,010	NA	NA	0	1	NA	26
Mercury	25/26	0.0061	1.98J	S01	0.158	0	0	0	5	NA	0
Nickel	26/26	15	613	S01	119	NA	NA	0	20	NA	5
Selenium	7/26	0.323J	3	Z2-EU36B-310	1.63	NA	NA	0	5	NA	0
Silver	5/26	0.082	0.819J	S01	0.420	NA	NA	0	2	NA	0
Thallium	21/26	0.043	0.54J	Z2-EU36B-310	0.217	NA	NA	0	1	0	1
Uranium	21/21	0.38	4.7	Z2-EU36B-308	1.46	NA	NA	0	NA	NA	8
Vanadium	26/26	6.6	56	Z2-EU36-210	26.4	NA	NA	0	0	NA	25
Zinc	26/26	23	390	Z2-EU36B-301	98.8	NA	NA	0	8	NA	0

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 OTHER ORGANICS DETECTS (mg/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result
Diesel Range Organics	3/8	5.2J	860J	Z2-EU36-208	342
Gasoline Range Organics	4/8	0.16J	25	Z2-EU36-208	7.36

EU = exposure unit

J = analyte was identified and result is approximate concentration

EU Z2-36 PPCB DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria			
						Max RL	Avg RL	Ind PRG	Res PRG
PCB-1254	8/27	8.1J	16,000	Z2-EU36B-301	2,166	0	1	1	3
PCB-1260	11/27	1J	249	S01	58.6	0	0	0	1
Polychlorinated biphenyl	11/21	8.1J	16,000	Z2-EU36B-301	1,504	0	1	1	2

Avg = average

EU = exposure unit

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

PPCB = pesticide and polychlorinated biphenyl

PRG = preliminary remediation goal

Res = residential

RL = remediation level

**EU Z2-36 RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Cesium-137	12/24	0.11	1.24	S01	0.550	0	0	2	NA	NA	12
Potassium-40	11/12	3.94J	29.9	ETTP-REL06	19.2	NA	NA	11	0	NA	11
Radium-226	3/3	0.757	1	ETTP-REL07	0.891	NA	NA	3	0	NA	3
Technetium-99	2/24	2.94	13.1	Z2-EU36B-301	8.02	NA	NA	0	NA	NA	2
Thorium-228	23/24	0.679J	1.83	Z2-EU36-210	1.24	NA	NA	23	0	NA	23
Thorium-230	22/24	0.228J	2.15	Z2-EU36-210	1.19	NA	NA	0	11	NA	0

**EU Z2-36 RADIONUCLIDES WITH
BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont.)**

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria					
						Max RL	Avg RL	Ind PRG	Bkg	GW SL	Res PRG
Thorium-232	24/24	0.21	1.87	Z2-EU36-201	1.08	NA	NA	24	0	NA	24
Uranium-234	24/24	0.276J	16.5	S01	3.03	0	0	0	NA	0	6
Uranium-235	17/24	0.0239J	0.932	S01	0.215	0	0	0	NA	0	8
Uranium-238	24/24	0.162J	7.03	S01	1.77	0	0	0	14	0	20

Avg = average

Bkg = background

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

Max = maximum

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

EU Z2-36 SVOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
1-Methylnaphthalene	2/4	81J	99J	Z2-EU36B-304	90	NA	NA	NA
2,4-Dimethylphenol	1/27	94J	94J	Z2-EU36B-310	94	0	NA	0
2-Methylnaphthalene	13/27	27.6J	10,000	Z2-EU36-203	1,217	0	NA	1
Acenaphthene	2/27	520	10,000	Z2-EU36B-310	5,260	0	NA	0
Acenaphthylene	2/27	84J	150J	Z2-EU36-203	117	0	NA	0
Anthracene	6/27	81J	28,000	Z2-EU36B-310	4,919	0	NA	0
Benzo(a)anthracene	9/27	360J	31,000	Z2-EU36B-310	4,452	1	NA	4
Benzo(a)pyrene	8/27	358J	25,000	Z2-EU36B-310	4,259	2	NA	8
Benzo(b)fluoranthene	10/27	120J	34,000	Z2-EU36B-310	5,024	1	NA	6
Benzo(ghi)perylene	8/27	160J	5,200	Z2-EU36B-310	1,492	0	NA	0
Benzo(k)fluoranthene	9/27	192J	15,000	Z2-EU36B-310	2,469	0	NA	1
Bis(2-ethylhexyl)phthalate	5/27	215J	3,000J	Z2-EU36B-301	969	0	0	0
Carbazole	3/27	120J	8,500	Z2-EU36B-310	3,020	0	NA	0
Chrysene	9/26	197J	2,280	S01	942	0	NA	0
Dibenz(a,h)anthracene	3/27	390J	1,700	Z2-EU36B-310	957	0	NA	3
Dibenzofuran	2/27	270J	7,200	Z2-EU36B-310	3,735	0	NA	0
Fluoranthene	12/27	79J	91,000	Z2-EU36B-310	9,073	0	NA	0
Fluorene	3/27	280J	11,000	Z2-EU36B-310	4,010	0	NA	0
Indeno(1,2,3-cd)pyrene	9/27	160J	10,000	Z2-EU36B-310	1,815	0	NA	4
Naphthalene	10/38	76J	7,400J	Z2-EU36-208	1,350	0	NA	1
Pentachlorophenol	1/27	280J	280J	S08	280	0	NA	0
Phenanthrene	13/27	77J	85,000	Z2-EU36B-310	7,453	0	NA	1
Pyrene	13/27	89J	71,000	Z2-EU36B-310	7,413	0	NA	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

SVOC = semivolatile organic compound

EU Z2-36 VOC DETECTS (ug/kg) 0-10 ft

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
(1,1-Dimethylethyl)benzene	1/11	390	390	Z2-EU36-208	390	0	NA	0
(1-Methylpropyl)benzene	2/11	21	1,300	Z2-EU36-208	661	0	NA	0
1,2,4-Trimethylbenzene	2/11	4.5J	47,000	Z2-EU36-208	23,502	0	NA	1
1,2-Dichloropropane	1/18	250J	250J	Z2-EU36-208	250	0	NA	0
1,2-Dimethylbenzene	1/12	23,000	23,000	Z2-EU36-208	23,000	0	NA	0
1,3,5-Trimethylbenzene	1/11	20,000	20,000	Z2-EU36-208	20,000	0	NA	1

EU Z2-36 VOC DETECTS (ug/kg) 0-10 ft (contd.)

Analyte	Detect frequency	Minimum detect	Maximum detect	Location(s) of maximum detect	Average detected result	Number of analyses exceeding criteria		
						Ind PRG	GW SL	Res PRG
1-Methyl-4-(1-methylethyl) benzene	2/11	14	3,800	Z2-EU36-208	1,907	NA	NA	NA
2-Butanone	1/18	8.3J	8.3J	Z2-EU36-203	8.3	0	NA	0
Acetone	3/18	17J	490J	Z2-EU36B-303	326	0	NA	0
Benzene	1/19	640	640	Z2-EU36-208	640	0	0	0
Butylbenzene	2/11	22	2,900	Z2-EU36-208	1,461	0	NA	0
Cumene	2/11	15	3,000	Z2-EU36-208	1,508	0	NA	0
Ethylbenzene	2/19	11	20,000	Z2-EU36-208	10,006	0	NA	0
M + P Xylene	2/12	2.1J	65,000	Z2-EU36-208	32,501	0	NA	1
Methylene chloride	1/18	1.1J	1.1J	S01	1.1	0	0	0
Propylbenzene	2/11	25	6,500	Z2-EU36-208	3,263	0	NA	0
Tetrachloroethene	3/18	0.76J	0.89J	S03	0.83	0	0	0
Toluene	4/19	0.32J	4,400J	Z2-EU36-208	1,100	0	0	0

EU = exposure unit

GW = groundwater

Ind = industrial

J = analyte was identified and result is approximate concentration

NA = not applicable

PRG = preliminary remediation goal

Res = residential

RL = remediation level

SL = screening level

VOC = volatile organic compound

2.2.6 ZONE 2 ROD APPENDIX A FFA SITES EVALUATION

This section presents characterization summaries for FFA sites in EU Z2-36. FFA characterization area sites listed in Appendix A of the Zone 2 ROD are the primary concern. However, other FFA sites also may be addressed. There are two FFA sites in EU Z2-36 – the K-1098-C Asphalt Plant FFA site and the K-1503 Neutralization Pit FFA site.

K-1098-C Asphalt Plant FFA Site: The K-1098-C FFA Site is located in the interior portion of the K-1501-A/B Class 2 SU. Sampling to characterize this FFA site was conducted as part of the Class 2 SU characterization activities described in Sects. 2.1.2.3 and 2.2.5.

K-1503 Neutralization Pit FFA Site: The K-1503 Neutralization Pit FFA Site is located in the K-1501-J Class 2 SU. Sampling to characterize this FFA site was conducted as part of the Class 2 SU characterization activities described in Sects. 2.1.2.3 and 2.2.5.

3.0 RISK EVALUATION AND ACTION/NO FURTHER ACTION DECISION

3.1 INTRODUCTION

In this section, data are evaluated in terms of the four decision rules presented in the Zone 2 RAWP. The decision rules include:

- Does the concentration of any Zone 2 contaminant of concern (COC) exceed its maximum RL?
- Does the mean concentration of any Zone 2 COC exceed its average RL across the EU?
- Does the EU pose a risk exceeding an industrial 1×10^{-4} excess lifetime cancer risk (ELCR) or target organ hazard index (HI) of 1?
- Does the site pose a threat to groundwater based on MCL exceedances or soil RLs for protection of groundwater?

Results from comparison of the data to Zone 2 soils RLs, Ind PRGs (set at an ELCR of 1×10^{-5} or a HI of 1), and background levels is presented in Table A.3. In addition, the EU summary in Sect. 2.2.5 presents an evaluation of data by analyte group. The conclusions for current conditions in EU Z2-36 are summarized in the following table.

EU #	Max RL exceeded?	Average RL over EU exceeded?	Industrial risk above 1×10^{-4} ?	Potential source to groundwater?	Action required?
Z2-36	No	No	No	No	No
EU = exposure unit RL = remediation level					

3.2	DATA EVALUATION FOR THE ACTION /NO FURTHER ACTION DECISION
-----	--

The requirements for determining NFA in the Zone 2 EUs are stated in the protection goals of the Zone 2 ROD remedial action objective. Four decision rules developed in the DVS DQOs state the specific criteria against which each EU must be compared to make the NFA decision. These four decision rules are presented in Sect. 3.2 of this PCCR. The way decision rule evaluations are conducted and special data handling requirements are discussed in Sect. 3.3. In summary, the decision rule criteria for NFA are that each EU must meet each of the following compositional constraints:

- Zone 2 soils Max RLs—maximum allowable concentrations of Zone 2 soils COCs. Zone 2 soils Max RLs are presented in the Zone 1 ROD and Sect. 3.2 of this PCCR.
- Zone 2 soils Avg RLs—limit on the allowable average concentrations of Zone 2 soils COCs across an EU. Zone 2 soils Avg RLs are presented in the Zone 1 ROD and Sect. 3.2 of this PCCR.
- Cumulative risk across the EU—cumulative risk across an EU cannot exceed 1×10^{-4} ELCR or HI of 1. A stepwise evaluation of cumulative risk is performed by comparing EU data to 1×10^{-5} industrial PRGs. The 1×10^{-5} Ind PRGs for the analytes required by the RDR/RAWP are presented in Sect. 3.2 of this PCCR.
- Groundwater protection goals—composition of Zone 2 soils cannot pose a threat to groundwater. This evaluation is conducted by assessing local groundwater monitoring results and comparing soils composition to calculated SLs. Groundwater SLs are presented in Sect. 3.2 of this PCCR.

3.3	SUMMARY AND CONCLUSIONS
-----	-------------------------

EU Z2-36

In this section, soils composition from the 0-10-ft depth interval in EU Z2-36 are evaluated in terms of the decision rule criteria discussed in Sect. 3.2 of this PCCR.

Maximum RL screening. There are no Max RL exceedances in EU Z2-36.

Average RL screening. The Avg RL screening process includes the Zone 2 ROD requirement that the weighted average concentrations of Zone 2 COCs across the EU may not exceed their respective Avg RLs. The screening process begins by documenting the individual locations of Avg RL exceedances in the EU. Next, the average detected concentration of any COC with an Avg RL exceedance is compared to the Avg RL. If the detected average concentration is less than the Avg RL, then the COC is dropped from further screening. If a COC's average detected concentration exceeds the Avg RL, then a new average concentration is calculated where half the value of the detection limit is used for nondetects. If the new average exceeds the Avg RL, then a weighted average concentration for the COC is calculated and the weighted average concentration is compared to the Avg RL.

The first step in the Avg RL screen, comparison of average detected concentrations to Avg RLs, is presented in the following table. Two Avg RLs, PCB-1254 and polychlorinated biphenyl, were exceeded and both exceedances occurred at the K-1401 storm drain sediment sample location.

Average detected concentrations of analytes with Avg RL exceedances compared to Avg RLs

Analyte with Avg RL exceedance(s)	Number of exceedances	Avg RL (ug/kg)	Average detected concentration (ug/kg)	Exceeds Avg RL?
PCB-1254	1	10,000	2,166	No
Polychlorinated biphenyl	1	10,000	1,504	No

Avg = average

RL = remediation level

Thus, it is concluded there are no Avg RL exceedances across EU Z2-36

Risk evaluation The 1×10^5 Ind PRGs are used as an initial screen to test for the possibility that a 1×10^4 industrial risk would be exceeded. The first step in the risk screen is to document all of the chemicals and radionuclides with 1×10^5 Ind PRG exceedances. The 1×10^5 Ind PRGs for Ra-226, Th-228, Th-230, and Th-232 are not considered in the risk evaluation because risk for those radionuclides is evaluated with the Ra/Th decay series RLs, and K-40 is considered in the risk evaluation only if its average detected concentration exceeds its background concentration. The second step in the risk screen is to compare the average detected concentrations of chemicals and radionuclides with individual Ind PRG exceedances to the 1×10^5 Ind PRGs. If the average detected concentration of a chemical or radionuclide is less than the 1×10^5 Ind PRG, that chemical or radionuclide is no longer evaluated for risk. If the average detected concentration of a chemical or radionuclide exceeds the 1×10^5 Ind PRG, then the average concentration is recalculated using one-half the detection limit for nondetects. If the recalculated average concentration exceeds the 1×10^4 Ind PRG (i.e., 10 times the 1×10^5 Ind PRG), then a weighted average calculation is performed (weighted average is explained in this PCCR). If the weighted average exceeds the 1×10^4 Ind PRG, then a quantitative risk assessment is performed. Lastly, all chemicals and radionuclides with individual 1×10^5 Ind PRG exceedances are evaluated for their combined impact on cumulative risk. An estimate of cumulative risk is made by calculating the fraction each average concentration is of its 1×10^5 Ind PRG, then summing those fractions. If the sum is > 7.5 (i.e., approximately 75% of the 1×10^4 Ind PRGs), then the need for quantitative risk assessment is evaluated.

The data summaries in Sect. 2.2.5 illustrate there are several metal, PCB, and SVOC Ind PRG exceedances in EU Z2-36. As described above, the Ra-226, Th-228, Th-230, and Th-232 Ind PRG exceedances are not considered and, because the average detected concentration is less than the background concentration (32.12 pCi/g), the K-40 Ind PRG exceedances also are not considered. The average detected concentrations of the remaining chemicals and radionuclides with 1×10^5 Ind PRGs exceedances are compared to their 1×10^5 Ind PRGs in the following table.

Average detected concentrations of analytes with Ind PRG exceedances compared to 1×10^5 Ind PRGs

Analyte with 1×10^5 Ind PRG exceedance(s)	Number of exceedances	1×10^5 Ind PRG	Average detected concentration	Exceeds 1×10^5 Ind PRG?
Arsenic	3	16 mg/kg	8.55 mg/kg	No
Iron	1	100,000 mg/kg	33,227 mg/kg	No
PCB-1254	1	7400 ug/kg	2166 ug/kg	No
Polychlorinated biphenyl	1	7400 ug/kg	1504 ug/kg	No
Cs-137	1	1.13 pCi/g	0.550 pCi/g	No
Benz(a)anthracene	1	21,096 ug/kg	4452 ug/kg	No
Benzo(a)pyrene	2	2110 ug/kg	4259 ug/kg	Yes
Benzo(b)fluoranthene	1	21,096 ug/kg	5024 ug/kg	No

Ind = industrial

PRG = preliminary remediation goal

Only the average detected concentration of benzo(a)pyrene exceeds its Ind PRG. Therefore, benzo(a)pyrene is carried forward in the risk evaluation.

The next step in the risk evaluation process is to recalculate the average concentration of benzo(a)pyrene using the detected concentrations and one-half the detection limit for non-detects and compare the recalculated average concentration to the 1×10^{-5} Ind PRG. The recalculated average concentration of benzo(a)pyrene is shown in the following table. Analytical results for which detection limits are not available have been excluded from the calculation.

Average concentration of benzo(a)pyrene recalculated using detects and one-half the detection limit for non-detects compared to the 1×10^{-5} Ind PRG

Analyte	1×10^{-5} Ind PRG	Recalculated average detected concentration ^a	Exceeds 1×10^{-5} Ind PRG?
Benzo(a)pyrene	2110 ug/kg	1543 ug/kg	No

^aThe recalculated average concentration is calculated using detected results and one-half the detection limit for non-detects and does not include analytical results where detection limits are not available.

Thus, it is concluded that no individual chemical or radionuclide will cause EU Z2-36 to exceed the 1×10^{-4} risk limit of the Zone 2 ROD.

The fraction of each average detected concentration relative to the respective 1×10^{-5} Ind PRG was calculated for all chemicals and radionuclides with 1×10^{-5} Ind PRG exceedances, except for K-40, Ra-226, Th-228, Th-230, and Th-232. Chemicals and radionuclides with individual 1×10^{-5} Ind PRG exceedances, the fraction of their average concentrations relative to their respective 1×10^{-5} Ind PRGs, and the sum of fractions is shown in the following table.

Chemicals and radionuclides with individual Ind PRG exceedances, their average detected concentration, and the fraction of the average results relative to Ind PRGs

Analyte	Average detected concentration	1×10^{-5} Ind PRG	Result/Ind PRG fraction
Arsenic	8.55 mg/kg	16 mg/kg	0.53
Iron	33,227 mg/kg	100,000 mg/kg	0.33
PCB-1254	2166 ug/kg	7436 ug/kg	0.29
Polychlorinated biphenyl	1504 ug/kg	7436 ug/kg	0.2
Cs-137	0.550 pCi/g	1.13 pCi/g	0.49
Benz(a)anthracene	4452 ug/kg	21,096 ug/kg	0.21
Benzo(a)pyrene	1543 ug/kg ^a	2110 ug/kg	0.73
Benzo(b)fluoranthene	5024 ug/kg	21,096 ug/kg	0.24
Sum of fractions			3.02

^aRecalculated using detected results and one-half the detection limit for non-detects.

For EU Z2-36, the sum of fractions is 3.02, which is significantly less than the 7.5 sum of fractions benchmark for evaluating the need for a quantitative risk assessment (i.e., approximately 75% of the 1×10^{-4} Ind PRGs). Therefore, it is concluded the combined impact of all Ind PRG exceedances will not cause EU Z2-36 to exceed the 1×10^{-4} risk limit of the Zone 2 ROD.

Threat to groundwater The threat to groundwater from an EU is evaluated by looking at MCL exceedances in local groundwater wells and comparing the chemicals and radionuclides with MCL exceedances to chemicals and radionuclides with GW SL exceedances. If there are matches between the two sets of analytes, then the mobilities of the matching analytes are evaluated, the volumetric extent of their GW SL exceedances are estimated, and a conclusion is drawn regarding whether any of the matching analytes is a source of groundwater contamination.

As discussed in Sect. 2.2.5, there have been a substantial number of historical VOC MCL exceedances across the EU. However, the sources of VOC contamination have been identified as being located outside of the EU and there are no GWSL exceedances in soil samples collected from EU Z2-36. Therefore, it is concluded that soils in EU Z2-36 do not pose a threat to groundwater.

Qualitative risk screening for unrestricted use There is a low probability that the acreage of EU Z2-36 could be released with no land use restrictions. There is one location with two PCB Avg RL exceedances that will remain because the exceedances do not cause the average concentrations across the EU to exceed the Avg RL, and there are widespread Ind PRG exceedances and residential PRG exceedances. An appropriate evaluation of residential risk should be conducted to make a definitive conclusion regarding unrestricted use.

Zone 2 ROD Appendix A FFA Sites

Based on sampling analytical results at the EU Z2-36 FFA Sites (Sect. 2.2.5 and 2.2.6) and an evaluation of the EU-wide contaminant profile (above), soils in the following Zone 2 ROD Appendix A FFA site do not pose a potential threat to the industrial worker:

- K-1098-C Asphalt Plant FFA Site
- K-1503 Neutralization Pit FFA Site

4.0	RECOMMENDATION FOR ACTION/NO FURTHER ACTION
4.1	DECISION AND REMEDIATION ACTIVITIES

EU Z2-36: Based on analytical results of DVS and historical samples collected in EU Z2-36 and the Class 3 SU walkover assessment in the EU, the U.S. Department of Energy (DOE) recommends that NFA is appropriate for the 15 acres of this EU.

Based on the existence of known groundwater contaminant plumes beneath EU Z2-36, DOE does not recommend the 10-ft-depth land use restriction be lifted from the EU.

FFA Sites: Based on sampling analytical results and the recommendation for EU Z2-36, DOE recommends NFA as appropriate for the following FFA sites:

- K-1098-C Asphalt Plant FFA Site
- K-1503 Neutralization Pit FFA Site

4.2	EXCAVATION ACTIVITIES/CONFIRMATION SAMPLING
------------	--

None

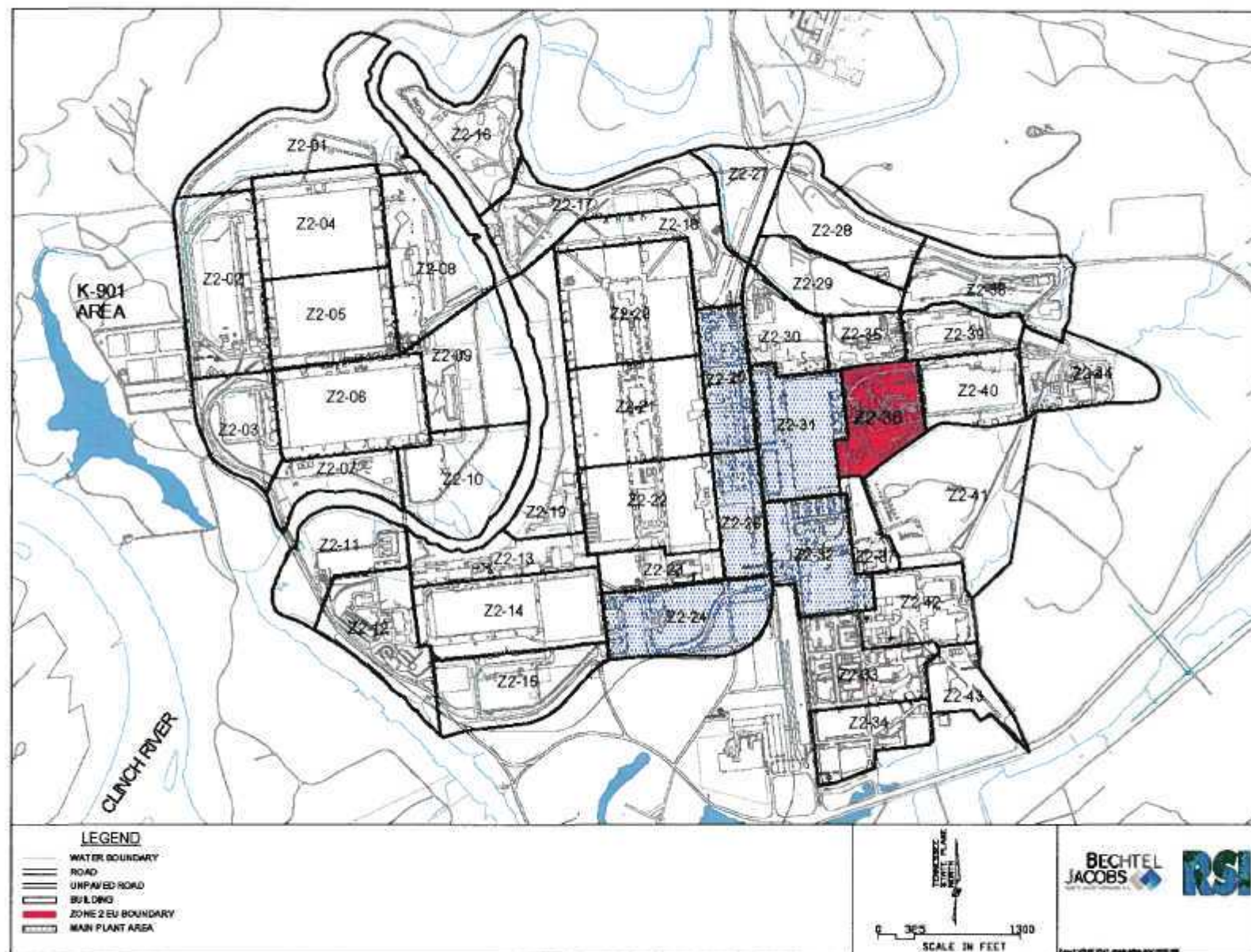


Fig. A.1. EU Z2-36 location map.

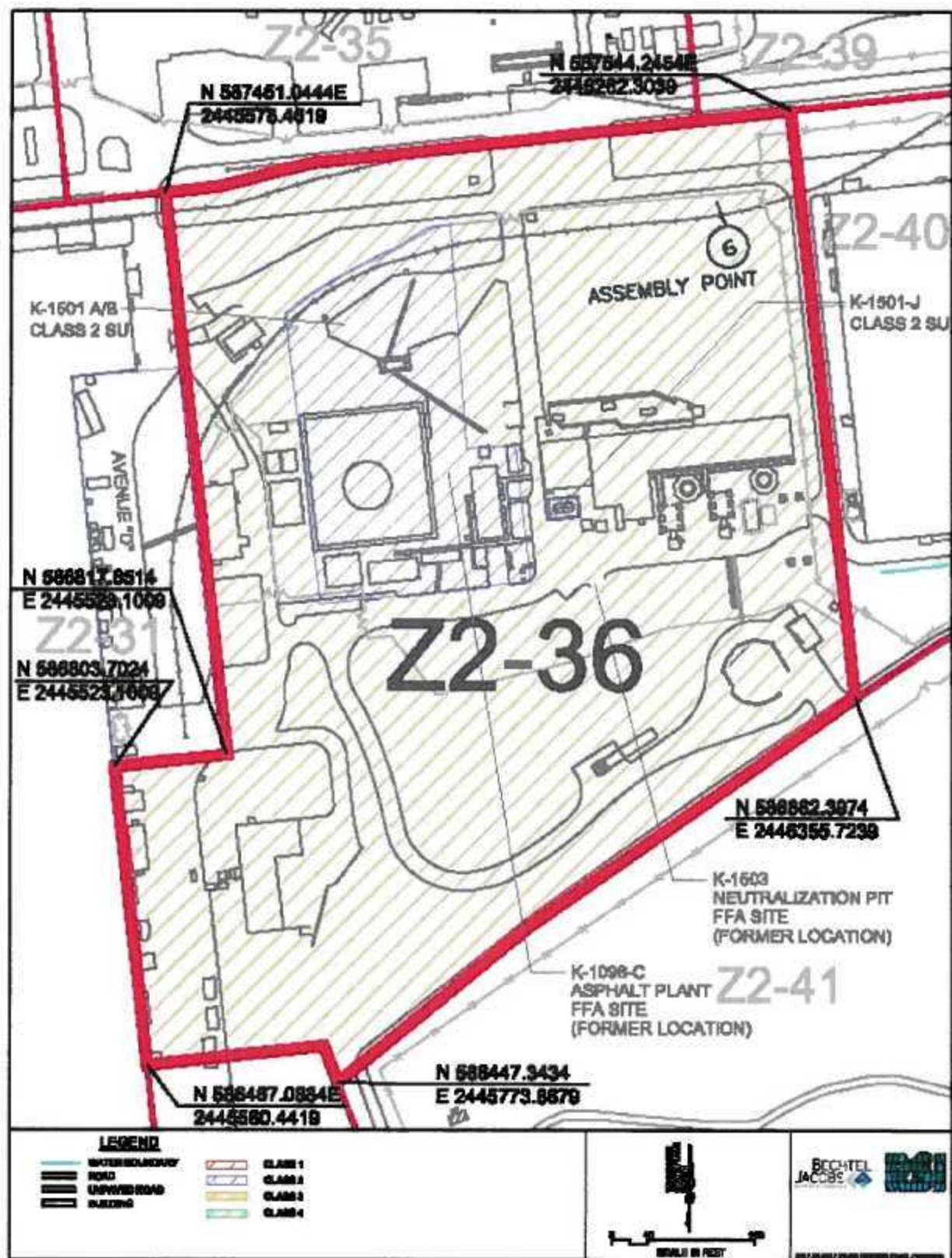


Fig. A.2. EU Z2-36 boundary location map.

Table A.1. EU Z2-36 facility and FFA site list

Facility name DQO scoping	Facility assessed?		Comments
	Yes	No	
K-1045-C Steam Plant Operator Office (was K-1045-B & -C)	X		Concrete slab
K-1098 Maintenance Shop and Storage	X		Concrete slab
K-1098-C Asphalt Plant	X		Also evaluated as a FFA site
K-1098-E Heat Treat Facility	X		
K-1204-05 Sewage Ejector Station	X		
K-1310-BJ	X		
K-1310-BM OMI Maintenance Office and Breakroom	X		
K-1310-DD	X		
K-1310-DJ	X		
K-1310-JH	X		
K-1310-KC		X	Trailer has been removed
K-1310-KD	X		
K-1310-KK		X	Trailer has been removed
K-1310-KL		X	Trailer has been removed
K-1310-KM		X	Trailer has been removed
K-1400 Office Building	X		
K-1420-D	X		
K-1423 Grease Burial Site		X	FFA site located in EU Z2-25
K-1501/K-1501-B Steam Plant	X		
K-1501-A Oil Storage Tank	X		Concrete slab
K-1501-B Oil Storage Tank	X		Concrete slab
K-1501-C Foam House	X		Concrete slab
K-1501-D Oil Unloading Station	X		
K-1501-E Coal Crusher and Unloading Station	X		
K-1501-F Conveyor Station	X		Concrete slab
K-1501-G Sulfuric Acid Storage Tank	X		Concrete slab
K-1501-H Maintenance Facility	X		
K-1501-J Fuel Storage Tank	X		Concrete slab
K-1501-K PCB Unloading Station	X		Concrete slab
K-1501-L Instrument Maintenance Shop	X		
K-1501-N Grass Covered Coal Storage Yard	X		
K-1501-P1 Buel Electrostatic Precipitator	X		
K-1501-P2 Buel Electrostatic Precipitator	X		
K-1501-Q Electrical Storage Shop	X		Concrete slab
K-1501-S Coal Storage Yard (South)	X		
K-1501-S1 Brick Stack	X		
K-1501-S2 Brick Stack	X		
K-1501-T Brine Salt Tank	X		Concrete slab
K-1501-U Sulfuric Acid Tank		X	Tank has been removed
K-1501-V Equipment Storage	X		
K-1503 Neutralization Pit	X		Also evaluated as a FFA site
K-1534 Gas Valve Shelter	X		
K-1028-84	X		Guard shack
K-1310-FW	X		Change house trailer
K-1310-GS	X		OMI office trailer
K-1501	X		Staging area
K-1501-W	X		OMI maintenance shop building
K-1501-X	X		Metal compressor building
K-1501-Y	X		Metal compressor building
K-1501-Z	X		Maintenance storage building
K-700-A-67	X		Transformer substation

DQO = data quality objective FFA = Federal Facility Agreement
EU = exposure unit

Table A.2. EU Z2-36 sample summary

SU class	Date sampled	Location ID	Location		Sample Interval	Screening		Off-site laboratory							Comments and notes
			Easting	Northing		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
DYS sample locations															
2	07/15/08	Z2-EU36M-200	2445728	587021	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid
2	07/15/08	Z2-EU36-201	2445868	587041	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid, DRO/GRO added
2	07/15/08	Z2-EU36-202	2445964	587090	0-10 ft, 3 interval composite									D	K-1501-A/B Class 2 SU systematic grid
2	07/11/08	Z2-EU36-203	2445811	587119	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid, DRO/GRO added
2	07/14/08	Z2-EU36-204	2445907	587129	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid, DRO/GRO added
2	07/11/08	Z2-EU36-205	2445755	587198	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid
2	07/11/08	Z2-EU36-206	2445851	587207	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid, DRO/GRO added
2	07/09/08	Z2-EU36M-207	2445794	587234	0-10 ft, 2 interval composite, gravelly surface										K-1501-A/B Class 2 SU systematic grid
2	07/09/08	Z2-EU36-208	2445891	587295	0-10 ft, 2 interval composite, asphalt surface - 1/2 in										K-1501-A/B Class 2 SU systematic grid, VOC hits of 105 ppm at 5 ft and 207 ppm at 8 ft, therefore, added VOC and DRO/GRO analyses
2	07/09/08	Z2-EU36-209	2445834	587374	0-10 ft, 3 interval composite										K-1501-A/B Class 2 SU systematic grid, DRO/GRO added
2	07/08/08	Z2-EU36-210	2446145	587076	0-5 ft, 3 interval composite										K-1501-J Class 2 SU, DRO/GRO added, refusal at 5 ft
2	07/16/08	Z2-EU36-211	2446239	587086	0-3 ft, 3 interval composite										K-1501-J Class 2 SU
2	10/15/08	Z2-EU36B-212	2446018	587093	0-10 ft discrete samples										No samples collected as there were no RAD or VOC screen exceedances
2	10/15/08	Z2-EU36B-213	2446035	587097	7-7.5 ft discrete samples										K-1501-F Class 2 SU, VOC hit of 24 ppm at 7 ft, BTEX analysis only
3		Z2-EU36B-300	2445990	587424	Sediment/dredge sample										K-1204-S, not sampled - no sediment present
3	07/18/08	Z2-EU36B-301	2445391	586659	Sediment sample										Storm drain east of K-1401, sample from storm drain
3	07/16/08	Z2-EU36B-302	2445582	586653	0-10 ft, 3 interval composite										Storm drain east of K-1401, sample from outside of storm drain
3	07/18/08	Z2-EU36B-303	2445999	587014	Sediment sample										Storm drain SE K-1501-H, sample from storm drain
3	07/16/08	Z2-EU36B-304	2446008	587014	0-10 ft, 3 interval composite										Storm drain SE K-1501-H, sample from outside of storm drain
3	07/08/08	Z2-EU36B-305	2446055	587380	4 Point composite sample (0-3 ft)										K-1501-N Coal Yard
3	07/16/08	Z2-EU36B-306A	2445829	586769	4 Point composite sample (0-2 ft)										K-1501-S Coal Yard
3	07/18/08	Z2-EU36B-307	2445880	587120	Sediment sample										Storm drain northwest of K-1501-H, sample from storm drain

Table A.2. EU Z2-36 sample summary (cont.)

SU class	Date sampled	Location ID	Location		Sample Interval	Screening		Off-site laboratory							Comments and notes
			Easting	Northing		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
3	07/15/08	Z2-EU06B-308	2445886	587114	0-10 ft, 3 interval composite	1	1	1	1		1				Stream drain northwest of K-1501-B, sample from outside of storm drain
3		Z2-EU06B-309			Sediment sample										Sumpt east of K-1501, not collected due to lack of sediment
3	03/30/07	Z2-EU06B-310	2446010	587191	Sediment sample			1	1	1	1	1	1		Sumpt east of K-1501, collected from pump prior to remedial action, DRO/GRO added
DVS sampling totals						19	19	23	21	9	21	12		8	
Historical sample locations															
3	6/27/01	ETTP-REL05	2445952	586878	Surface soil sample 0 0-0.5 ft					1					
3	6/27/01	ETTP-REL06	2445938	586860	Surface soil sample 0 0-0.5 ft					1					
3	6/27/01	ETTP-REL07	2445917	586870	Surface soil sample 0 0-0.5 ft					1					
3	10/30/00	S01	2445669	586611	Surface soil sample 0 0-0.5 ft			1	2	2	2	1			
3	11/2/00	S02	2445656	586654	Surface soil sample 0 0-0.5 ft					1		1			
3	11/2/00	S03	2445658	586693	Surface soil sample 0 0-0.5 ft			1	1	1	1	1			
3	11/2/00	S04	2445662	586753	Surface soil sample 0 0-0.5 ft			1		1					
3	11/2/00	S05	2445734	586764	Surface soil sample 0 0-0.5 ft					1		1			
3	11/2/00	S06	2445759	586804	Surface soil sample 0 0-0.5 ft			1	1	1	1	1			
3	11/2/00	S07	2445715	586794	Surface soil sample 0 0-0.5 ft					1					
3	11/2/00	S08	2445675	586789	Surface soil sample 0 0-0.5 ft				1	1	1				
3	11/2/00	S09	2445627	586779	Surface soil sample 0 0-0.5 ft					1		1			
3	11/2/00	S10	2445660	586810	Surface soil sample 0 0-0.5 ft			1	1	1	1	1			
3	11/2/00	S11	2445715	586819	Surface soil sample 0 0-0.5 ft					1					
Historical sampling totals								5	6	15	6	7			

BTEX = benzene, toluene, ethylbenzene, xylene

D = duplicate

DRO = diesel range organics

DVS = Dynamic Verification Strategy

EU = exposure unit

GRO = gasoline range organics

ID = identification

PCB = polychlorinated biphenyl

RAD = radiological

SU = soil unit

SVOC = semivolatile organic compound

VOC = volatile organic compound

Table A.3. EU Z2-36 data summary for soil samples collected from 0 to 10 ft below ground surface*

Analyte	Frequency of detect	Minimum detect	Maximum detect	Location(s) of maximum detected result	Average detected result	Maximum RL	Frequency of detects exceeding maximum RL	Average RL	Frequency of detects exceeding average RL	PRG (10 ⁶ or 1)	Frequency of detects exceeding PRG Min	Background concentration	Frequency of detects exceeding background
Inorganics (mg/kg)													
Aluminum	26/26	1,400	24,000	Z2-EU36-202	12,802		NA		NA	100,000	0/26	40,300	0/26
Antimony	21/26	0.016	2.43	Z2-EU36B-310	0.338		NA		NA	408.8	0/26	1.52	2/26
Arsenic	25/26	0.97	37	Z2-EU36B-303	8.55	900	0/26	300	0/26	15.9	3/26	14.95	3/26
Barium	26/26	47	260	Z2-EU36B-303	113		NA		NA	66,577	0/26	124.93	7/26
Beryllium	25/26	0.45	1.7	Z2-EU36-205	1.04	6,000	0/26	2,000	0/26	1,941	0/26	2.2	0/26
Boron	21/21	0.28	20	Z2-EU36B-301	4.32		NA		NA	100,000	0/21	NA	NA
Cadmium	26/26	0.1	4.68	SO1	0.634		NA		NA	451	0/26	0.22	18/26
Calcium	26/26	1,400	250,000	Z2-EU36-203	42,315		NA		NA	NA	NA	2,400	22/26
Chromium	26/26	9.883	160	Z2-EU36B-301	35.6		NA		NA	640	0/26	44.88	2/26
Cobalt	26/26	3.5	260	Z2-EU36-211	15.1		NA		NA	133,310	0/26	42	0/26
Copper	26/26	11	321	SO1	79.9		NA		NA	40,577	0/26	22.48	20/26
Iron	26/26	8,800	140,000	Z2-EU36B-303	33,227		NA		NA	100,000	1/26	58,600	1/26
Lead	26/26	7.7	340	Z2-EU36B-301	41.1		NA		NA	800	0/26	37.91	6/26
Lithium	21/21	6.8	35	Z2-EU36B-306	18.1		NA		NA	20,439	0/21	48.94	0/21
Magnesium	26/26	7811	65,000	Z2-EU36B-301	12,084		NA		NA	NA	NA	3,300	19/26
Manganese	26/26	180	4,200	Z2-EU36B-303	1,010		NA		NA	19,458	0/26	2,200	1/26
Mercury	25/26	0.0061	1.983	SO1	0.158	1,800	0/26	600	0/26	307	0/26	0.17	5/26
Molybdenum	17/21	0.16	6.5	Z2-EU36B-303	1.74		NA		NA	5,110	0/21	NA	NA
Nickel	26/26	15	613	SO1	119		NA		NA	20,439	0/26	26.07	20/26
Potassium	26/26	370	3,500	Z2-EU36-211	1,972		NA		NA	NA	NA	5,074.69	0/26
				Z2-EU36B-302									
Selenium	7/26	0.3231	3	Z2-EU36B-310	1.63		NA		NA	5,110	0/26	1.47	5/26
Silver	5/26	0.082	0.8191	SO1	0.42		NA		NA	5,110	0/26	0.6	2/26
Sodium	22/26	39.4	2901	Z2-EU36B-310	129		NA		NA	NA	NA	497	0/26
Thallium	21/26	0.043	0.547	Z2-EU36B-310	0.217		NA		NA	67.5	0/26	0.4	1/26
Uranium	21/21	0.38	4.7	Z2-EU36B-308	1.46		NA		NA	204	0/21	NA	NA
Vanadium	26/26	6.6	56	Z2-EU36-210	26.4		NA		NA	1,022	0/26	63.47	0/26
Zinc	26/26	23	390	Z2-EU36B-301	98.8		NA		NA	100,000	0/26	89.7	8/26
Other Organics (mg/kg)													
Dioxin Range Organics	3/8	5.23	8601	Z2-EU36-208	342		NA		NA		NA		NA
Quinoline Range Organics	4/8	0.161	25	Z2-EU36-208	7.36		NA		NA		NA		NA
Pesticides and PCBs (ug/kg)													
PCB-1016	0/27	ND	ND		ND	100,000	0/27	10,000	0/27	37,000	0/27		NA
PCB-1221	0/27	ND	ND		ND	100,000	0/27	10,000	0/27	7,436	0/27		NA
PCB-1232	0/27	ND	ND		ND	100,000	0/27	10,000	0/27	7,436	0/27		NA
PCB-1242	0/27	ND	ND		ND	100,000	0/27	10,000	0/27	7,436	0/27		NA
PCB-1248	0/27	ND	ND		ND	100,000	0/27	10,000	0/27	7,436	0/27		NA
PCB-1254	8/27	8.11	16,000	Z2-EU36B-301	2166	100,000	0/27	10,000	1/27	7,436	1/27		NA
PCB-1260	11/27	117	249	SO1	58.6	100,000	0/27	10,000	0/27	7,436	0/27		NA
Polychlorinated biphenyl	11/21	8.11	16,000	Z2-EU36B-301	1,504	100,000	0/21	10,000	1/21	7,436	1/21		NA
Radionuclides (pCi/g)													
Americium-241	4/4	0.862	1.441	Z2-EU36-206	1.228		NA		NA	11,900	0/4		NA
Alpha activity	9/9	3.241	10.1	Z2-EU36-204	6.62		NA		NA		NA		NA
Americium-241	0/1	ND	ND		ND		NA		NA	0.16	0/1		NA
Americium-241	1/2	0.123	0.123	SO1	0.123		NA		NA	57	0/2		NA
Beryllium-7	1/1	2.933	2.933	Z2-EU36B-307	2.93		NA		NA	1,200	0/1		NA
Beta activity	9/9	3.033	5.57	Z2-EU36-204	5.89		NA		NA		NA		NA
Bismuth-214	4/4	0.8661	1.343	Z2-EU36-210	1.06		NA		NA	134,000	0/4		NA

Table A.3. (continued)

Analyte	Frequency of detect ^a	Minimum detect ^a	Maximum detect ^a	Location(s) of maximum detected result	Average detected result	Maximum RL	Frequency of detects exceeding maximum RL	Average RL	Frequency of detects exceeding average RL	PRG limit (10 ⁻⁴ or 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Cesium-137	12/24	0.11	1.24	SD1	0.550	20	0/24	2	0/24	1.13	2/24		NA
Cobalt-56	0/1	ND	ND		ND		NA		NA		NA		NA
Cobalt-60	3/21	0.00457	0.00952	S10	0.008		NA		NA	0.6	0/21		NA
Lead-212	7/7	0.678	1.65	Z2-EU36-210	1.23		NA		NA	61,300	0/7		NA
Lead-214	5/5	0.622J	1.41J	Z2-EU36-209	0.971		NA		NA	756,000	0/5		NA
Neptunium-237	1/11	0.0682	0.0682	S01	0.068	50	0/11	5	0/11	2.72	0/11		NA
Plutonium-238	4/5	0.078J	0.078J	S01	0.078		NA		NA	160	0/5		NA
Plutonium-239	2/5	0.0722	0.104J	S01	0.088		NA		NA	144	0/5		NA
Potassium-40	11/12	3.94J	29.9	ETTP-KEL06	19.2		NA		NA	2.73	11/12	32.12	0/12
Protactinium-234m	1/1	7.21	7.21	S01	7.21		NA		NA	250,000,000	0/1		NA
Ra/Th decay series ^c	24/24	0	0.95	Z2-EU36-210	0.189	15	0/24	5	0/24		NA		NA
Radioactive Strontium (Total)	2/2	0.0749	0.733	S01	0.414		NA		NA		NA		NA
Radium-226 ^c	3/3	0.757	1	ETTP-KEL07	0.891		NA		NA	0.26	3/3	1.25	0/3
Sodium-22	0/1	ND	ND		ND		NA		NA		NA		NA
Sructum-90	0/3	ND	ND		ND		NA		NA	110	0/3		NA
Technetium-99	2/24	2.94	13.1	Z2-EU36B-301	8.02		NA		NA	8,960	0/24		NA
Thallium-208	7/7	0.207	0.761J	Z2-EU36-201	0.416		NA		NA	368,000	0/7		NA
Thorium-228 ^c	23/24	0.679J	1.83	Z2-EU36-210	1.24		NA		NA	0.18	23/24	1.86	0/24
Thorium-230 ^c	22/24	0.228J	2.15	Z2-EU36-210	1.19		NA		NA	202	0/24	1.2	11/24
Thorium-232 ^c	24/24	0.21	1.87	Z2-EU36-201	1.08		NA		NA	0.18	24/24	1.95	0/24
Thorium-234	1/10	4.65	4.65	S01	4.65		NA		NA	32,800	0/10		NA
Total Activity	1/12	4.27	4.27	S09	4.27		NA		NA		NA		NA
Uranium-234	24/24	0.276J	16.5	S01	3.03	2,000	0/24	700	0/24	332	0/24		NA
Uranium-235	17/24	0.0239J	0.932	S01	0.213	80	0/24	8	0/24	3.98	0/24		NA
Uranium-238	24/24	0.162J	7.05	S01	1.77	500	0/24	50	0/24	18	0/24	1.47	14/24
Semivolatile organics (ug/kg)													
1,2,4-Trichlorobenzene	0/38	ND	ND		ND		NA		NA	215,925	0/38		NA
1,3-Dichlorobenzene	0/38	ND	ND		ND		NA		NA	600,000	0/38		NA
1,5-Dichlorobenzene	0/38	ND	ND		ND		NA		NA	600,000	0/38		NA
1,4-Dichlorobenzene	0/38	ND	ND		ND		NA		NA	78,665	0/38		NA
1-Methylnaphthalene	2/4	81J	99J	Z2-EU36B-304	90		NA		NA		NA		NA
2,3,4,6-Tetrachlorophenol	0/21	ND	ND		ND		NA		NA	18,468,189	0/21		NA
2,4,5-Trichlorophenol	0/27	ND	ND		ND		NA		NA	61,560,629	0/27		NA
2,4,6-Trichlorophenol	0/27	ND	ND		ND		NA		NA	61,561	0/27		NA
2,4-Dichlorophenol	0/27	ND	ND		ND		NA		NA	1,846,819	0/27		NA
2,4-Dimethylphenol	1/27	94J	94J	Z2-EU36B-310	94		NA		NA	12,312,126	0/27		NA
2,4-Dinitrophenol	0/27	ND	ND		ND		NA		NA	1,231,213	0/27		NA
2,4-Dinitrotoluene	0/27	ND	ND		ND		NA		NA	25,348	0/27		NA
2,6-Dinitrotoluene	0/27	ND	ND		ND		NA		NA	25,348	0/27		NA
2-Chloronaphthalene	0/27	ND	ND		ND		NA		NA	23,382,732	0/27		NA
2-Chlorophenol	0/27	ND	ND		ND		NA		NA	235,768	0/27		NA
2-Methyl-4,6-dinitrophenol	0/27	ND	ND		ND		NA		NA	61,561	0/27		NA
2-Methylnaphthalene	13/27	27.6J	10,000	Z2-EU36-203	1217		NA		NA	187,691	0/27		NA
2-Methylphenol	0/27	ND	ND		ND		NA		NA	30,780,315	0/27		NA
2-Nitrobenzenesulfonic	0/27	ND	ND		ND		NA		NA	1,830,232	0/27		NA
2-Nitrophenol	0/27	ND	ND		ND		NA		NA		NA		NA
3,3'-Dichlorobenzidine	0/27	ND	ND		ND		NA		NA	38,304	0/27		NA
3-Methylphenol	0/21	ND	ND		ND		NA		NA	30,780,315	0/21		NA
3-Nitrobenzenesulfonic	0/27	ND	ND		ND		NA		NA	18,468	0/27		NA
4-Bromophenyl phenyl ether	0/27	ND	ND		ND		NA		NA		NA		NA
4-Chloro-3-methylphenol	0/27	ND	ND		ND		NA		NA		NA		NA

Table A.3. (continued)

Analyte	Frequency of detect ^a	Minimum detect ^a	Maximum detect	Location(s) of maximum detected result	Average detected result	Maximum RL	Frequency of detects exceeding maximum RL	Average RL	Frequency of detects exceeding average RL	PRG limit (10 ⁻⁵ or 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
4-Chlorobenzenesulfonic acid	0/27	ND	ND		ND	NA	NA	NA	NA	2,462,425	0/27	NA	NA
4-Chlorophenyl phenyl ether	0/27	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	0/6	ND	ND		ND	NA	NA	NA	NA	3,100,000	0/6	NA	NA
4-Nitrobenzenesulfonic acid	0/27	ND	ND		ND	NA	NA	NA	NA	184,648	0/27	NA	NA
4-Nitrophenol	0/27	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	2/27	520	10,000	Z2-EU368-310	5,260	NA	NA	NA	NA	29,219,327	0/27	NA	NA
Acenaphthylene	3/27	84	150	Z2-EU36-203	117	NA	NA	NA	NA	29,219,327	0/27	NA	NA
Aniline	0/21	ND	ND		ND	NA	NA	NA	NA	3,024,031	0/21	NA	NA
Anthracene	6/27	811	28,000	Z2-EU368-310	4,919	NA	NA	NA	NA	100,000,000	0/27	NA	NA
Benz(a)anthracene	9/27	360	31,000	Z2-EU368-310	4,452	NA	NA	NA	NA	21,096	1/27	NA	NA
Benzonitrile	0/21	ND	ND		ND	NA	NA	NA	NA	100,000,000	0/21	NA	NA
Benz(a)pyrene	8/27	358	25,000	Z2-EU368-310	4,239	NA	NA	NA	NA	2,110	2/27	NA	NA
Benz(b)fluoranthene	10/27	120	34,000	Z2-EU368-310	5,024	NA	NA	NA	NA	21,096	1/27	NA	NA
Benz(g)hperylene	8/27	160	5,200	Z2-EU368-310	1,492	NA	NA	NA	NA	29,126,201	0/27	NA	NA
Benz(k)fluoranthene	9/27	192	15,000	Z2-EU368-310	2,469	NA	NA	NA	NA	210,962	0/27	NA	NA
Benzene sulfonic acid	0/21	ND	ND		ND	NA	NA	NA	NA	100,000,000	0/21	NA	NA
Bis(2-chloroethoxy) methane	0/27	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl) ether	0/27	ND	ND		ND	NA	NA	NA	NA	5,755	0/27	NA	NA
Bis(2-chloroisopropyl) ether	0/27	ND	ND		ND	NA	NA	NA	NA	73,518	0/27	NA	NA
Bis(2-ethylhexyl) phthalate	5/27	215	3,000	Z2-EU368-305	969	NA	NA	NA	NA	1,231,213	0/27	NA	NA
Butyl benzyl phthalate	0/27	ND	ND		ND	NA	NA	NA	NA	100,000,000	0/27	NA	NA
Carbazole	3/27	120	8,500	Z2-EU368-310	3,020	NA	NA	NA	NA	861,849	0/27	NA	NA
Chrysene	9/26	197	2,200	S01	942	NA	NA	NA	NA	2,109,623	0/26	NA	NA
Dibenz(a,h)anthracene	3/27	390	1,700	Z2-EU368-310	957	NA	NA	NA	NA	2,110	0/27	NA	NA
Dibenzofuran	2/27	270	7,200	Z2-EU368-310	3,735	NA	NA	NA	NA	1,563,342	0/27	NA	NA
Diethyl phthalate	0/27	ND	ND		ND	NA	NA	NA	NA	100,000,000	0/27	NA	NA
Dimethyl phthalate	0/27	ND	ND		ND	NA	NA	NA	NA	100,000,000	0/27	NA	NA
Di-n-butyl phthalate	0/27	ND	ND		ND	NA	NA	NA	NA	61,560,629	0/27	NA	NA
Di-o-octyl phthalate	0/27	ND	ND		ND	NA	NA	NA	NA	24,824,252	0/27	NA	NA
Diphenylamine	0/6	ND	ND		ND	NA	NA	NA	NA	15,000,000	0/6	NA	NA
Diphenylhydrazine	0/21	ND	ND		ND	NA	NA	NA	NA	156,700	0/21	NA	NA
Fluoranthene	12/27	79	91,000	Z2-EU368-310	9,073	NA	NA	NA	NA	22,000,353	0/27	NA	NA
Fluorene	3/27	280	11,000	Z2-EU368-310	4,070	NA	NA	NA	NA	26,281,433	0/27	NA	NA
Hexachlorobenzene	0/27	ND	ND		ND	NA	NA	NA	NA	10,773	0/27	NA	NA
Hexachlorobenzene d5	0/38	ND	ND		ND	NA	NA	NA	NA	184,682	0/38	NA	NA
Hexachlorocyclopentadiene	0/27	ND	ND		ND	NA	NA	NA	NA	3,658,717	0/27	NA	NA
Hexachloroethane	0/27	ND	ND		ND	NA	NA	NA	NA	615,606	0/27	NA	NA
Indeno(1,2,3-cd)pyrene	9/27	160	10,000	Z2-EU368-310	1,815	NA	NA	NA	NA	21,096	0/27	NA	NA
Isophorone	0/27	ND	ND		ND	NA	NA	NA	NA	5,119,795	0/27	NA	NA
Naphthalene	10/38	76	7,400	Z2-EU36-208	1,350	NA	NA	NA	NA	187,691	0/38	NA	NA
Nitrobenzene	0/27	ND	ND		ND	NA	NA	NA	NA	102,935	0/27	NA	NA
N-Nitrosodimethylamine	0/21	ND	ND		ND	NA	NA	NA	NA	338	0/21	NA	NA
N-Nitroso-di-n-propylamine	0/27	ND	ND		ND	NA	NA	NA	NA	2,462	0/27	NA	NA
N-Nitrosodiphenylamine	0/21	ND	ND		ND	NA	NA	NA	NA	3,517,750	0/21	NA	NA
Pentachlorophenol	1/27	280	280	S08	280	NA	NA	NA	NA	89,982	0/27	NA	NA
Phenanthrene	13/27	77	85,000	Z2-EU368-310	7,453	NA	NA	NA	NA	29,126,201	0/27	NA	NA
Phenol	0/27	ND	ND		ND	NA	NA	NA	NA	100,000,000	0/27	NA	NA
Pyrene	13/27	89	71,000	Z2-EU368-310	7,413	NA	NA	NA	NA	29,126,201	0/27	NA	NA
Pyridine	0/21	ND	ND		ND	NA	NA	NA	NA	615,606	0/21	NA	NA
Volatile organics (ug/kg)													
(1,1-Dimethylethyl)benzene	1/11	390	390	Z2-EU36-208	390	NA	NA	NA	NA	390,000	0/11	NA	NA

Table A.3. (continued)

Analyte	Frequency of detect ^a	Minimum detect ^b	Maximum detect	Location(s) of maximum detected result	Average detected result	Maximum RL	Frequency of detects exceeding maximum RL	Average RL	Frequency of detects exceeding average RL	PRC limit (10 ⁻⁵ or 1)	Frequency of detects exceeding PRC limit	Background concentration	Frequency of detects exceeding background
1,1-Dichloro-2,2,2-trifluoroethane	0/1	21	1,349	Z2-EU36-208	661	NA	NA	NA	NA	220,000	0/1	NA	NA
1,1,1,2-Tetrachloroethane	0/1	ND	ND		ND	NA	NA	NA	NA	72,755	0/1	NA	NA
1,1,1-Trichloro-2,2,2-trifluoroethane	0/7	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	1,200,000	0/18	NA	NA
1,1,2,2-Tetrachloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	9,294	0/18	NA	NA
1,1,2-Trichloro-1,2,2-trifluoroethane	0/1	ND	ND		ND	NA	NA	NA	NA	5,600,000	0/1	NA	NA
1,1,2-Trichloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	16,050	0/18	NA	NA
1,1-Dichloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	1,735,654	0/18	NA	NA
1,1-Dichloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	413,325	0/18	NA	NA
1,1-Dichloropropane	0/1	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	0/1	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichloropropane	0/1	ND	ND		ND	NA	NA	NA	NA	760	0/1	NA	NA
1,2,4-Trimethylbenzene	2/1	4.57	47,000	Z2-EU36-208	23,502	NA	NA	NA	NA	170,272	0/1	NA	NA
1,2-Dibromo-3-chloropropane	0/1	ND	ND		ND	NA	NA	NA	NA	11,000	0/1	NA	NA
1,2-Dibromopropane	0/1	ND	ND		ND	NA	NA	NA	NA	630	0/1	NA	NA
1,2-Dichloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	6,035	0/18	NA	NA
1,2-Dichloroethane	0/7	ND	ND		ND	NA	NA	NA	NA	150,000	0/7	NA	NA
1,2-Dichloropropane	1/18	2501	2501	Z2-EU36-208	250	NA	NA	NA	NA	7,422	0/18	NA	NA
1,2-Dimethylbenzene	1/12	23,000	23,000	Z2-EU36-208	23,000	NA	NA	NA	NA	420,000	0/12	NA	NA
1,3,5-Trimethylbenzene	1/1	20,000	20,000	Z2-EU36-208	20,000	NA	NA	NA	NA	69,712	0/1	NA	NA
1,3-Dichloropropane	0/1	ND	ND		ND	NA	NA	NA	NA	360,521	0/1	NA	NA
1-Chloro-4-methylbenzene	0/1	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
1-chlorobenzene	0/1	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl-4-(1-methylallyl)benzene	2/1	14	3,800	Z2-EU36-208	1,907	NA	NA	NA	NA	NA	NA	NA	NA
2,2-Dichloropropane	0/1	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanol	1/18	8.31	8.31	Z2-EU36-203	8.3	NA	NA	NA	NA	113,264,388	0/18	NA	NA
2-Hexanol	0/18	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
2-Methoxy-2-methylpropane	0/1	ND	ND		ND	NA	NA	NA	NA	700,000	0/1	NA	NA
4-Methyl-2-pentanol	0/18	ND	ND		ND	NA	NA	NA	NA	47,001,434	0/18	NA	NA
Acetone	3/18	171	4901	Z2-EU36B-303	326	NA	NA	NA	NA	54,320,986	0/18	NA	NA
Benzene	1/19	640	640	Z2-EU36-208	640	NA	NA	NA	NA	14,094	0/19	NA	NA
Bromobenzene	0/1	ND	ND		ND	NA	NA	NA	NA	92,152	0/1	NA	NA
Bromochloromethane	0/1	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane	0/18	ND	ND		ND	NA	NA	NA	NA	18,306	0/18	NA	NA
Bromoform	0/18	ND	ND		ND	NA	NA	NA	NA	2,181,998	0/18	NA	NA
Bromomethane	0/18	ND	ND		ND	NA	NA	NA	NA	13,078	0/18	NA	NA
Buylbenzene	2/1	22	2,900	Z2-EU36-208	1,461	NA	NA	NA	NA	240,000	0/1	NA	NA
Carbon disulfide	0/18	ND	ND		ND	NA	NA	NA	NA	720,000	0/18	NA	NA
Carbon tetrachloride	0/18	ND	ND		ND	NA	NA	NA	NA	5,493	0/18	NA	NA
Chlorobenzene	0/18	ND	ND		ND	NA	NA	NA	NA	530,466	0/18	NA	NA
Chloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	64,853	0/18	NA	NA
Chloroform	0/18	ND	ND		ND	NA	NA	NA	NA	4,698	0/18	NA	NA
Chloromethane	0/18	ND	ND		ND	NA	NA	NA	NA	155,746	0/18	NA	NA
cis-1,2-Dichloroethane	0/12	ND	ND		ND	NA	NA	NA	NA	146,301	0/12	NA	NA
cis-1,3-Dichloropropane	0/18	ND	ND		ND	NA	NA	NA	NA	17,645	0/18	NA	NA
Cumene	2/1	15	3,000	Z2-EU36-208	1,500	NA	NA	NA	NA	520,000	0/1	NA	NA
Dibromochloromethane	0/18	ND	ND		ND	NA	NA	NA	NA	25,543	0/18	NA	NA
Dibromomethane	0/1	ND	ND		ND	NA	NA	NA	NA	233,550	0/1	NA	NA

Table A 3 (continued)

Analyte	Frequency of detect	Minimum detect	Maximum detect	Location(s) of maximum detected result	Average detected result	Maximum RL	Frequency of detects exceeding maximum RL	Average RL	Frequency of detects exceeding average RL	PRG limit (10 ⁻⁵ or 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Dichlorodifluoromethane	0/1	ND	ND		ND	NA	NA	NA	NA	308,058	0/1	NA	NA
Ethylbenzene	2/39	11	20,000	Z2-EU36-208	10,006	NA	NA	NA	NA	393,000	0/39	NA	NA
Iodooctane	0/11	ND	ND		ND	NA	NA	NA	NA	NA	NA	NA	NA
M + P Xylene	2/12	211	65,000	Z2-EU36-208	32,501	NA	NA	NA	NA	420,000	0/12	NA	NA
Methylcyclohexane	1/38	111	111	S01	11	NA	NA	NA	NA	205,265	0/38	NA	NA
o-Chloroanisole	0/1	ND	ND		ND	NA	NA	NA	NA	160,010	0/1	NA	NA
Propylbenzene	2/11	25	6,500	Z2-EU36-208	3,263	NA	NA	NA	NA	240,000	0/11	NA	NA
Styrene	0/18	ND	ND		ND	NA	NA	NA	NA	1,700,000	0/18	NA	NA
Tetrachloroethene	3/18	0.763	0.893	S03	0.83	NA	NA	NA	NA	13,086	0/18	NA	NA
Toluene	4/19	0.323	4,400	Z2-EU36-208	1,100	NA	NA	NA	NA	520,000	0/19	NA	NA
Total Xylene	0/8	ND	ND		ND	NA	NA	NA	NA	420,000	0/8	NA	NA
trans-1,2-Dichloroethane	0/12	ND	ND		ND	NA	NA	NA	NA	234,823	0/12	NA	NA
trans-1,3-Dichloropropane	0/18	ND	ND		ND	NA	NA	NA	NA	17,643	0/18	NA	NA
Trichloroethane	0/18	ND	ND		ND	NA	NA	NA	NA	1,347	0/18	NA	NA
Trichloroethoxymethane	0/11	ND	ND		ND	NA	NA	NA	NA	1,276,034	0/11	NA	NA
Vinyl acetate	0/11	ND	ND		ND	NA	NA	NA	NA	1,396,422	0/11	NA	NA
Vinyl chloride	0/18	ND	ND		ND	NA	NA	NA	NA	7,461	0/18	NA	NA

*Sellers in summary include FTTP R01-05 FTTP RPL06 FTTP RPL07 S01 S02 S03 S04 S05 S06 S07 S08 S09 S10 S11 /2 PU16 201 /2 EU16 202 /2 EU36 203 /2 EU36 204 /2 FU36 204 /2 PU16 206 /2 FU36 206 /2 FU36 209 /2 EU46 210 /2 FU36 211 /2 FU36B 213 /2 FU36B 201 /2 EU46 212 /2 FU36B 304 /2 FU36B 305 /2 FU36B 306 /2 FU36B 307 /2 FU36B 308 /2 FU36B 310 /2 PU16M 200 and /2 PU16M 207

^aValues in these columns are for detailed results. And datasets are not included.

^aRecovery of the unknown drug series results are calculated relative to each sample based on detection of unknown 226, 240, 244 and unknown 232 as discussed in the Zone 2 ROD.

These parameters are also included in near-term risk calculations for the EU (2002) human health risk effects of three radionuclides (thorium 232, radium 226 and radon 222) decay series are consistent with the Pa/Pb decay series. Results discussed in the June 2002

FU – EXPENSES UNIT

¹ = bruise was positively identified and scored as a positive observation.

NA = not applicable

ND = not discussed

PCB = polychlorinated biphenyl

PRG - preliminary remediation goal

BSTB - radiation.com
