I-10018-0034

DOE/OR/01-2368&D1

Fiscal Year 2008 Phased Construction Completion Report for EU Z2-33 in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee

This document is approved for public release per review by:

8/15/08

BJC ETTP Classification & Information Office Date

BECHTEL JACOBS
Bechtel Jacobs Company LLC

DOE Contract No. DE-AC05-98OR22700
Job No. 23900
ETDD-08-0025
September 11, 2008

Mr. Stephen H. McCracken
Contracting Officer's Representative
for Bechtel Jacobs Company LLC
U.S. Department of Energy, EM-90
Post Office Box 2001
Oak Ridge, Tennessee 37831

Dear Mr. McCracken:

DE-AC05-98OR22700: H-4 Clause, Government Furnished Services and Items (GFS&I 8-E-002) Request for Post-Record of Decision (ROD) Comprehensive Environmental Response, Compensation, and Liability Act Document Approvals: Fiscal Year 2008 Phased Construction Completion Report for EU Z2-33 in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/01-2368&D1)

Enclosed are 13 copies and two compact disks of the referenced document for transmittal to EPA and TDEC (jointly the Regulators) for their approval. This Phased Construction Completion Report documents that Exposure Unit Z2-33, Balance of Site Laboratories Area is suitable for an unrestricted industrial land use to a depth of ten feet, as required by the Zone 2 ROD. If the Exposure Unit or buildings located on it are leased or transferred, then these agreements must include the land use controls and restrictions required by the Zone 2 ROD.

In accordance with the accelerated approval cycle protocol for post-ROD documents, approval is required within 29 days of DOE receipt of this transmittal, or by October 10, 2008.

Questions or comments should be addressed to Greg Eidam at (865) 576-3393.

Sincerely,

Stephen J. Buckley
Vice President and Deputy General Manager

SJB:SBG:sep

Enclosures: As stated

c/enc: W. J. Biloski
L. A. Birk
R. R. Butler
R. O. Collins, DOE-ORO
K. R. Doughty, DOE-ORO
S. B. Garland II
J. D. Kopotic, DOE-ORO
R. R. Lee
File—EMEFDMC–RC

c: S. J. Buckley
S. Cange, DOE-ORO
P. H. Divjak
G. R. Eidam
T. L. Salamacha
S. K. Shook

DOE/OR/01-2368&D1

Fiscal Year 2008 Phased Construction Completion Report for EU Z2-33 in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee

Date Issued—September 2008

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

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 1 and Class 2 SU Characterization Approach 9
2.2.3 Class 3 and Class 4 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 Z2-33 32

5. REMEDIATION ACTIVITIES 35

5.1 REMEDIAL ACTION OF BOS LABORATORIES SUBGRADE PITS 35
5.1.1 Facility Descriptions 35
5.1.2 Characterization 37
5.1.3 Facility RAs 37
5.1.4 End State 40
5.2 SURFACE SOILS REMEDIAL ACTION SOUTH OF BUILDING K-1004-J IN EU Z2-33 AND EU Z2-42 40
5.2.1 Facility Description and Characterization 40
5.2.2 Soil Remedial Action 40
5.2.3 End State 41

6. DEVIATIONS FROM GOVERNING DOCUMENTS 45

7. COSTS AND SCHEDULE FOR REMEDIAL ACTION(S) 47

8. WASTE MANAGEMENT ACTIVITIES FOR REMEDIAL ACTION(S) 49

9. OPERATIONS AND MAINTENANCE 51

10. MONITORING SCHEDULE AND/OR EXPECTATIONS 53

11. LAND USE CONTROLS 55

11.1 POSSIBLE LIFTING OF LAND USE CONTROLS 55
11.2 DEFINITIONS 55
11.3 INDUSTRIAL CONTROLS AT DEPTH 55
11.4 POTENTIAL UNRESTRICTED USE 56
11.5 REMAINING ACTIVITIES 56

12. REFERENCES 61

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. Location of EU Z2-33 at ETTP Zone 2 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. Locations of Acid Dilution Pits, K-1015-A Laundry Pit, and soil remedial actionss 36
7. K-1004-A, -B, and -C building slab and acid dilution pits prior to remedial action 38
8. K-1004-A, B, C building slab and acid dilution pits following remedial 38
9. K-1015 building slab and Laundry Pit prior to remedial action 39
10. K-1015 building slab and Laundry Pit following remedial action 39
11. Confirmation radiation survey for area south of the K-1015 Laundry Pit 42
12. Confirmation radiation survey for three locations south of Bldg. K-1004-J 43
13. ETTP Zone 2 RA characterization status as of this PCCR 59

TABLES

1. Zone 2 EU groups and acreages 5
2. FFA sites in EU Z2-33 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[a] 20
5. DVS decision rules for Zone 2 soils 24
6. DVS evaluation summary for EU Z2-33 29
7. Final status assessment summary for EU Z2-33 31
8. Summary of conclusions for EU Z2-33 Zone 2 ROD Appendix A FFA sites 32
9. FY 2007 FCNs and concurrences 45
10. Remedial action cost for EUs Z2-33 and Z2-42 47
11. Waste disposition for EUs Z2-33 and Z2-42 RA 49

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 and remedial actions (RAs) were completed for EU Z2-33. Remedial action was also performed at two additional areas in adjacent EU Z2-42 because of their close proximity and similar nature to a small surface soil RA in EU Z2-33.

Remedial actions for building slabs performed in EU Z2-33 during fiscal year (FY) 2007 were reported in the *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). Recommended RAs for EU Z2-42 were described in the *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). Remedial actions performed in the Balance of Site (BOS) Laboratory Area of EU Z2-33 and two small areas in EU Z2-42 are described in Sects. 5 through 10 of this Phased Construction Completion Report (PCCR). The purpose of this PCCR is to address the following:

- Document DVS characterization results for EU Z2-33,
- 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,
- Identify additional areas not defined in the Zone 2 ROD that require remediation based on the DVS evaluation results, and
- Describe RAs performed in the EU Z2-33 BOS Laboratory Area and two small areas in EU Z2-42.

Approximately 18 acres in EU Z2-33 are addressed in this PCCR. Based on the results of the DVS evaluation and RAs performed, all 18 acres are recommended for unrestricted industrial use to 10 ft bgs. Three Federal Facility Agreement sites are addressed and recommended for no further action within this acreage, including:

- K-1004-L Recirculating Cooling Water Lines Leak Sites,
- K-1044 Heavy Equipment Repair Shop, and
- K-1015-A Laundry Pit.

Remedial actions for EU Z2-33 were developed in response to DVS characterization results described in the EU Z2-33 Technical Memorandum (Appendix A) and to support reindustrialization of the East Tennessee Technology Park as a commercial industrial park. Remediation criteria were designed for the protection of a future industrial worker who normally would not have the potential for exposure to soil below 10 ft bgs. Accordingly, 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 Z2-33 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 Z2-33. A qualitative screening evaluation considered the likelihood of unrestricted land use being protective of future site occupants. Based on this qualitative assessment, all 18 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 and the RAs performed. Additional supporting detail (e.g., field work summaries, maps, survey results, and data summaries) is provided in the EU Z2-33 technical memorandum (Appendix A). The EU Z2-33 Technical Memorandum is prepared from the post-RA perspective, assuming that RA has already been performed. 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) 2008 results of Dynamic Verification Strategy (DVS) characterization activities and remedial actions (RAs) for exposure unit (EU) Z2-33 Balance of Site (BOS) laboratories area and for RA in adjacent EU Z2-42 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 *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 from a post-RA perspective:

- Document EU Z2-33 DVS characterization results;
- Describe and document the risk evaluation and determine if EU Z2-33 meets the Zone 2 ROD requirements for unrestricted industrial use to 10 ft bgs;
- Identify additional areas in EU Z2-33 not defined in the Zone 2 ROD that require remediation based on the DVS evaluation results; and
- Describe RAs performed in EU Z2-33 and two small areas in the adjacent EU Z2-42. Recommended RAs for EU Z2-42 were described in the *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 2006).

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 and RAs were completed in FY 2008 for EU Z2-33. Two small surface soil RAs were identified in adjacent EU Z2-42 (DOE 2006) that are across the street from and created by the same process as a similar soil area in EU Z2-33. Because of their close proximity and similar nature and extent, the two soil areas were incorporated into the EU Z2-33 RA.

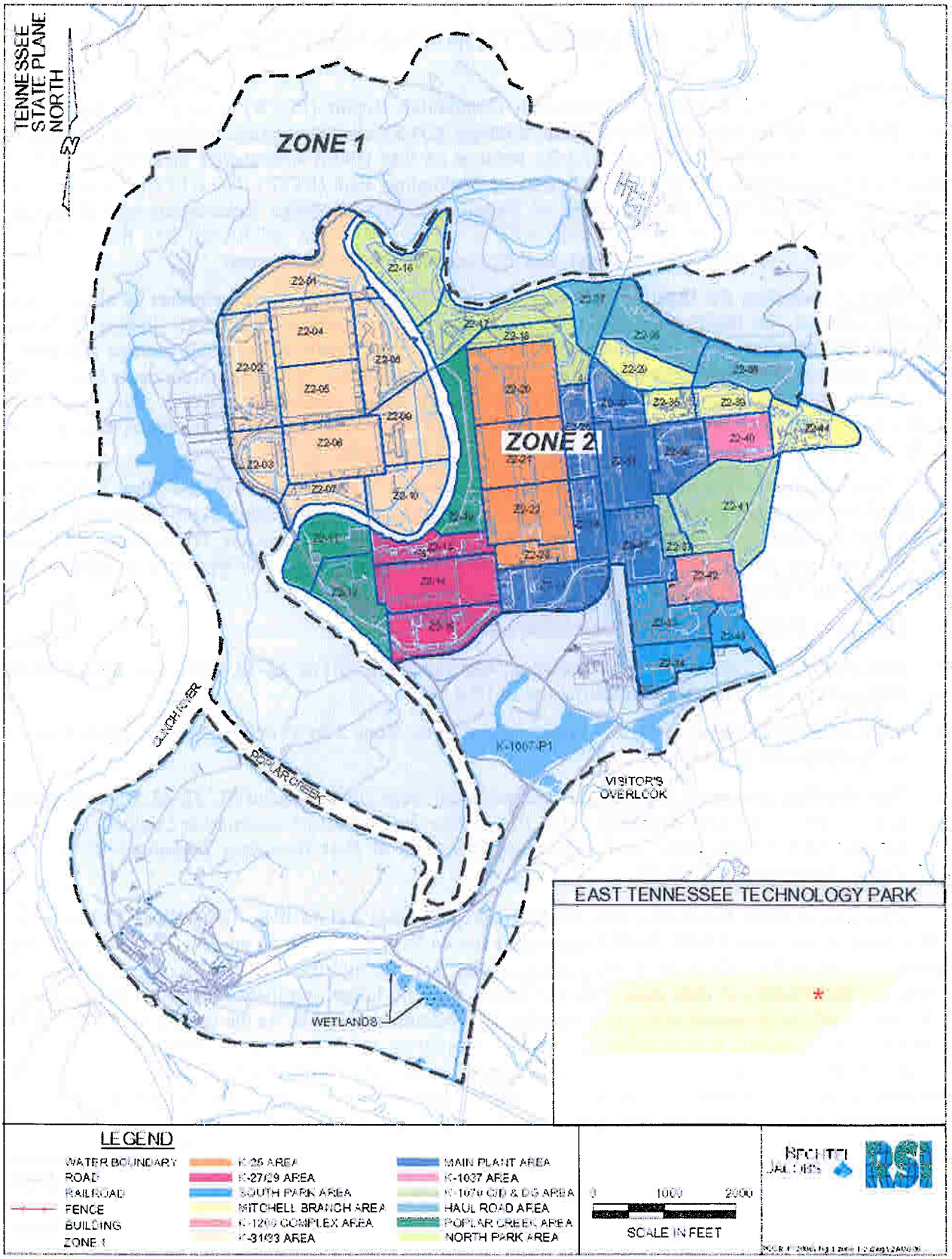

Fig. 1. ETTP site map with Zone 2 DQO scoping EU groups and EUs.

The main body of this report describes the DVS process, scope of work performed, and RAs completed. 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 building slabs performed in EU Z2-33 are reported 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). Remedial actions performed in the BOS Laboratory Area of EU Z2-33 and adjacent EU Z2-42 are described in Sects. 5 through 10. 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.

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 Z2-33 in the South Park 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 DVS characterization program and RAs. Therefore, EU groups were not completed in their entirety. Evaluation and discussion of the DVS program completed in EU Z2-33 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

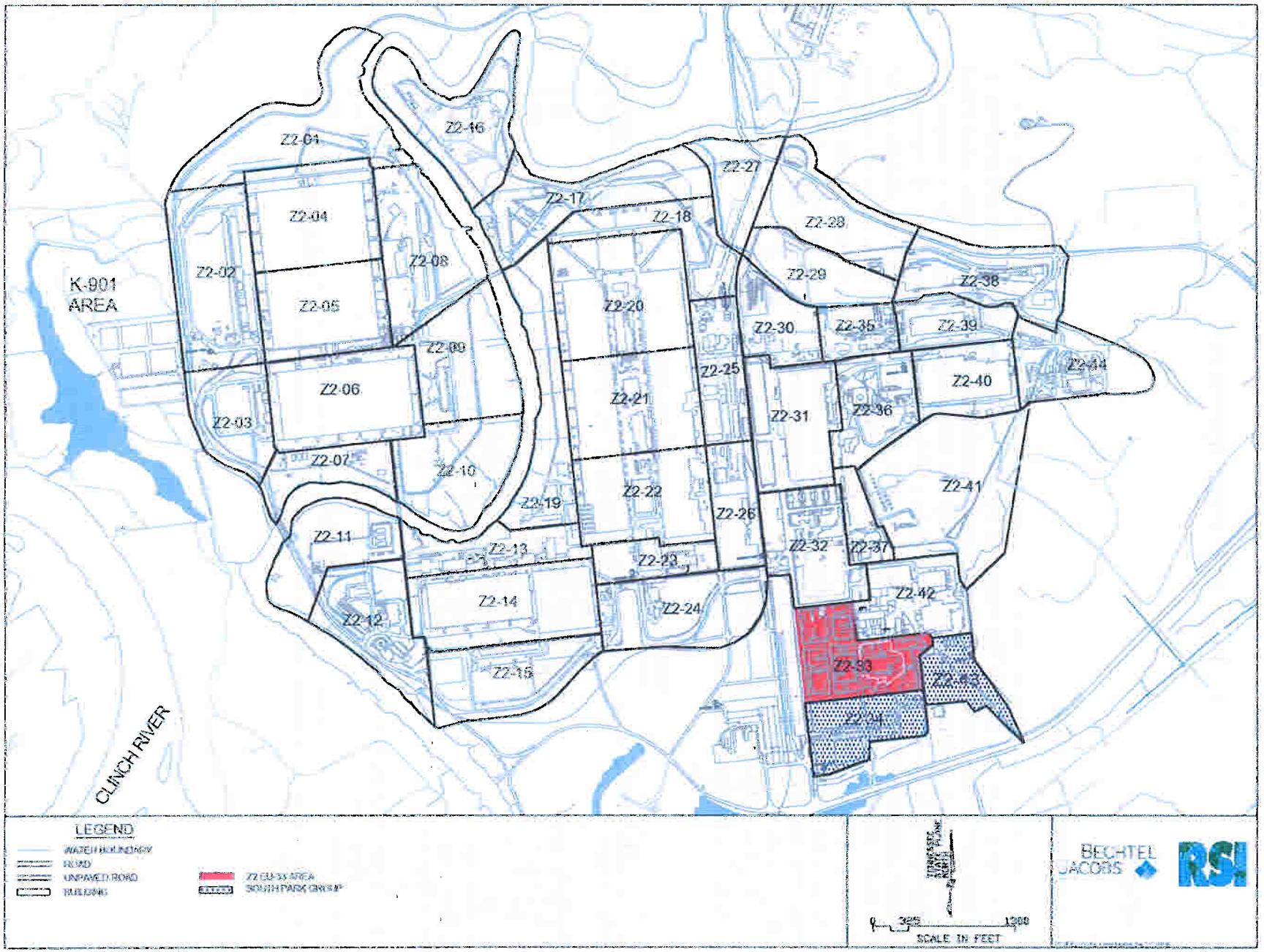

Fig. 2. Location of EU Z2-33 at ETTP Zone 2.

2.1.2 Excluded Acreage

Concrete slab removal at Bldgs. K-1004-A, K-1004-B, K-1004-C, K-1004-D, and K-1004-L (and a small soil RA adjacent to K-1004-L) presented in the FY 2007 Zone 2 PCCR (DOE 2007b) is excluded from this document.

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 Z2-33 included the following:

- 0.4 acres in Class 1 SUs,
- 3.9 acres in Class 2 SUs,
- 13.5 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 focused primarily on Class 1 and Class 2 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 three Federal Facility Agreement (FFA) sites (DOE 1992) in EU Z2-33 that are addressed 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 Z2-33

FFA site	EU	Final status assessed in this PCCR?	Explanation, if not assessed
K-1004-L RCW Lines Leak Sites	Z2-33	Yes	
K-1044 Heavy Equipment Repair Shop	Z2-33	Yes	
K-1015-A Laundry Pit	Z2-33	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 1 and Class 2 SU Characterization Approach

Implementation of the Class 1 and 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 1 and 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 1 and 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).

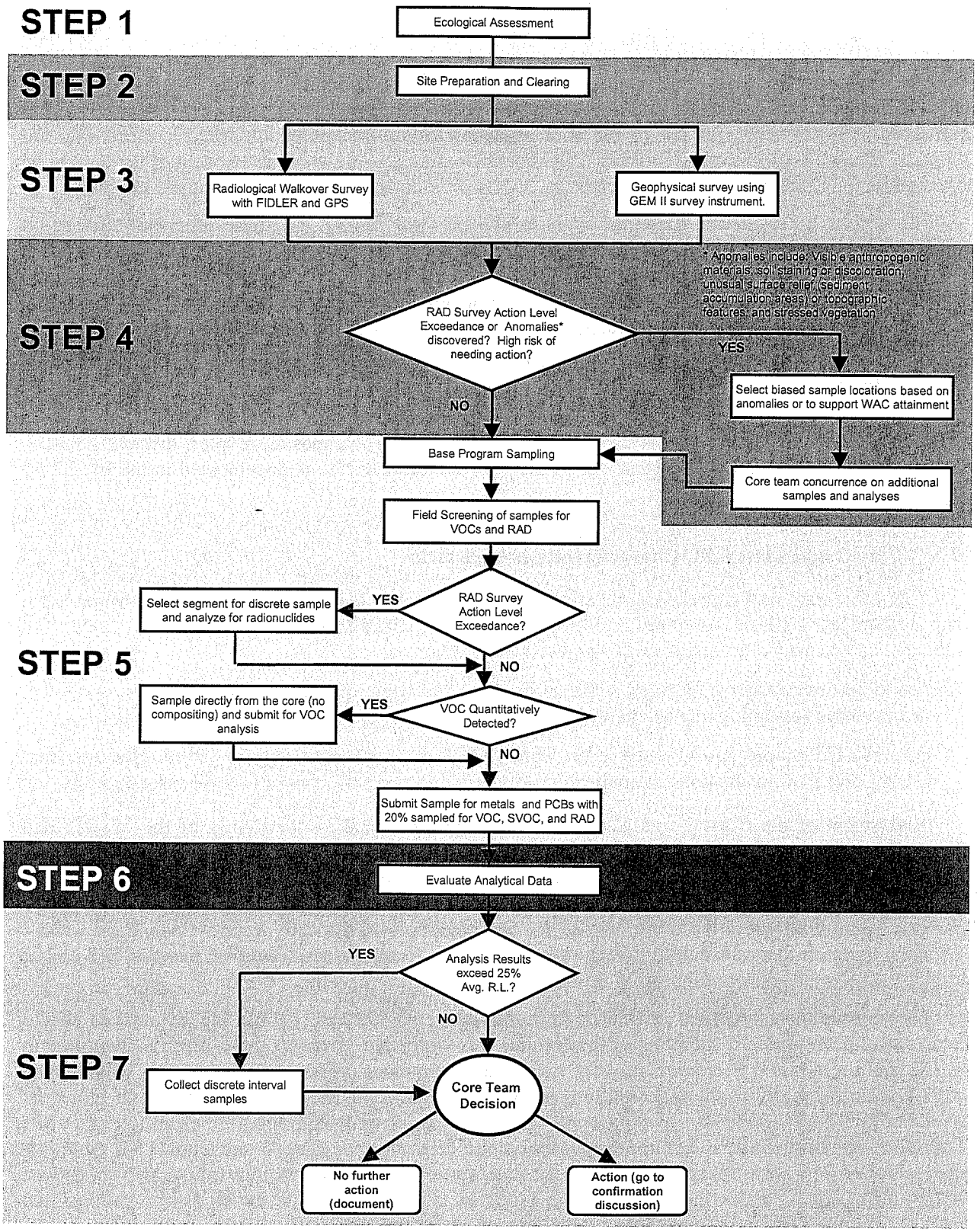

Fig. 3. Zone 2 DVS Class 1 and Class 2 SU sampling and analysis decision process flow.

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 Z2-33 TM (Appendix A).

2.2.3 Class 3 and Class 4 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 Z2-33. 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 1 and 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 and Class 4 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 and Class 4 SUs 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 and Class 4 SUs in Zone 2.

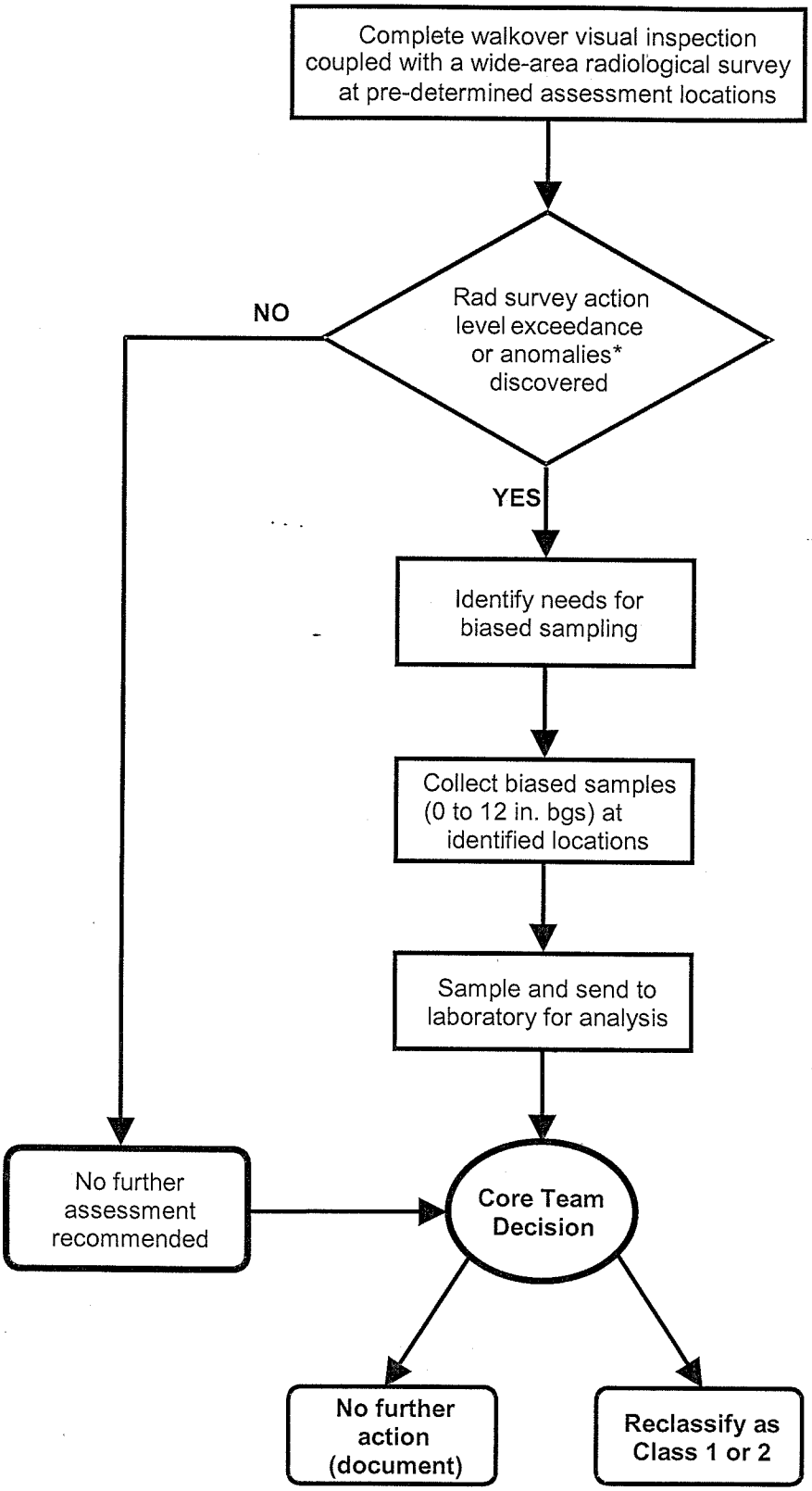

Fig. 4. Zone 2 DVS Class 3 and Class 4 SU sampling and analysis decision process flow.

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. Class 3 and Class 4 SU radiological surveys were 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. At a burial trench site (e.g., EU Z2-41), the waste matrix was commonly comprised of course materials, debris, rubble, and fill materials, which precluded the use of EnCore® samplers for VOC analysis. 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 Field Change Notice (FCN) 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-EU33M-206).

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 ETTP (DOE 1993a) was not representative of ETTP 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 Group TM, which were provided to the RA Core Team for early review but formally submitted for approval as appendices 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. 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})
Metals (mg/kg) (mg/L for groundwater)						
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[c]	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
Radionuclides (pCi/g) (ug/L for groundwater)						
Cesium-137[c]	20	2	1.1			0.06
Cobalt-60			0.6			0.04
Gross alpha activity						
Gross beta activity						
Neptunium-237[c]	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
Pesticides and PCBs (ug/kg)						
PCB-1016[c]	100,000	10,000	37,000			393
PCB-1221[c]	100,000	10,000	7,436			112
PCB-1232[c]	100,000	10,000	7,436			112
PCB-1242[c]	100,000	10,000	7,436			112
PCB-1248[c]	100,000	10,000	7,436			112
PCB-1254[c]	100,000	10,000	7,436			112
PCB-1260[c]	100,000	10,000	7,436			112
Polychlorinated biphenyl[c]	100,000	10,000	7,436			112

Table 4. (continued)

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10^{-5})	Background	Groundwater SL[b]	Residential PRG (10^{-6})
Semivolatile Organic Compounds (ug/kg) (ug/L for groundwater)						
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
Di-n-octylphthalate			25,000,000			244,000

Table 4. (continued)

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10^{-5})	Background	Groundwater SL[b]	Residential PRG (10^{-6})
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
Volatile Organic Compounds (ug/kg) (ug/L for groundwater)						
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
Tetrachloroethene			13,000		4,720	484
Toluene			520,000		502,000	65,600

Table 4. (continued)

Chemicals and radionuclides	Maximum RL	Average RL	Industrial PRG (10^{-5})	Background	Groundwater SL[b]	Residential PRG (10^{-6})
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[e]					100 mg/kg	
Gasoline Range Organics[e]					100 mg/kg	

[a]Chemicals 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).
[b]Referred to as soil exposure concentrations in the Zone 2 ROD.
[c]Zone 2 ROD contaminant of concern.
[d]Radium-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).
[e]Diesel-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
DVS = Dynamic Verification Strategy
ETTP = East Tennessee Technology Park
PRG = preliminary remediation goal
RAD = radiological
RL = remediation level
ROD = Record of Decision
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

[a]Soil 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 each EU 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.

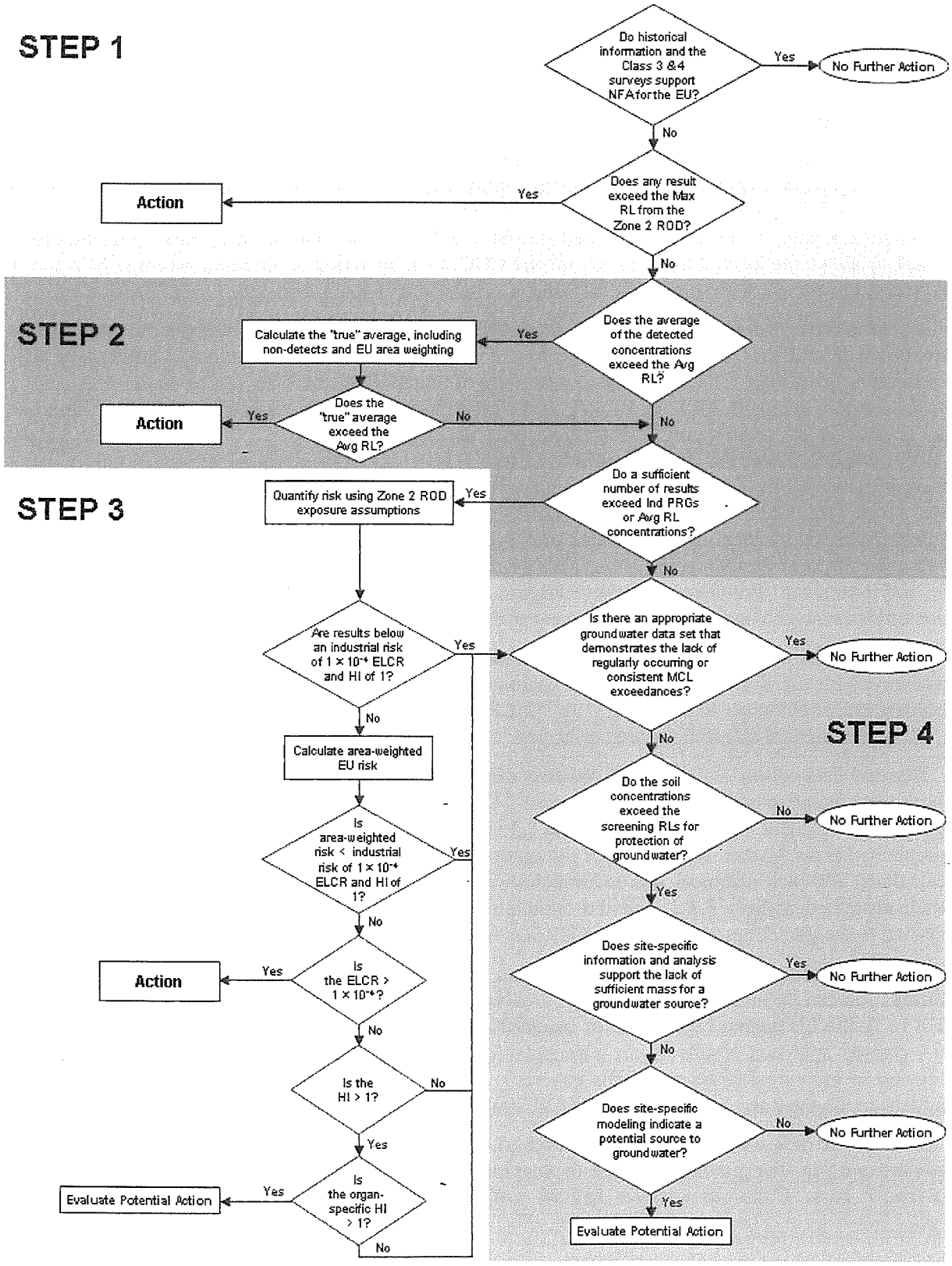

Fig. 5. Risk evaluation process.

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,

---

[a]Radium and thorium isotopes are excluded from the risk evaluation (see Sect. 3.3.2 for further discussion).

[b]Number 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.

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 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 Z2-33 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 Z2-33 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 Z2-33 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. The EU Z2-33 Technical Memorandum was prepared from the post-RA perspective.

Table 6. DVS evaluation summary for EU Z2-33

Bulk acreage summary	
Total acreage in Zone 2	819
Acreage included in this PCCR	18
Acreage for NFA – no RA	18
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	0.4
Class 2 SU acreage	3.9
Class 3 SU acreage	13.5
Class 4 SU acreage	0

Table 6. (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: 140	VOC: 70
	PCB: 140	Other: 0
	Radionuclide: 151	TCLP SVOC: 0
	SVOC: 103	TCLP Metals: 0
Radiological walkover survey acreage	Approximately 0.2 acres (new surveys)	
Geophysical survey acreage	0.0	
Linear feet of soil core obtained	Approximately 943 ft	
Class 3 and Class 4 SU walkover assessments	Assessment point locations: 15 Mid-point locations: 7 Discretionary point locations: 20 Total locations assessed: 42	
FFA Sites Addressed – NFA[a]		
K-1004-L Recirculating Cooling Water Lines Leak Sites		
K-1044 Heavy Equipment Repair Shop		
K-1015-A Laundry Pit		
FFA Sites – Additional Action		
None		

[a]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 Z2-33

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
18	South Park	K-1004-L Recirculating Cooling Water Lines Leak Sites	--	--	Passes risk screen	Max RL: NFA Avg RL: NFA Risk: NFA GW: NFA	NFA for soils
		K-1044 Heavy Equipment Repair Shop			Passes risk screen	Max RL: NFA Avg RL: NFA Risk: NFA GW: NFA	NFA for soils
		K-1015-A Laundry 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 Z2-33 Zone 2 ROD Appendix A FFA sites

Zone 2 ROD Appendix A FFA Site	Recommendation
K-1004-L Recirculating Cooling Water Lines Leak Sites	NFA
K-1044 Heavy Equipment Repair Shop	NFA
K-1015-A Laundry Pit	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 Z2-33. 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 Z2-33

EU Z2-33 is located along the south boundary of Zone 2 in the South Park EU Group (Fig. 1), and is bounded on the north by EU Z2-32 and EU Z2-42, on the east by EU Z2-43 and Zone 1, on the south by EU Z2-34, and on the west by Zone 1. 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. EU Z2-33 is the heart of what is commonly referred to as the administrative section of ETTP, which generally housed offices and laboratories.

Exposure unit Z2-33 has three FFA sites that are listed in Appendix A of the Zone 2 ROD (Fig. 2):

- K-1004-L Recirculating Cooling Water (RCW) Lines Leak Sites,
- K-1015-A Laundry Pit, and
- K-1044 Heavy Equipment Repair Shop.

Two conceptual models apply to EU Z2-33. The conceptual model for the Class 1 SUs is a surface release model of radiological contamination. The model defines limited mobility through the soil column and identifies the most probable mode of secondary transport as suspended solids in surface water. The conceptual model for the acid dilution pits is a point source release to underlying soils and potentially to local groundwater.

EU Z2-33 contains Class 1, Class 2, and Class 3 SUs. The Class 1 SUs include the K-1004-J Lab South Class 1 SU, which is an area of approximately 0.4 acres located along the northern boundary of EU Z2-33 with Cs-137 maximum RL exceedances in historical samples. The other is the K-1015 Class 1 SU, which is a small area of soil south of the K-1015 Laundry Pit with historic Cs-137, U-234, U-235, and U-238 average RL exceedances and U-235 maximum RL exceedances. Radiological walkover surveys and sampling were performed in these SUs.

The Class 2 SUs include the K-1004 Area Drain Line Class 2 SU with a high degree of uncertainty regarding the impact of the K-1004 Area Drain Line to EU soils and two small areas centered around historical sample locations KAH-SS-B22 and KAH-SS-S31. Radiological walkover surveys and sampling were performed in these SUs.

The remainder of EU Z2-33 is a Class 3 SU where walkover assessments and biased sampling was performed.

The following is a summary of the data evaluation for EU Z2-33.

EU #	Max RL exceeded?	Average RL over EU exceeded?	Industrial risk above 1×10^{-4}?	Potential source to groundwater?	Action required?
Z2-33	No	No	No	No	No

- The only Max RL exceedance was from a Ra/Th decay series exceedance in two samples of sediment collected from the K-1006 north sump, which is an active facility. The RA Core Team agreed the K-1006 north sump would not be addressed at this time.
- No average COC concentration across EU Z2-33 exceeded its Avg RL.
- The industrial risk for EU Z2-33 was calculated to be $< 1 \times 10^{-4}$ ELCR, with a target organ HI of 1.
- The soils do not pose a threat to groundwater.
- No further action is necessary to meet industrial land use.
- There was a low probability that EU Z2-33 acreage could be released with no land use restrictions. Avg RL exceedances for radionuclides and PCBs, and Ind and Res PRG exceedances for metals, radionuclides, PCBs, SVOCs, and VOCs occurred in this EU.

5. REMEDIATION ACTIVITIES

Remedial actions presented in this PCCR for EU Z2-33 and EU Z2-42 include the following:

- BOS laboratories below grade pits, and
- Surface soils south of Bldg. K-1004-J in EU Z2-33 and EU Z2-42. Recommended RAs for EU Z2-42 were described in the *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 2006). The RA in EU Z2-42 is described in the 2006 Zone 2 PCCR.

The following sections present the characterization findings that led to the RAs and a description of the RAs. The locations of the below grade pits and soil RAs are shown in Fig. 6. With the exception of the K-1015 Laundry Pit, the pits had no unique identifiers and were assigned numbers based on DVS walkover assessment discretionary point sample location ID number (e.g., pit 318 is named for sample location ID EU33D-318).

The final report for the RAs listed above is described in this section and Sects. 6, 7, and 8.

5.1 REMEDIAL ACTION OF BOS LABORATORIES SUBGRADE PITS

The BOS laboratories below grade pits RAs included:

- Excavating and removing six acid dilution pits (318, 329, 330, 331, 332 and 335);
- Closing pit 304 in place;
- Excavating and removing the K-1015 Laundry Pit;
- Excavating the inlet pipes to pits 330 and 332; and
- Excavating two small areas of soil adjacent to pit 329 and the K-1015 Laundry Pit.

5.1.1 Facility Descriptions

The acid dilution pits and K-1015-A Laundry Pit FFA site were subsurface structures contained in the EU Z2-33 BOS Labs Area. The pits were reinforced concrete shells with acid-brick linings that had tops located near ground surface and depths extending to ~8 ft. The acid dilution pits received laboratory liquid wastes that were neutralized in the pits and discharged to the storm sewer system. The K-1015-A Laundry Pit FFA site was located south of the K-1015 Laundry. Wash water from the laundry flowed to the pit to allow particulates (mostly fibrous) to settle prior to discharge to the sanitary sewer system in an adjacent manhole.

Use of the acid dilution pits and laundry pit was discontinued in 1985 and 1996, respectively. These pits were identified for RA because of maximum RL and groundwater exceedances for radionuclides, metals, VOCs, and PCBs of their solids contents from DVS characterization activities described in the EU Z2-33 Technical Memorandum (see Appendix A). Example contaminants and their concentrations included PCB-1260 (1,000,000 ug/kg), Cs-137 (215 pCi/g), mercury (3120 mg/kg), benzene (640,000 ug/kg), carbon tetrachloride (11,000,000 ug/kg), and TCE (1,400,000,000 ug/kg).

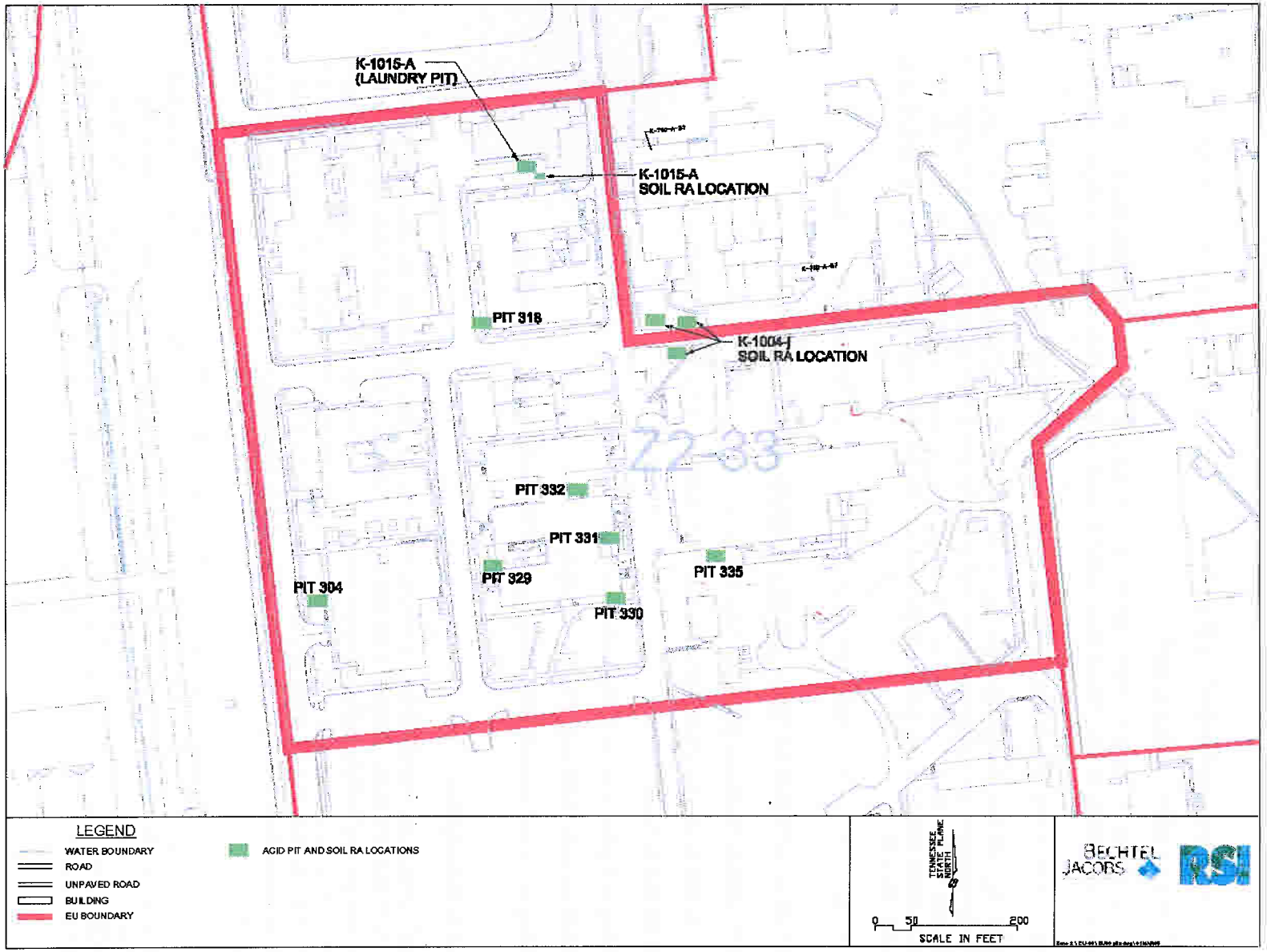

Fig. 6. Locations of Acid Dilution Pits, K-1015-A Laundry Pit, and soil remedial actions.

5.1.2 Characterization

Pit liquid and solid contents were sampled to establish facility safety basis and waste disposition pathways prior to RA. DVS characterization biased sampling of the soil immediately adjacent to and downgradient of each pit was sampled from the depth of each pit bottom to bedrock to assess any potential pit leakage. Sample results indicated groundwater SL exceedances for VOCs (TCE at 50,000 ug/kg, chloroform at 31,000 ug/kg, and PERC at 300,000 ug/kg) in soil adjacent to pit 329, which suggested it had leaked in the past. Step-out sampling was performed 12.5 ft downgradient of the pit to define the areal and vertical extent of contamination. These sampling results indicated lateral migration had not occurred and the contaminated soil was limited to the area immediately downgradient and adjacent to the pit.

Two historic sample locations adjacent to the K-1015-A Laundry Pit (KAH-SS-B12 and KAH-SS-B13) with U-235 maximum RL exceedances in shallow soil (94.5 pCi/g and 149 pCi/g, respectively) were identified during DVS characterization. After conducting a biased area remediation (BAR) survey, it was determined that a small area (~200 ft^2) exceeded the 2688 cpm action level. Sampling outside of the BAR survey area confirmed the boundary definition.

Inlet and outlet pipes were exposed near each pit, severed, and their contents sampled. After sampling, the pipe ends were plugged with mortar. Analytical results from the inlet pipes to pits 330 and 332 found PCB (5.2 ug/kg at location Z2-EU33B-243, 10.0 ug/kg at location EU33B-310) and radionuclide (3.3 pCi/g Cs-137 at location Z2-EU33B-241, 11.9 pCi/g Thorium-232 at location EU33B-243) maximum RL exceedances.

5.1.3 Facility RAs

Two inlet pipes to pits 330 and 332 were removed in their entirety from the pit to where they exited Bldgs. K-1004-A and K-1004-B, respectively. Adjacent and underlying soil was removed, and composite confirmation samples obtained from the remaining soil indicated an absence of residual soil contamination requiring additional removal. The excavations were backfilled with clean native soil and seeded with domestic grass as an erosion control measure until native grass seeding occurs.

After the inlet and outlet pipes were severed and plugged, pit RA was accomplished by removing or solidifying the contents in place, excavating around each pit, and intact pit removal. Removed pits were placed on plastic sheeting laid on the ground, crushed, and the debris was placed in waste containers. Pit 335 and the K-1015-A Laundry Pit broke apart during removal and were removed in large pieces. Consistent with FCN-ETTP-Zone 2-053, confirmation samples were not obtained from the excavations where DVS characterization data indicated an absence of contamination and from pits that were removed intact. However, four-point confirmation samples were obtained from pit 335 and the K-1015-A Laundry Pit excavations, and those sample results exhibited no elevated contaminant levels. Clean native soil was used to fill the excavations, which were seeded with domestic grass as an erosion control measure until native grass seeding occurs.

A view of the K-1004-A, -B, and -C building slab and acid dilution pit locations prior to their removal is shown in Fig. 7. A view of the area after completion of RA and prior to seeding is shown in Fig. 8. The K-1015 building slab and Laundry Pit are shown prior to RA in Fig. 9 and after slab and laundry pit RA in Fig. 10. Remedial action of the building slab is described in the FY 2007 PCCR for Zone 2 (DOE 2007b).

Fig. 7. K-1004-A, -B, and -C building slab and acid dilution pits 330, 331, and 332 prior to remedial action.

Fig. 8. K-1004-A, B, C building slab and acid dilution pits 330, 331, and 332 following remedial action.

Fig. 9. K-1015 building slab and Laundry Pit prior to remedial action.

Fig. 10. K-1015 building slab and Laundry Pit following remedial action.

The 304 acid dilution pit interior had been coated with a coal-tar derivative epoxy product called Tarset, which is typically used to line storage tanks containing highly corrosive material to prevent compromising the storage tank integrity. It was agreed by the RA Core Team (FCN-ETTP-Zone 2-064) that if visual inspection demonstrated Tarset material integrity after the contents were removed and the pit rinsed, the pit could be closed in place and filled with clean native soil or grout. These actions were performed and the pit was grouted to the surface.

Soil RAs occurred adjacent to pit 329 and adjacent to the K-1015-A Laundry Pit simultaneously with pit removal. The 329 pit location was excavated approximately 10 ft downgradient and to a depth of approximately 10.5 ft. Confirmation sampling at the base of the excavation revealed an exceedance of the groundwater SL for carbon tetrachloride (5700 ug/kg). Because of this exceedance, the excavation was extended to a depth of approximately 12 ft, where carbon tetrachloride was not detected.

The roughly 200 ft^2 area south of the K-1015 Laundry Pit was excavated to a nominal depth of 1 ft. Results from the confirmation radiation survey (Fig. 11) indicated all the soil requiring RA had been removed.

5.1.4 End State

Native grasses, which require no maintenance, were planted in the BOS Labs area prior to the RAs. These grasses failed to grow because of the very dry 2007 spring and summer. A decision on when to replant has not been made, but domestic grass that will require mowing has been planted as an erosion control measure.

5.2 SURFACE SOILS REMEDIAL ACTION SOUTH OF BUILDING K-1004-J IN EU Z2-33 AND EU Z2-42

5.2.1 Facility Description and Characterization

Three small grassy areas encompassing roughly 3500 ft^2 were identified during DVS characterization. During RA characterization of EU Z2-33, Cs-137 maximum RL exceedances were identified in the shallow soil of a grassy area south of Bldg. K-1004-J (215 pCi/g at location Z2-EU33B-313, 65.9 pCi/g at location Z2-EU33B-241, and 24.6 pCi/g at location Z2-EU33B-106). The Cs-137 maximum RL value was also exceeded in four samples in EU Z2-42 (327 pCi/g at location Z2-EU42B-113, 58.1 pCi/g at location Z2-EU42B-114, 21.2 pCi/g at location Z2-EU33B-315, and 44.5 pCi/g at location Z2-EU42B-102), and BAR surveys were performed to describe the RA areas. The Cs-137 maximum RL exceedances and BAR survey in EU Z2-33 are described in Appendix A. The surface soil RA for EU Z2-42 was prescribed by the Cs-137 maximum RL exceedance and BAR survey described in *Fiscal Year 2006 Phased Construction completion Report for the Zone 2 Soils, Slabs, and Subsurface Structures* (DOE 2006, Appendix F). The source of contamination was deemed to be the K 1004-J Underground Tank (R074) FFA site, which is an underground low-level waste storage tank for contaminated liquids that was decontaminated and filled with sand under previous actions.

5.2.2 Soil Remedial Action

The upper nominal 1 ft of soil was removed from the three locations south of Bldg. K-1004-J between November 2-12, 2007. Consistent with the FY 2006 PCCR, Appendix F (DOE 2006) and FCN-ETTP-Zone 2-053, confirmation was performed using a radiation survey and composite sample from the three excavated areas. Results from the radiation survey and analytical results indicated all the soil requiring RA had been removed (see Fig. 12).

5.2.3 End State

Domestic grass that will require mowing was planted at the three surface soil RA areas south of Bldg. K-1004-J.

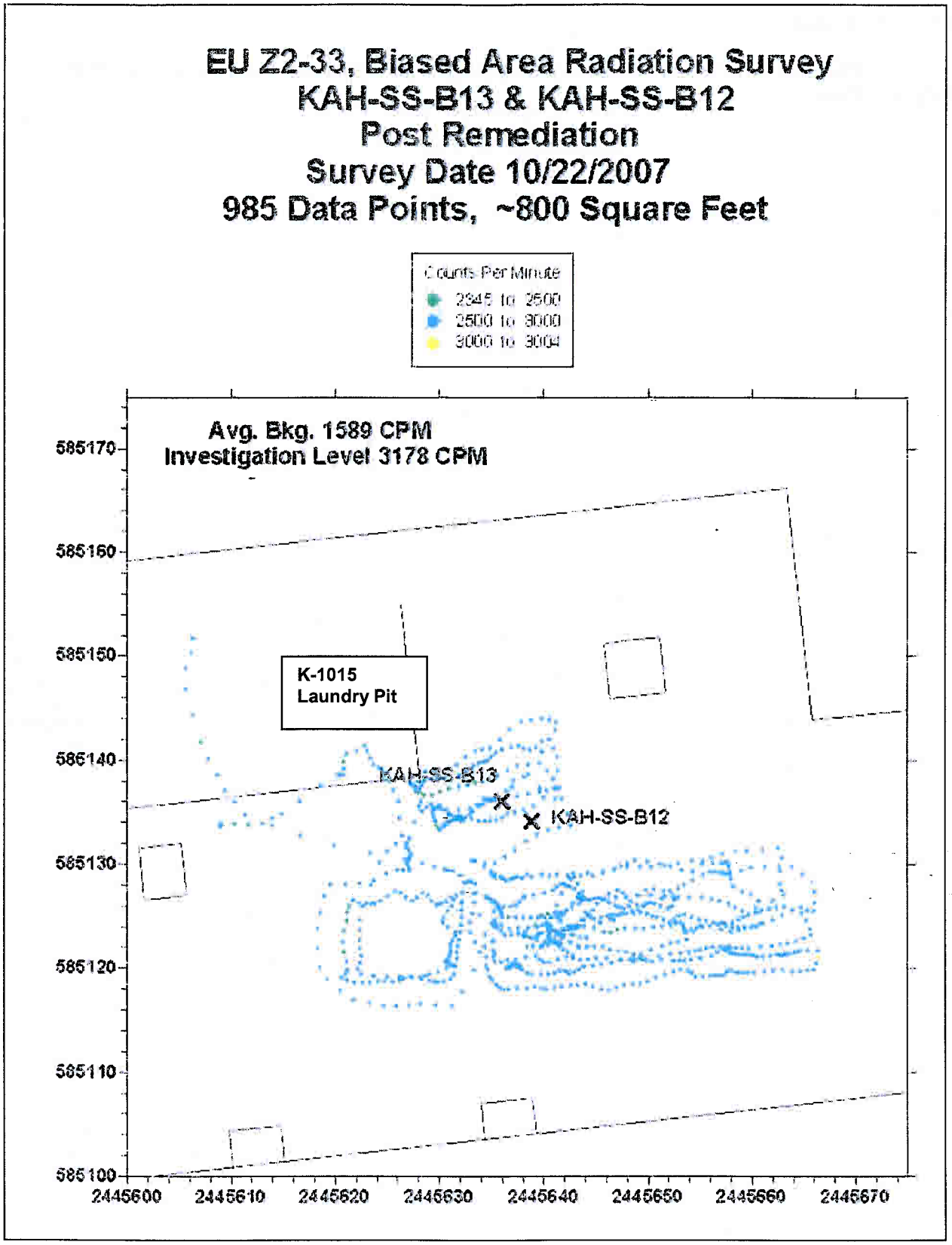

Fig. 11. Confirmation radiation survey for area south of the K-1015 Laundry Pit.

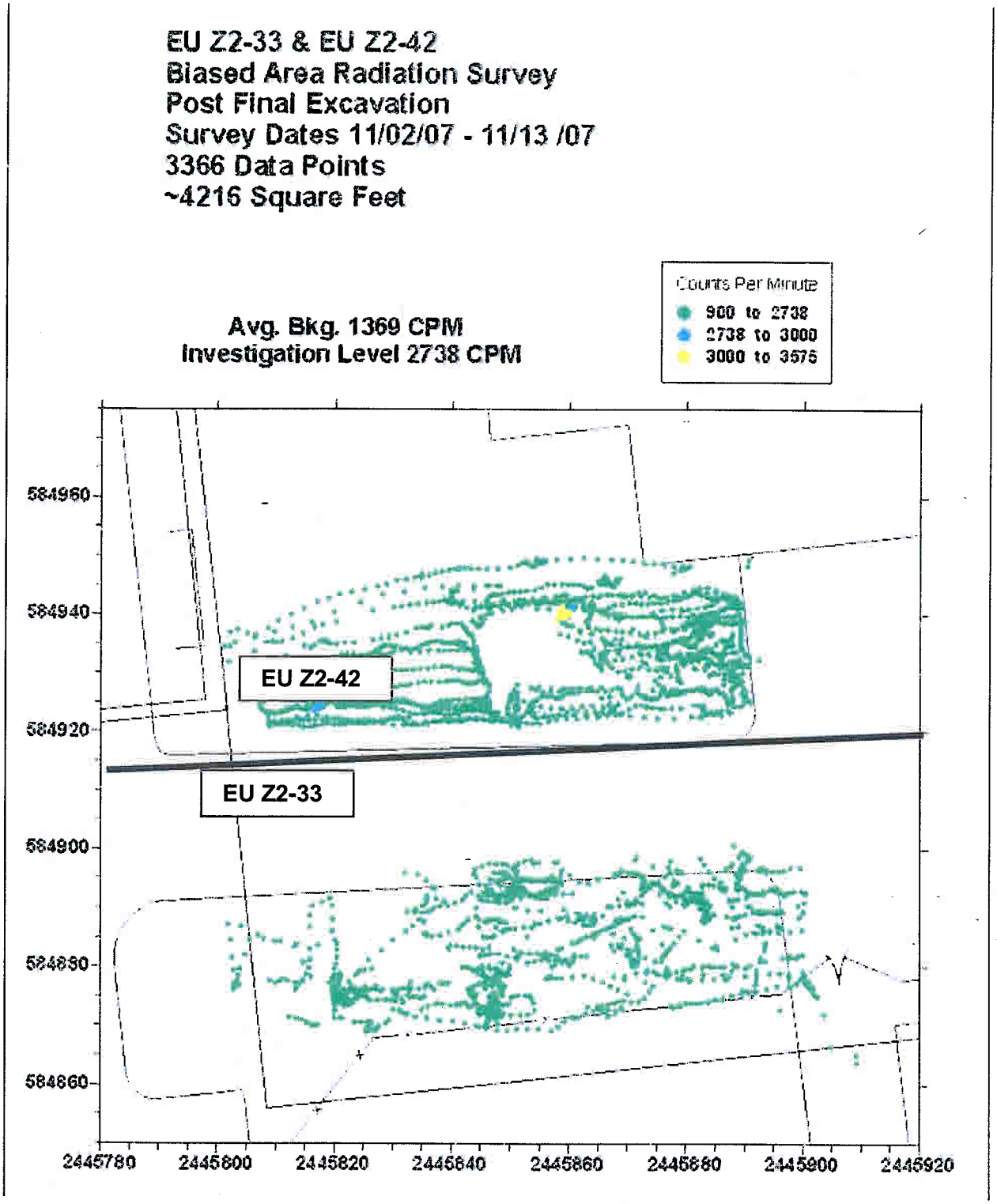

Fig. 12. Confirmation radiation survey for three locations south of Bldg. K-1004-J.

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 Z2-33, however, the 18 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. FY 2007 FCNs and concurrences

FCN number	Title or description	Date submitted	Date approved
FCN-ETTP-Zone 2-017	South Park Area EU Group DQO Scoping Package Class 3 Sample Additions (Z2-EU33, EU34, EU43)	8/31/2006	9/13/06
FCN-ETTP-Zone 2-019	South Park Area EU Group DQO Scoping Package Sample Classification Changes (Z2-EU33)	11/3/2006	11/13/2006
FCN-ETTP-Zone 2-020	South Park Area EU Group DQO Scoping Package RAB Definition in area South of K-1004-J (Z2-EU33)	11/3/2006	11/8/2006
FCN-ETTP-Zone 2-021	South Park Area EU Group DQO Scoping Package Acid Dilution Pit Sample Additions (Z2-EU33)	12/5/2006	1/5/2007
FCN-ETTP-Zone 2-029	South Park Area EU Group DQO Scoping Package limited soil remediation at K-1004-L (Z2-EU33)	1/5/2007	1/5/2007
FCN-ETTP-Zone 2-039	South Park Area EU Group DQO Scoping Package for biased sampling adjacent to K-1225 (Z2-EU33)	4/4/2007	4/23/2007
FCN-ETTP-Zone 2-045	South Park Area EU Group DQO Scoping Package for step out sampling downgradient of the K-1004 dilution pits (Z2-EU33)	5/15/2007	5/24/2007
FCN-ETTP-Zone 2-046	South Park Area EU Group DQO Scoping Package for sampling the K-1006 dilution pit (Z2-EU33)	5/18/2007	5/22/2007
FCN-ETTP-Zone 2-063	South Park Area EU Group DQO Scoping Package for adding BOS Labs dilution pit waste to the Zone 2 WHP (Z2-EU33)	8/16/2007	9/5/2007
FCN-ETTP-Zone 2-053	South Park Area EU Group DQO Scoping Package for EU 33 dilution pits RA	6/21/2007	7/3/2007

Table 9. (continued)

FCN number	Title or description	Date submitted	Date approved
FCN-ETTP-Zone 2-053 Amendment	South Park Area EU Group DQO Scoping Package Amendment for pits 313 and 314 inlet pipe RA, omitting pit confirmation sampling, and closing 373 pit in place	10/5/2007	10/30/2007
FCN-ETTP-Zone 2-054	South Park Area EU Group DQO Scoping Package for biased sampling in Manhole (MH) 057 (Z2-EU33)	7/2/2007 revision 7/23/2007	8/21/2007
FCN-ETTP-Zone 2-063	South Park Area EU Group DQO Scoping Package for adding BOS Labs dilution pit waste to the Zone 2 WHP (Z2-EU33)	8/16/2007	9/5/2007
FCN-ETTP-Zone 2-064	South Park Area EU Group DQO Scoping Package for closing BOS Labs dilution pit at K-1006 in place (Z2-EU33)	8/23/2007	9/5/2007

BOS = Balance of Site
DQO = data quality objective
ETTP = East Tennessee Technology Park
EMWMF = Environmental Management Waste Management Facility
EU = exposure unit
FCN = Field Change Notice
FY = fiscal year
HVSS = Happy Valley Service Station
ORR = Oak Ridge Reservation
RA = remedial action
RAB = radiation area boundary
RCW = recirculating water
UST = underground storage tank
WAC = waste acceptance criteria
WHP = Waste Handling Plan

7. COSTS AND SCHEDULE FOR REMEDIAL ACTION(S)

Remedial action of the BOS labs dilution pits began on August 7, 2007, and was completed in August 2008 when the last of the waste was shipped off site. Remedial action of the soils south of K-1004-J was performed from November 1-13, 2007.

The costs for performing RAs in EUs Z2-33 and Z2-42 are presented in Table 10.

Table 10. Remedial action cost for EUs Z2-33 and Z2-42

Activity	Cost ($ 1000)
All RAs	$880
Waste management	$2498
Total	**$3378**

EU = exposure unit
RA = remedial action

8. WASTE MANAGEMENT ACTIVITIES FOR REMEDIAL ACTION(S)

A summary of waste disposition for the RAs performed in EUs Z2-33 and EU Z2-42 is shown in Table 11. The waste disposal at EMWMF was included in Waste Lot 155.5, Soils from BOS Laboratories, which was shipped in September 2008.

Table 11. Waste disposition for EUs Z2-33 and Z2-42 RA

RA	Waste stream	Disposal facility	Volume
BOS laboratories below-grade pits	Solids	Energy Solutions	51 yd^3
	Liquids	Energy Solutions	2424 gal
Surface soils south of Bldg. K-1004-J in EUs Z2-33 and Z2-42	Soil	EMWMF	106 yd^3
. . .		**Total volume**	**157 yd^3**

BOS = Balance of Site
EMWMF = Environmental Management Waste Management Facility
EU = exposure unit
RA = remedial action

9. OPERATIONS AND MAINTENANCE

Aside from mowing, no operations and maintenance is required for the RAs performed.

10. MONITORING SCHEDULE AND/OR EXPECTATIONS

There are no monitoring requirements for the RAs performed in EUs Z2-33 and Z2-42.

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 Z2-33 is presented in Sect. 11.4.

Dynamic Verification Strategy characterization of EU Z2-33 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 Z2-33 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 Z2-33 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 Z2-33 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 Z2-33 at a

depth of +/- 25 ft below ground surface. Therefore, it is proposed to retain land use restrictions below 10 ft for EU Z2-33.

11.4 POTENTIAL UNRESTRICTED USE

To conduct the evaluation and determine the probability of lifting land use controls, EU Z2-33 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 Z2-33. Several 1×10^{-6} residential PRGs were exceeded in this EU by metals, PCBs, and radionuclides.

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 12. 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 12. (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	Buildings K-1225 and K-1006 are leased facilities
Z2-34	✓	✓	✓		FY 2007 PCCR	
Z2-35					PCCR or Zone 2 RAR	
Z2-36					PCCR or Zone 2 RAR	
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	

[a]The 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

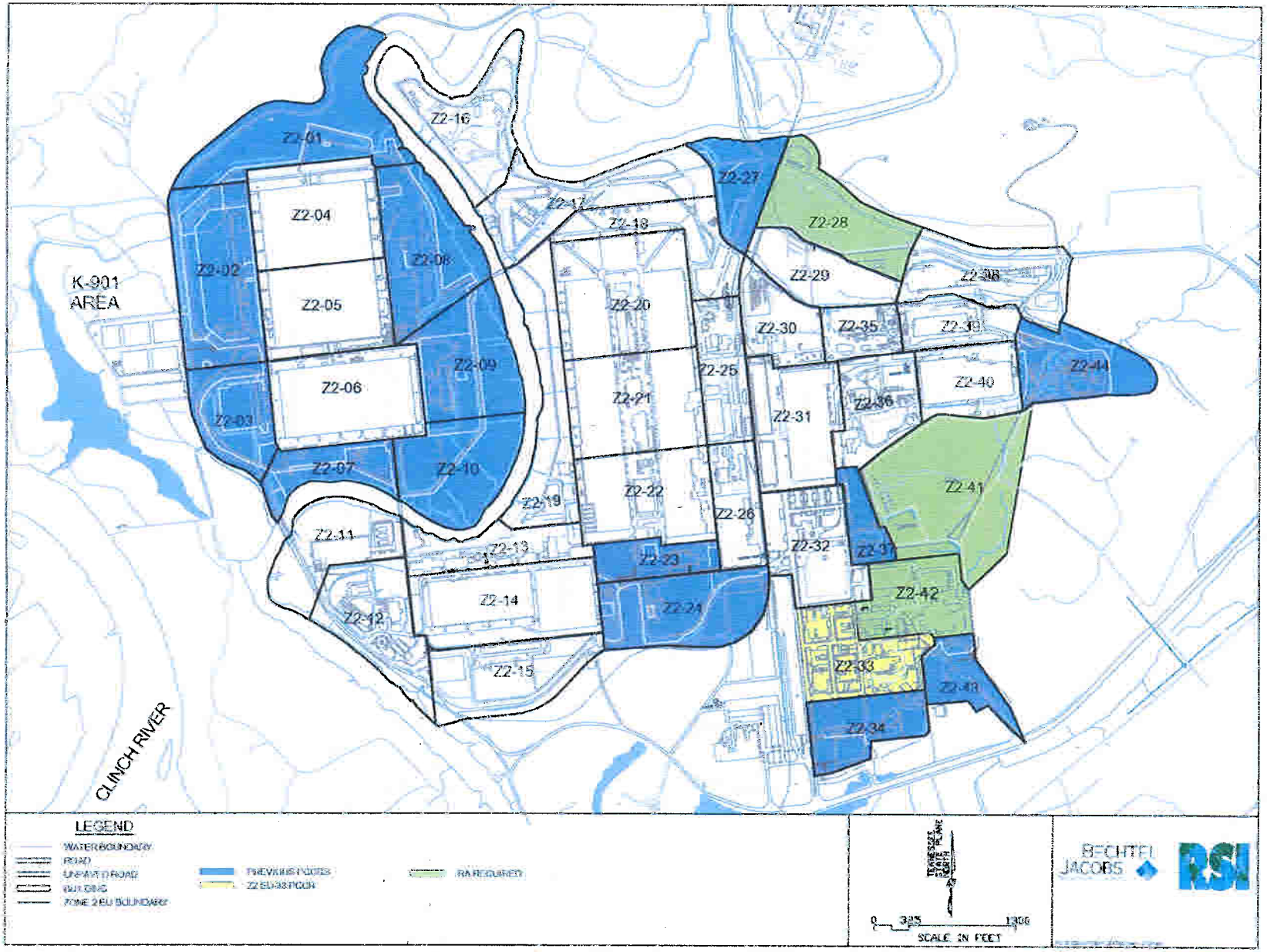

Fig. 13. ETTP Zone 2 RA characterization status as of this PCCR.

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.
EXPOSURE UNIT Z2-33 SOUTH PARK AREA
TECHNICAL MEMORANDUM

TABLES

A.1. EU Z2-33 facility and FFA site list A-81
A.2. EU Z2-33 sample summary A-83
A.3. EU Z2-33 sample locations removed during remedial actions and D&D A-93
A.4. EU Z2-33 data summary for soil samples collected from 0 to 10 ft below ground surface A-95
A.5. EU Z2-33 concrete data summary A-101
A.6. EU Z2-33 data summary for soil samples collected from ≥ 10 ft below ground surface A-105

FIGURES

A.1. EU Z2-33 location map A-64
A.2. EU Z2-33 boundary location map A-65
A.3. EU Z2-33 BAR survey locations A-66
A.4. EU Z2-42 initial BAR survey results A-67
A.5. EU Z2-42 post-RA BAR survey results A-68
A.6. K-1004-J Lab South Class 1 SU pre-RA BAR survey results A-69
A.7. K-1004-J Lab South Class 1 SU post-RA BAR survey results A-70
A.8. K-1015 pre-RA BAR survey results A-71
A.9. K-1015 post-RA BAR survey results A-72
A.10. K-1004-L gravel wash area post-RA BAR survey results A-73
A.11. BAR survey for KAH-SS-B22 ..... A-74
A.12. BAR survey for KAH-SS-S31 ..... A-75
A.13. EU Z2-33 assessment locations A-76
A.14. All EU Z2-33 DVS and historical sample locations from all depths A-77
A.15. EU Z2-33 DVS and historical sample locations representative of current conditions A-78
A.16. EU Z2-33 sample locations removed during a remedial action or D&D A-79
A.17. EU Z2-33 acid pit locations A-80

DYNAMIC VERIFICATION STRATEGY (DVS) TECHNICAL MEMORANDUM

EXPOSURE UNIT (EU) GROUP: Zone 2 South Park Group EU 33

INTRODUCTION

The purpose of this Technical Memorandum (TM) is to document the recommendation for an action/no further action (NFA) decision for Zone 2 EU 33 (EU Z2-33) in the South Park EU Group. The recommendation for this EU is based on existing historical data and DVS soil characterization activities. These data are used to determine the nature and extent of contamination in the EU and to evaluate the need for an action. When it is determined an action is necessary, the data also are 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 Z2-33 is located along the south boundary of Zone 2 in the South Park EU Group (Fig. A.1). It is bounded on the north by EU Z2-32 and EU Z2-42, on the east by EU Z2-43 and Zone 1, on the south by EU Z2-34, and on the west by Zone 1.

1.2 EU Z2-33 ACREAGE

EU Z2-33 has an area of approximately 18 acres (Fig. A.2).

1.3 SUMMARY DESCRIPTION

Site operations impacted all of the land area in EU Z2-33. Impacts to the EU included construction of buildings, roads, parking lots, and sidewalks. EU Z2-33 was the heart of what is commonly referred to as the administrative section of ETTP, which generally housed office and laboratory buildings.

1.4 SOIL UNITS (SUs)

Class 1 SU: 0.4 acres

Class 2 SU: 3.9 acres

Class 3 SU: 13.5 acres

Class 4 SU: None

The EU Z2-33 soil unit boundaries are shown on Fig. A.2.

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

There are three FFA sites in EU Z2-33 that are listed in Appendix A of the Zone 2 ROD (Fig. A.2):

- K-1004-L Recirculating Cooling Water (RCW) Lines Leak Sites,
- K-1015-A Laundry Pit, and
- K-1044 Heavy Equipment Repair Shop.

The Data Quality Objective (DQO) Scoping Package for the South Park EU Group lists 56 facilities in EU Z2-33 (see Table 1).

2.0 DVS INVESTIGATIONS AND RESULTS

2.1 DVS FIELD ACTIVITIES

DVS activities were conducted in accordance with the *Remedial Design Report/Remedial Action Work Plan for Zone 2 Soils, Slabs, and Infrastructure, East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/01-2224&D3) (Zone 2 RDR/RAWP).

2.1.1 CLASS 1 SUs

K-1004-J Lab South Class 1 SU: An area of approximately 0.4 acres was classified as a Class 1 SU. The K-1004-J Lab South Class 1 SU is located along the northern boundary of EU Z2-33 and lies directly south of the K-1004-J Laboratory, which is in EU Z2-42. There were Cs-137 maximum remediation level (RL) exceedances in historical samples from EU Z2-33 and soil contamination at the K-1004-J Laboratory SU. An action for these exceedances and contamination was documented in the EU Z2-42 Technical Memorandum. The contaminated soils in EU Z2-42 were contiguous with the Class 1 SU in EU Z2-33. Historical sample locations with maximum RL exceedances were RAD18, RAD19, RAD20, and RAD21, and early characterization location Z2-EU33B-111.

K-1015 Class 1 SU: A small area of soil south of the K-1015 Laundry Pit was classified as a Class 1 SU. The K-1015 Laundry Pit is an FFA site and is included in the Zone 2 ROD for a remedial action. Two historical samples located immediately south of the Laundry Pit, KAH-SS-B12 and KAH-SS-B13, had Cs-137, U-234, U-235, and U-238 average RL exceedances and U-235 maximum RL exceedances. A third sample, Z2-EU33-2019, was noted in the DQO Scoping Package as having a U-235 average RL exceedance. However, review of the historical data showed that gamma spectroscopy analysis resulted in an average RL exceedance while alpha spectroscopy analysis did not. Consistent with the data evaluation process for uranium isotopes presented in the Zone 2 RDR/RAWP, the alpha spectroscopy analysis was accepted over the gamma spectroscopy analysis.

2.1.1.1 CLASS 1 SU RADIOLOGICAL WALKOVER SURVEY

Biased area radiation (BAR) surveys were conducted over three areas in EU Z2-33 to delineate remedial action boundaries and document current conditions following remedial actions. The K-1004-J Lab South Class 1 SU and the K-1015 Class 1 SU were surveyed. The third surveyed area was in a Class 3 SU but is included in this section because its purpose was to delineate possible remedial action boundaries around a maximum RL exceedance discovered as a result of the Class 3 SU walkover assessment (Sect. 2.3.1).

In addition to the BAR surveys conducted in EU Z2-33, the results of pre- and post-remedial action BAR surveys for a single location in EU Z2-42 are also reported. The area surveyed in EU Z2-42 was located directly north of the EU Z2-33 K-1004-J Lab South Class 1 SU and was the northern extent of the area of soil contamination associated with the K-1004-J Lab. The surveyed area was contiguous with the K-1004-J Lab South Class 1 SU, except for a road separating the two areas. As documented in the EU Z2-42 TM, the soil contaminant was Cs-137.

The BAR surveys were conducted according to the *Class 1 and Class 2 Soil Unit Radiological Investigation and Biased Area Radiation Survey Protocol*, which is included in the Zone 2 RDR/RAWP. Results of the BAR surveys, including the BAR surveys in EU Z2-42, are presented in *Walkover Inspections and Radiological Surveys for FY2007 Exposure Units in Zone2, East Tennessee Technology Park, Oak Ridge, Tennessee* (BJC/OR-2691) and summarized below. BAR survey locations are shown on Fig. A.3.

K-1004-J Lab in EU Z2-42: Pre-remedial action BAR surveys were conducted in EU Z2-42 on August 25, 2005 and January 25, 2006, south of the K-1004-J Laboratory and immediately north of the K-1004-J Lab South Class 1 SU. The land area surveyed in EU Z2-42 was contiguous with the K-1004-J Lab South Class 1 SU, except for a road separating the two areas, which is coincident with the boundary between EU Z2-33 and EU Z2-42. Results of the pre-remedial action BAR survey are shown graphically on Fig. A.4. Two areas with action level (AL) exceedances were observed during the BAR survey and are delineated on Fig. A.4 with red boxes. Radiation measurements during the pre-remedial action BAR survey attained a maximum 21,118 cpm in the eastern part of the two areas. The two areas were excavated and replaced with clean soil in October 2007.

Post-remedial action BAR surveys were conducted at the K-1004-J Laboratory area in EU Z2-42 on November 2 and 8, 2007, prior to filling with clean soil (see Fig. A.5). Survey results showed that the contaminated soil was effectively removed. Two spots of elevated radiation are apparent in Fig. A.5—one on the northwest corner of the eastern excavation and the other on the southwest corner of the western excavation. Based on a comparison of count rates from the pre-remedial action BAR surveys with analytical results, it was determined the maximum count rate

during the post-remedial action BAR surveys, 3574 cpm, represented a Cs-137 concentration at or less than the Cs-137 average RL concentration. Because the area of maximum elevated radioactivity at the eastern excavation was small (approximately 1 ft by 1 ft), no additional excavation was conducted.

K-1004-J Lab South Class 1 SU: A pre-remedial action BAR survey was conducted in this Class 1 SU on August 25, 2005, to delineate possible remedial action boundaries for the area of soil contamination. Results of the BAR survey showed elevated radiation measurements over almost the entire approximately 2400 ft^2 area (see Fig. A.6). The surveyed area was excavated and replaced with clean soil in October 2007.

Post-remedial action BAR surveys were conducted over the excavated area on November 2, 8, 12, and 13, 2007, prior to filling with clean soil. Results of the post-remedial action BAR surveys demonstrated that the remedial action was successful in removing the contaminated soil (see Fig. A.7).

K-1015 Class 1 SU: A BAR survey was conducted in this Class 1 SU on July 6, 2006, to delineate possible remedial action boundaries for a soil area located south of and adjacent to the K-1015 Laundry Pit FFA site. Results showed an area approximately 20 ft long and 10 ft wide (approximately 200 ft^2) extending to the south of the K-1015 Laundry Pit with radiation measurements in excess of the AL (see Fig. A.8).

A post-remedial action BAR survey was conducted in this SU on October 22, 2007 (see Fig. A.9). No radiation in excess of the AL was detected.

Gravel Wash Area: A gravel-covered area located south of the K-1004-L pad was used to rinse radionuclide-contaminated filters. The area was identified as having radiation in excess of the screening level (SL) during the Class 3 SU walkover assessment (Sect. 2.1.3.1). Analytical results from biased sampling showed U-234, U-235, and U-238 in excess of their average RLs and U-238 in excess of its maximum RL. The gravel wash area was excavated and a follow-up BAR survey was conducted January 19, 2007.

The BAR survey results for this area showed an approximately 10-ft by 10-ft area (approximately 100 ft^2) with radiation measurements exceeding the AL (see Fig. A.10).

2.1.1.2	CLASS 1 SU GEOPHYSICAL SURVEY

None

2.1.1.3	CLASS 1 SU SOIL SAMPLING

DVS biased sampling in the EU Z2-33 Class 1 SUs was conducted as described below.

K-1004-J Lab South Class 1 SU: There were five DVS sample locations in the K-1004-J Lab South Class 1 SU that included two systematic grid sample locations identified during DQO scoping, one historical confirmation sample, and two 4-point composite step-out samples. One of the systematic grid samples coincided with the highest radiation measurement obtained during the pre-remedial action BAR surveys (Sect. 2.1.1.1). As agreed to by the Core Team, confirmation sampling was conducted at only one historical sample location in the SU (RAD20) because the four historical sample locations were closely spaced and fell within the area of AL exceedances defined during the pre-remedial action BAR surveys. Step-out sampling was conducted both within and outside the area of AL exceedances defined during the BAR surveys.

K-1015 Class 1 SU: There were seven DVS sample locations in the K-1015 Class 1 SU. DVS sample locations included confirmation locations for historical locations KAH-SS-B12, KAH-SS-B13, and Z2-EU33-2019, and four locations selected outside the BAR survey area of radiation exceeding the AL (Sect. 2.1.1.1) to confirm the boundaries of radiological contamination.

Details of the actual sampling and analysis in the Class 1 SUs, including depths, analytes, and deviations from planned sampling, are presented in Table 2.

2.1.2	CLASS 2 SUS

The K-1004 Area Drain Line Class 2 SU in EU Z2-33 was defined to address a high degree of uncertainty regarding the impact of the K-1004 Area Drain Line to EU soils. In addition, two small areas centered around historical sample locations KAH-SS-B22 and KAH-SS-S31 were defined during DQO scoping to delineate the extent of Cs-137 average RL exceedances.

2.1.2.1 CLASS 2 SU RADIOLOGICAL WALKOVER SURVEY

Two BAR surveys were conducted to delineate the extent of radionuclide average RL exceedances at historical sample locations KAH-SS-B22 and KAH-SS-S31. The BAR surveys were conducted according to the *Class 1 and Class 2 Soil Unit Radiological Investigation and Biased Area Radiation Survey Protocol*, which is included in the Zone 2 RDR/RAWP. Results of the BAR surveys are presented in *Walkover Inspections and Radiological Surveys for FY2007 Exposure Units in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee* (BJC/OR-2691) and summarized below.

Results of the Class 2 SU BAR surveys are presented graphically on Figs. A.11 and A.12, respectively. The AL was not exceeded at either of the two locations.

2.1.2.2 CLASS 2 SU GEOPHYSICAL SURVEY

None

2.1.2.3 CLASS 2 SU SOIL SAMPLING

Seventeen DVS systematic grid sample locations were identified during DQO scoping and sampled in the Class 2 SU of EU Z2-33. Also, confirmation samples were collected at historical sample locations KAH-SS-B22 and KAH-SS-S31 with Cs-137 average RL exceedances.

2.1.3 CLASS 3 AND CLASS 4 SU WALKOVER ASSESSMENT

The protocol for addressing the Class 3 and Class 4 SUs in EU Z2-33 is the *Class 3 and Class 4 Soil Unit Walkover Inspection Protocol* Rev 01 (found in Appendix A of the Zone 2 RDR/RAWP). The purpose of the Class 3 SU walkover assessments is 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 Z2-33 are presented in the document *Walkover Inspections and Radiological Surveys for FY2007 Exposure Units in Zone 2, East Tennessee Technology Park, Oak Ridge, Tennessee* (BJC/OR-2691) (Assessment Report). A summary of the report results is presented below in Sects. 2.1.3.1 and 2.1.3.2. The assessment point (AP), mid-point (MP), and discretionary point (DP) locations are shown on Fig. A.13.

A total of 15 APs were identified in EU Z2-33 prior to the start of fieldwork and are documented in the DQO Scoping Package. The actual number of APs evaluated in EU Z2-33 corresponds to the number planned.

In addition to the APs, the field team made assessments at seven MP locations, which are selected in the field and located approximately half way between APs, and conducted discretionary surveys at a total of 20 locations (see below). Mid-point and DP locations were not specified in planning documents.

	Number of APs	Number of MPs	Number of DPs
EU Z2-33	15	7	20

AP = assessment point
DP = discretionary point
EU = exposure unit
MP = mid-point

2.1.3.1 CLASS 3 AND CLASS 4 SU RADIOLOGICAL SURVEY SUMMARY

Screening level (SL): 3892 cpm

SL exceedances: One

The radiation SL was exceeded at a DP located in what was identified in the Assessment Report as a gravel wash area south of the K-1004-L pad.

2.1.3.2 CLASS 3 AND CLASS 4 SU ANTHROPOGENIC FEATURES

Number of identified anthropogenic features: 19

Exposure unit Z2-33 is located in an industrialized portion of ETTP, which included numerous anthropogenic features such as facilities and associated constructed features such as roads, sidewalks, and paved areas. Plant facilities and their associated constructed features were assessed as part of the Class 3 and Class 4 SU walkover assessment protocol and are reported in Sect. 2.1.3.3. Other than plant facilities and associated constructed features, 19 anthropogenic features were identified in EU Z2-33 during the Class 3 SU walkover assessment. The anthropogenic features listed below consist of a brief description and DP identifier, both taken from the Assessment Report.

1) Valve Vault, north side of Avenue E and 3rd Street (DP EU33-316);
2) Dilution Pit southwest of K-1004-D (DP EU33-318);
3) Storm Drain, west of K-1310-D (DP EU33-319);
4) Valve Vault, northwest corner of K-1310-JX on Avenue E (DP EU33-320);
5) Valve Vault, southeast corner of K-1006 on Avenue E (DP EU33-321);
6) Steam Vault, on Avenue E north of intersection with 3rd Street (DP EU33-322);
7) Storm Drain, south of K-1004-B (DP EU33-323);
8) Storm Drain, south of southeast corner of K-1004-B (DP EU33-324);
9) Storm Drain, southwest corner of Avenue D and 5th Street (DP EU33-325);
10) Valve Vault, west of K-1205-A (DP EU33-326);
11) Vault, ~80 ft southwest of K-1039-1 and ~35 ft east of K-1310-JK (DP EU33-327);
12) K-1004-A,B,C dilution pit west (DP EU33-329);
13) K-1004-A,B,C dilution pit south (DP EU33-330);
14) K-1004-A,B,C dilution pit east (DP EU33-331);
15) K-1004-A,B,C dilution pit east center (DP EU33-332);
16) Gravel wash area south of the K-1004-L pad (DP EU33-333);
17) Brick-lined drain pit adjacent to gravel wash area (DP EU33-334);
18) Acid dilution pit south of K-1004-L (DP EU33-335); and
19) Bottle area at the northwest corner of K-1004-L pad (DP EU33-336).

As stated in Sect. 2.1.3.1, the radiation SL was exceeded at the gravel wash area south of the K-1004-L pad. Nine anthropogenic features were selected for biased sampling based on the radiation SL exceedance, visual observations indicative of possible chemical contamination, and on-site history (Sect. 2.1.3.4).

In addition to the anthropogenic features listed above, sediment accumulation area DP EU33-317 was identified in EU Z2-33 during the Class 3 SU walkover assessment.

2.1.3.3 CLASS 3 SU FACILITIES ASSESSMENTS

According to the DQO Scoping Package, 51 facilities were located in EU Z2-33. Thirty-one facilities were assessed during the Class 3 SU walkover assessment (Table 1), including four facilities not identified in the Scoping Package, and were reported in the Assessment Report. In summary, one facility was selected for biased sampling based on a radiation SL exceedance and eight other facilities were selected for biased sampling based on visual evidence of possible chemical contamination and process knowledge (Sect. 2.1.3.4).

2.1.3.4 CLASS 3 AND CLASS 4 SU BIASED SAMPLING

Based on the visual observations and radiation surveys of each anthropogenic feature as well as process knowledge, biased sampling was conducted at nine anthropogenic features. These features are listed below with brief descriptions taken from the Assessment Report and the DP location identifier:

- Dilution pit southwest of K-1004-D (EU33D-318);
- K-1004-A, B, C dilution pit west (EU33D-329);
- K-1004-A, B, C dilution pit south (EU33D-330);
- K-1004-A, B, C dilution pit east (EU33D-331);
- K-1004-A, B, C dilution pit east central (EU33D-332)
- Gravel wash area south of the K-1004-L pad (EU33D-333);
- Brick-lined drain pit adjacent to the gravel wash area (EU33D-334);
- Acid dilution pit south of K-1004-L (EU33D-335); and
- Bottle area at the northwest corner of the K-1004-L pad (EU33D-336).

Based on visual observations and radiation surveys as well as process knowledge, biased sampling was conducted at the following facilities:

- K-1003 Dispensary,
- K-1004-F Laboratory Storage Building,
- K-1004-L,
- K-1004-M Former Electrical Switchgear Room,
- K-1006 Development Laboratory,
- K-1015 Laundry Facility,
- K-700-A-13 Substation,
- K-700-A-17 Substation, and
- K-700-A-74 Substation.

Biased sampling was recommended in the Assessment Report for a sediment accumulation area located east of K-1310-D, but a sample was not collected because of accessibility problems arising from decontamination and decommissioning (D&D) activities. Because of the high density of sample locations in EU Z2-33, a sample from this sediment accumulation area would provide no new information regarding potential source areas in the EU and no new sampling is planned at this location. A different sediment accumulation sample location located east of the K-1004-J Lab South Class 1 SU was identified and sampled during DVS sampling. This location received runoff from a D&D truck wash contamination area.

2.2 DVS AND HISTORICAL SAMPLE RESULTS

Sample locations with samples from all depth intervals were assigned to applicable focused investigation areas (SUs, DPs, facilities, and FFA sites). Then, consistent with requirements of the Zone 2 ROD, soil and concrete, including brick and mortar, data from the 0 to 10 ft depth interval (i.e., any sample with a starting depth < 10 ft bgs) were evaluated by focused investigation area (see Sects. 2.2.5 and 2.2.6). The sample locations presented in Sects. 2.2.1 through 2.2.3 are all historical and DVS soil and concrete sample locations in EU Z2-33. However, in response to analytical results from DVS sampling, the RA Core Team concurred that several remedial actions needed to be conducted in EU Z2-33. As a result of the remedial actions, several DVS and historical sample locations were removed. In addition, several EU Z2-33 facilities were undergoing D&D during the time of DVS characterization activities that resulted in additional removal of DVS and historical sample locations. Table 3 summarizes remedial action and D&D activities in EU Z2-33, and details soil and concrete sample locations that were removed and sample locations representative of current conditions at focused investigation areas impacted by remedial actions and D&D activities. In some cases, representative sampling was conducted in the > 10 ft depth interval as confirmation following a remedial action or to determine if leakage from a subsurface structure had introduced contaminants into the subsurface. These sample locations are shown in Table 3 and the analytical results are included in Sects. 2.2.5 and 2.2.6. Only those focused investigation areas listed in Table 3 were impacted as just described. The sample locations for focused investigation areas not listed in Table 3 are presented in Sects. 2.2.1 through 2.2.3.

Analytical results for soil samples representative of current conditions and collected from the 0 to 10 ft depth interval are summarized in Table 4. Analytical data representative of current conditions for concrete and related material (e.g., brick, mortar) are summarized in Table 5. The full data set for EU Z2-33 contains several soil samples collected from depths up to 23 ft bgs. Results for samples collected from ≥ 10 ft bgs and representative of current conditions at that depth are summarized in Table 6. A compact disc containing electronic files for the historical and DVS analytical data used to generate the data tables is provided with this Phased Construction Completion Report (PCCR). All DVS and historical soil and concrete sample locations, regardless of depth, are shown on Fig. A.14 (location ID numbers not included for figure legibility). Dynamic Verification Strategy and historical soil and concrete sample locations representative of current conditions are shown on Fig. A.15. Several samples from locations shown on Fig. A.14 were collected from a depth of ≥ 10 ft because they help define current conditions. Soil and concrete sample locations removed during a remedial action or D&D are shown on Fig. A.16.

2.2.1 CLASS 1 SUS

There were 27 DVS and historical sample locations in the EU Z2-33 Class 1 SUs. All soil, concrete and concrete-related material sample locations with samples from all depth intervals are presented below [some sample

locations are no longer representative of current conditions (see Table 3)]. Historical sample locations Z2-EU33B-110 and Z2-EU33B-2019 were sampled in the 0 to 10 ft depth interval and the ≥ 10 ft interval.

DVS sample locations	Historical sample locations
Locations with samples collected from 0 to 10 ft bgs	
K-1004-J Lab South Class 1 SU Systematic Grid Locations[a] (Z2-EU33B-105, Z2-EU33B-106)	K-1004-J Lab South Class 1 SU (RAD18, RAD19, RAD20, RAD21, Z2-EU33-2026, Z2-EU33-2027, Z2-EU33B-110, Z2-EU33B-111)
K-1004-J Lab South Class 1 SU Historical Sample Confirmation Location (Z2-EU33B-103)	K-1015 Class 1 SU (KAH-SS-B12, KAH-SS-B13, Z2-EU33-2019)
K-1004-J Lab South Class 1 SU Step-out Locations (Z2-EU33B-129, Z2-EU33B-130)	
K-1004-J Lab South Class 1 SU Post-RA Confirmation Location (Z2-EU33B-380)	
K-1015 Class 1 SU Historical Sample Confirmation Sample Locations (Z2-EU33B-108, Z2-EU33B-109, Z2-EU33B-220[b])	
K-1015 Class 1 SU Boundary Confirmation Sample Locations[c] (Z2-EU33B-306, Z2-EU33B-307, Z2-EU33B-308, Z2-EU33B-309)	
Locations with samples collected from the ≥ 10 ft depth interval	
K-1015 Class 1 SU Post-RA Confirmation Location (Z2-EU33B-382)	K-1004-J Lab South Class 1 SU (Z2-EU33B-110)
	K-1015 Class 1 SU (Z2-EU33-2019)

[a]Sample location names identify these as biased locations, however, they are systematic grid locations.
[b]This sample location name indicates a Class 2 SU origin, however, the location is in a Class 1 SU.
[c]These locations are in the Class 3 SU surrounding the K-1015 Class 1 SU but are included here because they address the boundaries of the Class 1 SU.

DVS = Dynamic Verification Strategy
RA = remedial action
SU = soil unit

Sampling and analytical details for each sample location are presented in Table 2. The analytical data for samples representative of current conditions in the 0 to 10 ft depth interval are evaluated in Sect. 2.2.5. Numbers of analyses conducted for all samples from all sample depths in the Class 1 SUs are presented below by analyte group.

Metals	PPCBs	Radionuclides	SVOCs	VOCs
12	10	25	9	3

PPCB = pesticide and polychlorinated biphenyl
SVOC = semivolatile organic compound
VOC = volatile organic compound

2.2.2 CLASS 2 SUs

There were 23 DVS and historical sample locations in the EU Z2-33 Class 2 SUs (summarized below). All samples in the Class 2 SUs were collected from the 0 to 10 ft depth interval.

DVS sample locations	Historical sample locations
K-1004 Area Drain Line Class 2 SU Systematic Grid Locations (Z2-EU33-201, Z2-EU33-202,	K-1004 Area Drain Line Class 2 SU (KAH-SS-S61, KAH-SS-S71)

DVS sample locations	Historical sample locations
Z2-EU33-203, Z2-EU33-204, Z2-EU33-205, Z2-EU33M-206, Z2-EU33M-207, Z2-EU33M-208, Z2-EU33M-209, Z2-EU33-210, Z2-EU33-211, Z2-EU33M-212, Z2-EU33M-213, Z2-EU33M-214, Z2-EU33-215, Z2-EU33-216, Z2-EU33-217) KAH-SS-B22 Class 2 SU Historical Sample Confirmation Location (Z2-EU33B-221) KAH-SS-S31 Class 2 SU Historical Sample Confirmation Location (Z2-EU33B-222)	KAH-SS-B22 Class 2 SU (KAH-SS-B22) KAH-SS-S31 Class 2 SU (KAH-SS-S31)

DVS = Dynamic Verification Strategy
SU = soil unit

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

Metals	PPCBs	Radionuclides	SVOCs	VOCs
17	17	12	17	4

PPCB = pesticide and polychlorinated biphenyl
SVOC = semivolatile organic compound
VOC = volatile organic compound

2.2.3 CLASS 3 AND CLASS 4 SUs

There were 135 DVS and historical sample locations used to characterize the EU Z2-33 Class 3 SU, including 11 locations in the K-1015 Class 1 SU that bounded conditions in the adjacent K-1015-A Laundry Pit FFA site. All soil, concrete and concrete-related material sample locations with samples from all depth intervals are presented below. Some of these sample locations are no longer representative of current conditions (see Table 3). DVS sampling used biased sampling and was conducted in response to DQO scoping requirements and DP and facility observations made during the Class 3 SU walkover assessment (Sect. 2.1.3.4). Historical sample locations were assigned to DPs, facilities, and other features based on proximity. Several sample locations presented in this section were in the Class 2 SU but are presented here because they were identified during the Class 3 SU walkover assessment (Fig. A.13). Samples were collected from both the 0 to 10 ft depth interval and ≥ 10 ft interval at three sample locations presented below (424, 425, and Z2-EU33B-2019).

DVS sample locations	Historical sample locations
Locations with samples collected from 0 to 10 ft bgs	
K-1015-A Laundry Pit FFA Site (Z2-EU33B-108[a], Z2-EU33B-109[a], Z2-EU33B-220[a], Z2-EU33B-223, Z2-EU33B-225, Z2-EU33B-227, Z2-EU33B-235, Z2-EU33B-306[a], Z2-EU33B-307[a], Z2-EU33B-308[a], Z2-EU33B-309[a]) K-1044 Heavy Equipment Repair Shop FFA Site (Z2-EU33B-232, Z2-EU33B-233) Sediment Accumulation Area (Z2-EU33B-342) Dilution Pit SW of K-1004-D (DP EU33D-318) (Z2-EU33B-113, Z2-EU33B-310, Z2-EU33B-311) K-1004-A,B,C Dilution Pit West (DP EU33D-329) (Z2-EU33B-125, Z2-EU33B-131, Z2-EU33B-137, Z2-EU33B-140, Z2-EU33B-141, Z2-EU33B-316)	K-1015-A Laundry Pit FFA Site (424, 425, KAH-SS-B12[a], KAH-SS-B13[a], KAH-SS-S11, Z2-EU33-2018, Z2-EU33-2019) K-1004-D Facility Locations (K-1004D-S1, K-1003D-S2, K-1004D-S3, KAH-SS-S41, Z2-EU33-2004, Z2-EU33-2005, Z2-EU33-2006, Z2-EU33-2007, Z2-EU33-2008, Z2-EU33-2009, Z2-EU33-2010, Z2-EU33-2011, Z2EU33-K1004D[b]) K-1004-P Facility Locations (Z2-EU33-2012, Z2-EU33-2013) K-1006 Facility Locations (K-1006-01, K-1006-02, K-1006-03, KAH-SS-S81)

DVS sample locations	Historical sample locations
K-1004-A,B,C Dilution Pit South (DP EU33D-330) (Z2-EU33B-122, Z2-EU33B-314, Z2-EU33B-315, Z2-EU33B-379)	K-1015 Laundry Facility Locations (Z2-EU33-2014, Z2-EU33-2015, Z2-EU33-2016, Z2-EU33-2017)
K-1004-A,B,C Dilution Pit East (DP EU33D-331) (Z2-EU33B-116)	K-1205-A Facility Locations (Z2-EU33-2001, Z2-EU33-2002, Z2-EU33-2003)
K-1004-A,B,C Dilution Pit East Center (DP EU33D-332) (Z2-EU33B-119, Z2-EU33B-313, Z2-EU33B-378)	Other Class 3 SU Historical Locations (414, 415, 416, KAH-SS-S21)
Gravel Wash Area (EU33D-333) (Z2-EU33B-333, Z2-EU33B-359, Z2-EU33B-360, Z2-EU33B-361, Z2-EU33B-368, Z2-EU33B-369, Z2-EU33B-370, Z2-EU33B-371, Z2-EU33B-372)	
Brick-Lined Drain Pit (EU33D-334) (Z2-EU33B-334)	
Acid Dilution Pit South of K-1004-L (EU33D-335) (Z2-EU33B-335, Z2-EU33B-365)	
Bottle Area Near K-1004-L (EU33D-336) (Z2-EU33B-336)	
K-1003 Facility Location (Z2-EU33B-326)	
K-1004-F Facility Locations (Z2-EU33B-325, Z2-EU33B-329, Z2-EU33B-330, Z2-EU33B-331, Z2-EU33B-332)	
K-1004-L Facility Locations (Z2-EU33B-337, Z2-EU33B-339, Z2-EU33B-340, Z2-EU33B-341, Z2-EU33B-343, Z2-EU33B-344, Z2-EU33B-346, Z2-EU33B-348, Z2-EU33B-349, Z2-EU33B-350, Z2-EU33B-351, Z2-EU33B-352, Z2-EU33B-353, Z2-EU33B-354, Z2-EU33B-356, Z2-EU33B-357, Z2-EU33B-358, Z2-EU33B-362, Z2-EU33B-363, Z2-EU33B-364)	
K-1004-M Facility Locations (Z2-EU33B-338, Z2-EU33B-345, Z2-EU33B-347)	
K-1006 Facility Locations (Z2-EU33B-128, Z2-EU33B-327, Z2-EU33B-328, Z2-EU33B-373)	
K-1015 Laundry Facility Locations (Z2-EU33B-301, Z2-EU33B-302, Z2-EU33B-303)	
K-700-A-13 Substation Facility Location (Z2-EU33B-317)	
K-700-A-17 Substation Facility Location (Z2-EU33B-320)	

DVS sample locations	Historical sample locations
K-700-A-74 Substation Facility Location (Z2-EU33B-323)	
Locations with samples collected from ≥ 10 ft depth interval	
K-1015-A Laundry Pit FFA Site (Z2-EU33B-229, Z2-EU33B-230, Z2-EU33B-382)	K-1015 Laundry Pit FFA Site (424, 425, Z2-EU33-2019[a])
Dilution Pit SW of K-1004-D (DP EU33D-318) (Z2-EU33B-114)	
K-1004-A,B,C Dilution Pit West (DP EU33D-329) (Z2-EU33B-126, Z2-EU33B-132, Z2-EU33B-138, Z2-EU33B-377, Z2-EU33B-383)	
K-1004-A,B,C Dilution Pit South (DP EU33D-330) (Z2-EU33B-123)	
K-1004-A,B,C Dilution Pit East (DP EU33D-331) (Z2-EU33B-117)	
K-1004-A,B,C Dilution Pit East Center (DP EU33D-332) (Z2-EU33B-120)	
Acid Dilution Pit South of K-1004-L (EU33D-335) (Z2-EU33B-381)	
K-1004-L Facility Locations (Z2-EU33B-355)	
K-1006 Facility Locations (Z2-EU33B-374)	

[a]These Class 1 SU sample locations assigned to the K-1015-A Laundry Pit FFA site are also included in the K-1015 Class 1 SU (see Sect. 2.2.1), which is adjacent to the K-1015-A Laundry Pit FFA site. These locations are listed here because they bound the conditions in K-1015 Laundry Pit FFA site.

[b]This sample location was removed when sediment from the sewer ejector sump pit was removed by D&D Operations after production of the first draft of this TM.

Sampling and analytical details for each sample location are presented in Table 2. Analytical data for samples representative of current conditions in the 0 to 10 ft depth interval are evaluated in Sect. 2.2.5. The number of analyses conducted for all samples from all sample depths in the Class 3 SUs is presented below by analyte group. This analyte tally does not include analytes from K-1015-A Laundry Pit FFA site locations that are also included in the K-1015 Class 1 SU (Sect. 2.2.1).

Metals	Other Organics[a]	PPCBs[b]	Radionuclides	SVOCs	VOCs
110	4	112	111	74	64

[a]Includes diesel range organics and gasoline range organics.
[b]The total count is for PCBs but includes 13 pesticide analyses.

PPCB = pesticide and polychlorinated biphenyl
SVOC = semivolatile organic compound
VOC = volatile organic compound

2.2.4 INFRASTRUCTURE

The K-1004 Area Drain Line Class 2 SU sampling in EU Z2-33 was designed to test the impact of plant infrastructure on SU soils.

2.2.5 EU EVALUATION

In this section, characterization data and other information are evaluated for EU Z2-33. 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 as they pertain to the analytes listed in Appendix A of the RDR/RAWP (i.e., the QAPP) are presented in Sect. 3.1 of this PCCR.

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 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 Z2-33 Conceptual Site Model (CSM)

Land classification as proposed in the DQO Scoping Package identified two Class 1 SUs within EU Z2-33. One Class 1 SU is associated with surface soils near the K-1015-A Laundry Pit and the other is an area of soil contaminated by a Cs-137 spill south of the K-1004-J Laboratory. The Class 1 SU near the K-1004-J Laboratory also included the K-1004-H concrete pad located northwest of the K-1004-L Facility. Historical samples from these two SUs had reported radioactive contamination above Max RLs. Radiological surveys and verification sampling was planned at these two Class 1 SUs. The conceptual model for both SUs is a surface release model of radiological contamination. The model defines limited mobility through the soil column and identifies the most probable mode of secondary transport as suspended solids in surface water. Radiological survey and sampling in the areas confirmed the extent of impact and showed no lateral transport beyond the release point.

Land classification as proposed in the DQO Scoping Package identified a Class 2 SU along the utility corridors that are in proximity to all of the labs within the EU. A broad range of chemicals and radioisotopes had been used in the labs and discharged into acid pits and sumps that connected into the local storm drain systems. The classification of the utility corridors was based on the presumption that line breaks and leaks could have occurred in these systems and released contaminants to soils along the corridors. Because releases would have occurred underground from the buried pipes, sampling was targeted at the base of the utility corridor in the underlying native soil.

The remainder of the EU was classified as a Class 3 SU and evaluated using the Class 3 and Class 4 SU walkover assessment protocol, which is presented in the RDR/RAWP. During the Class 3 SU walkover assessments and associated facility assessments, six acid pits were inspected and found to contain residual solids and liquids. These materials were sampled to determine if they had exceeded any Zone 2 evaluation criteria. These materials did exceed one or more Zone 2 Max RLs and had high concentrations of polychlorinated biphenyls (PCBs), mercury,

uranium isotopes, Cs-137 and several volatile organic compounds (VOCs). Analytical results from the acid pit samples indicated removal actions were necessary. Liquids and semi-solid sludges were removed from the pits and all but one of the pit structures were excavated for off-site disposal; the exception was closed in place. The conceptual model for these structures was a point source release to underlying soils and potentially to local groundwater. Sampling around these structures consisted of close proximity borings that recovered soil cores to depths equal to and deeper than the base of the structures. These close off-set locations were placed in a groundwater downgradient direction from the structures and samples were collected and analyzed for full-suite analyses. In all except one case, sample results indicated the pits had not leaked to the underlying soils. Therefore, no significant contaminant mass was present that would pose a threat to local groundwater. At one location, soil contamination was present in samples at the off-set location and soils were excavated around the pit. A confirmation sample was collected following RA to confirm the contamination had been removed.

EU Z2-33 Groundwater Evaluation

There are 12 groundwater monitoring wells in EU Z2-33, 10 bedrock wells, and 2 unconsolidated zone wells. Ten of the 12 wells are located in proximity to the K-1004-L Facility and in open areas to the south of the facility. Two bedrock wells are located in the western portion of the EU northwest and southeast of the K-1006 Facility. Water levels in these wells ranged from 13-25 ft bgs. Both unconsolidated zone wells were consistently dry, which indicates flow in the area is predominantly in the bedrock formations. Flow in the area is toward the K-1007-P Ponds to the south and southwest of the EU. Conduit flow predominates within the Chickamauga limestone units underlying this portion of the site.

Several of the bedrock wells south of the K-1004-L Facility have reported VOCs above MCLs. Two recently completed wells to the south in EU Z2-34 also have reported low-level detections of VOCs. The highest reported concentrations were from a bedrock well location near the K-1004-L Facility acid sump (BRW-038). This well was placed in proximity to the acid sump in 1989 and has consistently reported elevated PCE and TCE detections in groundwater during the monitoring period of 1989-1995. The last sampling event at this location was in 1995 and reported concentrations of 17 ppb PCE and 120 ppb TCE. Monitoring was performed under a previous groundwater monitoring program (IWQP) that has been discontinued. The existing data are insufficient to adequately assess the importance of the PCE and TCE detections. The concentration trends for these chemicals have been clearly declining since the first round of sampling performed in 1989. Concentrations of these chemicals in the wells to the south are an order of magnitude lower than the BRW-038 samples. The BRW-038 well was damaged some time after 1995 and was inaccessible for further sampling. Off-set soil sampling downgradient of the acid pits was performed as part of the DVS characterization program in 2007. At the K-1004-L locations, VOC contamination was not observed at the off-set sampling location. One soil boring near the acid pit on the west side of the K-1004-B lab did detect VOCs. Step-out locations 12.5 ft around this location did not detect contamination, which indicates the possible source was very small in lateral extent.

Soil sampling in EU Z2-33 investigated the acid sumps, which were considered possible point sources of VOCs. Samples from the off-set locations and confirmation sampling at several of the pit locations following removal of the sumps demonstrated no significant mass of contaminated soil that would pose a threat to local groundwater.

EU Z2-33 Sampling Results

Exposure unit Z2-33 (18 acres) was classified into Class 1, 2, and 3 SUs. Approximately 0.5 acres were classified as Class 1 SUs, including the K-1004-J Lab South Class 1 SU (0.4 acres) located south of the K-1004-J Laboratory and classified during DQO scoping. Sampling in the K-1004-J Lab South Class 1 SU included historical sampling, DVS systematic grid sampling, DVS confirmation sampling, and DVS step-out sampling for boundary definition (Sect. 2.2.1). A BAR survey was conducted in the K-1004-J Lab South Class 1 SU and area of AL exceedance was identified (Sect. 2.1.1.1). An additional approximately 0.1 acres of soil located around the K-1015-A Laundry Pit is also addressed in this Technical Memorandum as the K-1015 Class 1 SU. Sampling in the K-1015 Class 1 SU included historical sampling, DVS confirmation sampling, and DVS boundary definition sampling (Sect. 2.2.1). A BAR survey was conducted in the K-1015 Class 1 SU and an area of AL exceedance was identified (Sect. 2.1.1.1). Class 1 SU boundaries are shown on Fig. A.2 and sample locations are shown on Fig. A.14.

The Class 2 SUs consisted of the large K-1004 Area Drain Line Class 2 SU, which encompassed almost the entire 3.9 acres of Class 2 SU acreage. These SUs were located along the utility line corridors in the southeast/central portion of the site (Fig. A.2). The purpose of this SU was to determine the impact of utility lines to EU soils, including the K-1004 Area Drain Line.

Sampling in the K-1004 Area Drain Line Class 2 SU included historical sampling and DVS systematic grid sampling (Sect. 2.2.2). Two small Class 2 SUs, KAH-SS-B22 and KAH-SS-S31, were identified during DQO scoping to delineate the extent of Cs-137 Avg RL exceedance. Sampling in these two SUs included DVS confirmation sampling. BAR surveys also were conducted in these SUs but no AL exceedance was observed (Sect. 2.1.2.1). Class 2 SU boundaries are shown on Fig. A.2 and sample locations are shown in Fig. A.14.

The remaining 13.5 acres of EU Z2-33 were classified a Class 3 SU so a Class 3 SU walkover assessment was conducted. Because EU Z2-33 is located in an industrialized portion of ETTP, there are many anthropogenic features, some of these being facilities. Thirty-one of these facilities were evaluated as part of the Class 3 SU walkover assessment (Sect. 2.1.3.3). Biased sampling was conducted around nine facilities (Sect. 2.1.3.4) based on assessment conclusions that these facilities were potential sources of contamination. In addition, early characterization sampling was conducted around three other facilities (Sect. 2.2.3). Nineteen non-facility, anthropogenic features were identified (Sect. 2.1.3.2) and seven anthropogenic features were selected for biased sampling based on radiation survey results or visual evaluations (Sect. 2.1.3.4). A sediment accumulation area was identified during the Class 3 SU walkover assessment but the area was inaccessible for sampling. Instead, a sample was collected from another sediment accumulation area identified by the sampling crew. Class 3 SU boundaries are shown on Fig. A.2 and sample locations are shown on Fig. A.14.

A summary of sampling results for EU Z2-33 is provided in the following sections. Data summarized are for samples collected at the locations presented in Sects. 2.2.1, 2.2.2, and 2.2.3. For sites already addressed by a remedial action or D&D, only data from sample locations representative of the current conditions were summarized (Table 3). This summary begins with a presentation of analytical results for the focused investigation areas in the EU and concludes with an overall summary for EU Z2-33. The focused investigation areas discussed below include the Class 1 and Class 2 SUs, DPs and facilities selected for biased sampling based on recommendations in the Assessment Report, and a sediment accumulation area. This section concludes with data summary tables and a written description of the nature and extent of the chemicals and radionuclides observed. The EU Z2-33 summary also includes analytical data for the FFA sites summarized in Sect. 2.2.6. Analytical results in this section are generally from samples collected from the 0-10 ft depth interval. In a few cases, samples collected from $\geq$ 10 ft are included if they represented current conditions that have been addressed by a remedial action or D&D (Table 3). Sample locations representative of current conditions are shown on Fig. A.15. The Class 1 and Class 2 SU RA locations are shown on Fig. A.17.

K-1004-J Lab South Class 1 SU: As defined in the DQO Scoping Package, this area has known radionuclide soil contamination that originated from the K-1004-J Laboratory in EU Z2-42. There were eight historical sample locations in this Class 1 SU (see Sect. 2.2.1) and four Cs-137 Max RL exceedances in these locations (Sect. 2.1.1). Concrete sampling was conducted at two historical sample locations on the K-1004-H pad. An area of AL exceedances was described (Sect. 2.1.1.1) after completion of the BAR survey. Only one DVS confirmation sample location (RAD20) (Sect. 2.2.1) was identified because of the proximity of the four historical locations to each other. DVS step-out sampling was conducted within (location Z2-EU33B-129) and outside (location Z2-EU33B-130) the BAR survey area of AL exceedances. In addition to the biased DVS sample locations, two DVS systematic grid locations were identified during DQO scoping (Sect. 2.1.1).

A remedial action was conducted at this SU, and several of the historical and DVS sample locations have been removed (see Table 3). Five sample locations that defined conditions in this SU following remedial action included two concrete locations from the K-1004-H pad (Z2-EU33-2026 and Z2-EU33-2027), a systematic grid location (Z2-EU33B-105), the composited step-out samples from outside the area of contamination (Z2-EU33B-130), and a composited confirmation sample from the excavator bucket representing the last soils excavated during the remedial action (Z2-EU33B-380) (see Table 3). Analytical results summarized below are from sample locations representative of current conditions that showed a Cs-137 Avg RL exceedance in the step-out sample, radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and semivolatile organic compound (SVOC) detection.

EU Z2-33 K-1004-J LAB SOUTH CLASS 1 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
Arsenic	2/2	4.1	4.9	Z2-EU33-2027	4.5	0	0	0	0	0	2
Cadmium	2/2	0.92	1.2	Z2-EU33-2027	1.06	NA	NA	0	2	NA	0
Calcium	2/2	170,000	180,000	Z2-EU33-2026	175,000	NA	NA	NA	2	NA	NA
Iron	2/2	4,700	5,400	Z2-EU33-2027	5,050	NA	NA	0	0	NA	2
Magnesium	2/2	58,000	63,000	Z2-EU33-2026	60,500	NA	NA	NA	2	NA	NA
Vanadium	2/2	11	11	Z2-EU33-2026 Z2EU33-2027	11	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
SU = soil unit

EU Z2-33 K-1004-J LAB SOUTH CLASS 1 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	2/2	6.9J	14J	Z2-EU33-2026	10.5	0	0	0	0
Polychlorinated Biphenyl	2/2	6.9J	14J	Z2-EU33-2026	10.5	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 Z2-33 K-1004-J LAB SOUTH CLASS 1 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
Cesium-137	2/5	1.74	5.41	Z2-EU33B-130	3.58	0	1	2	NA	NA	2
Potassium-40	3/4	9.33	12.1	Z2-EU33B-105	10.9	NA	NA	3	0	NA	3
Radium-226	2/3	0.256	1.07	Z2-EU33B-105	0.663	NA	NA	1	0	NA	2
Thorium-228	2/4	1	1.03	Z2-EU33B-130	1.02	NA	NA	2	0	NA	2
Thorium-232	3/4	0.179	1.08	Z2-EU33B-130	0.706	NA	NA	3	0	NA	3
Uranium-234	4/4	0.392J	5.44	Z2-EU33B-130	1.89	0	0	0	NA	0	1
Uranium-238	4/4	0.419	3.32	Z2-EU33B-130	1.27	0	0	0	1	0	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
SU = soil unit

EU Z2-33 K-1004-J LAB SOUTH CLASS 1 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
Bis(2-ethylhexyl)phthalate	1/2	200J	200J	Z2-EU33-2027	200	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
SVOC = semivolatile organic compound

K-1015 Class 1 SU: Although this Class 1 SU was not defined during DQO scoping, it was addressed under DVS as a Class 1 SU because of maximum RL exceedances in historical samples from the area. This Class 1 SU is located in the K-1015 Laundry Pit FFA site (Sect. 2.2.6) and had three historical sample locations (Sect. 2.2.1) with radionuclide maximum RLs exceeded at two of the locations (Sect. 2.1.1). A BAR survey was conducted to determine the area of AL exceedances (Sect. 2.1.1.1) and DVS confirmation sample locations were selected at the historical locations with Max RL exceedances. A third DVS confirmation sample location was selected at historical sample location Z2-EU33B-2019 (Sect. 2.2.1) and four DVS boundary confirmation sample locations were selected in the Class 3 SU surrounding this Class 1 SU. The boundary confirmation sample locations were not step-out locations. All sample locations in this SU are presented in Sect. 2.2.1.

A remedial action was conducted at this SU, and several of the historical and DVS sample locations have been removed (see Table 3). Sample locations that defined current conditions in the SU included four historical locations (see Table 3 and Sect. 2.2.1), four DVS sample locations (Z2-EU33B-306 through Z2-EU33B-309) that defined the areal extent of the SU as well as the extent of possible soil contamination in the K-1015-A Laundry Pit FFA site (Sect. 2.2.6), and one location (Z2-EU33B-229) sampled at a depth > 10 ft bgs to bound the vertical extent of soil contamination in the K-1015 Class 1 SU and K-1015-A Laundry Pit FFA site (Sect. 2.2.6). Analytical results summarized below showed radionuclide Ind PRG exceedances, a U-234 GW SL exceedance, metal and radionuclide Bkg exceedances, and SVOC and VOC detections.

EU Z2-33 K-1015 CLASS 1 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	8/8	7,600J	18,800J	Z2-EU33B-309	13,063	NA	NA	0	0	NA	7
Arsenic	8/8	3.1J	7.8	Z2-EU33-2018	4.73	0	0	0	0	0	8
Barium	8/8	50.7J	170J	Z2-EU33B-229	104	NA	NA	0	2	0	0
Beryllium	8/8	0.33	2.3	Z2-EU33B-229	1.03	0	0	0	1	NA	0
Cadmium	6/8	0.079	3.9	Z2-EU33-2018	0.772	NA	NA	0	1	NA	1
Calcium	8/8	1,140J	65,200	Z2-EU33B-306	16,495	NA	NA	NA	6	NA	NA
Chromium	8/8	12J	34.3	425	20.7	NA	NA	0	0	0	3
Copper	8/8	8.6	33J	Z2-EU33B-229	18	NA	NA	0	2	NA	0
Iron	8/8	16,000J	57,000J	Z2-EU33B-229	32,550	NA	NA	0	0	NA	8
Lead	8/8	16.8J	51J	Z2-EU33B-309	30.0	NA	NA	0	3	0	0
Manganese	8/8	320J	3510	Z2-EU33B-309	1432	NA	NA	0	2	NA	8
Mercury	7/7	0.053J	1.2J	Z2-EU33B-307	0.275	0	0	0	3	NA	0
Nickel	8/8	6	57	Z2-EU33-2018	24.2	NA	NA	0	4	NA	0
Silver	5/8	0.072J	1.2	Z2-EU33-2018	0.313	NA	NA	0	1	NA	0
Uranium	6/6	0.4	3.4	Z2-EU33-2018	1.40	NA	NA	0	NA	NA	3
Vanadium	8/8	13	40J	Z2-EU33B-309	26.0	NA	NA	0	0	NA	8

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

PCBs were analyzed for in six samples but were not detected.

EU Z2-33 K-1015 CLASS 1 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
Cesium-137	1/9	0.564	0.564	KAH-SS-S11	0.564	0	0	0	NA	NA	1
Neptunium-237	1/7	0.5896	0.5896	KAH-SS-S11	0.590	0	0	0	NA	NA	1
Potassium-40	6/6	7.1	27.8	Z2-EU33B-229	19.9	NA	NA	6	0	NA	6

EU Z2-33 K-1015 CLASS 1 SU RADIONUCLIDES WITH BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont'd)

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
Radium-226	5/5	0.776	0.99	Z2-EU33B-309	0.899	NA	NA	5	0	NA	5
Technetium-99	1/9	0.3807	0.3807	KAH-SS-S11	0.381	NA	NA	0	NA	NA	1
Thorium-228	9/9	0.727	1.78	Z2-EU33B-229	1.30	NA	NA	9	0	NA	9
Thorium-230	9/9	0.452	6.148	KAH-SS-S11	1.53	NA	NA	0	3	NA	1
Thorium-232	9/9	0.543	1.49	Z2-EU33B-229	1.16	NA	NA	9	0	NA	9
Uranium-234	8/9	0.735	83.79	KAH-SS-S11	11.5	0	0	0	NA	1	1
Uranium-235	5/9	0.058	2.956	KAH-SS-S11	0.684	0	0	0	NA	0	1
Uranium-238	9/9	0.321	20.47	KAH-SS-S11	3.16	0	0	1	2	0	7

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

EU Z2-33 K-1015 CLASS 1 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
Acenaphthene	1/3	78J	78J	Z2-EU33B-307	78	0	NA	0
Anthracene	1/3	110J	110J	Z2-EU33B-307	110	0	NA	0
Benz(a)anthracene	1/3	240J	240J	Z2-EU33B-307	240	0	NA	0
Benzo(a)pyrene	1/3	180J	180J	Z2-EU33B-307	180	0	NA	1
Benzo(b)fluoranthene	1/3	210J	210J	Z2-EU33B-307	210	0	NA	0
Benzo(ghi)perylene	1/3	130J	130J	Z2-EU33B-307	130	0	NA	0
Benzo(k)fluoranthene	1/3	190J	190J	Z2-EU33B-307	190	0	NA	0
Bis(2-ethylhexyl)phthalate	1/3	1800	1800	Z2-EU33-2018	1,800	0	0	0
Butyl benzyl phthalate	1/3	69J	69J	Z2-EU33-2018	69	0	NA	0
Carbazole	1/3	78J	78J	Z2-EU33B-307	78	0	NA	0
Chrysene	1/3	280J	280J	Z2-EU33B-307	280	0	NA	0
Di-n-octylphthalate	1/3	120J	120J	Z2-EU33-2018	120	0	NA	0
Fluoranthene	1/3	590	590	Z2-EU33B-307	590	0	NA	0
Fluorene	1/3	63J	63J	Z2-EU33B-307	63	0	NA	0
Indeno(1,2,3-cd)pyrene	1/3	120J	120J	Z2-EU33B-307	120	0	NA	0
Phenanthrene	1/3	520	520	Z2-EU33B-307	520	0	NA	0
Pyrene	1/3	470	470	Z2-EU33B-307	470	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
SL = screening level
SU = soil unit
SVOC = semivolatile organic compound

EU Z2-33 K-1015 CLASS 1 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
1,1,2-Trichloro-1,2,2-trifluoroethane	1/4	21	21	424	21	0	NA	0
Toluene	2/4	9	22	425	15.5	0	0	0

EU = exposure unit
GW = groundwater
Ind = industrial
NA = not applicable
PRG = preliminary remediation goal
Res = residential
SL = screening level
SU = soil unit
VOC = volatile organic compound

K-1004 Area Drain Line Class 2 SU: Seventeen DVS systematic grid sample locations were identified in this SU (see Sect. 2.2.2) to address the impacts of the K-1004 Area Drain Line and other utilities to the EU soils. Also, there were two historical sample locations in this SU (Sect. 2.2.2). Analytical results summarized below from DVS and historical sampling in this SU did show Ind PRG exceedances for one metal, several radionuclides, and one SVOC; metal and radionuclide Bkg exceedances; and PCB, SVOC, and VOC detections.

EU Z2-33 K-1004 AREA DRAIN LINE 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	17/17	7,940J	15,900J	Z2-EU33-216	10,724	NA	NA	0	0	NA	17
Arsenic	17/17	1.3J	17.6	Z2-EU33-203	5.39	0	0	1	1	0	17
Barium	17/17	35.8	222	Z2-EU33-216	94.2	NA	NA	0	2	0	0
Cadmium	17/17	0.028J	1.3	Z2-EU33M-207	0.256	NA	NA	0	6	NA	0
Calcium	17/17	767J	161,000	Z2-EU33M-214	25,660	NA	NA	NA	14	NA	NA
Chromium	17/17	9.8J	27J	Z2-EU33-203	18.0	NA	NA	0	0	0	3
Cobalt	17/17	4.7J	283J	Z2-EU33M-21227	.2	NA	NA	0	1	NA	1
Copper	17/17	3.8J	42.8J	Z2-EU33-205	14.6	NA	NA	0	2	NA	0
Iron	17/17	13,200	46,300	Z2-EU33-203	22,994	NA	NA	0	0	NA	17
Lead	17/17	14.3J	274J	Z2-EU33M-21350	.1	NA	NA	0	5	0	0
Magnesium	17/17	430J	2,2100J	Z2-EU33M-209	6,096	NA	NA	NA	7	NA	NA
Manganese	17/17	115J	2,160J	Z2-EU33-216	969	NA	NA	0	0	NA	16
Mercury	12/17	0.013J	0.44J	Z2-EU33M-213	0.204	0	0	0	7	NA	0
Nickel	17/17	4.9	45.3J	Z2-EU33-205	16.6	NA	NA	0	2	NA	0
Selenium	7/17	0.15J	1.5J	Z2-EU33-203	0.443	NA	NA	0	1	NA	0
Silver	16/17	0.083J	1.9J	Z2-EU33M-214	0.310	NA	NA	0	2	NA	0
Uranium	17/17	0.64J	38.7	Z2-EU33M-2073.	72	NA	NA	0	NA	NA	8
Vanadium	17/17	14.7	42.4J	Z2-EU33-203	22.7	NA	NA	0	0	NA	17
Zinc	17/17	15.7J	377J	Z2-EU33-205	59.4	NA	NA	0	2	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
SU = soil unit

EU Z2-33 K-1004 AREA DRAIN LINE 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	3/17	60	120J	Z2-EU33M-207	85.3	0	0	0	1
PCB-1260	2/17	54J	60	Z2-EU33-205	57	0	0	0	0
Polychlorinated Biphenyl	3/17	76	170J	Z2-EU33M-207	122	0	0	0	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
SU = soil unit

EU Z2-33 K-1004 AREA DRAIN LINE 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
Cesium-137	3/8	0.2715J	0.6505	KAH-SS-S61	0.451	0	0	0	NA	NA	3
Potassium-40	6/6	16	25.5	Z2-EU33-211	21.2	NA	NA	6	0	NA	6
Radium-226	6/6	0.71J	1.18	Z2-EU33-202	0.987	NA	NA	6	0	NA	6
Technetium-99	2/8	0.58	1.28	Z2-EU33M-207	0.93	NA	NA	0	NA	NA	2
Thorium-228	8/8	0.81J	1.84	Z2-EU33M-212	1.32	NA	NA	8	0	NA	8
Thorium-230	8/8	0.68J	1.5	Z2-EU33M-207	1.17	NA	NA	0	3	NA	0
Thorium-232	8/8	0.86J	1.62	Z2-EU33-211	1.23	NA	NA	8	0	NA	8
Uranium-234	8/8	1.17	42.4	Z2-EU33-217	10.8	0	0	0	NA	0	2
Uranium-235	7/8	0.04	2.43	Z2-EU33-217	0.741	0	0	0	NA	0	3
Uranium-238	8/8	1.15	41.4	Z2-EU33-217	9.51	0	0	2	6	0	8

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 Z2-33 K-1004 AREA DRAIN LINE 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	2/17	46J	850	Z2-EU33M-212	448	0	NA	NA
Acenaphthene	4/17	51J	1000	Z2-EU33M-212	311	0	NA	0
Acenaphthylene	2/17	260J	670	Z2-EU33-203	465	0	NA	0
Anthracene	5/17	46J	2,800J	Z2-EU33M-212	810	0	NA	0
Benz(a)anthracene	10/17	46J	3,900J	Z2-EU33M-212	796	0	NA	2
Benzo(a)pyrene	11/17	45J	2,900J	Z2-EU33M-212	552	1	NA	6
Benzo(b)fluoranthene	10/17	48J	4,900	Z2-EU33-203	898	0	NA	2
Benzo(ghi)perylene	8/17	42J	2,100	Z2-EU33-203	502	0	NA	0
Benzo(k)fluoranthene	8/17	57J	2,400	Z2-EU33M-212	458	0	NA	0
Bis(2-ethylhexyl)phthalate	4/17	69J	110J	Z2-EU33-202	91	0	0	0
Butyl benzyl phthalate	1/17	49J	49J	Z2-EU33M-208	49	0	NA	0
Carbazole	4/17	54J	1600	Z2-EU33M-212	494	0	NA	0
Chrysene	12/17	44J	3,500J	Z2-EU33M-212	626	0	NA	0
Dibenz(a,h)anthracene	3/17	94J	540J	Z2-EU33-203	255	0	NA	3
Dibenzofuran	3/17	55J	1300	Z2-EU33M-212	508	0	NA	0
Fluoranthene	11/17	73J	10,000J	Z2-EU33M-212	1,840	0	NA	0
Fluorene	5/17	52J	2,300J	Z2-EU33M-212	602	0	NA	0
Indeno(1,2,3-cd)pyrene	7/17	49J	1,900	Z2-EU33-203	549	0	NA	2
Naphthalene	2/17	57J	1,400J	Z2-EU33M-212	729	0	NA	0
Phenanthrene	8/17	67J	12,000J	Z2-EU33M-212	2162	0	NA	0
Pyrene	11/17	50J	8,600J	Z2-EU33M-212	1,447	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
SL = screening level
SU = soil unit
SVOC = semivolatile organic compound

EU Z2-33 K-1004 AREA DRAIN LINE 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
2-Butanone	1/4	16J	16J	Z2-EU33-217	16	0	NA	0
Acetone	2/4	37	43J	Z2-EU33-217	40	0	NA	0
Benzene	1/4	2.2J	2.2J	Z2-EU33-217	2.2	0	0	0
cis-1,2-Dichloroethene	2/4	1.2J	3.9J	Z2-EU33-211	2.55	0	NA	0
Toluene	1/4	16J	16J	Z2-EU33-217	16	0	0	0
Trichloroethene	1/4	1.9J	1.9J	Z2-EU33-217	1.9	0	0	0
Vinyl chloride	2/4	8.2	37J	Z2-EU33-217	22.6	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
SL = screening level
SU = soil unit
VOC = volatile organic compound

KAH-SS-B22 Class 2 SU: This Class 2 SU was defined to delineate the extent of a Cs-137 Avg RL exceedance at historical sample location KAH-SS-B22 (Sect. 2.1.2). Also, a BAR survey was conducted but no AL exceedances were observed (Sect. 2.1.2.1). A DVS confirmation sample location was selected at the historical sample location (Sect. 2.2.2) but analytical results did not confirm the Avg RL exceedance. Analytical results summarized below for the DVS confirmation sample did show radionuclide Ind PRG and Bkg exceedances.

EU Z2-33 KAH-SS-B22 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	23.4	23.4	Z2-EU33B-221	23.4	NA	NA	1	0	NA	1
Radium-226	1/1	0.91	0.91	Z2-EU33B-221	0.91	NA	NA	1	0	NA	1
Thorium-228	1/1	1.32	1.32	Z2-EU33B-221	1.32	NA	NA	1	0	NA	1
Thorium-230	1/1	1.22	1.22	Z2-EU33B-221	1.22	NA	NA	0	1	NA	0
Thorium-232	1/1	1.32	1.32	Z2-EU33B-221	1.32	NA	NA	1	0	NA	1
Uranium-238	1/1	1.02	1.02	Z2-EU33B-221	1.02	0	0	0	0	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

KAH-SS-S31 Class 2 SU: This Class 2 SU was defined to delineate the extent of a Cs-137 Avg RL exceedance at historical sample location KAH-SS-S31 (Sect. 2.1.2). Also, a BAR survey was conducted but no AL exceedances were observed (Sect. 2.1.2.1). A DVS confirmation sample location was selected at the historical sample location (Sect. 2.2.2) but analytical results did not confirm the Avg RL exceedance. Analytical results summarized below for the DVS confirmation sample did show radionuclide Ind PRG and Bkg exceedances.

EU Z2-33 KAH-SS-S31 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	15.4	15.4	Z2-EU33B-222	15.4	NA	NA	1	0	NA	1
Radium-226	1/1	0.84	0.84	Z2-EU33B-222	0.84	NA	NA	1	0	NA	1
Thorium-228	1/1	1.15	1.15	Z2-EU33B-222	1.15	NA	NA	1	0	NA	1
Thorium-230	1/1	1.47	1.47	Z2-EU33B-222	1.47	NA	NA	0	1	NA	0

EU Z2-33 KAH-SS-S31 CLASS 2 SU RADIONUCLIDES WITH BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont'd)

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	1/1	1.05	1.05	Z2-EU33B-222	1.05	NA	NA	1	0	NA	1
Uranium-238	1/1	1.01	1.01	Z2-EU33B-222	1.01	0	0	0	0	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

Sediment Accumulation Area: Sediment accumulation area DP EU33D-316 was identified during the Class 3 SU walkover assessment. However, upon returning to collect a sample, the area was inaccessible as a result of D&D activities. In its place, a DVS biased sample was collected from an area with accumulated sediment from the D&D truck wash station east of the K-1004-J Lab South Class 1 SU. This sample was analyzed for radionuclides to investigate possible radiological contamination resulting from runoff from the truck wash station. Analytical results summarized below showed Ind PRG exceedances for radium and thorium isotopes and K-40 but no evidence that runoff from the truck wash station resulted in an accumulation of radionuclides.

EU Z2-33 SEDIMENT ACCUMULATION AREA 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	1/1	0.39	0.39	Z2-EU33B-342	0.39	0	0	0	NA	NA	1
Potassium-40	1/1	14.3	14.3	Z2-EU33B-342	14.3	NA	NA	1	0	NA	1
Radium-226	1/1	0.89	0.89	Z2-EU33B-342	0.89	NA	NA	1	0	NA	1
Thorium-228	1/1	1.57	1.57	Z2-EU33B-342	1.57	NA	NA	1	0	NA	1
Thorium-232	1/1	1.17	1.17	Z2-EU33B-342	1.17	NA	NA	1	0	NA	1
Uranium-234	1/1	4.51	4.51	Z2-EU33B-342	4.51	0	0	0	NA	0	1
Uranium-238	1/1	2.88	2.88	Z2-EU33B-342	2.88	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

Dilution Pit Southwest of K-1004-D (DP EU33D-318): Biased sampling was recommended in the Assessment Report for this site based on the Class 3 SU walkover assessment visual observations. A sediment sample collected from the pit exceeded multiple evaluation criteria for metals, PCBs, radionuclides, and VOCs. Two soil samples collected outside the dilution pit and at the pit's base level were analyzed for metals, PCBs, radionuclides, SVOCs, and VOCs. A 10-ft composite sample location was located in the groundwater downgradient direction from the dilution pit and analyzed for metals, PCBs, radionuclide, SVOCs, and VOCs. Analytical results from these samples located outside the dilution pit showed contaminants had not leaked from the pit. The dilution pit was removed during a remedial action that also removed the sediment sample location (Table 3). Soil sample locations representative of current conditions are presented in Table 3. Samples from these representative locations included the two from the base level of the dilution pit (Z2-EU33B-113 and Z2-EU33B-114), one that was collected from a depth > 10 ft bgs (Table 3), and the sample location in the groundwater downgradient direction from the dilution pit (Z2-EU33B-311). Analytical results summarized below for locations representative of current conditions showed radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and SVOC and VOC detections.

EU Z2-33 DILUTION PIT SOUTHWEST OF K-1004-D 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	3/3	6,100	16,000	Z2-EU33B-114	9,670	NA	NA	0	0	NA	1
Arsenic	3/3	1.2	4.1	Z2-EU33B-114	2.57	0	0	0	0	0	3
Cadmium	3/3	0.054J	0.26	Z2-EU33B-114	0.161	NA	NA	0	1	NA	0
Calcium	3/3	2290J	5,300	Z2-EU33B-113	3497	NA	NA	NA	2	NA	NA
Copper	3/3	8J	34J	Z2-EU33B-113	22.3	NA	NA	0	2	NA	0
Iron	3/3	12,900J	50,000J	Z2-EU33B-114	25,300	NA	NA	0	0	NA	3
Manganese	3/3	120J	1,400J	Z2-EU33B-114	634	NA	NA	0	0	NA	2
Mercury	3/3	0.025J	0.97	Z2-EU33B-113	0.378	0	0	0	1	NA	0
Nickel	3/3	9.1	31	Z2-EU33B-114	16.8	NA	NA	0	1	NA	0
Nickel	3/3	9.1	31	Z2-EU33B-114	16.8	NA	NA	0	1	NA	0
Selenium	3/3	0.18J	3.7	Z2-EU33B-114	1.51	NA	NA	0	1	NA	0
Uranium	3/3	0.89	8	Z2-EU33B-113	3.46	NA	NA	0	NA	NA	1
Vanadium	3/3	15.8	31J	Z2-EU33B-114	21.9	NA	NA	0	0	NA	3

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

PCBs were for analyzed in three samples but were not detected.

EU Z2-33 DILUTION PIT SOUTHWEST OF K-1004-D 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	3/3	10	27.2	Z2-EU33B-114	16.9	NA	NA	3	0	NA	3
Radium-226	1/1	0.95	0.95	Z2-EU33B-311	0.95	NA	NA	1	0	NA	1
Thorium-228	3/3	1.24	1.99	Z2-EU33B-114	1.53	NA	NA	3	1	NA	3
Thorium-230	3/3	1.14	1.55	Z2-EU33B-114	1.31	NA	NA	0	2	NA	0
Thorium-232	3/3	1	1.72	Z2-EU33B-114	1.32	NA	NA	3	0	NA	3
Uranium-234	3/3	1.05	4.38	Z2-EU33B-113	2.36	0	0	0	NA	0	1
Uranium-235	2/3	0.108J	0.22J	Z2-EU33B-113	0.164	0	0	0	NA	0	1
Uranium-238	3/3	1.36	2.92	Z2-EU33B-113	1.89	0	0	0	1	0	3

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 Z2-33 DILUTION PIT SOUTHWEST OF K-1004-D 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
Benz(a)anthracene	1/3	93J	93J	Z2-EU33B-113	93	0	NA	0
Benzo(a)pyrene	1/3	48J	48J	Z2-EU33B-311	48	0	NA	0
Benzo(b)fluoranthene	2/3	73J	94J	Z2-EU33B-113	83.5	0	NA	0
Benzo(ghi)perylene	1/3	83J	83J	Z2-EU33B-311	83	0	NA	0
Benzo(k)fluoranthene	1/3	61J	61J	Z2-EU33B-311	61	0	NA	0
Chrysene	2/3	57J	92J	Z2-EU33B-113	74.5	0	NA	0
Fluoranthene	1/3	250J	250J	Z2-EU33B-113	250	0	NA	0
Indeno(1,2,3-cd)pyrene	1/3	58J	58J	Z2-EU33B-311	58	0	NA	0

EU Z2-33 DILUTION PIT SOUTHWEST OF K-1004-D SVOC DETECTS (ug/kg) 0-10 ft (cont'd)

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
Naphthalene	1/5	9.4	9.4	Z2-EU33B-113	9.4	0	NA	0
Phenanthrene	1/3	87J	87J	Z2-EU33B-113	87	0	NA	0
Pyrene	2/3	43J	180J	Z2-EU33B-113	112	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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 DILUTION PIT SOUTHWEST OF K-1004-D 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
1,1,1-Trichloroethane	2/3	96	4,300	Z2-EU33B-113	2,198	0	0	0
1,1,2-Trichloro-1,2,2-trifluoroethane	2/2	2.5J	150	Z2-EU33B-113	76.3	0	NA	0
1,1,2-Trichloroethane	1/3	7.4	7.4	Z2-EU33B-113	7.4	0	0	0
1,1-Dichloroethane	2/3	42	480	Z2-EU33B-113	261	0	NA	0
1,1-Dichloroethene	2/3	37	320	Z2-EU33B-113	179	0	0	0
1,2-Dichloroethane	1/3	11	11	Z2-EU33B-113	11	0	NA	0
Acetone	2/3	10J	64	Z2-EU33B-113	37	0	NA	0
Carbon disulfide	1/3	6.9	6.9	Z2-EU33B-113	6.9	0	NA	0
Chloroform	1/3	41	41	Z2-EU33B-113	41	0	0	0
cis-1,2-Dichloroethene	2/3	9.8	9.9	Z2-EU33B-113	9.85	0	NA	0
Methylene chloride	2/3	7.1	40	Z2-EU33B-113	23.6	0	0	0
Tetrachloroethene	1/3	7.7	7.7	Z2-EU33B-113	7.7	0	0	0
Toluene	1/3	30	30	Z2-EU33B-113	30	0	0	0
trans-1,2-Dichloroethene	1/3	2.3J	2.3J	Z2-EU33B-113	2.3	0	NA	0
Trichloroethene	2/3	29	580	Z2-EU33B-113	305	0	0	1

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
SL = screening level
VOC = volatile organic compound

K-1004-A,B,C Dilution Pit West (DP EU33D-329): Biased sampling was recommended in the Assessment Report for this site based on Class 3 SU walkover assessment visual observations. A sediment sample collected from the pit exceeded multiple metal, PCB, radionuclide, and VOC evaluation criteria. Two soil samples collected outside the dilution pit and at the pit's base level were analyzed for metals, PCBs, radionuclides, SVOCs, and VOCs. Four additional soil samples were collected in a step-wise manner in the groundwater downgradient direction from the dilution pit and analyzed for VOCs. Analytical results from these samples showed elevated VOCs in the pit base level samples but not in the downgradient samples. Interpretation of these analytical results determined metal, PCB, and radionuclide contaminants had been contained within the pit and only VOCs had migrated out of the pit. The dilution pit was removed during a remedial action that also removed the original sediment sample location and the two pit base level soil sample locations (Table 3). Confirmation sample Z2-EU33B-377 was collected following the remedial action and analyzed for VOCs. Analytical results showed elevated VOCs resulting in additional soil being excavated, removal of the confirmation sample location (Table 3), and collection of a confirmation sample to be analyzed for VOCs for the second excavation. Soil sample locations representative of current conditions at the K-1004-A,B,C Dilution Pit West are presented in Table 3. These locations included downgradient sample locations Z2-EU33B-131, Z2-EU33B-137, Z2-EU33B-140, and Z2-EU33B-141 and final confirmation sample Z2-EU33B-383, which were collected from a depth > 10 ft bgs. All samples from the representative sample

locations were analyzed for VOCs only. Analytical results summarized below from the sample locations representative of current conditions show VOC detections.

EU Z2-33 K-1004-A,B,C DILUTION PIT WEST 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-Dichloroethene	1/5	3.1J	3.1J	Z2-EU33B-383	3.1	0	0	0
Acetone	1/5	110	110	Z2-EU33B-383	110	0	NA	0
Carbon disulfide	1/5	12	12	Z2-EU33B-383	12	0	NA	0
Chloroform	1/5	140	140	Z2-EU33B-383	140	0	0	0
cis-1,2-Dichloroethene	2/5	570	1,300	Z2-EU33B-383	935	0	NA	0
Tetrachloroethene	2/5	2.3J	29	Z2-EU33B-383	15.7	0	0	0
Toluene	1/5	2.6J	2.6J	Z2-EU33B-383	2.6	0	0	0
trans-1,2-Dichloroethene	2/5	2.5J	11	Z2-EU33B-383	6.75	0	NA	0
Trichloroethene	2/5	4.3J	170	Z2-EU33B-383	87.2	0	0	1
Vinyl chloride	1/5	120	120	Z2-EU33B-383	120	0	0	1

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
SL = screening level
VOC = volatile organic compound

K-1004-A,B,C Dilution Pit South (DP EU33D-330): Biased sampling was recommended in the Assessment Report for this site based on Class 3 SU walkover assessment visual observations. A sediment sample collected from the pit exceeded multiple metal, PCB, radionuclide, SVOC, and VOC evaluation criteria. Two soil samples collected outside the dilution pit and at the pit's base level were analyzed for metals, PCBs, radionuclides, SVOCs, and VOCs. An additional 10-ft composite sample was collected southwest of the pit. Analytical results from these samples showed contaminants had been contained by the dilution pit, which was removed during a remedial action that also removed the original sediment sample location (Table 3). A confirmation sample was collected from the excavation at the end of the remedial action. Sample locations representative of current conditions at the K-1004-A,B,C Dilution Pit South are presented in Table 3. These locations included samples Z2-EU33B-122 and Z2-EU33B-123 from the base level of the pit [one sample was at a depth > 10 ft bgs (see Table 3)], 10-ft composite sample Z2-EU33B-315 southwest of the pit, and confirmation sample Z2-EU33B-379. Analytical results summarized below show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and PCB, SVOC, and VOC detections.

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH 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	4/4	10,600J	22,000	Z2-EU33B-122	16,900	NA	NA	0	0	NA	4
Arsenic	4/4	4.1J	6.4	Z2-EU33B-122	5.4	0	0	0	0	0	4
Barium	4/4	31J	132	Z2-EU33B-315	66.8	NA	NA	0	1	0	0
Cadmium	4/4	0.2	0.69	Z2-EU33B-123	0.338	NA	NA	0	2	NA	0
Calcium	4/4	2,200	21,700	Z2-EU33B-315	11,275	NA	NA	NA	3	NA	NA
Chromium	4/4	19.8J	130	Z2-EU33B-123	59.5	NA	NA	0	2	0	2
Copper	4/4	19J	33J	Z2-EU33B-123	23.4	NA	NA	0	2	NA	0
Iron	4/4	18,600	52,000	Z2-EU33B-122	41,150	NA	NA	0	0	NA	4
Lead	4/4	26.5J	61	Z2-EU33B-123 Z2-EU33B-123	37.6	NA	NA	0	1	0	0
Manganese	4/4	310J	1,830	Z2-EU33B-315	913	NA	NA	0	0	NA	4
Mercury	4/4	0.085	0.86J	Z2-EU33B-122	0.474	0	0	0	3	NA	0
Selenium	3/4	0.13J	4.2	Z2-EU33B-123	2.68	NA	NA	0	2	NA	0
Silver	2/4	0.45J	2.1	Z2-EU33B-123	1.28	NA	NA	0	1	NA	0

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH METALS WITH BACKGROUND, PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont'd)

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	4/4	0.88	15	Z2-EU33B-123	5.05	NA	NA	0	NA	NA	3
Vanadium	4/4	20.4	67J	Z2-EU33B-122	42.1	NA	NA	0	1	NA	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

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH 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	2/4	24	60	Z2-EU33B-123	42	0	0	0	0
Polychlorinated Biphenyl	2/4	24	60	Z2-EU33B-123	42	0	0	0	0

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

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH 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	1/4	0.146	0.146	Z2-EU33B-315	0.146	0	0	0	NA	NA	1
Potassium-40	4/4	15.2	23.4J	Z2-EU33B-379	17.8	NA	NA	4	0	NA	4
Radium-226	1/1	0.93	0.93	Z2-EU33B-315	0.93	NA	NA	1	0	NA	1
Thorium-228	4/4	1.07	2.07	Z2-EU33B-123	1.66	NA	NA	4	2	NA	4
Thorium-230	4/4	1.2J	2.23	Z2-EU33B-122	1.61	NA	NA	0	3	NA	0
Thorium-232	4/4	1.43	2.18	Z2-EU33B-122	1.71	NA	NA	4	1	NA	4
Uranium-234	4/4	1.34	6.03	Z2-EU33B-122	2.85	0	0	0	NA	0	1
Uranium-238	4/4	1.35	5.08	Z2-EU33B-122	2.69	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

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH 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	1/4	140J	140J	Z2-EU33B-379	140	0	NA	NA
Fluoranthene	2/4	67J	130J	Z2-EU33B-379	98.5	0	NA	0
Indeno(1,2,3-cd)pyrene	1/4	200J	200J	Z2-EU33B-379	200	0	NA	0
Naphthalene	1/6	110J	110J	Z2-EU33B-379	110	0	NA	0

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH SVOC DETECTS (ug/kg) 0-10 ft (cont'd)

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	2/4	45J	120J	Z2-EU33B-379	82.5	0	NA	0
Pyrene	2/4	48J	100J	Z2-EU33B-379	74	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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 K-1004-A,B,C DILUTION PIT SOUTH 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
Carbon tetrachloride	3/3	1.2J	6.7	Z2-EU33B-123	3.5	0	0	0
Chloroform	1/3	3.8J	3.8J	Z2-EU33B-123	3.8	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
SL = screening level
VOC = volatile organic compound

K-1004-A,B,C Dilution Pit East (DP EU33D-331): Biased sampling was recommended for this site in the Assessment Report based on Class 3 SU walkover assessment visual observations. A sediment sample could not be collected from the pit because it was filled with construction debris. Two soil samples collected outside the dilution pit and at the pit's base level were analyzed for metals, PCBs, radionuclides, SVOCs, and VOCs. Although a sample from the pit was not collected and the two base-level samples showed no criteria exceedances, the pit was removed during a remedial action. Because the pit was removed during a remedial action, the inability to collect a sediment sample from the pit has no impact on the understanding of current conditions. Sample locations representative of current conditions are presented in Table 3. These locations included two samples from the pit's base level (one collected from a depth > 10 ft bgs). Analytical results summarized below for sample locations representative of current conditions show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and PCB, SVOC, and VOC detections.

EU Z2-33 K-1004-A,B,C DILUTION PIT EAST 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	11,000	18,000	Z2-EU33B-116	14,500	NA	NA	0	0	NA	2
Arsenic	2/2	3.6	12	Z2-EU33B-116	7.8	0	0	0	0	0	2
Cadmium	1/2	0.39	0.39	Z2-EU33B-116	0.39	NA	NA	0	1	NA	0
Calcium	2/2	1,900	5,300	Z2-EU33B-116	3,600	NA	NA	NA	1	NA	NA
Chromium	2/2	22	29	Z2-EU33B-116	25.5	NA	NA	0	0	0	1
Copper	2/2	7.8J	39J	Z2-EU33B-116	23.4	NA	NA	0	1	NA	0
Iron	2/2	38,000J	74,000J	Z2-EU33B-116	56,000	NA	NA	0	1	NA	2
Lead	2/2	26	73	Z2-EU33B-116	49.5	NA	NA	0	1	0	0
Manganese	2/2	590J	1,400J	Z2-EU33B-116	995	NA	NA	0	0	NA	2
Selenium	2/2	2.8	4.1	Z2-EU33B-116	3.45	NA	NA	0	2	NA	0
Thallium	2/2	0.17J	0.49J	Z2-EU33B-116	0.33	NA	NA	0	1	0	0
Uranium	2/2	1.3	3.6	Z2-EU33B-116	2.45	NA	NA	0	NA	NA	1

EU Z2-33 K-1004-A,B,C DILUTION PIT EAST METALS WITH BACKGROUND, PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont'd)

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	2/2	1.3	3.6	Z2-EU33B-116	2.45	NA	NA	0	NA	NA	1
Vanadium	2/2	32J	75J	Z2-EU33B-116	53.5	NA	NA	0	1	NA	2
Zinc	2/2	25	120	Z2-EU33B-116	72.5	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 Z2-33 K-1004-A,B,C DILUTION PIT EAST 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	2/2	6.1J	20J	Z2-EU33B-117	13.1	0	0	0	0
Polychlorinated Biphenyl	2/2	6.1J	20J	Z2-EU33B-117	13.1	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

EU Z2-33 K-1004-A,B,C DILUTION PIT EAST 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	2/2	13.8	18.4	Z2-EU33B-117	16.1	NA	NA	2	0	NA	2
Thorium-228	2/2	1.25	1.69	Z2-EU33B-116	1.47	NA	NA	2	0	NA	2
Thorium-230	2/2	0.874	2.4	Z2-EU33B-116	1.64	NA	NA	0	1	NA	0
Thorium-232	2/2	1.24	1.71	Z2-EU33B-116	1.48	NA	NA	2	0	NA	2
Uranium-238	2/2	1.14	2.21	Z2-EU33B-116	1.68	0	0	0	1	0	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 Z2-33 K-1004-A,B,C DILUTION PIT EAST 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
Benz(a)anthracene	1/2	100J	100J	Z2-EU33B-116	100	0	NA	0
Benzo(b)fluoranthene	1/2	110J	110J	Z2-EU33B-116	110	0	NA	0
Fluoranthene	1/2	270J	270J	Z2-EU33B-116	270	0	NA	0
Naphthalene	1/4	160	160	Z2-EU33B-116	160	0	NA	0
Phenanthrene	1/2	230J	230J	Z2-EU33B-116	230	0	NA	0
Pyrene	1/2	190J	190J	Z2-EU33B-116	190	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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 K-1004-A,B,C DILUTION PIT EAST 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
1,2,3-Trichlorobenzene	1/2	2.7J	2.7J	Z2-EU33B-117	2.7	NA	NA	NA

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
SL = screening level
VOC = volatile organic compound

K-1004-A,B,C Dilution Pit East Center (DP EU33D-332): Biased sampling was recommended for this site in the Assessment Report based on Class 3 SU walkover assessment visual observations. A sediment sample collected from the pit exceeded multiple metal, PCB, radionuclide, and VOC evaluation criteria. Two soil samples collected outside the dilution pit and at the pit's base level were analyzed for metals, PCBs, radionuclides, SVOCs, and VOCs. Analytical results from the two samples collected at the base level of the pit showed no contamination had leaked from the pit. A remedial action conducted in this area removed the dilution pit and the sediment sample location (Table 3). A confirmation sample was collected following the remedial action. Sample locations representative of current conditions at the K-1004-A,B,C Dilution Pit East Center are presented in Table 3. These locations included samples Z2-EU33B-119, Z2-EU33B-120 from the base level of the pit [one sample was at a depth of ≥ 10 ft (Table 3)] and confirmation sample location Z2-EU33B-378. Analytical results summarized below from the sample locations representative of current conditions show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and one VOC detection.

EU Z2-33 K-1004-A,B,C DILUTION PIT EAST CENTER 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	3/3	7,500	15,000	Z2-EU33B-378	10,733	NA	NA	0	0	NA	2
Arsenic	3/3	1.7	11J	Z2-EU33B-378	5.67	0	0	0	0	0	3
Cadmium	2/3	0.15	0.31	Z2-EU33B-378	0.23	NA	NA	0	1	NA	0
Calcium	3/3	1,200	43,000	Z2-EU33B-119	17,667	NA	NA	NA	2	NA	NA
Chromium	3/3	13	25	Z2-EU33B-119	20	NA	NA	0	0	0	1
Copper	3/3	4.2J	25J	Z2-EU33B-378	13.7	NA	NA	0	1	NA	0
Iron	3/3	21,000J	46,000J	Z2-EU33B-378	31,667	NA	NA	0	0	NA	3
Magnesium	3/3	570	23,000	Z2-EU33B-119	9,090	NA	NA	NA	2	NA	NA
Manganese	3/3	640J	680J	Z2-EU33B-120	657	NA	NA	0	0	NA	3
Mercury	3/3	0.12J	7.1J	Z2-EU33B-378	2.45	0	0	0	1	NA	1
Selenium	2/3	1.9	1.9	Z2-EU33B-119 Z2-EU33B-120	1.9	NA	NA	0	2	NA	0
Uranium	3/3	0.78	2.6	Z2-EU33B-119	1.96	NA	NA	0	NA	NA	2
Vanadium	3/3	23J	54	Z2-EU33B-378	35	NA	NA	0	0	NA	3

Avg = average
Bkg = background
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
Max = maximum

Polychlorinated biphenyls were analyzed for in the three samples but were not detected.

EU Z2-33 K-1004-A,B,C DILUTION PIT EAST CENTER 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	1/3	0.297J	0.297J	Z2-EU33B-378	0.297	0	0	0	NA	NA	1
Potassium-40	3/3	11.2	15.8J	Z2-EU33B-378	14.2	NA	NA	3	0	NA	3
Thorium-228	3/3	1.2	1.94	Z2-EU33B-378	1.62	NA	NA	3	1	NA	3
Thorium-230	3/3	1.35	2.05	Z2-EU33B-119	1.70	NA	NA	0	3	NA	0
Thorium-232	3/3	1.24	1.49	Z2-EU33B-378	1.36	NA	NA	3	0	NA	3
Uranium-234	3/3	4.37	8.39	Z2-EU33B-119	6.75	0	0	0	NA	0	3
Uranium-235	3/3	0.141J	0.371J	Z2-EU33B-119	0.276	0	0	0	NA	0	2
Uranium-238	3/3	1.4	2.52	Z2-EU33B-378	2.11	0	0	0	2	0	3

Avg = average
Bkg = background
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
Max = maximum

Semivolatile organic compounds were analyzed for in two samples but were not detected.

EU Z2-33 K-I004-A,B,C DILUTION PIT EAST CENTER 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
Trichloroethene	1/2	2.6J	2.6J	Z2-EU33B-119	2.6	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
SL = screening level
VOC = volatile organic compound

Gravel Wash Area (EU33D-333): This area is located south and adjacent to the former K-1004-L concrete pad and was reported to have been used for rinsing filters. Biased sampling for this site was recommended in the Assessment Report based on a radiation measurement that exceeded the SL. The boundaries of the gravel wash area were delineated visually and three soil sample locations were identified along the eastern, southern, and western boundaries (K-1004-L concrete pad was the northern boundary), and one sample location was identified inside the gravel wash area. The U-234 and U-238 Avg RLs and U-238 Max RL were exceeded at the sample location inside the gravel wash area and the PCB-1254 Avg RL was exceeded at the eastern boundary sample location. The gravel wash area was removed during a remedial action that also removed all four sample locations. A follow-up BAR survey identified a small area with residual radiation in excess of the AL (Sect. 2.1.1.1) and additional soils were excavated. Following the remedial action, five confirmation samples were collected from the excavation and analyzed for uranium isotopes. Sample locations that represent current conditions are presented in Table 3. Analytical results summarized below from the sample locations representative of current conditions show two U-238 Bkg exceedances.

EU Z2-33 GRAVEL WASH AREA 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
Uranium-238	5/5	1.15	2.98	Z2-EU33B-371	1.73	0	0	0	2	0	5

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

Brick-Lined Drain Pit (EU33D-334): This pit is a storm drain that received runoff from the Gravel Wash Area (EU33D-333) and was recommended for biased sampling in the Assessment Report. A DVS biased sample location was identified (Sect. 2.2.3) and a sample of sediment from the storm drain was collected. Analytical results summarized below show U-235 and U-238 Avg RL exceedances; one metal and several radionuclide and SVOC Ind PRG exceedances; metal and radionuclide Bkg exceedances; U-234 and U-238 GW SL exceedances; and PCB, SVOC, and VOC detections.

EU Z2-33 BRICK-LINED DRAIN PIT 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	1/1	8,180	8,180	Z2-EU33B-334	8,180	NA	NA	0	0	NA	1
Arsenic	1/1	10.9J	10.9J	Z2-EU33B-334	10.9	0	0	0	0	0	1
Barium	1/1	248J	248J	Z2-EU33B-334	248	NA	NA	0	1	0	0
Cadmium	1/1	6.5J	6.5J	Z2-EU33B-334	6.5	NA	NA	0	1	NA	1
Calcium	1/1	89,600J	89,600J	Z2-EU33B-334	89,600	NA	NA	NA	1	NA	NA
Chromium	1/1	100	100	Z2-EU33B-334	100	NA	NA	0	1	0	1
Copper	1/1	191	191	Z2-EU33B-334	191	NA	NA	0	1	NA	0
Iron	1/1	15,800J	15,800J	Z2-EU33B-334	15,800	NA	NA	0	0	NA	1
Lead	1/1	236J	236J	Z2-EU33B-334	236	NA	NA	0	1	0	0
Magnesium	1/1	11,200J	11,200J	Z2-EU33B-334	11,200	NA	NA	NA	1	NA	NA
Manganese	1/1	371J	371J	Z2-EU33B-334	371	NA	NA	0	0	NA	1
Mercury	1/1	13.3J	13.3J	Z2-EU33B-334	13.3	0	0	0	1	NA	1
Nickel	1/1	107J	107J	Z2-EU33B-334	107	NA	NA	0	1	NA	0
Silver	1/1	6.1J	6.1J	Z2-EU33B-334	6.1	NA	NA	0	1	NA	0
Sodium	1/1	1,260	1,260	Z2-EU33B-334	1,260	NA	NA	NA	1	NA	NA
Uranium	1/1	692J	692J	Z2-EU33B-334	692	NA	NA	1	NA	NA	1
Vanadium	1/1	11	11	Z2-EU33B-334	11	NA	NA	0	0	NA	1
Zinc	1/1	797	797	Z2-EU33B-334	797	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 Z2-33 BRICK-LINED DRAIN PIT 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	1/1	2,300	2,300	Z2-EU33B-334	2,300	0	0	0	1
PCB-1260	1/1	920J	920J	Z2-EU33B-334	920	0	0	0	1
Polychlorinated Biphenyl	1/1	3,300J	3,300J	Z2-EU33B-334	3,300	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 Z2-33 BRICK-LINED DRAIN PIT 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	7.3	7.3	Z2-EU33B-334	7.3	NA	NA	1	0	NA	1
Radium-226	1/1	0.65	0.65	Z2-EU33B-334	0.65	NA	NA	1	0	NA	1
Technetium-99	1/1	11.6	11.6	Z2-EU33B-334	11.6	NA	NA	0	NA	NA	1
Thorium-228	1/1	0.52	0.52	Z2-EU33B-334	0.52	NA	NA	1	0	NA	1
Thorium-232	1/1	0.67	0.67	Z2-EU33B-334	0.67	NA	NA	1	0	NA	1
Uranium-234	1/1	227	227	Z2-EU33B-334	227	0	0	0	NA	1	1
Uranium-235	1/1	11.5	11.5	Z2-EU33B-334	11.5	0	1	1	NA	0	1
Uranium-238	1/1	244	244	Z2-EU33B-334	244	0	1	1	1	1	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

EU Z2-33 BRICK-LINED DRAIN PIT 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	1/1	11,000	11,000	Z2-EU33B-334	11,000	0	NA	NA
Acenaphthene	1/1	38,000	38,000	Z2-EU33B-334	38,000	0	NA	0
Anthracene	1/1	82,000	82,000	Z2-EU33B-334	82,000	0	NA	0
Benz(a)anthracene	1/1	190,000	190,000	Z2-EU33B-334	190,000	1	NA	1
Benzo(a)pyrene	1/1	170,000	170,000	Z2-EU33B-334	170,000	1	NA	1
Benzo(b)fluoranthene	1/1	170,000	170,000	Z2-EU33B-334	170,000	1	NA	1
Benzo(ghi)perylene	1/1	92,000	92,000	Z2-EU33B-334	92,000	0	NA	0
Benzo(k)fluoranthene	1/1	170,000	170,000	Z2-EU33B-334	170,000	0	NA	1
Bis(2-ethylhexyl)phthalate	1/1	18,000	18,000	Z2-EU33B-334	18,000	0	0	0
Butyl benzyl phthalate	1/1	19,000	19,000	Z2-EU33B-334	19,000	0	NA	0
Carbazole	1/1	53,000	53,000	Z2-EU33B-334	53,000	0	NA	1
Chrysene	1/1	220,000	220,000	Z2-EU33B-334	220,000	0	NA	1
Dibenz(a,h)anthracene	1/1	23,000	23,000	Z2-EU33B-334	23,000	1	NA	1
Dibenzofuran	1/1	23,000	23,000	Z2-EU33B-334	23,000	0	NA	1
Fluoranthene	1/1	500,000	500,000	Z2-EU33B-334	500,000	0	NA	1
Fluorene	1/1	29,000	29,000	Z2-EU33B-334	29,000	0	NA	0
Indeno(1,2,3-cd)pyrene	1/1	77,000	77,000	Z2-EU33B-334	77,000	1	NA	1
m+p Methylphenol	1/1	450J	450J	Z2-EU33B-334	450	NA	NA	NA
Naphthalene	1/1	31,000	31,000	Z2-EU33B-334	31,000	0	NA	1
Phenanthrene	1/1	370,000	370,000	Z2-EU33B-334	370,000	0	NA	1
Phenol	1/1	260J	260J	Z2-EU33B-334	260	0	NA	0
Pyrene	1/1	340,000	340,000	Z2-EU33B-334	340,000	0	NA	1

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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 BRICK-LINED DRAIN PIT 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
cis-1,2-Dichloroethene	1/1	91J	91J	Z2-EU33B-334	91	0	NA	0
Trichloroethene	1/1	140J	140J	Z2-EU33B-334	140	0	0	1

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
SL = screening level
VOC = volatile organic compound

Acid Dilution Pit South of K-1004-L (EU33D-335): Biased sampling was recommended for this site in the Assessment Report based on Class 3 SU walkover assessment visual observations summarized. A sediment sample collected from the pit exceeded multiple metal, PCB, radionuclide, and VOC evaluation criteria. Also, a sediment sample was collected from a manhole adjacent to pit. Analytical results from the manhole sample showed arsenic and iron Ind PRG exceedances and a chromium GW SL exceedance. The pit was removed during a remedial action that also removed the sediment sample location (Table 3). Following the remedial action, a confirmation sample was collected from a depth > 10 ft bgs. Sample locations representative of current conditions are presented in Table 3 and include sediment sample Z2-EU33B-365 inside the manhole and confirmation sample Z2-EU33B-381. Analytical results summarized below from the sample locations representative of current conditions show two metal and three radionuclide Ind PRG exceedances, a chromium GW SL exceedance, metal and radionuclide Bkg exceedances, and one SVOC and one VOC detection.

EU Z2-33 ACID DILUTION PIT SOUTH OF K-1004-L 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	5,330J	13,000	Z2-EU33B-381	9,165	NA	NA	0	0	NA	1
Antimony	1/2	3.5J	3.5J	Z2-EU33B-365	3.5	NA	NA	0	1	0	1
Arsenic	2/2	4.8	21.5J	Z2-EU33B-365	13.2	0	0	1	1	0	2
Cadmium	2/2	0.3J	3	Z2-EU33B-365	1.65	NA	NA	0	2	NA	0
Calcium	2/2	1,100J	16,000J	Z2-EU33B-381	8,550	NA	NA	NA	1	NA	NA
Chromium	2/2	23J	213J	Z2-EU33B-365	118	NA	NA	0	1	1	2
Copper	2/2	19	24,000J	Z2-EU33B-365	12,010	NA	NA	0	1	NA	1
Iron	2/2	33,000	433,000J	Z2-EU33B-365	233,000	NA	NA	1	1	NA	2
Lead	2/2	25	538	Z2-EU33B-365	282	NA	NA	0	1	0	1
Magnesium	2/2	1,600	3,890J	Z2-EU33B-365	2,745	NA	NA	NA	1	NA	NA
Manganese	2/2	589J	620J	Z2-EU33B-381	605	NA	NA	0	0	NA	2
Mercury	2/2	0.1	0.64J	Z2-EU33B-365	0.37	0	0	0	1	NA	0
Nickel	2/2	23	97.6J	Z2-EU33B-365	60.3	NA	NA	0	1	NA	0
Selenium	1/2	1.7	1.7	Z2-EU33B-381	1.7	NA	NA	0	1	NA	0
Silver	1/2	17.3	17.3	Z2-EU33B-365	17.3	NA	NA	0	1	NA	0
Uranium	2/2	1.5J	3.4J	Z2-EU33B-365	2.45	NA	NA	0	NA	NA	1
Vanadium	2/2	17.2J	25	Z2-EU33B-381	21.1	NA	NA	0	0	NA	2
Zinc	2/2	51	656J	Z2-EU33B-365	354	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 Z2-33 ACID DILUTION PIT SOUTH OF K-1004-L 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	19J	19J	Z2-EU33B-381	19	0	0	0	0
Polychlorinated Biphenyl	1/2	19J	19J	Z2-EU33B-381	19	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

EU Z2-33 ACID DILUTION PIT SOUTH OF K-1004-L 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
Neptunium-237	1/2	1.2J	1.2J	Z2-EU33B-365	1.2	0	0	0	NA	NA	1
Potassium-40	1/2	22.3	22.3	Z2-EU33B-381	22.3	NA	NA	1	0	NA	1
Thorium-228	1/2	1.3	1.3	Z2-EU33B-381	1.3	NA	NA	1	0	NA	1
Thorium-232	1/2	0.775	0.775	Z2-EU33B-381	0.775	NA	NA	1	0	NA	1
Uranium-238	2/2	_0.67	1.48	Z2-EU33B-381	1.075	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 Z2-33 ACID DILUTION PIT SOUTH OF K-1004-L 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
Bis(2-ethylhexyl)phthalate	1/1	370J	370J	Z2-EU33B-365	370	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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 ACID DILUTION PIT SOUTH OF K-1004-L 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
Trichloroethene	1/2	300J	300J	Z2-EU33B-381	300	0	0	1

EU = exposure unit
GW = groundwater
Ind = industrial
J = analyte was identified and result is approximate concentration
PRG = preliminary remediation goal
Res = residential
SL = screening level
VOC = volatile organic compound

Bottle Area Near K-1004-L (EU33D-336): This area was located on the north side of the former K-1004-L concrete pad and was used to store bottles for K-1004-L Laboratory operations. This area was removed when the K-1004-L pad was removed during D&D. Analytical results from the sample locations representative of current conditions at the former K-1004-L pad (see Table 3) are summarized below in the K-1004-L Facility summary.

K-1003 Facility: Biased sampling was recommended for this site in the Assessment Report (former K-1003 Dispensary) based on site knowledge and visual inspection performed during the Class 3 SU walkover assessment.

One DVS biased sample location was identified (Sect. 2.2.3). Analytical results summarized below show metal Bkg exceedances and SVOC detections.

EU Z2-33 K-1003 FACILITY 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	1/1	12,200J	12,200J	Z2-EU33B-326	12,200	NA	NA	0	0	NA	1
Arsenic	1/1	6.6J	6.6J	Z2-EU33B-326	6.6	0	0	0	0	0	1
Cadmium	1/1	0.31	0.31	Z2-EU33B-326	0.31	NA	NA	0	1	NA	0
Calcium	1/1	10,100J	10,100J	Z2-EU33B-326	10,100	NA	NA	NA	1	NA	NA
Copper	1/1	26.5J	26.5J	Z2-EU33B-326	26.5	NA	NA	0	1	NA	0
Iron	1/1	31,500	31,500	Z2-EU33B-326	31,500	NA	NA	0	0	NA	1
Lead	1/1	118J	118J	Z2-EU33B-326	118	NA	NA	0	1	0	0
Manganese	1/1	403	403	Z2-EU33B-326	403	NA	NA	0	0	NA	1
Mercury	1/1	0.21	0.21	Z2-EU33B-326	0.21	0	0	0	1	NA	0
Vanadium	1/1	25.7J	25.7J	Z2-EU33B-326	25.7	NA	NA	0	0	NA	1
Zinc	1/1	147J	147J	Z2-EU33B-326	147	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

PCBs were analyzed for but were not detected.

EU Z2-33 K-1003 FACILITY 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
Acenaphthylene	1/1	75J	75J	Z2-EU33B-326	75	0	NA	0
Benz(a)anthracene	1/1	370J	370J	Z2-EU33B-326	370	0	NA	0
Benzo(a)pyrene	1/1	400J	400J	Z2-EU33B-326	400	0	NA	1
Benzo(b)fluoranthene	1/1	730	730	Z2-EU33B-326	730	0	NA	1
Benzo(ghi)perylene	1/1	290J	290J	Z2-EU33B-326	290	0	NA	0
Bis(2-ethylhexyl)phthalate	1/1	54J	54J	Z2-EU33B-326	54	0	0	0
Butyl benzyl phthalate	1/1	79J	79J	Z2-EU33B-326	79	0	NA	0
Chrysene	1/1	460J	460J	Z2-EU33B-326	460	0	NA	0
Dibenz(a,h)anthracene	1/1	81J	81J	Z2-EU33B-326	81	0	NA	1
Fluoranthene	1/1	520J	520J	Z2-EU33B-326	520	0	NA	0
Indeno(1,2,3-cd)pyrene	1/1	260J	260J	Z2-EU33B-326	260	0	NA	0
Pyrene	1/1	470J	470J	Z2-EU33B-326	470	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
SL = screening level
SVOC = semivolatile organic compound

K-1004-D Facility: The K-1004-D facility basement and pad were not recommended for biased sampling in the Assessment Report. However, there were several historical soil (including sewer ejector sump pit sediment) and concrete sample locations around K-1004-D (Sect. 2.2.3) that are included in this section. Analytical results for the historical soil and concrete samples summarized below show PCB Avg RL exceedances in three concrete samples from the facility's basement; metal, PCB, and radionuclide Ind PRG exceedances; metal and radionuclide Bkg exceedances; and diesel-range organic (DRO), gasoline-range organic (GRO), PCB, pesticide, and SVOC detections. (Note: DRO and GRO were detected in a sediment sample from the sewer ejector sump pit located in the

basement of Bldg. K-1004-D. The sediment was removed from the sump pit by D&D Operations after production of the first draft of this TM).

EU Z2-33 K-1004-D FACILITY 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	17/17	5,000	29,400	K1004D-S3	13,094	NA	NA	0	0	NA	11
Antimony	16/17	0.018J	19	Z2EU33-K1004D	1.32	NA	NA	0	1	0	1
Arsenic	17/17	2	31	Z2EU33-K1004D	5.13	0	0	1	1	0	17
Barium	17/17	40	269	K1004D-S3	111	NA	NA	0	5	0	0
Beryllium	17/17	0.35	3.1	Z2-EU33-2006	1.50	0	0	0	4	NA	0
Cadmium	17/17	0.23	13	Z2-EU33-2006	3.68	NA	NA	0	17	NA	4
Calcium	17/17	1,990	210,000	Z2-EU33-2006	61,071	NA	NA	NA	16	NA	NA
Chromium	17/17	7J	140J	Z2EU33-K1004D	26.6	NA	NA	0	1	0	4
Copper	17/17	6.6	1,100	Z2EU33-K1004D	93.3	NA	NA	0	6	NA	1
Iron	17/17	4,900	510,000J	Z2EU33-K1004D	48,724	NA	NA	1	1	NA	17
Lead	17/17	3.7	1,300	Z2EU33-K1004D	139	NA	NA	1	5	0	2
Magnesium	17/17	1,600J	63,000	Z2-EU33-2006	13,185	NA	NA	NA	8	NA	NA
Manganese	17/17	270J	4,350	K1004D-S3	959	NA	NA	0	1	NA	17
Mercury	14/15	0.012J	30	Z2EU33-K1004D	2.37	0	0	0	8	NA	1
Nickel	17/17	6.3J	452	K1004D-S3	67.1	NA	NA	0	5	NA	2
Selenium	5/17	0.228J	14J	Z2EU33-K1004D	3.19	NA	NA	0	1	NA	0
Silver	4/17	0.1J	130	Z2EU33-K1004D	43.5	NA	NA	0	2	NA	2
Sodium	17/17	67J	820	Z2-EU33-2004	259	NA	NA	NA	2	NA	NA
Thallium	17/17	0.019J	0.439	K1004D-S2	0.133	NA	NA	0	1	0	0
Uranium	14/14	0.56	8J	Z2EU33-K1004D	2.22	NA	NA	0	NA	NA	5
Vanadium	17/17	7.3J	39.1	K1004D-S3	18.8	NA	NA	0	0	NA	14
Zinc	17/17	19J	1,900J	Z2-EU33-2006	392	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 Z2-33 K-1004-D SOIL 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	7,500	7,500	Z2EU33-K1004D	7,500
Gasoline Range Organics	1/1	0.47J	0.47J	Z2EU33-K1004D	0.47

EU = exposure unit
J = analyte was identified and result is approximate concentration

EU Z2-33 K-1004-D FACILITY 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
4,4'-DDE	1/6	150	150	K1004D-S3	150	NA	NA	0	NA
4,4'-DDT	3/6	110J	230J	K1004D-S1	187	NA	NA	0	NA
alpha-Chlordane	1/6	8.5J	8.5J	K1004D-S1	8.5	NA	NA	0	NA
gamma-Chlordane	1/6	6J	6J	K1004D-S1	6	NA	NA	0	NA
Endosulfan sulfate	1/6	250J	250J	K1004D-S1	250	NA	NA	0	NA
Endrin	2/6	86J	230J	K1004D-S2	158	NA	NA	0	NA
Heptachlor	1/6	6.5J	6.5J	K1004D-S1	6.5	NA	NA	0	NA
Heptachlor epoxide	3/6	3.5J	9.5J	K1004D-S2	7.07	NA	NA	0	NA

EU Z2-33 K-1004-D FACILITY PPCB DETECTS (ug/kg) 0-10 ft (cont'd)

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
4,4'-DDE	1/6	150	150	K1004D-S3	150	NA	NA	0	NA
4,4'-DDT	3/6	110J	230J	K1004D-S1	187	NA	NA	0	NA
alpha-Chlordane	1/6	8.5J	8.5J	K1004D-S1	8.5	NA	NA	0	NA
gamma-Chlordane	1/6	6J	6J	K1004D-S1	6	NA	NA	0	NA
Endosulfan sulfate	1/6	250J	250J	K1004D-S1	250	NA	NA	0	NA
Endrin	2/6	86J	230J	K1004D-S2	158	NA	NA	0	NA
Heptachlor	1/6	6.5J	6.5J	K1004D-S1	6.5	NA	NA	0	NA
Heptachlor epoxide	3/6	3.5J	9.5J	K1004D-S2	7.07	NA	NA	0	NA
PCB-1254	10/17	42J	51,000	Z2-EU33-2004	9,951	0	3	3	9
Polychlorinated Biphenyl	7/14	42J	51,000	Z2-EU33-2004	13,736	0	3	3	6

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 Z2-33 K-1004-D 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	1/13	1.004	1.004	KAH-SS-S41	1.00	0	0	0	NA	NA	1
Potassium-40	11/12	3.8	54.5	Z2-EU33-2008	17.7	NA	NA	11	3	NA	11
Radium-226	11/12	0.163	1.28	Z2-EU33-2009	0.716	NA	NA	9	2	NA	11
Thorium-228	11/13	0.464	1.75	Z2-EU33-2007	0.970	NA	NA	11	0	NA	11
Thorium-230	9/13	0.558J	2.81	Z2-EU33-2004	1.35	NA	NA	0	4	NA	0
Thorium-232	12/13	0.43	1.61	Z2-EU33-2007	0.953	NA	NA	12	0	NA	12
Uranium-234	13/13	0.453J	5.25	Z2EU33-K1004D	1.74	0	0	0	NA	0	2
Uranium-235	4/13	0.136	0.296	Z2-EU33-2005	0.208	0	0	0	NA	0	2
Uranium-238	13/13	0.288	3.23	Z2EU33-K1004D	1.27	0	0	0	4	0	8

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 Z2-33 K-1004-D FACILITY 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	1/12	45J	45J	K1004D-S3	45	0	NA	NA
4-Bromophenyl phenyl ether	1/12	97J	97J	K1004D-S1	97	NA	NA	NA
Acenaphthene	1/12	120J	120J	Z2-EU33-2007	120	0	NA	0
Acenaphthylene	2/12	63J	87J	K1004D-S2	75	0	NA	0
Anthracene	3/12	59J	210J	Z2-EU33-2007	133	0	NA	0
Benz(a)anthracene	6/12	190J	1,100	K1004D-S2	583	0	NA	2
Benzo(a)pyrene	6/12	160J	1,300	K1004D-S2	567	0	NA	6
Benzo(b)fluoranthene	6/12	320J	1,400	K1004D-S2 Z2-EU33-K1004D	727	0	NA	2
Benzo(ghi)perylene	4/12	330J	1,200	K1004D-S2	580	0	NA	0
Benzo(k)fluoranthene	9/12	230J	1,400	K1004D-S2	462	0	NA	0

EU Z2-33 K-1004-D FACILITY SVOC DETECTS (ug/kg) 0-10 ft (cont'd)

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	1/12	45J	45J	K1004D-S3	45	0	NA	NA
4-Bromophenyl phenyl ether	1/12	97J	97J	K1004D-S1	97	NA	NA	NA
Acenaphthene	1/12	120J	120J	Z2-EU33-2007	120	0	NA	0
Acenaphthylene	2/12	63J	87J	K1004D-S2	75	0	NA	0
Anthracene	3/12	59J	210J	Z2-EU33-2007	133	0	NA	0
Benz(a)anthracene	6/12	190J	1,100	K1004D-S2	583	0	NA	2
Benzo(a)pyrene	6/12	160J	1,300	K1004D-S2	567	0	NA	6
Benzo(b)fluoranthene	6/12	320J	1,400	K1004D-S2	727	0	NA	2
Benzo(ghi)perylene	4/12	330J	1,200	Z2-EU33-K1004D K1004D-S2	580	0	NA	0
Benzo(k)fluoranthene	9/12	230J	1,400	K1004D-S2	462	0	NA	0
Bis(2-ethylhexyl)phthalate	5/12	160J	8,800	Z2EU33-K1004D	2,016	0	0	0
Butyl benzyl phthalate	2/12	240J	430J	Z2-EU33-2007	335	0	NA	0
Carbazole	4/12	44J	180J	K1004D-S2	105	0	NA	0
Chrysene	6/12	290J	1,800	K1004D-S2	757	0	NA	0
Dibenz(a,h)anthracene	3/12	83J	300J	K1004D-S2	158	0	NA	3
Di-n-butyl phthalate	4/12	110J	590J	Z2-EU33-2004	270	0	NA	0
Fluoranthene	7/12	170J	2,800	K1004D-S2	1,163	0	NA	0
Fluorene	2/12	110J	4,100	Z2EU33-K1004D	2,105	0	NA	0
Indeno(1,2,3-cd)pyrene	4/12	390J	1,300	K1004D-S2	630	0	NA	1
Pentachlorophenol	1/12	74J	74J	K1004D-S2	74	0	NA	0
Phenanthrene	6/12	120J	1,200J	Z2-EU33-2007	482	0	NA	0
Phenol	2/12	96J	170J	Z2-EU33-2010	133	0	NA	0
Pyrene	6/12	150J	2,300	K1004D-S2	868	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
SL = screening level
SVOC = semivolatile organic compound

VOCs were analyzed for in four samples but were not detected.

K-1004-F Facility: Biased sampling was recommended for this site in the Assessment Report based on site knowledge regarding former use of the facility. Five DVS biased sample locations were identified (Sect. 2.2.3). The K-1004-F pad was removed during D&D alo ng with four concrete sample locations removed in the process (Table 3) since the Class 3 SU walkover assessment. The remaining soil sample location (Table 3) is representative of current conditions. Analytical results summarized below show one SVOC Ind PRG exceedance, metal Bkg exceedances, and detections of PCBs and SVOCs.

EU Z2-33 K-1004-F FACILITY SOIL 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
Arsenic	1/1	10.3	10.3	Z2-EU33B-325	10.3	0	0	0	0	0	1
Cadmium	1/1	0.37	0.37	Z2-EU33B-325	0.37	NA	NA	0	1	NA	0
Calcium	1/1	62,300J	62,300J	Z2-EU33B-325	62,300	NA	NA	NA	1	NA	NA
Magnesium	1/1	17,200J	17,200J	Z2-EU33B-325	17,200	NA	NA	NA	1	NA	NA
Iron	1/1	12,300J	12,300J	Z2-EU33B-325	12,300	NA	NA	0	0	NA	1
Manganese	1/1	626J	626J	Z2-EU33B-325	626	NA	NA	0	0	NA	1
Nickel	1/1	41.4J	41.4J	Z2-EU33B-325	41.4	NA	NA	0	1	NA	0
Uranium	1/1	2.3	2.3	Z2-EU33B-325	2.3	NA	NA	0	NA	NA	1

EU Z2-33 K-1004-F FACILITY SOIL METALS WITH BACKGROUND, PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont'd)

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
Vanadium	1/1	15.6	15.6	Z2-EU33B-325	15.6	NA	NA	0	0	NA	1
Zinc	1/1	163J	163J	Z2-EU33B-325	163	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 Z2-33 K-1004-F FACILITY SOIL 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	1/1	48	48	Z2-EU33B-325	48	0	0	0	0
PCB-1260	1/1	27J	27J	Z2-EU33B-325	27	0	0	0	0
Polychlorinated Biphenyl	1/1	75J	75J	Z2-EU33B-325	75	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

EU Z2-33 K-1004-F FACILITY SOIL 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
Acenaphthylene	1/1	1,400	1,400	Z2-EU33B-325	1,400	0	NA	0
Anthracene	1/1	450	450	Z2-EU33B-325	450	0	NA	0
Benz(a)anthracene	1/1	3,100	3,100	Z2-EU33B-325	3,100	0	NA	1
Benzo(a)pyrene	1/1	4,600	4,600	Z2-EU33B-325	4,600	1	NA	1
Benzo(b)fluoranthene	1/1	5,300	5,300	Z2-EU33B-325	5,300	0	NA	1
Benzo(ghi)perylene	1/1	3,500	3,500	Z2-EU33B-325	3,500	0	NA	0
Benzo(k)fluoranthene	1/1	3,500	3,500	Z2-EU33B-325	3,500	0	NA	0
Carbazole	1/1	110J	110J	Z2-EU33B-325	110	0	NA	0
Chrysene	1/1	3,200	3,200	Z2-EU33B-325	3,200	0	NA	0
Dibenz(a,h)anthracene	1/1	900	900	Z2-EU33B-325	900	0	NA	1
Fluoranthene	1/1	4,600	4,600	Z2-EU33B-325	4,600	0	NA	0
Fluorene	1/1	48J	48J	Z2-EU33B-325	48	0	NA	0
Indeno(1,2,3-cd)pyrene	1/1	3,400	3,400	Z2-EU33B-325	3,400	0	NA	1
Phenanthrene	1/1	980	980	Z2-EU33B-325	980	0	NA	0
Pyrene	1/1	4,800	4,800	Z2-EU33B-325	4,800	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
SL = screening level
SVOC = semivolatile organic compound

K-1004-L Facility: Biased sampling was recommended in the Assessment Report for this facility based on site knowledge regarding activities conducted in the former K-1004-L Laboratory and on elevated radiation measurements and visual observations made during the Class 3 SU walkover assessment. Dynamic Verification Strategy and historical sample locations pertaining to the K-1004-L pad are presented in Sect. 2.2.3. The K-1004-L

pad was removed during D&D along with the process, soil, sediment, concrete, and asphalt sample locations (Table 3) since the Class 3 SU walkover assessment. Soil sample locations representative of current conditions at the former facility are presented in Table 3. Analytical results from the sample locations representative of current conditions at the former K-1004-L pad summarized below show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and PCB, SVOC, and VOC detections.

EU Z2-33 K-1004-L FACILITY SOIL 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	2,520J	14,800	Z2-EU33B-346	9,892	NA	NA	0	0	NA	4
Arsenic	5/5	2.3J	7.8	Z2-EU33B-362	4.98	0	0	0	0	0	5
Barium	5/5	45.8	161	Z2-EU33B-364	90.8	NA	NA	0	1	0	0
Cadmium	5/5	0.059J	0.82	Z2-EU33B-364	0.278	NA	NA	0	2	NA	0
Calcium	5/5	2,710J	291,000J	Z2-EU33B-364	63,888	NA	NA	NA	5	NA	NA
Chromium	5/5	10J	41.9J	Z2-EU33B-362	20.4	NA	NA	0	0	0	1
Iron	5/5	9,230J	30,700J	Z2-EU33B-346	21,066	NA	NA	0	0	NA	5
Lead	5/5	11.8J	41.2J	Z2-EU33B-362	23.1	NA	NA	0	1	0	0
Magnesium	5/5	779J	59,600J	Z2-EU33B-364	13,781	NA	NA	NA	2	NA	NA
Manganese	5/5	242J	1,200J	Z2-EU33B-362	605	NA	NA	0	0	NA	5
Mercury	3/5	0.074J	0.66J	Z2-EU33B-362	0.345	0	0	0	2	NA	0
Uranium	5/5	1J	94.3J	Z2-EU33B-362	22.2	NA	NA	0	NA	NA	4
Vanadium	5/5	8.6J	28	Z2-EU33B-346	20.3	NA	NA	0	0	NA	5
Zinc	5/5	22.4J	405J	Z2-EU33B-364	119	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 Z2-33 K-1004-L FACILITY SOIL 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	1/5	670	670	Z2-EU33B-364	670	0	0	0	1
Polychlorinated Biphenyl	1/5	670	670	Z2-EU33B-364	670	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 Z2-33 K-1004-L FACILITY SOIL 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	1/5	0.183	0.183	Z2-EU33B-363	0.183	0	0	0	NA	NA	1
Potassium-40	5/5	5.6	23.4	Z2-EU33B-352	13.9	NA	NA	5	0	NA	5
Radium-226	5/5	0.26	0.98	Z2-EU33B-346	0.724	NA	NA	4	0	NA	5
Technetium-99	2/5	1.3	48.7	Z2-EU33B-363	25	NA	NA	0	NA	NA	2
Thorium-228	5/5	0.17	1.47	Z2-EU33B-352	0.968	NA	NA	4	0	NA	5
Thorium-230	5/5	0.6	1.41	Z2-EU33B-346	1.18	NA	NA	0	4	NA	0
Thorium-232	5/5	0.26	1.38	Z2-EU33B-352	1.03	NA	NA	5	0	NA	5
Uranium-234	5/5	1.52	44	Z2-EU33B-362	19.6	0	0	0	NA	0	3
Uranium-235	5/5	0.132	3.26	Z2-EU33B-346	1.29	0	0	0	NA	0	3

EU Z2-33 K-1004-L FACILITY SOIL RADIONUCLIDES WITH BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont'd)

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-238	5/5	1.54	45.6	Z2-EU33B-362	20.7	0	0	2	5	0	5

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 Z2-33 K-1004-L FACILITY SOIL 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
Acenaphthene	1/4	91J	91J	Z2-EU33B-364	91	0	NA	0
Anthracene	1/4	140J	140J	Z2-EU33B-364	140	0	NA	0
Benz(a)anthracene	2/4	110J	430	Z2-EU33B-364	270	0	NA	0
Benzo(a)pyrene	2/4	100J	410	Z2-EU33B-364	255	0	NA	2
Benzo(b)fluoranthene	2/4	93J	540	Z2-EU33B-364	317	0	NA	0
Benzo(ghi)perylene	2/4	63J	340J	Z2-EU33B-364	202	0	NA	0
Benzo(k)fluoranthene	2/4	100J	470	Z2-EU33B-364	285	0	NA	0
Bis(2-ethylhexyl)phthalate	2/4	44J	370J	Z2-EU33B-364	207	0	0	0
Butyl benzyl phthalate	1/4	160J	160J	Z2-EU33B-364	160	0	NA	0
Carbazole	1/4	160J	160J	Z2-EU33B-364	160	0	NA	0
Chrysene	2/4	130J	610	Z2-EU33B-364	370	0	NA	0
Dibenz(a,h)anthracene	1/4	160J	160J	Z2-EU33B-364	160	0	NA	1
Dibenzofuran	1/4	66J	66J	Z2-EU33B-364	66	0	NA	0
Fluoranthene	2/4	260J	1500	Z2-EU33B-364	880	0	NA	0
Fluorene	1/4	76J	76J	Z2-EU33B-364	76	0	NA	0
Indeno(1,2,3-cd)pyrene	2/4	61J	290J	Z2-EU33B-364	176	0	NA	0
Naphthalene	1/4	67J	67J	Z2-EU33B-364	67	0	NA	0
Phenanthrene	2/4	170J	980	Z2-EU33B-364	575	0	NA	0
Pyrene	2/4	220J	950	Z2-EU33B-364	585	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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 K-1004-L FACILITY SOIL 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
Benzene	1/3	3.5J	3.5J	Z2-EU33B-346	3.5	0	0	0
cis-1,2-Dichloroethene	1/3	2.7J	2.7J	Z2-EU33B-346	2.7	0	NA	0
Ethylbenzene	1/3	7.4	7.4	Z2-EU33B-346	7.4	0	NA	0
Toluene	1/3	2J	2J	Z2-EU33B-346	2	0	0	0
Total Xylene	1/3	18	18	Z2-EU33B-346	18	0	NA	NA
trans-1,2-Dichloroethene	1/3	1.7J	1.7J	Z2-EU33B-346	1.7	0	NA	0
Trichloroethene	1/3	17	17	Z2-EU33B-364	17	0	0	0
Vinyl chloride	1/3	17	17	Z2-EU33B-346	17	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
SL = screening level
VOC = volatile organic compound

K-1004-M Facility: Biased sampling was recommended in the Assessment Report based on site knowledge regarding former use of the facility. Three DVS biased sample locations were identified (Sect. 2.2.3), including two locations in the concrete trench surrounding the slab where concrete and sediment samples were collected and one location where a concrete sample was collected. Average RL exceedances of U-234 and U-238 were observed in the two sediment samples from the drainage trench surrounding the slab. Since the time of sample collection, the K-1004-M slab, including the drainage trench, was removed during D&D along with all sample locations. The former K-1004-M slab was adjacent to the K-1004-L slab and current conditions at the K-1004-L slab (see above) are representative of current conditions at the site of the K-1004-M slab.

K-1004-P Facility Locations: Biased sampling was not recommended for these sites in the Assessment Report. However, there were several historical sample locations around K-1004-P (Sect. 2.2.3) that are included in this section. Analytical results for these historical samples summarized below show radionuclide Ind PRG exceedances, metal Bkg exceedances, and PCB and SVOC detections.

EU Z2-33 K-1004-P FACILITY SOIL 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	17,000	Z2-EU33-2013	14,500	NA	NA	0	0	NA	2
Arsenic	2/2	6.9	7.1	Z2-EU33-2012	7	0	0	0	0	0	2
Cadmium	2/2	1.2	1.4	Z2-EU33-2013	1.3	NA	NA	0	2	NA	0
Calcium	2/2	2,400J	14,000J	Z2-EU33-2012	8,200	NA	NA	NA	1	NA	NA
Chromium	2/2	21	25	Z2-EU33-2013	23	NA	NA	0	0	0	1
Copper	2/2	20J	25J	Z2-EU33-2013	22.5	NA	NA	0	1	NA	0
Iron	2/2	43,000	58,000	Z2-EU33-2013	50,500	NA	NA	0	0	NA	2
Manganese	2/2	160	180	Z2-EU33-2012	170	NA	NA	0	0	NA	1
Vanadium	2/2	30	38	Z2-EU33-2013	34	NA	NA	0	0	NA	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 Z2-33 K-1004-P FACILITY SOIL 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-EU33-2012	17	0	0	0	0
Polychlorinated Biphenyl	1/2	17J	17J	Z2-EU33-2012	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

EU Z2-33 K-1004-P FACILITY SOIL 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	15.6	15.6	Z2-EU33-2012	15.6	NA	NA	1	0	NA	1
Radium-226	1/1	0.879	0.879	Z2-EU33-2012	0.879	NA	NA	1	0	NA	1
Thorium-228	1/1	1.2	1.2	Z2-EU33-2012	1.2	NA	NA	1	0	NA	1
Thorium-232	1/1	1.18	1.18	Z2-EU33-2012	1.18	NA	NA	1	0	NA	1

EU Z2-33 K-1004-P FACILITY SOIL RADIONUCLIDES WITH BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont'd)

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-238	1/1	1.16	1.16	Z2-EU33-2012	1.16	0	0	0	0	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

EU Z2-33 K-1004-P FACILITY SOIL 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
N-Nitrosodiphenylamine	1/1	17J	17J	Z2-EU33-2012	17	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
SL = screening level
SVOC = semivolatile organic compound

VOCs were analyzed for but were not detected.

K-1006 Facility: The K-1006 Development Laboratory is an active facility. Biased sampling was recommended in the Assessment Report based on its current and historic use. Dynamic Verification Strategy biased sample locations were identified at the building sump on the north end of the facility, building sump on the south end of the facility, and acid drain pit located to the west of the facility. In addition, there are several historical sample locations associated with the K-1006 facility. DVS and historical sample locations are presented in Sect. 2.2.3.

Three DVS biased sample locations characterize building sumps Z2-EU33B-128 and Z2-EU33B-327 on the north end and Z2-EU33B-328 on the south. All three locations represent sediment samples from the sumps. Analytical results for the sump samples summarized below show two Ra/Th decay series Max and Avg RL exceedances in the north sump, PCB and U-238 Avg RL exceedances in the north sump, metal and radionuclide Ind PRG and Bkg exceedances in both sumps, PCB Ind PRG exceedances in the north sump, metal and radionuclide GW SL exceedances in the north sump, and detections of PCBs, SVOCs, and VOCs in both sumps.

EU Z2-33 K-1006 FACILITY 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	2/2	1.7J	3.2J	Z2-EU33B-327	2.45	NA	NA	0	2	0	1
Arsenic	2/2	9.2	93.1	Z2-EU33B-327	51.2	0	0	1	1	1	2
Barium	2/2	47.2	346	Z2-EU33B-327	197	NA	NA	0	1	0	0
Cadmium	2/2	19	24.2	Z2-EU33B-327	21.6	NA	NA	0	2	NA	2
Calcium	2/2	31,500J	72,400J	Z2-EU33B-328	51,950	NA	NA	NA	2	NA	NA
Chromium	2/2	58.8J	238J	Z2-EU33B-327	148	NA	NA	0	2	1	2
Copper	2/2	556J	1,010J	Z2-EU33B-328	783	NA	NA	0	2	NA	2
Iron	2/2	279,000	303,000	Z2-EU33B-328	291,000	NA	NA	2	2	NA	2
Lead	2/2	123J	434J	Z2-EU33B-327	279	NA	NA	0	2	0	1
Lithium	2/2	45.7J	51.5	Z2-EU33B-327	48.6	NA	NA	0	1	NA	0
Magnesium	2/2	1,140J	22,600J	Z2-EU33B-328	11,870	NA	NA	NA	1	NA	NA
Manganese	2/2	1,090	2,110	Z2-EU33B-327	1,600	NA	NA	0	0	NA	2
Mercury	2/2	0.86	1.6	Z2-EU33B-327	1.23	0	0	0	2	NA	0
Nickel	2/2	84.6	215	Z2-EU33B-327	150	NA	NA	0	2	NA	1

EU Z2-33 K-1006 FACILITY SUMP METALS WITH BACKGROUND, PRG, GW SL, AND/OR RL EXCEEDANCES (mg/kg) 0-10 ft (cont'd)

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	2/2	6.2	125	Z2-EU33B-327	65.6	NA	NA	0	2	NA	1
Uranium	2/2	12.8	87.8	Z2-EU33B-327	50.3	NA	NA	0	NA	NA	2
Vanadium	2/2	5.4J	30.3J	Z2-EU33B-328	17.9	NA	NA	0	0	NA	1
Zinc	2/2	152J	605J	Z2-EU33B-327	379	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 Z2-33 K-1006 FACILITY SUMP 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	23,000J	23,000J	Z2-EU33B-327	23,000	0	1	1	1
Polychlorinated Biphenyl	1/2	23,000J	23,000J	Z2-EU33B-327	23,000	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 Z2-33 K-1006 FACILITY 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
Cesium-137	2/2	0.117J	0.23	Z2-EU33B-327	0.174	0	0	0	NA	NA	2
Neptunium-237	1/2	1.3	1.3	Z2-EU33B-327	1.3	0	0	0	NA	NA	1
Potassium-40	1/2	3.8	3.8	Z2-EU33B-328	3.8	NA	NA	1	0	NA	1
Radium-226	3/3	0.32	2.18	Z2-EU33B-327	1.06	NA	NA	3	1	NA	3
Technetium-99	2/2	24.2	267	Z2-EU33B-327	146	NA	NA	0	NA	NA	2
Thorium-228	3/3	0.24	3.85	Z2-EU33B-327	1.79	NA	NA	3	1	NA	3
Thorium-230	2/3	22.1J	40.5	Z2-EU33B-327	31.3	NA	NA	0	2	NA	2
Thorium-232	3/3	0.21J	4.29	Z2-EU33B-327	1.97	NA	NA	3	1	NA	3
Ra/Th decay series	3/3	0	41.64	Z2-EU33B-327	31.3	2	2	NA	NA	NA	NA
Uranium-234	2/2	18.2	102	Z2-EU33B-327	60.1	0	0	0	NA	1	2
Uranium-235	2/2	1.14	5.8	Z2-EU33B-327	3.47	0	0	1	NA	0	2
Uranium-238	2/2	11.5	116	Z2-EU33B-327	63.8	0	1	1	2	1	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 Z2-33 K-1006 FACILITY 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
1,2,4-Trichlorobenzene	1/2	15,000J	15,000J	Z2-EU33B-327	15,000	0	NA	1
1,2-Dichlorobenzene	1/2	83J	83J	Z2-EU33B-327	83	0	NA	0
1,4-Dichlorobenzene	1/2	160J	160J	Z2-EU33B-327	160	0	NA	0
2-Methylnaphthalene	1/2	64J	64J	Z2-EU33B-327	64	0	NA	NA
Benzoic acid	1/2	5,500	5,500	Z2-EU33B-327	5,500	0	NA	0
Bis(2-ethylhexyl)phthalate	2/2	660J	66,000J	Z2-EU33B-327	33,330	0	0	1
Butyl benzyl phthalate	1/2	29,000J	29,000J	Z2-EU33B-327	29,000	0	NA	0
Di-n-butyl phthalate	1/2	1,200J	1,200J	Z2-EU33B-327	1,200	0	NA	0
Di-n-octylphthalate	1/2	1,400	1,400	Z2-EU33B-327	1,400	0	NA	0
Fluoranthene	1/2	83J	83J	Z2-EU33B-327	83	0	NA	0
Hexachlorobenzene	1/2	340J	340J	Z2-EU33B-327	340	0	NA	1
Naphthalene	1/2	16,000J	16,000J	Z2-EU33B-327	16,000	0	NA	1
Phenanthrene	1/2	62J	62J	Z2-EU33B-327	62	0	NA	0
Pyrene	1/2	70J	70J	Z2-EU33B-327	70	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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 K-1006 FACILITY SUMP 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
Carbon tetrachloride	1/2	3J	3J	Z2-EU33B-328	3	0	0	0
Chloroform	1/2	3.9J	3.9J	Z2-EU33B-327	3.9	0	0	0
cis-1,2-Dichloroethene	1/2	9.1J	9.1J	Z2-EU33B-327	9.1	0	NA	0
Ethylbenzene	1/2	30J	30J	Z2-EU33B-327	30	0	NA	0
Methylene chloride	1/2	31J	31J	Z2-EU33B-327	31	0	0	0
Tetrachloroethene	1/2	26J	26J	Z2-EU33B-327	26	0	0	0
Toluene	2/2	1J	20J	Z2-EU33B-327	10.5	0	0	0
Total Xylene	1/2	290J	290J	Z2-EU33B-327	290	0	NA	NA

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
SL = screening level
VOC = volatile organic compound

A sediment sample collected from the acid drain pit located west of K-1006 exceeded multiple metal, radionuclide, and VOC evaluation criteria. A soil sample was collected from > 10 ft bgs outside and below the base level of the pit in a groundwater downgradient direction from the pit. Analytical results from this sample showed contaminants had not leaked from the pit. Inlet and outlet pipes were severed and plugged, and the pit was triple rinsed and backfilled to the surface with grout. The sample location representative of current conditions at the K-1006 acid drain pit (Table 3) is located in a groundwater downgradient direction from the pit. Analytical results from the sample location representative of current conditions summarized below show radionuclide Ind PRG exceedances, metal Bkg exceedances, and one SVOC detection.

EU Z2-33 K-1006 FACILITY ACID DRAIN PIT 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	1/1	16,000	16,000	Z2-EU33B-374	16,000	NA	NA	0	0	NA	1
Arsenic	1/1	3.6J	3.6J	Z2-EU33B-374	3.6	0	0	0	0	0	1
Barium	1/1	130	130	Z2-EU33B-374	130	NA	NA	0	1	0	0
Calcium	1/1	15,000J	15,000J	Z2-EU33B-374	15,000	NA	NA	NA	1	NA	NA
Iron	1/1	40,000	40,000	Z2-EU33B-374	40,000	NA	NA	0	0	NA	1
Manganese	1/1	730J	730J	Z2-EU33B-374	730	NA	NA	0	0	NA	1
Vanadium	1/1	26	26	Z2-EU33B-374	26	NA	NA	0	0	NA	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

PCBs were analyzed for but were not detected.

EU Z2-33 K-1006 FACILITY ACID DRAIN PIT 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	13.3	13.3	Z2-EU33B-374	13.3	NA	NA	1	0	NA	1
Thorium-228	1/1	1.64J	1.64J	Z2-EU33B-374	1.64	NA	NA	1	0	NA	1
Thorium-232	1/1	1.46J	1.46J	Z2-EU33B-374	1.46	NA	NA	1	0	NA	1
Uranium-238	1/1	0.937J	0.937J	Z2-EU33B-374	0.937	0	0	0	0	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 Z2-33 K-1006 FACILITY ACID DRAIN PIT 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
3-Methylphenol	1/1	130J	130J	Z2-EU33B-374	130	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
SL = screening level
SVOC = semivolatile organic compound

VOCs were analyzed for but were not detected.

Historical sample locations at the K-1006 facility are all soil sample locations around the facility. Analytical results summarized below show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and PCB, pesticide, and SVOC detections.

EU Z2-33 K-1006 FACILITY HISTORICAL SOIL 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	3/3	16,800	20,500	K1006-01	18,667	NA	NA	0	0	NA	3
Arsenic	3/3	4.87J	5.93J	K1006-01	5.32	0	0	0	0	0	3
Barium	3/3	73.7	126	K1006-01	96.7	NA	NA	0	1	0	0
Cadmium	3/3	1.08J	1.6J	K1006-03	1.31	NA	NA	0	3	NA	0
Calcium	3/3	4,540	7,360	K1006-02	6,307	NA	NA	NA	3	NA	NA
Chromium	3/3	24.7	30.4	K1006-01	27.6	NA	NA	0	0	0	3
Copper	3/3	24.6	41.3	K1006-01	30.4	NA	NA	0	3	NA	0
Iron	3/3	23,800	35,000	K1006-03	27,567	NA	NA	0	0	NA	3
Manganese	3/3	950	1,130	K1006-01	1,027	NA	NA	0	0	NA	3
Nickel	3/3	22.6	46.3	K1006-01	33.5	NA	NA	0	2	NA	0
Vanadium	3/3	22	27.5	K1006-03	24.5	NA	NA	0	0	NA	3
Zinc	3/3	74.2	194	K1006-01	122	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 Z2-33 K-1006 FACILITY HISTORICAL SOIL 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
4,4'-DDT	1/3	19J	19J	K1006-01	19	NA	NA	0	NA
Endrin	1/3	20J	20J	K1006-01	20	NA	NA	0	NA
PCB-1260	1/3	91J	91J	K1006-01	91	0	0	0	0

Avg = average
EU = exposure unit
Ind = industrial
J = analyte was identified and result is approximate concentration
Max = maximum
NA = not applicable
PPCB = pesticide and polychlorinated biphenyl
PRG = preliminary remediation goal
Res = residential
RL = remediation level

EU Z2-33 K-1006 FACILITY HISTORICAL SOIL 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	2/3	0.155	0.6236	KAH-SS-S81	0.389	0	0	0	NA	NA	2
Technetium-99	2/3	0.111J	0.2773	KAH-SS-S81	0.194	NA	NA	0	NA	NA	1
Thorium-228	1/1	1.067	1.067	KAH-SS-S81	1.07	NA	NA	1	0	NA	1
Thorium-232	1/1	1.057	1.057	KAH-SS-S81	1.06	NA	NA	1	0	NA	1
Uranium-238	3/3	0.885	1.721	KAH-SS-S81	1.19	0	0	0	1	0	3

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 Z2-33 K-1006 FACILITY HISTORICAL SOIL 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
Acenaphthylene	2/3	56J	97J	K1006-01	76.5	0	NA	0
Benz(a)anthracene	3/3	93J	190J	K1006-01	131	0	NA	0
Benzo(a)pyrene	3/3	120J	240J	K1006-01	177	0	NA	3
Benzo(b)fluoranthene	3/3	110J	200J	K1006-01	157	0	NA	0
Benzo(ghi)perylene	3/3	100J	190J	K1006-01	147	0	NA	0
Benzo(k)fluoranthene	3/3	110J	210J	K1006-01	153	0	NA	0
Chrysene	3/3	110J	210J	K1006-01	153	0	NA	0
Dibenz(a,h)anthracene	1/3	50J	50J	K1006-01	50	0	NA	0
Fluoranthene	3/3	120J	340J	K1006-01	193	0	NA	0
Indeno(1,2,3-cd)pyrene	3/3	120J	240J	K1006-01	170	0	NA	0
Phenanthrene	1/3	110J	110J	K1006-01	110	0	NA	0
Pyrene	3/3	97J	250J	K1006-01	159	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
SL = screening level
SVOC = semivolatile organic compound

VOCs were analyzed for but were not detected.

K-1015 Laundry Facility: The K-1015 Laundry facility concrete pad was recommended for biased sampling in the Assessment Report based on site knowledge regarding former use of the facility. Three DVS biased sample locations were identified (Sect. 2.2.3) and three soil and two concrete samples were collected. In addition, there were several historical sample locations associated with this facility (Sect. 2.2.3). The concrete pad was removed during D&D after sampling had been conducted as were a number of sample locations (Table 3). Analytical results from DVS and historical soil sample locations representative of current conditions (see Table 3) summarized below show radionuclide Ind PRG exceedances, metal and radionuclide Bkg exceedances, and PCB detections.

EU Z2-33 K-1015 LAUNDRY FACILITY SOIL 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	4/4	8,500	18,000	Z2-EU33-2016	14,375	NA	NA	0	0	NA	4
Arsenic	4/4	3.6	8	Z2-EU33-2014	6.15	0	0	0	0	0	4
Cadmium	4/4	1.5	2	Z2-EU33-2016	1.83	NA	NA	0	4	NA	0
Calcium	4/4	1,400	14,000J	Z2-EU33-2016	5125	NA	NA	NA	2	NA	NA
Chromium	4/4	19	23	Z2-EU33-2017	21.3	NA	NA	0	0	0	1
Copper	4/4	11	26	Z2-EU33-2017	20.8	NA	NA	0	2	NA	0
Iron	4/4	41,000	54,000	Z2-EU33-2017	48,000	NA	NA	0	0	NA	4
Manganese	4/4	290	470	Z2-EU33-2014	365	NA	NA	0	0	NA	4
Selenium	3/4	1J	2.1	Z2-EU33-2017	1.47	NA	NA	0	1	NA	0
Vanadium	4/4	23	33	Z2-EU33-2017	29	NA	NA	0	0	NA	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

PCBs were analyzed for in four samples but were not detected.

EU Z2-33 K-1015 LAUNDRY FACILITY SOIL 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	16.9	27.2	Z2-EU33B-301	22.4	NA	NA	4	0	NA	4
Radium-226	4/4	0.416	1.02	Z2-EU33B-302	0.749	NA	NA	4	0	NA	4
Thorium-228	4/4	1.07	1.83	Z2-EU33B-301	1.56	NA	NA	4	0	NA	4
Thorium-230	4/4	0.75	1.89	Z2-EU33-2014	1.35	NA	NA	0	3	NA	0
Thorium-232	4/4	1.01	1.75	Z2-EU33-2014	1.49	NA	NA	4	0	NA	4
Uranium-235	2/4	0.132	0.29	Z2-EU33B-302	0.211	0	0	0	NA	0	1
Uranium-238	4/4	0.66	1.71	Z2-EU33B-302	1.17	0	0	0	1	0	3

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

SVOCs and VOCs were analyzed for in one sample but were not detected.

K-1205-A Facility Locations: The K-1205-A Condensate Station was not recommended for biased sampling in the Assessment Report. However, there were several historical soil sample locations around K-1205-A (Sect. 2.2.3) that are summarized in this report. The purpose of the facility was to collect condensate from the plant's steam heating system for recycling back into the system. Analytical results for the historical samples summarized below show metal Bkg exceedances.

EU Z2-33 K-1205-A FACILITY SOIL 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	3/3	8,500	11,000	Z2-EU33-2002	9,700	NA	NA	0	0	NA	3
Arsenic	3/3	5.1	6.1	Z2-EU33-2003	5.67	0	0	0	0	0	3
Cadmium	3/3	2.2J	3.2	Z2-EU33-2002	2.57	NA	NA	0	3	NA	0
Calcium	3/3	6,100	68,000	Z2-EU33-2003	31,367	NA	NA	NA	3	NA	NA
Iron	3/3	20,000	25,000	Z2-EU33-2003	22,333	NA	NA	0	0	NA	3
Magnesium	3/3	1,600	9,500	Z2-EU33-2003	4,367	NA	NA	NA	1	NA	NA
Manganese	3/3	920	2,600	Z2-EU33-2002	1,640	NA	NA	0	1	NA	3
Uranium	3/3	0.99	1.7	Z2-EU33-2001 Z2-EU33-2003	1.46	NA	NA	0	NA	NA	2
Vanadium	3/3	21	26	Z2-EU33-2002	23	NA	NA	0	0	NA	3
Zinc	3/3	32	110	Z2-EU33-2001	68.3	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

PCBs were analyzed for in three samples but were not detected.

Substation Facilities: Three electrical substation facilities were recommended for biased sampling in the Assessment Report based on site knowledge regarding former uses of the facilities (K-700-A-13 Substation, K-700-A-17 Substation, and K-700-A-74 Substation). Three DVS biased soil sample locations were identified (Sect. 2.2.3). Analytical results summarized below show PCB detections at one location.

EU Z2-33 SUBSTATION SOIL 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	1/3	1,400	1,400	Z2-EU33B-323	1,400	0	0	0	1
Polychlorinated Biphenyl	1/3	1,400	1,400	Z2-EU33B-323	1,400	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 Z2-33 Summary: This section presents a summary of the current nature and extent of contamination in the 0-10 ft depth interval by combining all analytical data for this EU (focused investigation summaries above and FFA site summaries in Sect. 2.2.6). In addition, four other historical sample locations not assigned to a focused investigation area or FFA site also are included (Sect. 2.2.3). A total of 172 historical and DVS sample locations in this EU have been sampled in the 0-10 ft and ≥ 10 ft depth intervals (Sects. 2.2.1, 2.2.2, and 2.2.3). Details of the sampling and analysis are presented in Table 2 and sample locations are shown on Fig. A.13. Several sample locations were removed during remedial actions or D&D (Table 3). The following summary includes all solid matrix samples (i.e., soil, sediment, concrete, brick, and mortar) that are representative of current conditions. Also, the summary includes soil samples collected from ≥ 10 ft bgs if those samples were collected to document the effectiveness of a remedial action or a facility demolition (Table 3), or if the sample documented possible contaminant leakage from a subsurface structure. This summary does not include data from historical locations KAH-SS-B22 and KAH-SS-S31 because DVS confirmation sampling did not confirm the historical analytical results. EU-wide compositional characteristics are evaluated in terms of human health risk and groundwater protection in Sect. 3.

Analytical results summarized below for current conditions in the 0-10 ft depth interval in this EU show two Ra/Th decay series Max and Avg RL exceedances; four PCB, one Cs-137, two U-235, and three U-238 Avg RL exceedances; one arsenic, two chromium, four U-234, and three U-238 GW SL exceedances; metal, PCB, radionuclide, and SVOC Ind PRG exceedances; and DRO, GRO, PCB, SVOC, and VOC detections.

Several RL and GW SL exceedances occurred in the two sediment samples from the K-1066 Facility north sump (sample locations Z2-EU33B-128 and Z2-EU33B-327). These exceedances included all Ra/Th decay series Max and Avg RL exceedances; one U-238 Avg RL exceedance; one PCB-1254 and one PCB Avg RL exceedance; and one arsenic, one chromium, one U-234, and one U-238 GW SL exceedances.

The remaining three PCB-1254 and PCB Avg RL exceedances occurred at three concrete sample locations Z2-EU33-2004, Z2-EU33-2005, and Z2-EU33-2006 in the K-1004-D Facility basement.

One U-235 Avg RL exceedance, one U-238 Avg RL exceedance, one U-234 GW SL exceedance, and one U-238 GW SL exceedance occurred in the sediment sample (sample location Z2-EU33B-334) from the storm drain adjacent to the gravel wash area (referred to as Brick-Lined Drain Pit).

One U-235 Avg RL exceedance, one U-238 Avg RL exceedance, one U-234 GW SL exceedance, and one U-238 GW SL exceedance occurred at a brick and mortar sample location inside a manhole adjacent to the K-1015-A Laundry Pit (sample location Z2-EU33B-235).

The Cs-137 Avg RL exceedance, which is representative of current conditions, occurred in the K-1004-J Lab South Class 1 SU step-out sample from outside the area of contamination defined by the BAR survey (sample location Z2-EU33B-130). Two other Cs-137 Avg RL exceedances originally recognized in the KAH-SS-B22 and KAH-SS-S31 Class 2 SUs (historical sample locations KAH-SS-B22 and KAH-SS-S31, respectively) were not included in this summary because confirmation sampling and BAR surveys failed to confirm the presence of Cs-137 concentrations in excess of the Avg RL.

The remaining chromium GW SL exceedance occurred in a sediment sample collected from a manhole east of the acid dilution pit, which is south of K-1004-L (sample location Z2-EU33B-365). The remaining U-234 GW SL exceedance occurred in historical soil sample location KAH-SS-S11 from the K-1015 Class 1 SU/K-1015-A Laundry Pit FFA Site.

Ind PRG exceedances fell into three groups: (1) exceedances associated with the RL and GW SL exceedances described above; (2) exceedances for K-40, Ra-226, Th-228, Th-230, and Th-232, which are evaluated for risk using the Ra/Th decay series RLs or under special circumstances as described in Sect. 3, or (3) other Ind PRG exceedances. The other Ind PRG exceedances occurred in seven focused investigation areas in this EU. The U-238 Ind PRG was exceeded in one soil sample from the K-1015 Class 1 SU/K-1015-A Laundry Pit FFA Site. Arsenic (one sample), U-238 (two samples), and benzo(a)pyrene (one sample) exceeded their Ind PRGs in the K-1004 Drain Line Class 2 SU soils. The benzo(a)pyrene Ind PRG was exceeded in one soil sample from the K-1004-F Facility, iron Ind PRG was exceeded in two sediment samples from the K-1006 Facility (one in the north sump and one in the south sump), U-238 Ind PRG was exceeded in two soil samples from the K-1004-L facility, Ind PRGs for total uranium, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)anthracene were exceeded in one sediment sample from the Brick-Lined Drain Pit at the Gravel Wash Area, and arsenic and iron exceed their Ind PRGs in a sediment sample from the manhole east of the dilution pit south of K-1004-L.

DRO (7500 mg/kg) and GRO (0.47 mg/kg) were detected at historical sample location Z2EU33-K1004D, which was located in a sewer ejector sump pit in the K-1004-D Facility basement. The DRO and GRO data are reported here but the sample location (Z2EU33-K1004D) was removed when D&D Operations removed the sump pit sediment after production of the initial draft of this TM.

EU Z2-33 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	87/87	2,520J	29,400	K1004D-S3	11,964	NA	NA	0	0	NA	70
Antimony	64/77	0.018J	19	Z2EU33-K1004D	0.594	NA	NA	0	4	0	3
Arsenic	87/87	1.2	93.1	Z2-EU33B-327	6.82	0	0	4	4	1	87
Barium	87/87	19	346	Z2-EU33B-327	94.2	NA	NA	0	16	0	0
Beryllium	86/87	0.12J	10.7	414	1.12	0	0	0	6	NA	0
Cadmium	82/87	0.028J	24.2	Z2-EU33B-327	1.88	NA	NA	0	54	NA	8
Calcium	87/87	767J	291,000J	Z2-EU33B-364	33,196	NA	NA	NA	72	NA	NA
Chromium	87/87	7J	238J	Z2-EU33B-327	29.5	NA	NA	0	8	2	29
Cobalt	87/87	2.1J	283J	Z2-EU33M-212	15.5	NA	NA	0	1	NA	1
Copper	87/87	3.8J	24,000J	Z2-EU33B-365	328	NA	NA	0	29	NA	4
Iron	87/87	4,700	510,000J	Z2EU33-K1004D	44,434	NA	NA	4	5	NA	87
Lead	87/87	3.5J	1,300	Z2EU33-K1004D	68.9	NA	NA	1	23	0	4
Lithium	68/76	3	51.5	Z2-EU33B-327	12.6	NA	NA	0	1	NA	0
Magnesium	87/87	430J	63,000	Z2-EU33-2006	7,726	NA	NA	NA	26	NA	NA
Manganese	87/87	115J	4,350	Z2-EU33-2026 K1004D-S3	945	NA	NA	0	5	NA	82
Mercury	71/82	0.012J	30	Z2EU33-K1004D	0.948	0	0	0	30	NA	3
Nickel	87/87	4.7	452	K1004D-S3	33.1	NA	NA	0	20	NA	3
Selenium	42/87	0.13J	14J	Z2EU33-K1004D	1.60	NA	NA	0	15	NA	0
Silver	43/87	0.072J	130	Z2EU33-K1004D	7.89	NA	NA	0	10	NA	3
Sodium	69/87	15.9	1,260	Z2-EU33B-334	138	NA	NA	NA	3	NA	NA
Thallium	55/87	0.019J	0.49J	Z2-EU33B-116	0.187	NA	NA	0	2	0	0
Uranium	76/76	0.33	692J	Z2-EU33B-334	14.1	NA	NA	1	NA	NA	34
Vanadium	87/87	5.4J	75J	Z2-EU33B-116	25.1	NA	NA	0	2	NA	83
Zinc	87/87	11	1,900J	Z2-EU33-2006	149	NA	NA	0	21	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 Z2-33 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	1/3	7,500	7,500	Z2EU33-K1004D	7,500
Gasoline Range Organics	1/3	0.47J	0.47J	Z2EU33-K1004D	0.47

EU = exposure unit
J = analyte was identified and result is approximate concentration

EU Z2-33 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
4,4'-DDE	1/9	150	150	K1004D-S3	150	NA	NA	0	NA
4,4'-DDT	4/9	19J	230J	K1004D-S1	145	NA	NA	0	NA
alpha-Chlordane	1/9	8.5J	8.5J	K1004D-S1	8.5	NA	NA	0	NA
gamma-Chlordane	1/9	6J	6J	K1004D-S1	6	NA	NA	0	NA
Endosulfan sulfate	1/9	250J	250J	K1004D-S1	250	NA	NA	0	NA
Endrin	3/9	20J	230J	K1004D-S2	112	NA	NA	0	NA
Heptachlor	1/9	6.5J	6.5J	K1004D-S1	6.5	NA	NA	0	NA
Heptachlor epoxide	3/9	3.5J	9.5J	K1004D-S2	7.07	NA	NA	0	NA
PCB-1254	22/86	21	51,000	Z2-EU33-2004	5,788	0	4	4	14
PCB-1260	12/86	6.1J	920J	Z2-EU33B-334	106	0	0	0	1
Polychlorinated Biphenyl	25/78	6.1J	51,000	Z2-EU33-2004	5,010	0	4	4	12

Avg = average
EU = exposure unit
Ind = industrial
J = analyte was identified and result is approximate concentration
Max = maximum
NA = not applicable
PPCB = pesticide and polychlorinated biphenyl
PRG = preliminary remediation goal
Res = residential
RL = remediation level

EU Z2-33 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	16/71	0.117J	5.41	Z2-EU33B-130	0.784	0	1	2	NA	NA	16
Neptunium-237	4/66	0.1775J	1.3	Z2-EU33B-327	0.817	0	0	0	NA	NA	4
Potassium-40	56/60	3.8	54.5	Z2-EU33-2008	17.1	NA	NA	56	3	NA	56
Radium-226	43/46	0.163	2.18	Z2-EU33B-327	0.825	NA	NA	39	3	NA	43
Ra/Th decay series	30/64	0.02	41.64	Z2-EU33B-327	2.59	2	2	NA	NA	NA	NA
Technetium-99	10/70	0.111J	267	Z2-EU33B-327	35.5	NA	NA	0	NA	NA	9
Thorium-228	64/69	0.17	3.85	Z2-EU33B-327	1.30	NA	NA	63	5	NA	64
Thorium-230	62/69	0.452	40.5	Z2-EU33B-327	2.29	NA	NA	0	31	NA	3
Thorium-232	66/69	0.179	4.29	Z2-EU33B-327	1.21	NA	NA	66	2	NA	66
Uranium-234	75/76	0.392J	387	Z2-EU33B-235	15.0	0	0	1	NA	4	20
Uranium-235	46/77	0.0331J	18.6	Z2-EU33B-235	1.22	0	2	3	NA	0	17
Uranium-238	76/76	0.288	244	Z2-EU33B-334	9.48	0	3	8	35	3	65

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 Z2-33 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
3-Methylphenol	1/27	130J	130J	Z2-EU33B-374	130	0	NA	0
4-Bromophenyl phenyl ether	1/67	97J	97J	K1004D-S1	97	NA	NA	NA
Acenaphthene	9/67	27J	38,000	Z2-EU33B-334	4,396	0	NA	0
Acenaphthylene	9/67	47J	1,400	Z2-EU33B-325	306	0	NA	0
Anthracene	13/67	46J	82,000	Z2-EU33B-334	6,711	0	NA	0
Benz(a)anthracene	28/67	46J	190,000	Z2-EU33B-334	7,372	1	NA	6
Benzo(a)pyrene	28/67	45J	170,000	Z2-EU33B-334	6,637	3	NA	22
Benzo(b)fluoranthene	29/67	48J	170,000	Z2-EU33B-334	6,587	1	NA	7
Benzo(ghi)perylene	22/67	42J	92,000	Z2-EU33B-334	4,690	0	NA	0
Benzo(k)fluoranthene	27/67	57J	170,000	Z2-EU33B-334	6,766	0	NA	1
Benzoic acid	1/57	5,500	5,500	Z2-EU33B-327	5,500	0	NA	0
Bis(2-ethylhexyl)phthalate	18/67	44J	66,000J	Z2-EU33B-327	5,441	0	0	1
Butyl benzyl phthalate	8/67	49J	29,000J	Z2-EU33B-327	6,128	0	NA	0
Carbazole	13/67	41J	53,000	Z2-EU33B-334	4,291	0	NA	1
Chrysene	30/67	44J	220,000	Z2-EU33B-334	7,915	0	NA	1
Dibenz(a,h)anthracene	11/67	50J	23,000	Z2-EU33B-334	2,312	1	NA	10
Dibenzofuran	6/67	55J	23,000	Z2-EU33B-334	4,108	0	NA	1
Di-n-butyl phthalate	5/55	110J	1,200J	Z2-EU33B-327	456	0	NA	0
Di-n-octylphthalate	2/67	120J	1,400	Z2-EU33B-327	760	0	NA	0
Fluoranthene	33/67	67J	500,000	Z2-EU33B-334	16,288	0	NA	1
Fluorene	12/67	48J	29,000	Z2-EU33B-334	3,043	0	NA	0
Hexachlorobenzene	1/67	340J	340J	Z2-EU33B-327	340	0	NA	1
Indeno(1,2,3-cd)pyrene	22/67	49J	77,000	Z2-EU33B-334	4,012	1	NA	5
m+p Methylphenol	1/27	450J	450J	Z2-EU33B-334	450	NA	NA	NA
Naphthalene	9/87	9.4	31,000	Z2-EU33B-334	5,438	0	NA	2
N-Nitrosodiphenylamine	1/61	17J	17J	Z2-EU33-2012	17	0	NA	0
Pentachlorophenol	1/66	74J	74J	K1004D-S2	74	0	NA	0
Phenanthrene	26/67	45J	370,000	Z2-EU33B-334	15,151	0	NA	1
Phenol	3/66	96J	260J	Z2-EU33B-334	175	0	NA	0
Pyrene	33/67	43J	340,000	Z2-EU33B-334	11,194	0	NA	1

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
SL = screening level
SVOC = semivolatile organic compound

EU Z2-33 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
1,1,1-Trichloroethane	2/41	96	4,300	Z2-EU33B-113	2,198	0	0	0
1,1,2-Trichloro-1,2,2-trifluoroethane	3/23	2.5J	150	Z2-EU33B-113	57.8	0	NA	0
1,1,2-Trichloroethane	1/41	7.4	7.4	Z2-EU33B-113	7.4	0	0	0
1,1-Dichloroethane	2/41	42	480	Z2-EU33B-113	261	0	NA	0
1,1-Dichloroethene	3/41	3.1J	320	Z2-EU33B-113	120	0	0	0
1,2,3-Trichlorobenzene	1/21	2.7J	2.7J	Z2-EU33B-117	2.7	NA	NA	NA
1,2-Dichloroethane	1/41	11	11	Z2-EU33B-113	11	0	NA	0
2-Butanone	1/41	16J	16J	Z2-EU33-217	16	0	NA	0
Acetone	5/41	10J	110	Z2-EU33B-383	52.8	0	NA	0
Benzene	2/41	2.2J	3.5J	Z2-EU33B-346	2.85	0	0	0
Carbon disulfide	2/41	6.9	12	Z2-EU33B-383	9.45	0	NA	0
Carbon tetrachloride	4/41	1.2J	6.7	Z2-EU33B-123	3.38	0	0	0
Chloroform	4/41	3.8J	140	Z2-EU33B-383	47.2	0	0	0

EU Z2-33 VOC DETECTS (ug/kg) 0-10 ft (cont'd)

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
cis-1,2-Dichloroethene	9/40	1.2J	1,300	Z2-EU33B-383	222	0	NA	0
Ethylbenzene	2/41	7.4	30J	Z2-EU33B-327	18.7	0	NA	0
Methylene chloride	3/41	7.1	40	Z2-EU33B-113	26.0	0	0	0
Tetrachloroethene	4/41	2.3J	29	Z2-EU33B-383	16.3	0	0	0
Toluene	8/41	1J	30	Z2-EU33B-113	12.8	0	0	0
Total Xylene	2/12	18	290J	Z2-EU33B-327	154	0	NA	NA
trans-1,2-Dichloroethene	4/39	1.7J	11	Z2-EU33B-383	4.38	0	NA	0
Trichloroethene	10/42	1.9J	580	Z2-EU33B-113	125	0	0	4
Vinyl chloride	4/41	8.2	120	Z2-EU33B-383	45.6	0	0	1

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
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 Z2-33. 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. Information included in the summaries for the FFA sites also is included in the summary for Z2-EU33 presented in Sect. 2.2.5.

K-1004-L Recirculating Cooling Water (RCW) Lines Leak Sites

During DQO scoping, it was decided that sampling in the K-1004-L RCW Lines Leak Sites FFA site was unnecessary. Previous sampling at other RCW lines leak sites in Zone 2 demonstrated that the RCW lines leak sites were not sources of contamination.

K-1015-A Laundry Pit FFA Site

The K-1015-A Laundry Pit in the K-1015-A Laundry Pit FFA site received wash water from the K-1015 Laundry Facility. Analytical results from DVS sampling of pit sediment (Z2-EU33B-223, Z2-EU33B-225, Z2-EU33B-227, and Z2-EU33B-235) showed metal GW SL exceedances, PCB Avg RL exceedances, radionuclide GW SL, Avg RL and Max RL exceedances. In addition, historical soil sample locations (KAH-SS-B12 and KAH-SS-B13) around the pit had radionuclide Avg RL and Max RL exceedances. The K-1015-A Laundry Pit was removed during a remedial action. This remedial action, and the K-1015 Class 1 SU remedial action (Sect. 2.2.5), also removed soils surrounding the pit. During process of these two remedial actions, several sample locations also were removed (Table 3). Following remedial action, a confirmation sample was collected at the base of the excavation at sample location Z2-EU33B-382. Sample locations representative of current conditions at the K-1015-A Laundry Pit FFA site are presented in Table 3. These locations had samples taken from > 10 ft bgs and included Z2-EU33B-229 and confirmation sample location Z2-EU33B-382. Sample locations representative of current conditions at the K-1015-A Laundry Pit FFA site are the same as locations representative of the K-1015 Class 1 SU (Sect. 2.2.5), except for the confirmation sample location at the FFA site and brick and mortar sample Z2-EU33B-235 taken from inside a manhole adjacent to the FFA site. Analytical results summarized below for samples representative of current conditions at the K-1015-A Laundry Pit FFA site include U-235 and U-238 Avg RL exceedances in the brick and mortar sample from the manhole; radionuclide Ind PRG exceedances; two U-234 and one U-238 GW SL exceedances; metal and radionuclide Bkg exceedances; and PCB, SVOC, and VOC detections.

EU Z2-33 K-1015 LAUNDRY PIT FFA SITE 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	9/9	7,600J	18,800J	Z2-EU33B-309	13,278	NA	NA	0	0	NA	8
Arsenic	9/9	3.1J	7.8	Z2-EU33-2018	4.89	0	0	0	0	0	9
Barium	9/9	50.7J	170J	Z2-EU33B-229	100	NA	NA	0	2	0	0
Beryllium	9/9	0.33	2.3	Z2-EU33B-229	1.08	0	0	0	1	NA	0
Cadmium	7/9	0.079	3.9	Z2-EU33-2018	0.687	NA	NA	0	1	NA	1
Calcium	9/9	1140J	65,200	Z2-EU33B-306	14,984	NA	NA	NA	7	NA	NA
Chromium	9/9	12J	34.3	425	21.6	NA	NA	0	0	0	4
Copper	9/9	8.6	33J	Z2-EU33B-229	17.8	NA	NA	0	2	NA	0
Iron	9/9	16,000J	57,000J	Z2-EU33B-229	34,267	NA	NA	0	0	NA	9
Lead	9/9	16.8J	51J	Z2-EU33B-309	29.4	NA	NA	0	3	0	0
Manganese	9/9	320J	3,510	Z2-EU33B-309	1364	NA	NA	0	2	NA	9
Mercury	8/8	0.053J	1.2J	Z2-EU33B-307	0.251	0	0	0	3	NA	0
Nickel	9/9	6	57	Z2-EU33-2018	23.3	NA	NA	0	4	NA	0
Selenium	3/9	1	1.8J	Z2-EU33B-382	1.3	NA	NA	0	1	NA	0
Silver	5/9	0.072J	1.2	Z2-EU33-2018	0.313	NA	NA	0	1	NA	0
Uranium	7/7	0.4	3.4	Z2-EU33-2018	1.36	NA	NA	0	NA	NA	3
Vanadium	9/9	13	40J	Z2-EU33B-309	27.2	NA	NA	0	0	NA	9

Avg = average
Bkg = background
EU = exposure unit
FFA = Federal Facility Agreement
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 Z2-33 K-1015 LAUNDRY PIT FFA SITE 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	1/8	50.7	50.7	Z2-EU33B-235	50.7	0	0	0	0
PCB-1260	1/8	39	39	Z2-EU33B-235	39	0	0	0	0
Polychlorinated Biphenyl	1/6	89.7	89.7	Z2-EU33B-235	89.7	0	0	0	0

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

EU Z2-33 K-1015 LAUNDRY PIT FFA SITE 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	1/10	0.564	0.564	KAH-SS-S11	0.564	0	0	0	NA	NA	1
Neptunium-237	1/8	0.5896	0.5896	KAH-SS-S11	0.590	0	0	0	NA	NA	1
Potassium-40	7/7	7.1	27.8	Z2-EU33B-229	19.3	NA	NA	7	0	NA	7
Radium-226	5/5	0.776	0.99	Z2-EU33B-309	0.899	NA	NA	5	0	NA	5
Technetium-99	1/10	0.3807	0.3807	KAH-SS-S11	0.381	NA	NA	0	NA	NA	1
Thorium-228	10/10	0.727	1.78	Z2-EU33B-229	1.31	NA	NA	10	0	NA	10
Thorium-230	10/10	0.452	6.148	KAH-SS-S11	1.48	NA	NA	0	3	NA	1
Thorium-232	10/10	0.543	1.6	Z2-EU33B-382	1.21	NA	NA	10	0	NA	10
Uranium-234	10/11	0.735	387	Z2-EU33B-235	48.1	0	0	1	NA	2	2

EU Z2-33 K-1015 LAUNDRY PIT FFA SITE RADIONUCLIDES WITH BACKGROUND, PRG, AND/OR RL EXCEEDANCES (pCi/g) 0-10 ft (cont'd)

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	6/11	0.058	18.6	Z2-EU33B-235	3.67	0	1	1	NA	0	2
Uranium-238	11/11	0.321	63.3	Z2-EU33B-235	8.44	0	1	2	3	1	9

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

EU Z2-33 K-1015 LAUNDRY PIT FFA SITE 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
Acenaphthene	1/4	78J	78J	Z2-EU33B-307	78	0	NA	0
Anthracene	1/4	110J	110J	Z2-EU33B-307	110	0	NA	0
Benz(a)anthracene	1/4	240J	240J	Z2-EU33B-307	240	0	NA	0
Benzo(a)pyrene	1/4	180J	180J	Z2-EU33B-307	180	0	NA	1
Benzo(b)fluoranthene	1/4	210J	210J	Z2-EU33B-307	210	0	NA	0
Benzo(ghi)perylene	1/4	130J	130J	Z2-EU33B-307	130	0	NA	0
Benzo(k)fluoranthene	1/4	190J	190J	Z2-EU33B-307	190	0	NA	0
Bis(2-ethylhexyl)phthalate	1/4	1,800	1,800	Z2-EU33-2018	1,800	0	0	0
Butyl benzyl phthalate	1/4	69J	69J	Z2-EU33-2018	69	0	NA	0
Carbazole	1/4	78J	78J	Z2-EU33B-307	78	0	NA	0
Chrysene	1/4	280J	280J	Z2-EU33B-307	280	0	NA	0
Di-n-octylphthalate	1/4	120J	120J	Z2-EU33-2018	120	0	NA	0
Fluoranthene	1/4	590	590	Z2-EU33B-307	590	0	NA	0
Fluorene	1/4	63J	63J	Z2-EU33B-307	63	0	NA	0
Indeno(1,2,3-cd)pyrene	1/4	120J	120J	Z2-EU33B-307	120	0	NA	0
Phenanthrene	1/4	520	520	Z2-EU33B-307	520	0	NA	0
Pyrene	1/4	470	470	Z2-EU33B-307	470	0	NA	0

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

EU Z2-33 K-1015 LAUNDRY PIT FFA SITE 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
1,1,2-Trichloro-1,2,2-trifluoroethane	1/5	21	21	424	21	0	NA	0
Toluene	2/5	9	22	425	15.5	0	0	0

EU = exposure unit
FFA = Federal Facility Agreement
GW = groundwater
Ind = industrial
NA = not applicable
PRG = preliminary remediation goal
Res = residential
SL = screening level
VOC = volatile organic compound

K-1044 Heavy Equipment Repair Shop FFA Site

The K-1044 Heavy Equipment Repair Shop FFA site is located in the northeast corner of EU Z2-33. The shop itself was demolished in 1958 and its footprint is now partially covered by Bldg. K-1225. Two biased sample locations were selected at the FFA site (Sect. 2.2.3). Analytical results summarized below from these samples show metal Bkg exceedances and PCB detections.

EU Z2-33 K-1044 HEAVY EQUIPMENT REPAIR SHOP FFA SITE 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	13,000	Z2-EU33B-232	12,500	NA	NA	0	0	NA	2
Arsenic	2/2	4	9.6	Z2-EU33B-232	6.8	0	0	0	0	0	2
Calcium	2/2	2,500	17,000	Z2-EU33B-233	9,750	NA	NA	NA	2	NA	NA
Chromium	2/2	17	33	Z2-EU33B-232	25	NA	NA	0	0	0	1
Iron	2/2	38,000J	42,000J	Z2-EU33B-232	40,000	NA	NA	0	0	NA	2
Manganese	2/2	610J	1,100J	Z2-EU33B-232	855	NA	NA	0	0	NA	2
Selenium	2/2	2.5	3.5	Z2-EU33B-232	3	NA	NA	0	2	NA	0
Vanadium	2/2	26J	52J	Z2-EU33B-232	39	NA	NA	0	0	NA	2

Avg = average
Bkg = background
EU = exposure unit
FFA = Federal Facility Agreement
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 Z2-33 K-1044 HEAVY EQUIPMENT REPAIR SHOP FFA SITE 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	21	21	Z2-EU33B-233	21	0	0	0	0
Polychlorinated Biphenyl	1/2	21	21	Z2-EU33B-233	21	0	0	0	0

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

SVOCs were analyzed for but were not detected.

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?

Table 3 presents 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. In addition, the EU summary in Sect. 2.2.5 presents an evaluation of EU data by analyte group. The following table summarizes the conclusions for current conditions in EU Z2-33.

EU #	Max RL exceeded?	Average RL over EU exceeded?	Industrial risk above 1×10^{-4}?	Potential source to groundwater?	Action required?
Z2-33	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 and the way the 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 Z2-33

In this section, soil compositions from the 0-10 ft depth interval are evaluated in terms of the decision rule criteria discussed in Sect. 3.2 of this PCCR. The data evaluated reflect current conditions that are post-remedial actions and post-D&D in EU Z2-33. The same remedial action that addressed the K-1004-J Lab South Class 1 SU in EU Z2-33 addressed soil contamination associated with the K-1004-J Laboratory in EU Z2-42. For EU Z2-33, data evaluated include soil samples collected from a depth of $\geq$ 10 ft bgs if the samples were collected to confirm the results of a remedial action or D&D, or if the samples were collected to document contaminant leakage from a subsurface structure. Also, data for concrete left on site was evaluated with the soil data because the concrete will remain a permanent solid matrix of the site.

Maximum RL screening. The Ra/Th decay series Max RL was exceeded in two samples of sediment collected from the K-1006 north sump. The K-1006 Development Laboratory is an active facility. The RA Core Team agreed the K-1006 north sump would not be addressed at this time.

Average RL screening. The Avg RL screening process included the requirements of the Zone 2 ROD, which stated the weighted average concentrations of Zone 2 COCs across the EU could not exceed their respective Avg RLs. The screening process began 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 was compared to the Avg RL. (Where noted below, the average detected concentration included data for soil and concrete samples, therefore, data will not match the data summaries that present either soil or concrete data.) If the detected average concentration was less than the Avg RL, the COC was dropped from further screening. If a COC's average detected concentration exceeded the average RL, then a new average concentration was calculated where half the value of the detection limit was used for nondetects. If the new average exceeded the Avg RL, then a weighted average concentration for the COC was calculated and the weighted average concentration was compared to the Avg RL.

The Avg RL for PCB-1254 was exceeded in four soil and concrete samples. The average detected concentration of PCB-1254 in EU soil and concrete was 5788 ug/kg, which was less than the Avg RL of 10,000 ug/kg.

The Avg RL for polychlorinated biphenyl (total PCB) was exceeded in four soil and concrete samples. The average detected concentration of total PCB in EU soil and concrete was 5010 ug/kg, which was less than the Avg RL of 10,000 ug/kg.

The Avg RL for Cs-137 was exceeded in one soil sample (historical locations KAH-SS-B22 and KAH-SS-S31 were not included because DVS sampling did not confirm Cs-137 Avg RL exceedances). The average detected concentration of Cs-137 in EU soil was 0.784 pCi/g, which was less than the Avg RL of 2 pCi/g.

The Ra/Th decay series Avg RL was exceeded in two samples from the K-1006 north sump. The RA Core Team has agreed that the K-1006 north sump will not be addressed at this time.

The Avg RL for U-235 was exceeded in a soil and a concrete sample. The average detected concentration of U-235 in EU soil and concrete is 1.22 pCi/g, which was less than the Avg RL of 8 pCi/g.

The Avg RL for U-238 was exceeded in soil and concrete samples. The average detected concentration of U-238 in EU soil and concrete was 8.32 pCi/g, which was less than the Avg RL of 50 pCi/g.

It was concluded that no average COC concentration across EU Z2-33 exceeded its Avg RL.

Risk evaluation. The 1×10^{-5} Ind PRGs were 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 was 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 were not considered in the risk evaluation because risk for those radionuclides was evaluated with the Ra/Th decay series RLs, and K-40 was considered in the risk evaluation only if its average detected concentration exceeded its background concentration. The second step in the risk screen was 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 was less than the 1×10^{-5} Ind PRG, that chemical or radionuclide was no longer evaluated for risk. If the average detected concentration of a chemical or radionuclide exceeded the 1×10^{-5} Ind PRG, then the average concentration was recalculated using one-half the detection limit for nondetects. If the recalculated average concentration exceeded the 1×10^{-4} Ind PRG (i.e., 10 times the 1×10^{-5} Ind PRG), then a weighted average calculation was performed (weighted average is explained in the PCCR). If the weighted average exceeded the 1×10^{-4} Ind PRG, then a quantitative risk assessment was performed. Lastly, all chemicals and radionuclides with individual 1×10^{-5} Ind PRG exceedances were evaluated for their combined impact on cumulative risk. An estimate of cumulative risk was made by calculating the fraction each average concentration was of its 1×10^{-5} Ind PRGs, then summing those fractions. If the sum was > 7.5 (i.e., approximately 75% of the 1×10^{-4} Ind PRGs), then a quantitative risk assessment was performed.

The data summaries in Sect. 2.2.5 illustrates that there were several Ind PRG exceedances. 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 was less than the background concentration (32.12 pCi/g), the K-40 Ind PRG exceedances also were not considered. Among the remaining chemicals and radionuclides with Ind PRG exceedances, only the average detected concentrations of benzo(a)pyrene (6637 ug/kg) and dibenz(a,h)anthracene (2312 ug/kg) exceeded their 1×10^{-5} Ind PRGs (2110 ug/kg for both).

Recalculating the EU Z2-33 average concentrations for benzo(a)pyrene and dibenz(a,h)anthracene by using one half the detection limit for non-detects resulted in new averages of 2799 ug/kg and 471 ug/kg, respectively. Thus, neither the recalculated average concentration of benzo(a)pyrene or benz(a,h)anthracene exceeded the 1×10^{-4} Ind PRG, although the benzo(a)pyrene recalculated average concentration exceeded the 1×10^{-5} Ind PRG.

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 benzo(a)pyrene and dibenz(a,h)anthracene. For these two chemicals, the recalculated averages were used (see above). Summing the fractions resulted in a value of 6.5. It was concluded that if all nondetects were to be accounted for and their weighted averages were calculated, the cumulative risk over EU Z2-33 would not exceed 1×10^{-4}.

In conclusion, the industrial risk for EU Z2-33 was calculated to be less than 1×10^{-4} ELCR, with a target organ HI of 1.

Threat to groundwater. The threat to groundwater from an EU was 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 were matches between the two sets of analytes, then the mobilities

of the matching analytes were evaluated, the volumetric extent of their GW SL exceedances were estimated, and a conclusion was drawn regarding whether any of the matching analytes was a source of groundwater contamination.

As discussed in the groundwater evaluation in Sect. 2.2.5, MCLs in local groundwater wells were exceeded by VOCs. No VOC GW SLs exceedances were observed in the EU Z2-33 data, however, one arsenic, two chromium, four U-234, and three U-238 GW SL exceedances were observed. The 10 GW SL exceedances occurred in five samples from locations KAH-SS-S11, Z2-EU33B-235, Z2-EU33B-327, Z2-EU33B-334, and Z2-EU33B-365. The sample from Z2-EU33B-235 was brick and concrete from a manhole while samples from Z2-EU33B-327, Z2-EU33B-334, and Z2-EU33B-365 were sediment from subsurface enclosures (sump, storm drain, and manhole, respectively). These sample locations represented 9 of the 10 GW SL exceedances. The last GW SL exceedance was KAH-SS-S11, which was a surface soil sample location. Arsenic, chromium, and uranium had low mobilities in aqueous environments, therefore, they adhered to the soil, sediment, and concrete/brick surfaces representing the matrices of the various samples with GW SL exceedances and did not represent a threat to groundwater.

Both DRO and GRO were detected in a sediment sample at historical location Z2EU33-K1004D. The sample was from a sewer ejector sump pit in the basement of the K-1004-D Facility. Although there were no site-specific or action-specific criteria in the Zone 2 ROD that pertained to DRO and GRO, underground storage tank rules of the Tennessee Department of Environment and Conservation Chap. 1200-1-15-06(7)(e)(4) state site-specific, risk-based cleanup levels may be used where appropriate. In the case of these DRO and GRO detections, the sample location was removed when D&D Operations removed the sump pit sediment after production of the initial draft of this TM.

Qualitative risk screening for unrestricted use. There was a low probability that EU Z2-33 acreage could be released with no land use restrictions. Avg RL exceedances for radionuclides and PCBs, and Ind and Res PRG exceedances for metals, radionuclides, PCBs, SVOCs, and VOCs occurred in this EU. Specific chemicals and radionuclides with criteria exceedances are presented in Sect. 2.2.5. An appropriate evaluation of residential risk should be conducted to make a definitive conclusion.

Zone 2 ROD Appendix A FFA Sites

Based on sampling analytical results at the EU Z2-33 FFA sites (Sect. 2.2.6) and an evaluation of the EU-wide contaminant profile (above), soils in the following Zone 2 ROD Appendix A FFA sites do not pose a potential threat to the future industrial worker or groundwater:

- K-1004-L RCW Lines Leak Site FFA site,
- K-1015-A Laundry Pit FFA Site, and
- K-1044 Heavy Equipment Repair Shop FFA Site.

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

EU Z2-33: Based on the analytical results of DVS and historical samples collected in EU Z2-33 and the Class 3 SU walkover assessment in the EU, the U.S. Department of Energy (DOE) recommends that NFA is appropriate under the Zone 2 ROD to meet industrial land use for the 18 acres of ETTP Zone 2 EU33.

There are 20 DVS and historical sample locations in EU Z2-33 with samples from ≥ 10 ft bgs. Analytical results summarized in Table 5 showed sporadic radionuclide Ind PRG exceedances; metal, radionuclide, and VOC Res PRG exceedances; and numerous metal and radionuclide Bkg exceedances. In addition, one or more groundwater contaminant plumes occurred under portions of this EU. Based primarily on the existence of known groundwater contamination, DOE does not recommend the 10-ft-depth use restriction be lifted.

FFA Sites: Based on sampling analytical results and the recommendation for EU Z2-33, DOE recommends NFA as appropriate for the following FFA sites:

- K-1004-L RCW Lines Leak Site FFA site,
- K-1015-A Laundry Pit FFA Site, and
- K-1044 Heavy Equipment Repair Shop FFA Site.

4.2 EXCAVATION ACTIVITIES/CONFIRMATION SAMPLING

Data and observations recorded in this TM reflect current conditions in EU Z2-33 (i.e., post-remedial action and post-D&D conditions). Data evaluations in Sect. 3.3 conclude there are no average RL or risk exceedances and no threats to groundwater in soils of the 0-10-ft-depth interval in the EU. Two maximum RL exceedances occur in the north sump of the active K-1006 Development Laboratory but the RA Core Team has agreed to defer actions until a later time. Therefore, no excavation activities or confirmation sampling is planned for EU Z2-33.

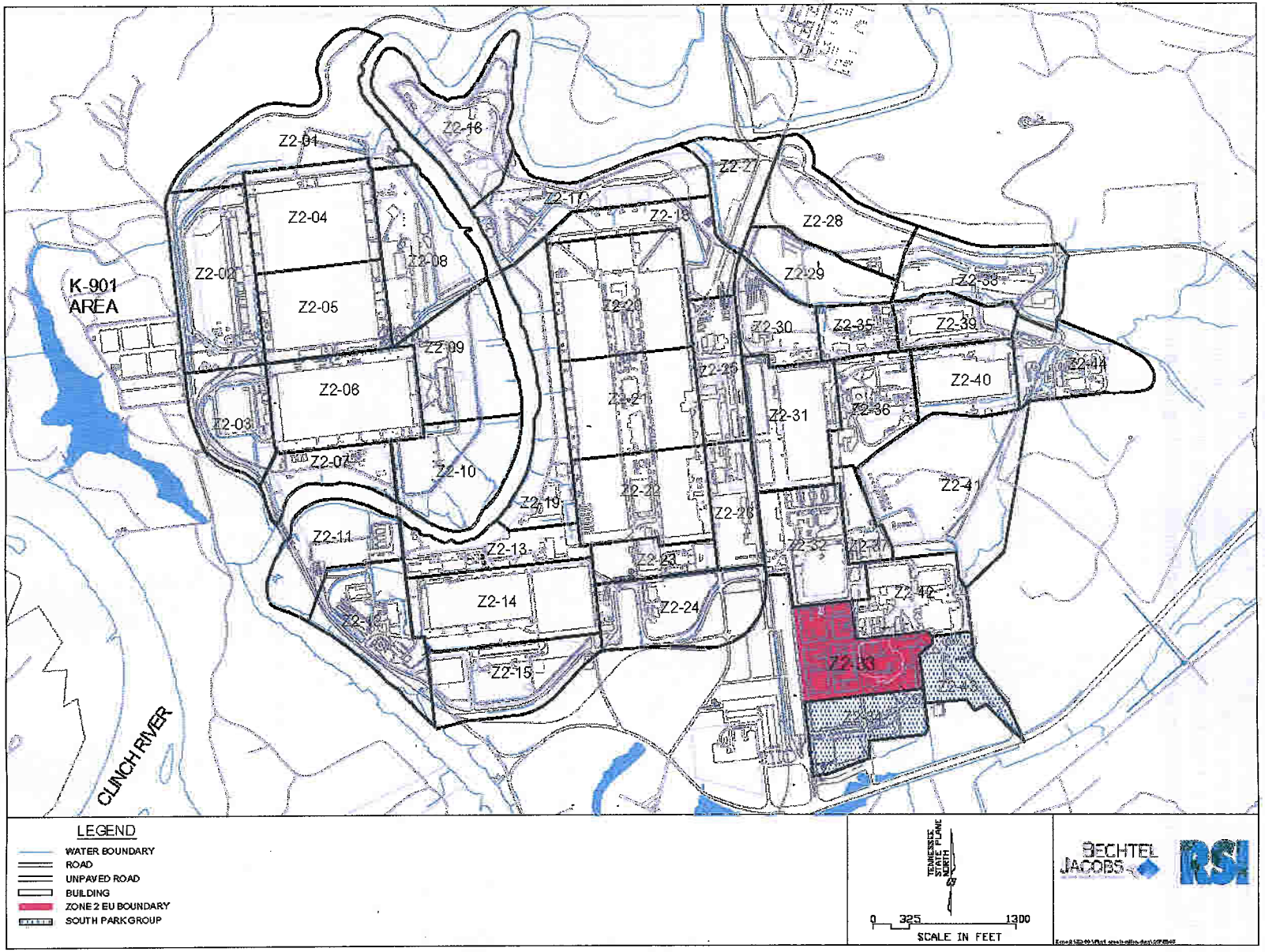

Fig. A.1. EU Z2-33 location map.

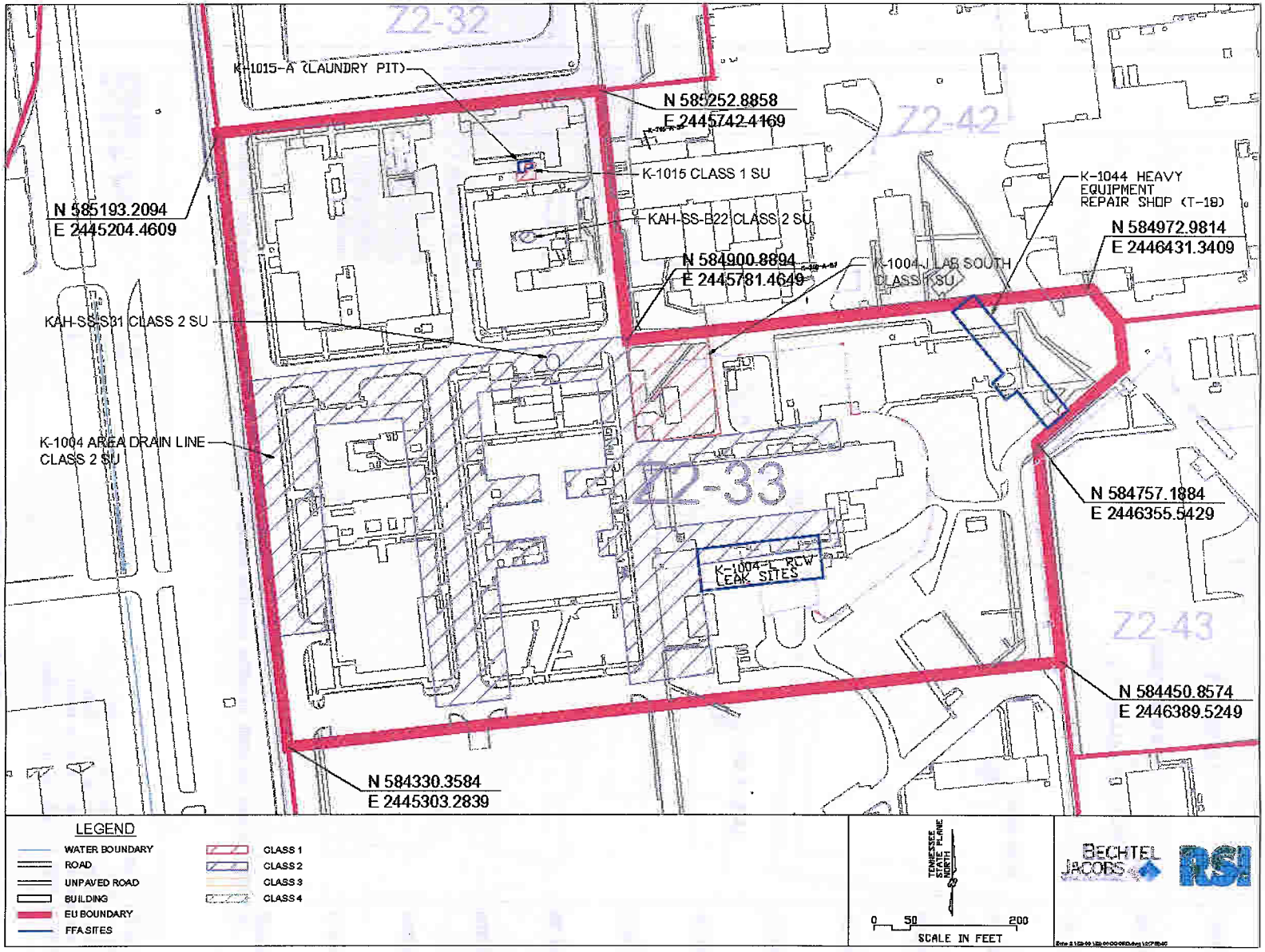

Fig. A.2. EU Z2-33 boundary location map.

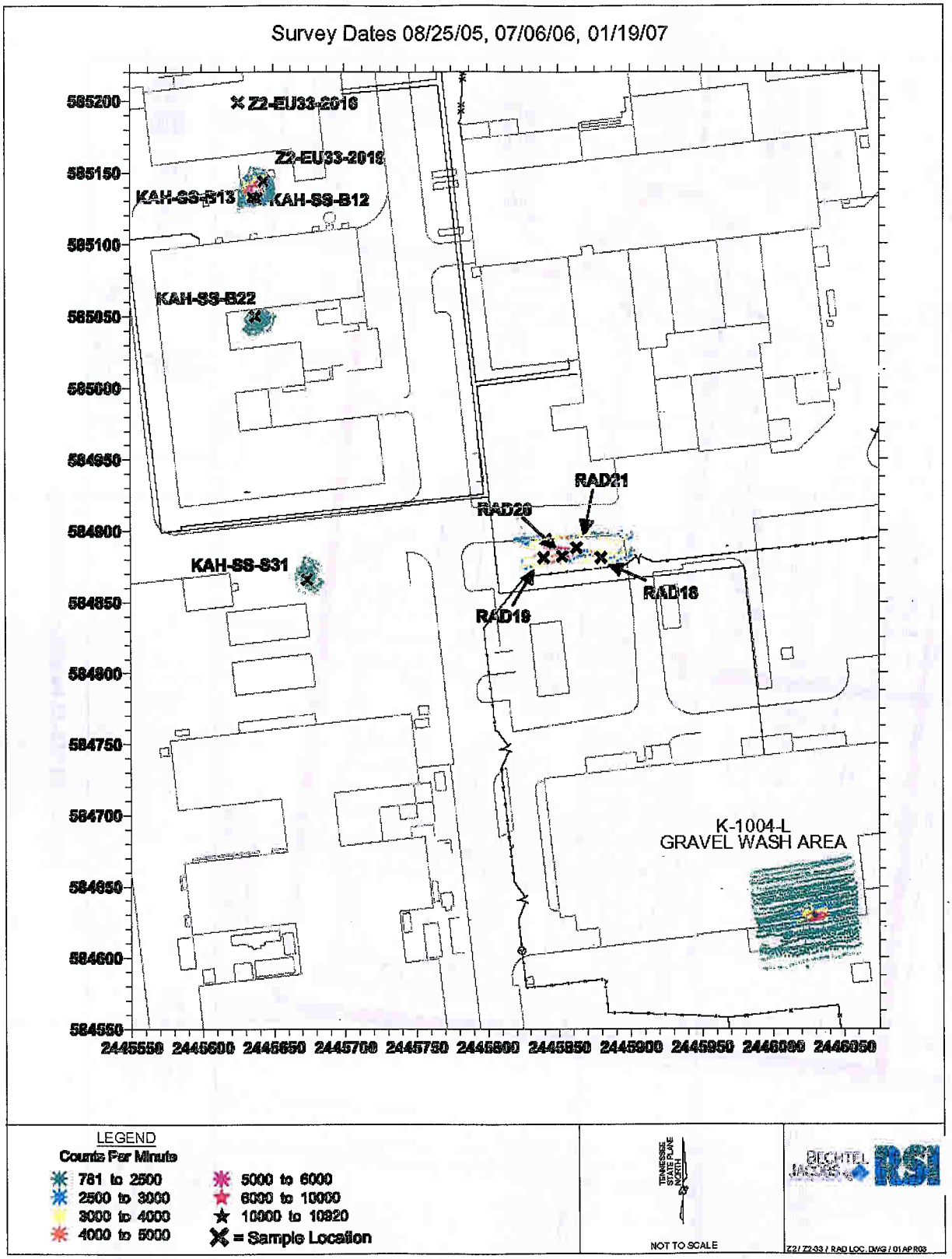

Fig. A.3. EU Z2-33 BAR survey locations.

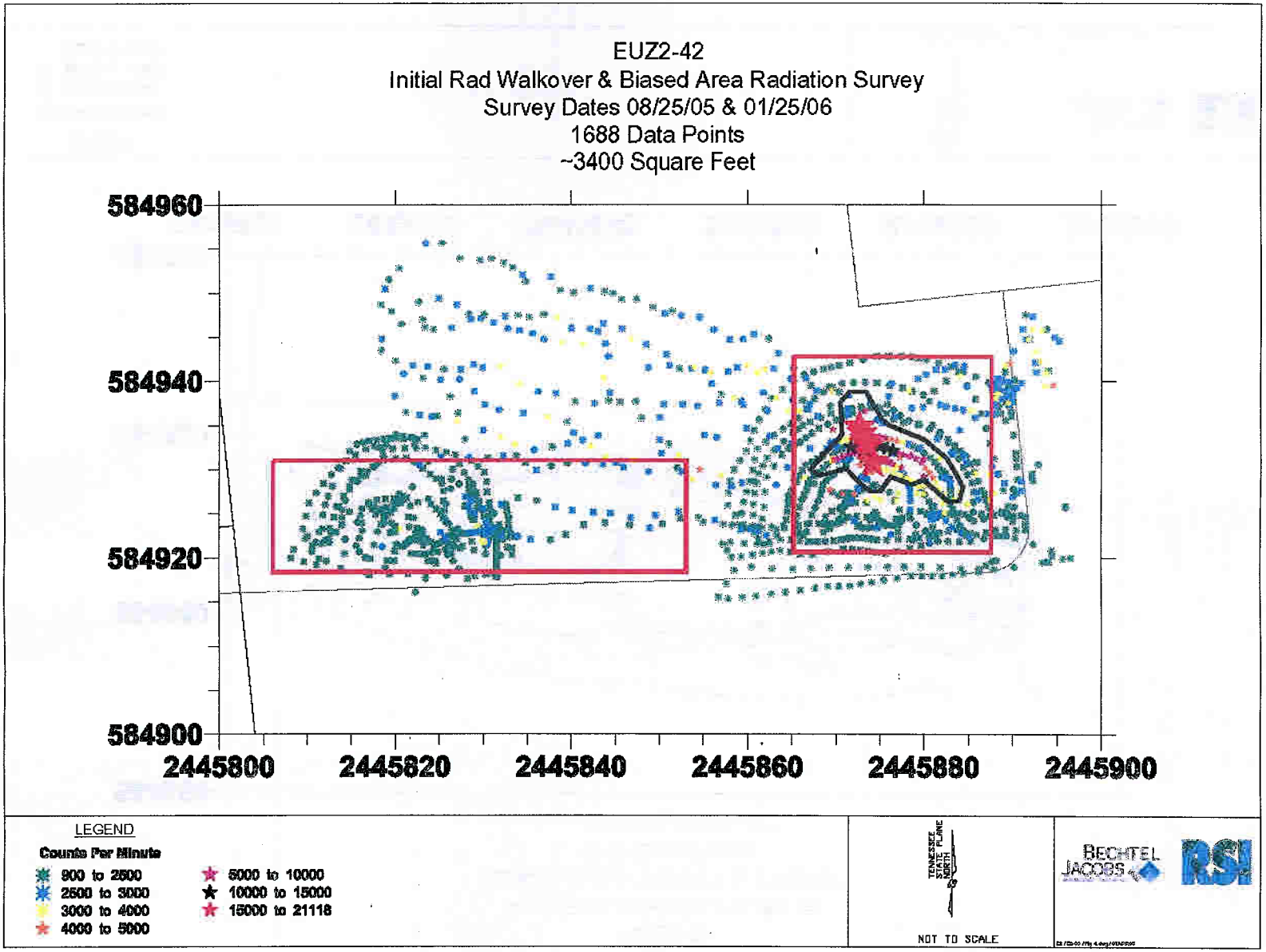

Fig. A.4. EU Z2-42 initial BAR survey results.

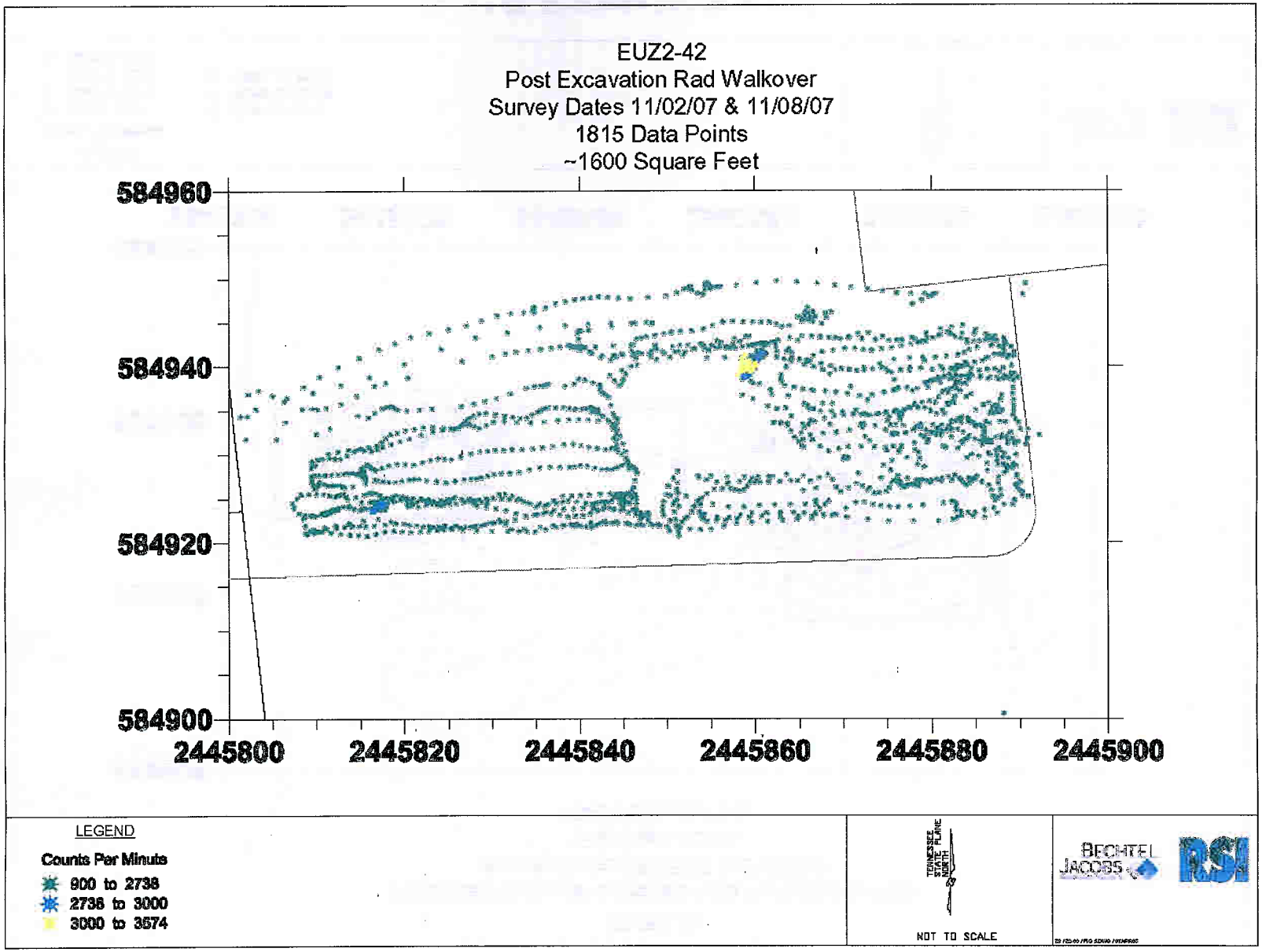

Fig. A.5. EU Z2-42 post-RA BAR survey results.

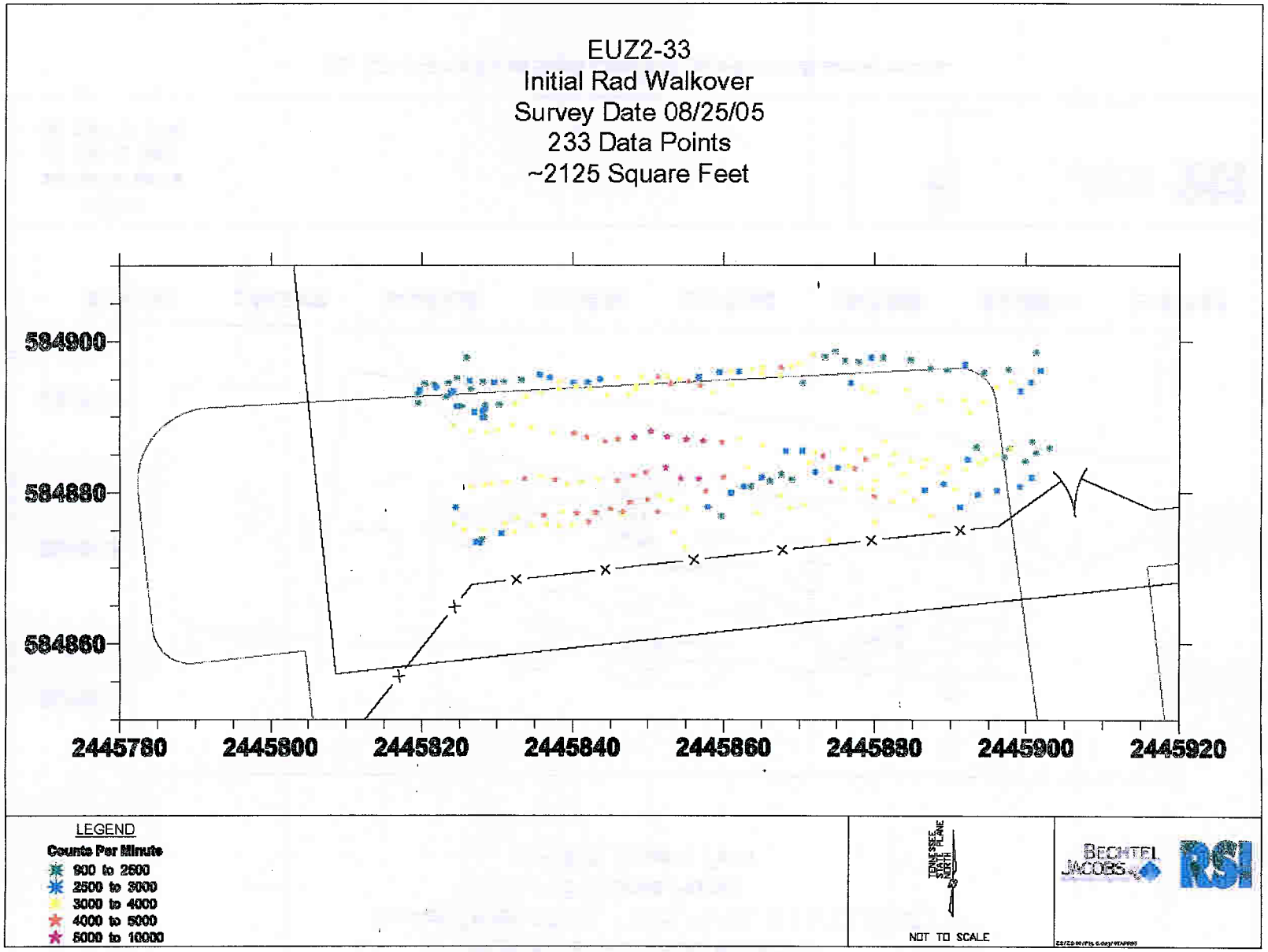

Fig. A.6. K-1004-J Lab South Class 1 SU pre-RA BAR survey results.

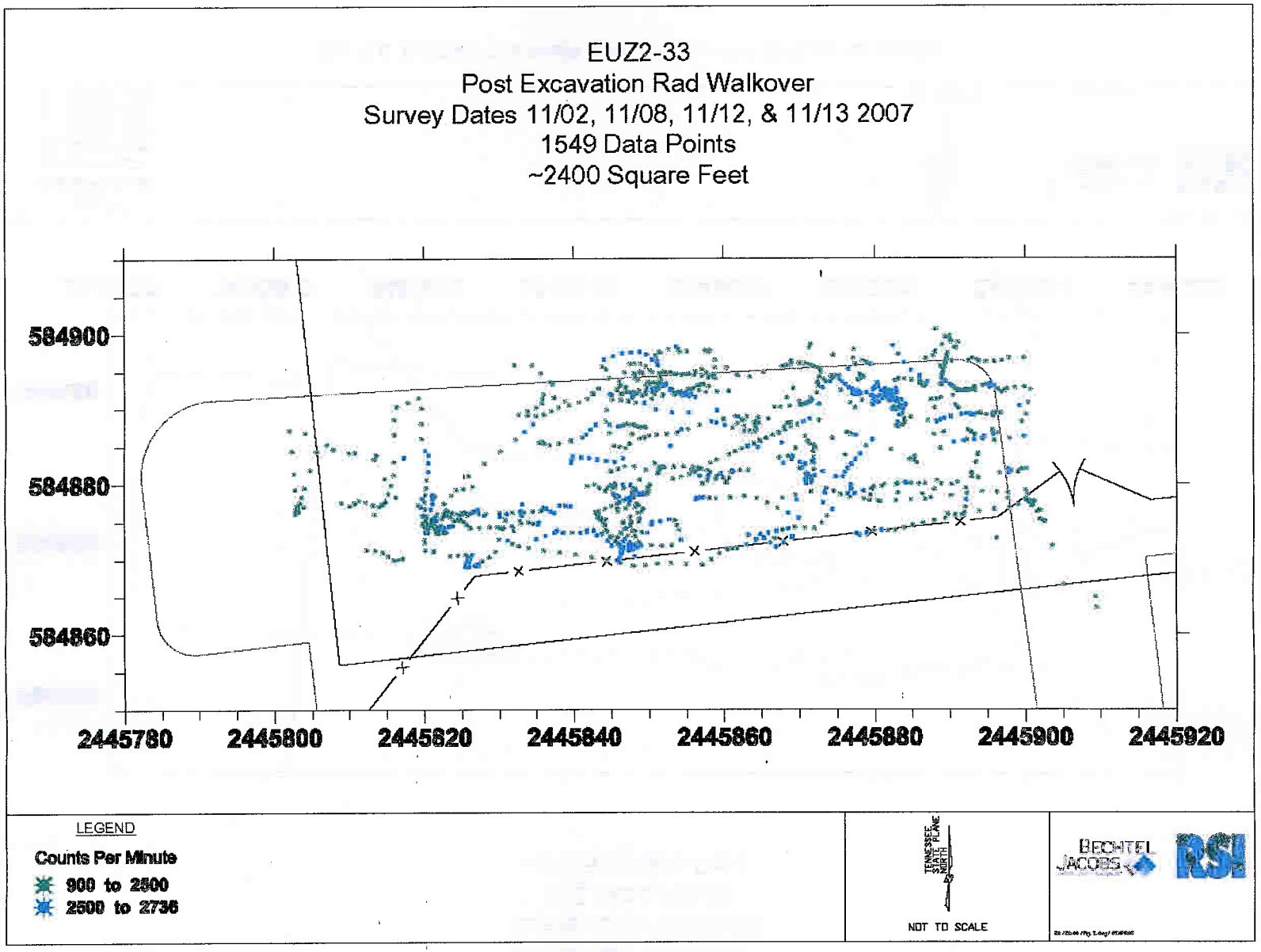

Fig. A.7. K-1004-J Lab South Class 1 SU post-RA BAR survey results.

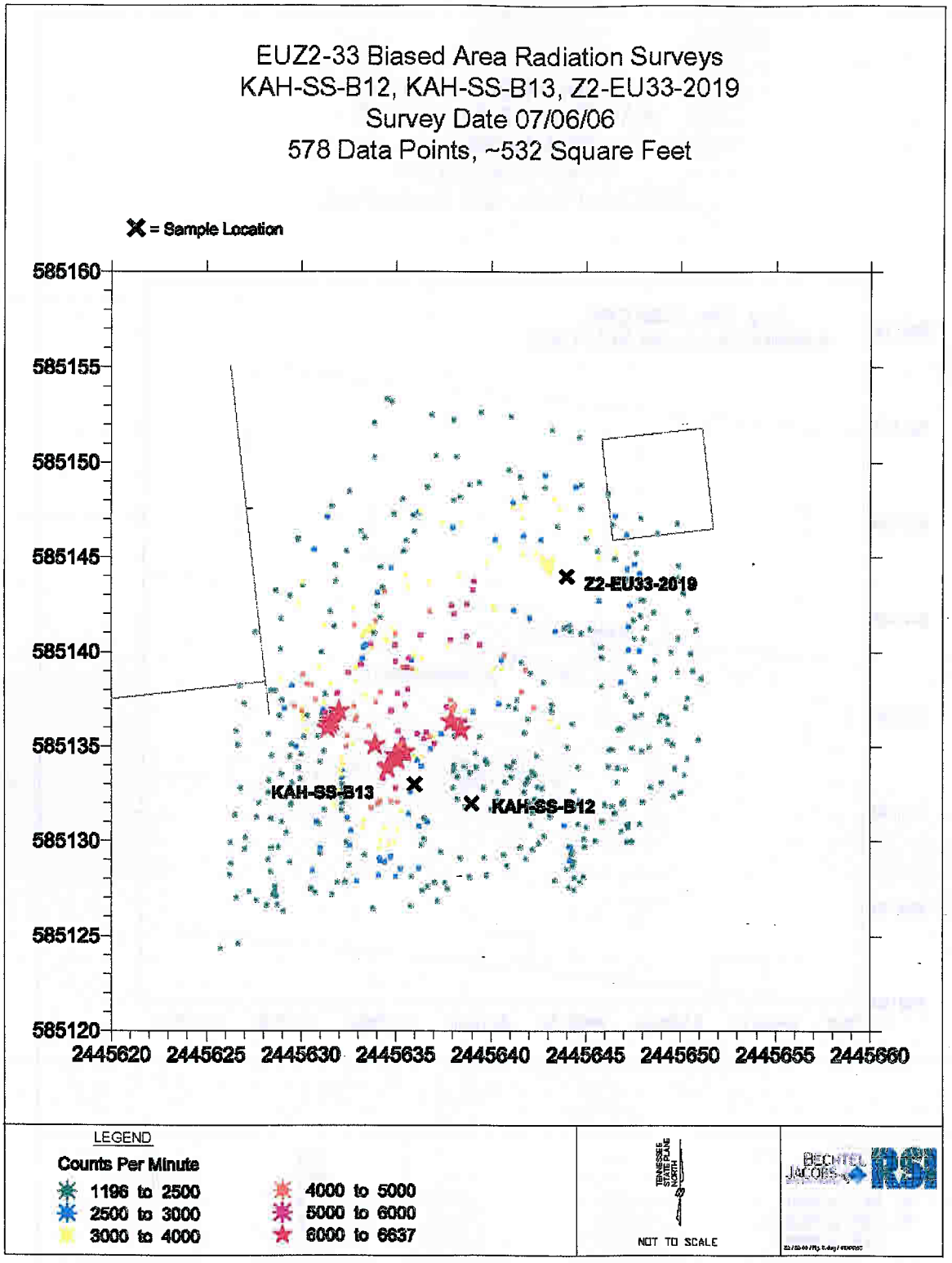

Fig. A.8. K-1015 pre-RA BAR survey results.

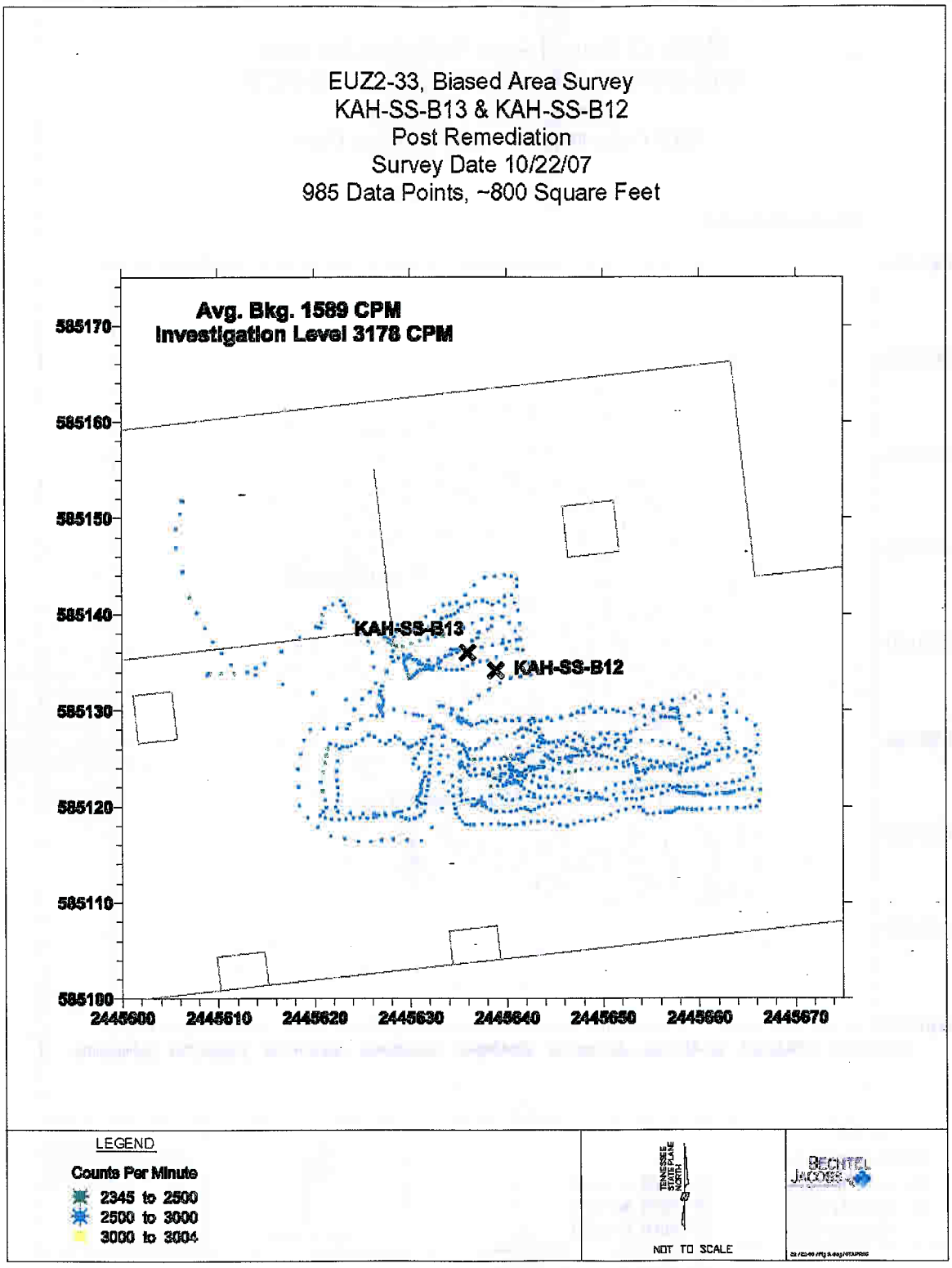

Fig. A.9. K-1015 post-RA BAR survey results.

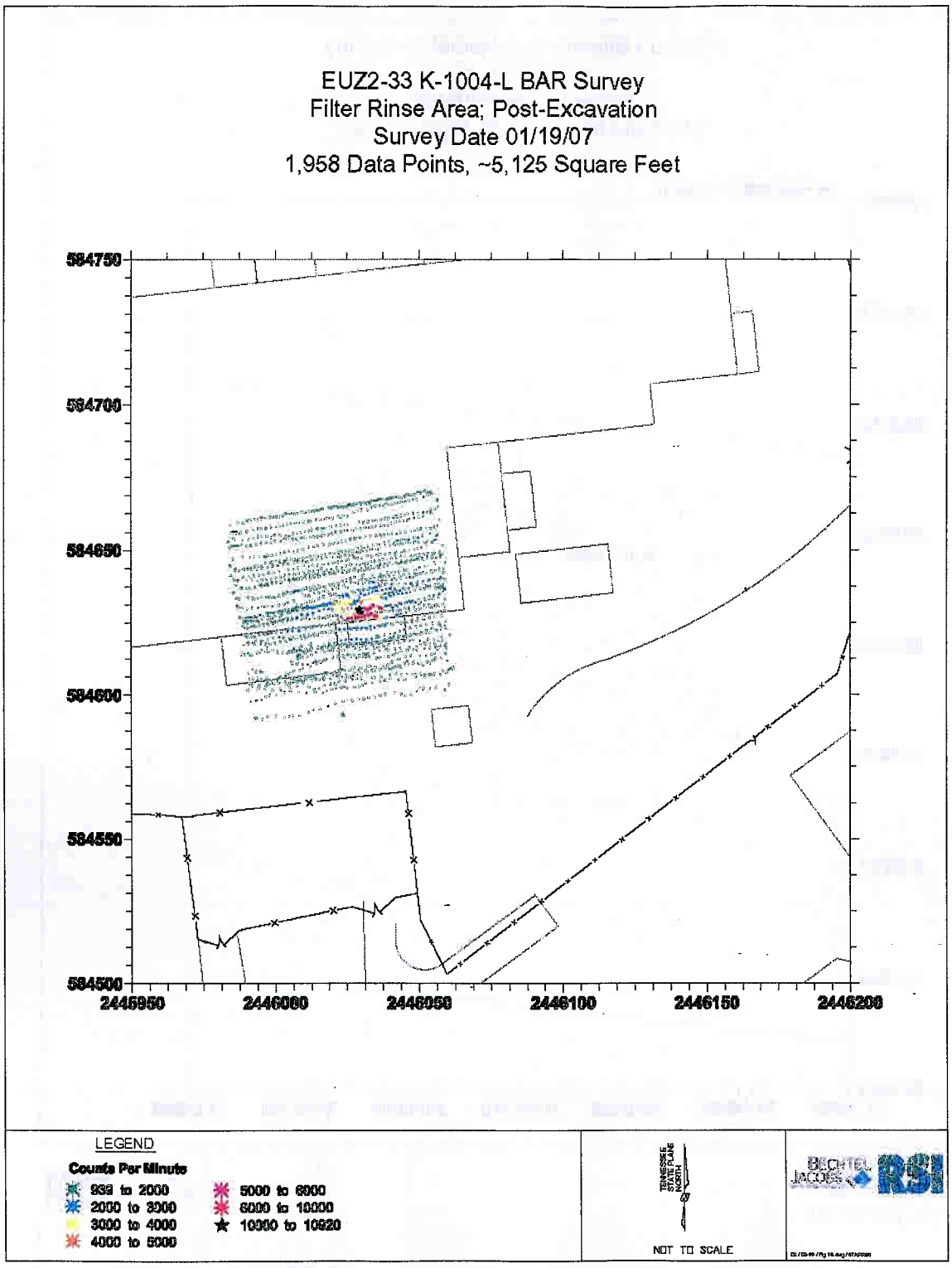

Fig. A.10. K-1004-L gravel wash area post-RA BAR survey results.

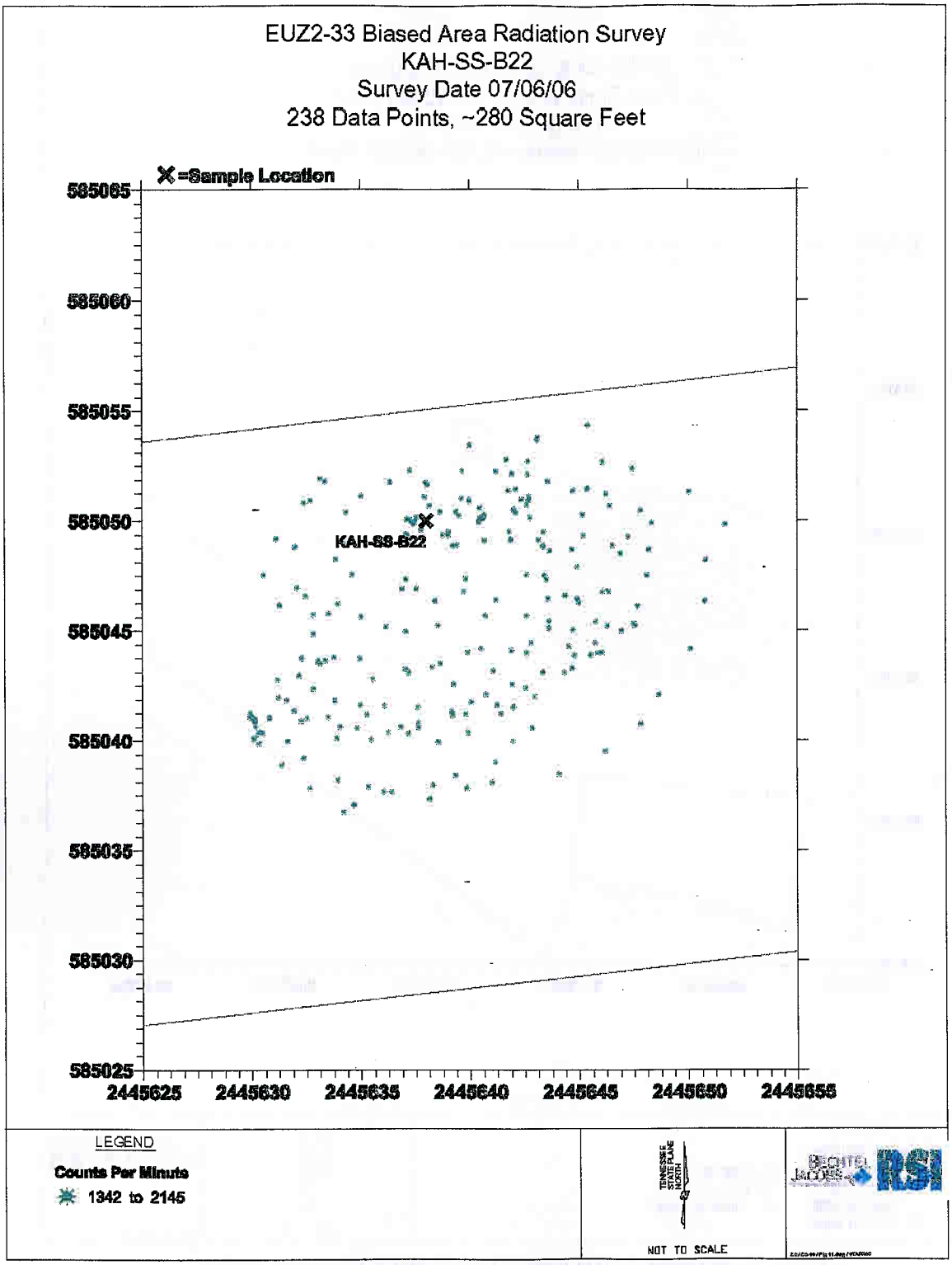

Fig. A.11. BAR survey for KAH-SS-B22.

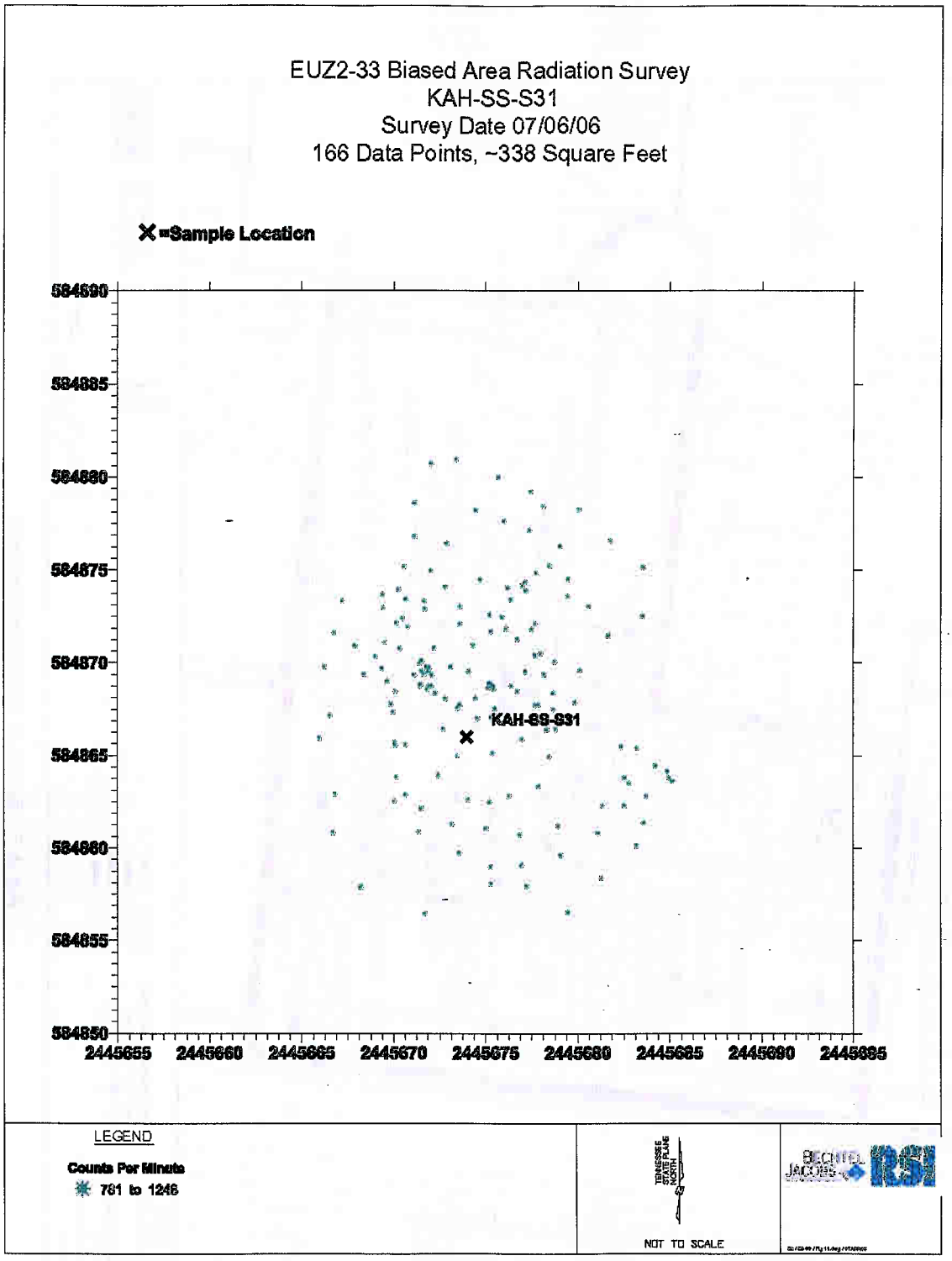

Fig. A.12. BAR survey for KAH-SS-S31.

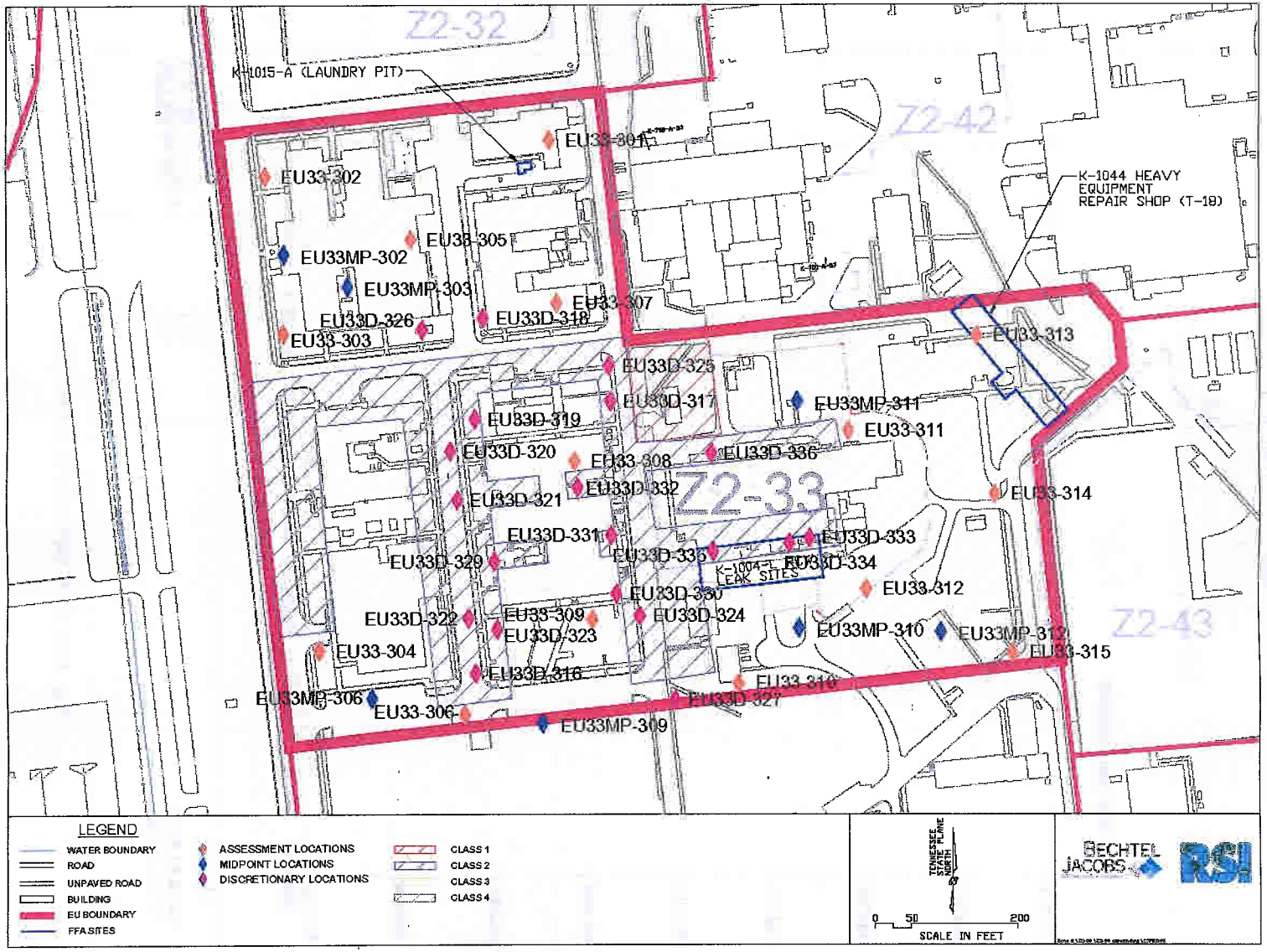

Fig. A.13. EU Z2-33 assessment locations.

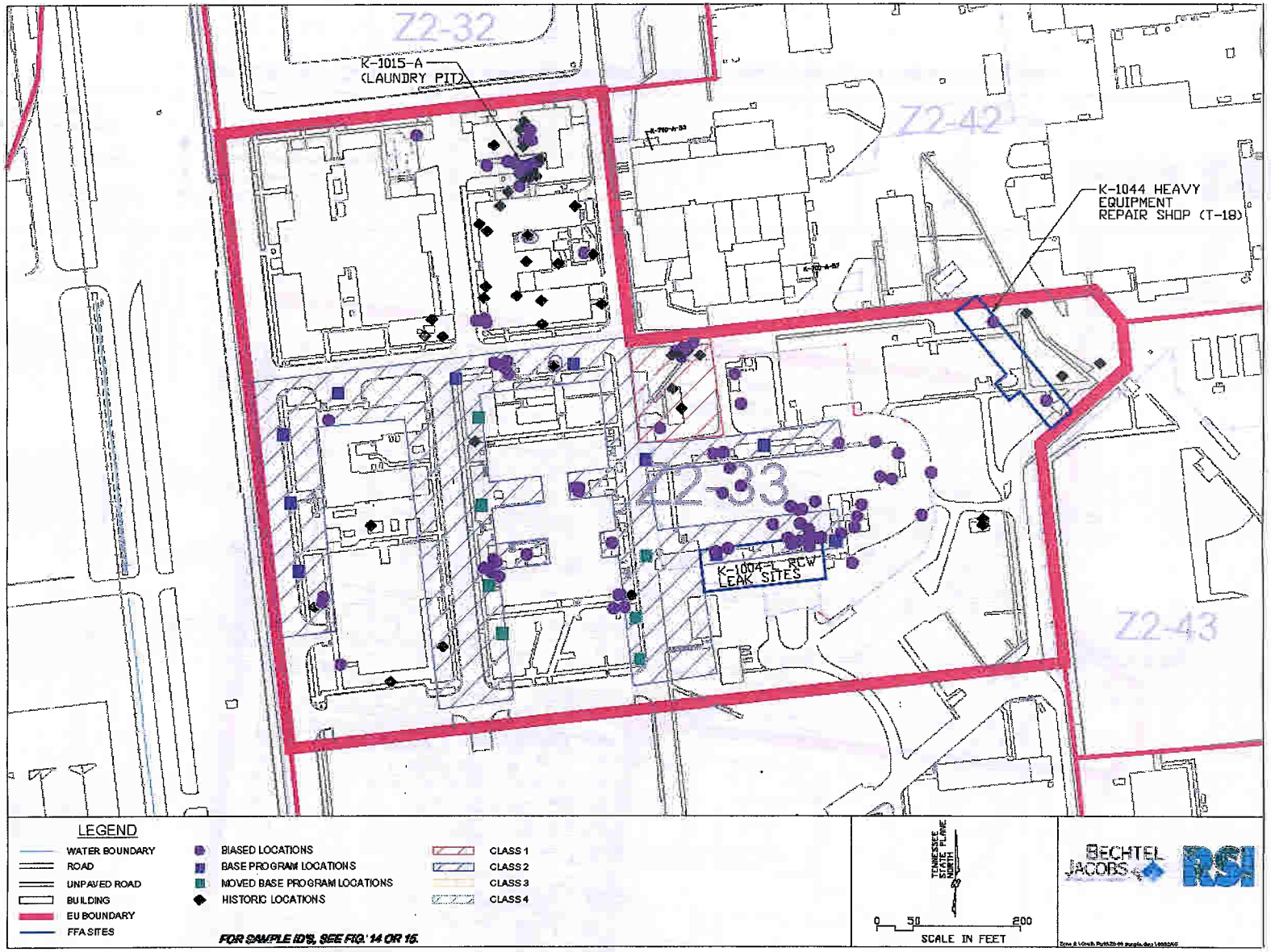

Fig. A.14. All EU Z2-33 DVS and historical sample locations from all depths.

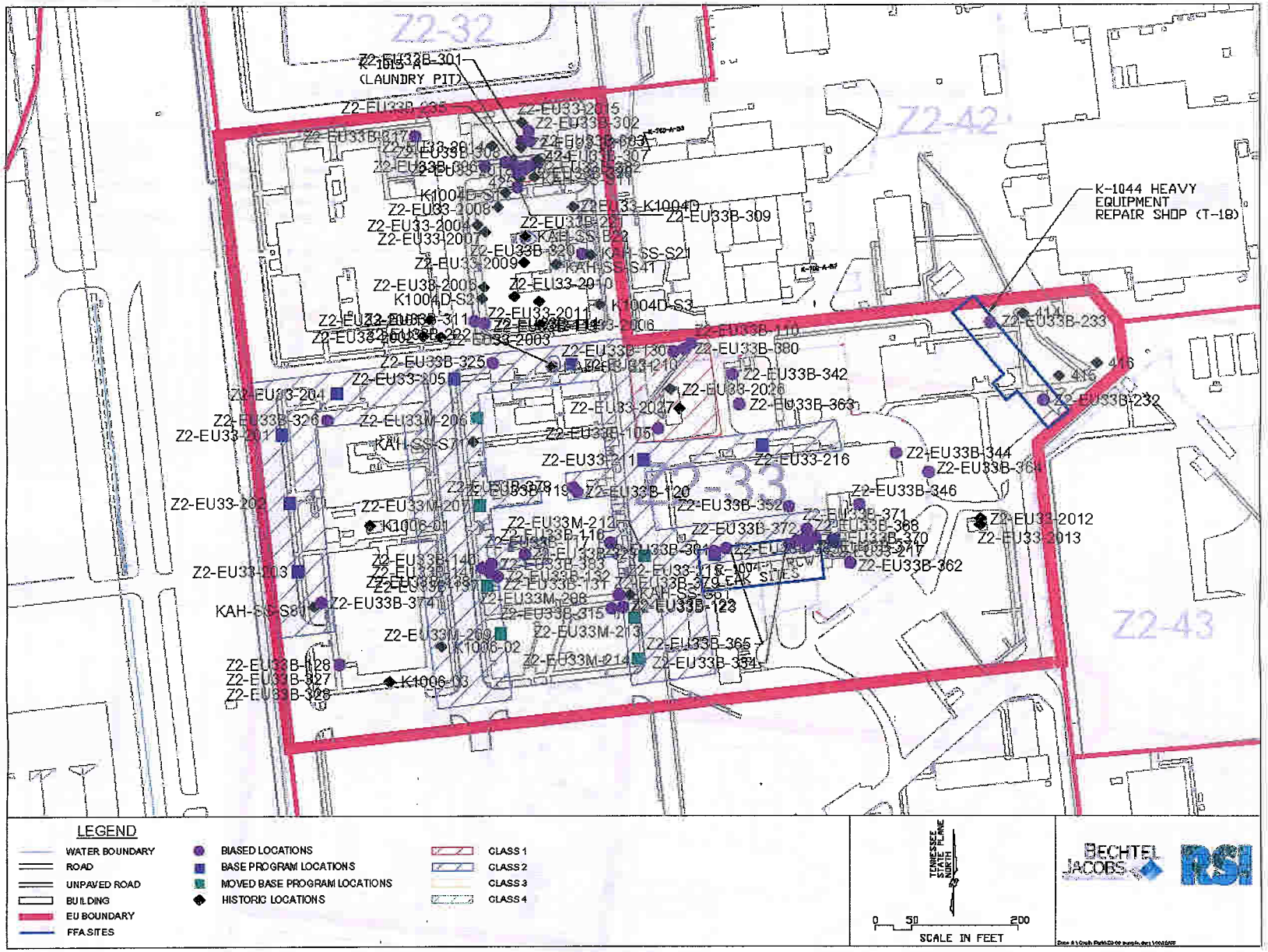

Fig. A.15. EU Z2-33 DVS and historical sample locations representative of current conditions.

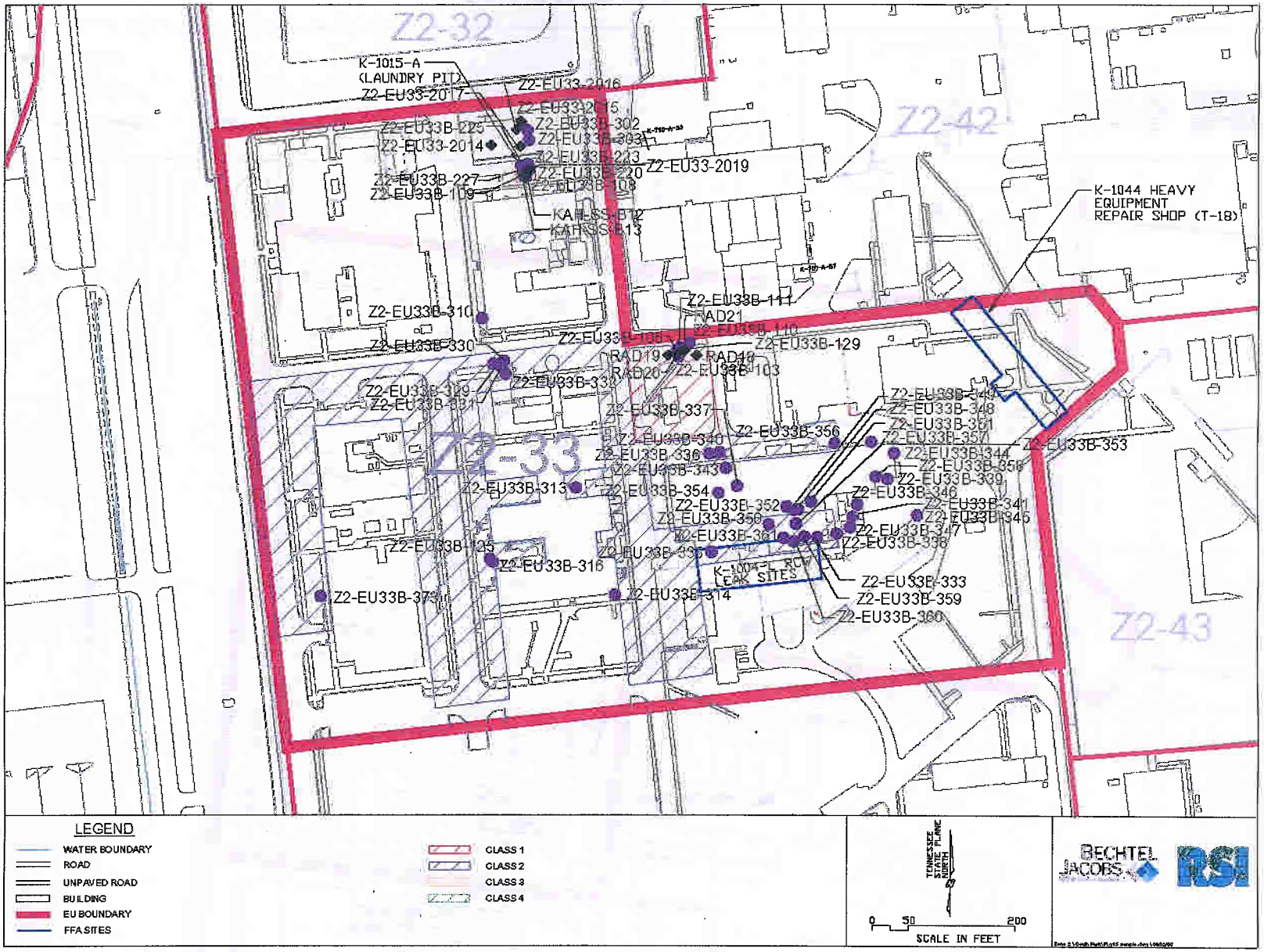

Fig. A.16. EU Z2-33 sample locations removed during a remedial action or D&D.

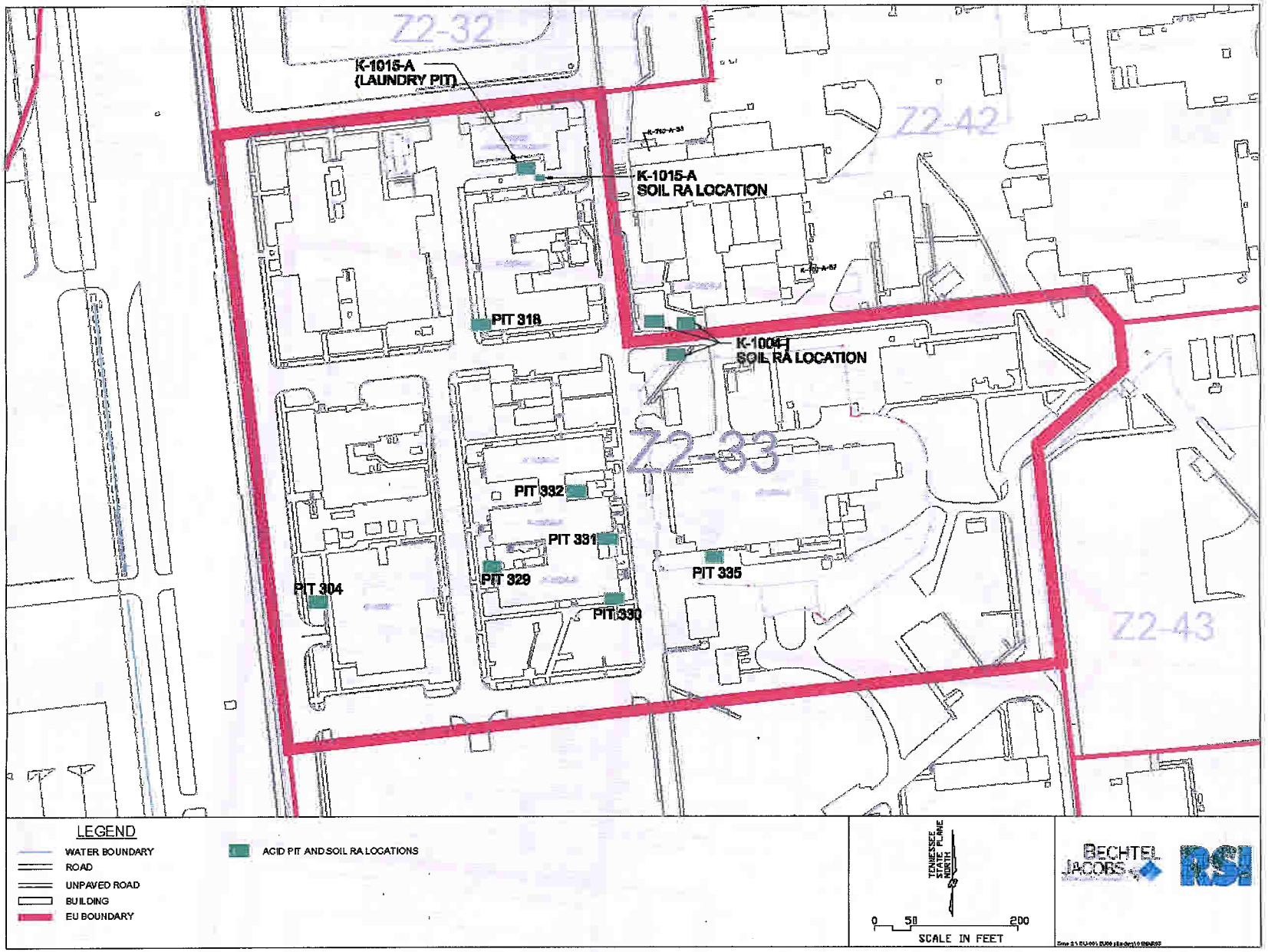

Fig. A.17. EU Z2-33 acid pit locations.

Table A.1. EU Z2-33 facility and FFA site list

Facility name DQO scoping	Facility assessed? Yes	No	Comments
K-700-A-13 Substation	X		
K-700-A-15 Substation		X	No longer exists
K-700-A-16 Substation		X	No longer exists
K-700-A-17 Substation	X		
K-700-A-26 Substation	X		
K-700-A-50 Substation	X		
K-700-A-62 Substation	X		
K-700-A-74 Substation	X		
K-1002 Cafeteria	X		
K-1003 Dispensary	X		
K-1004-A Laboratory		X	No longer exists
K-1004-B Laboratory		X	No longer exists
K-1004-C Laboratory		X	No longer exists
K-1004-D Laboratory	X		
K-1004-E Laboratory Storage Building		X	No longer exists
K-1004-F Laboratory Storage Building	X		
K-1004-H Liquid Gas Storage Shed		X	No longer exists
K-1004-L Laboratory Pilot Plant	X		Only concrete pad remains
K-1004-L RCW Lines Leak Site		X	FFA site included in DVS systematic sampling
K-1004-M Electrical Switchgear Room	X		
K-1004-N Cooling Tower	X		Only gravel pad remains
K-1004-P Test Facility – Isostatic		X	No longer exists
K-1004 Area Drain Line		X	Included in DVS systematic sampling
K-1006 Development Laboratory	X		
K-1006-A Cooling Tower		X	No longer exists
K-1006-C Chiller Building	X		
K-1006-D Boiler Building	X		
K-1015-A Laundry Pit	X		FFA site
K-1018 Emergency Generator Building	X		
K-1019-2B Bus Shelter		X	No longer exists
K-1028-62 Guard Portal – Portable		X	No longer exists
K-1039 Telephone Building	X		
K-1039-1 Integrated Communication Office	X		
K-1044 Heavy Equipment Shop		X	FFA site under Bldg. K-1225
K-1204-4 Sewage Ejector Station	X		
K-1205-A Condensate Station	X		
K-1225 Office Building	X		
K-1310-C Office Trailer	X		
K-1310-D Office Trailer	X		
K-1310-EE Storage Shed		X	No longer exists
K-1310-KJ Office/Break Trailer		X	No longer exists
K-1310-JC Shower Trailer		X	No longer exists
K-1310-JJ Tech. Trailer	X		
K-1310-JN Construction Breakroom Trailer	X		
K-1310-JU Storage Trailer		X	No longer exists
K-1310-JV Storage Trailer		X	No longer exists
K-1544 Sanitary Water Meter Pit	X		
K-1546-C Office Trailer		X	No longer exists
K-1550-J Engineering Office Trailer		X	No longer exists
K-1550-K Engineering Office Trailer		X	No longer exists
K-1550-L Engineering Office Trailer		X	No longer exists
K-1550-N Engineering Office Trailer		X	No longer exists

Table A.1. (continued)

Facility name DQO scoping	Facility assessed? Yes	No	Comments
K-1550-T Engineering Office Trailer		X	No longer exists
K-1550-U Engineering Office Trailer		X	No longer exists
K-1550-V Engineering Office Trailer		X	No longer exists
K-1550-W Engineering Office Trailer		X	No longer exists
Facilities not named in DQO scoping			
Former K-1015 Laundry Facility	X		
K-1310-JK Office and Breakroom Trailer	X		
K-1310-JP Mobile Mini Change Trailer	X		
K-1310-JX Mobile Mini Change Trailer	X		

DQO = data quality objective
DVS = Dynamic Verification Strategy
EU = exposure unit
FFA = Federal Facility Agreement

Table A.2. EU Z2-33 sample summary

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory						Splits/ duplicates	Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other		
DVS samples																
2	7/14/06	Z2-33	Z2-EU33-201	584771	2445293	0-10 ft, three-interval composite soil 0-0.5, 0.5-2, 8.5-10.0 ft	1	1	1	1		1				Class 2 systematic grid sample location
2	7/14/06	Z2-33	Z2-EU33-202	584675	2445304	0-10 ft, three-interval composite soil 0-0.5, 0.5-2, 8.9-10.0 ft	1	1	1	1	1	1	1		D	Class 2 systematic grid sample location
2	7/12/06	Z2-33	Z2-EU33-203	584579	2445315	0-10 ft, three-interval composite soil 0-0.5, 0.5-2, 8.5-10.0 ft	1	1	1	1		1				Class 2 systematic grid sample location
2	7/12/06	Z2-33	Z2-EU33-204	584829	2445370	0-15 ft, two-interval composite soil 1.65-3.15 ft and 10.0-11.5 ft (asphalt surface 4 in.)	1	1	1	1		1				Class 2 systematic grid sample location
2	7/6/06	Z2-33	Z2-EU33-205	584849	2445536	0-13 ft, three-interval composite soil 0-0.5, 0.5-2, 10.0-11.5 ft	1	1	1	1		1				Class 2 systematic grid sample location
2	7/6/06	Z2-33	Z2-EU33M-206	584794	2445568	0-13 ft, two-interval composite soil 0.8-2.3 ft and 8.0-9.5 ft (asphalt surface 2 in.)	1	1	1	1		1				Class 2 systematic grid sample location; sample location moved to avoid obstruction
2	7/6/06	Z2-33	Z2-EU33M-207	584671	2445572	0-13 ft, three-interval composite soil 0-0.5, 0.5-2, 10.0-11.5 ft	1	1	1	1	1	1				Class 2 systematic grid sample location; RAD reading of 334 cpm at 0.5 ft; sample location moved to avoid obstruction
2	7/6/06	Z2-33	Z2-EU33M-208	584558	2445582	0-11 ft, three-interval composite soil 0-0.5, 0.5-2, 10.0-11.0 ft	1	1	1	1	1	1			D	Class 2 systematic grid sample location; sample location moved to avoid obstruction; refusal at 11 ft
2	7/5/06	Z2-33	Z2-EU33M-209	584491	2445601	0-10 ft, three-interval composite soil 0-0.5, 0.5-2, 7.5-9.0 ft	1	1	1	1		1				Class 2 systematic grid sample location; sample location moved to avoid obstruction
2	7/7/06	Z2-33	Z2-EU33-210	584869	2445702	0-13.5 ft, two-interval composite soil 0.5-2.0 ft and 10.0-11.5 ft (asphalt surface 3 in.)	1	1	1	1		1				Class 2 systematic grid sample location
2	6/30/06	Z2-33	Z2-EU33-211	584735	2445802	0-13 ft, two-interval composite soil 1.5-3.0 ft and 7.0-8.5 ft (asphalt surface 6 in.)	1	1	1	1	1	1	1		MS/MSD	Class 2 systematic grid sample location; MS/MSD collected for VOCs
2	6/30/06	Z2-33	Z2-EU33M-212	584600	2445804	0-13 ft, two-interval composite soil 1.08-2.58 ft and 3.5-5.0 ft (asphalt surface 5 in.)	1	1	1	1	1	1				Class 2 systematic grid sample location; RAD reading of 267 cpm at 1.7 ft; sample location moved to avoid obstruction
2	7/5/06	Z2-33	Z2-EU33M-213	584513	2445789	0-5 ft, three-interval composite soil 0-0.5, 0.5-2, 3.5-5.0 ft	1	1	1	1		1				Class 2 systematic grid sample location; refusal at 5 ft; sample location moved to avoid obstruction
2	7/5/06	Z2-33	Z2-EU33M-214	584456	2445794	0-8 ft, three-interval composite soil 0-0.5, 0.5-2, 3.5-7.5 ft	1	1	1	1		1				Class 2 systematic grid sample location; refusal at 8 ft; sample location moved to avoid obstruction
2	10/5/06	Z2-33	Z2-EU33-215	584601	2445903	0-15.2 ft, one-point composite soil 9-10.3 ft, VOCs collected from 9.0-9.3 ft	1	1	1	1		1	1			Class 2 systematic grid sample location
2	10/4/06	Z2-33	Z2-EU33-216	584755	2445968	0-16 ft, two-interval composite soil (0.25-1.75 ft and 9.5-16.0 ft)	1	1	1	1		1			S	Class 2 systematic grid sample location
2	10/5/06	Z2-33	Z2-EU33-217	584621	2446069	0-10 ft, two-interval composite soil (0.1-1.6 ft and 7.0-8.5 ft); VOCs collected from 7.0-7.4 ft; RAD collected from 9.1-9.8 ft	1	1	1	1	1	1	1		S	Class 2 systematic grid sample location; RAD reading of 347 cpm at 9.5 ft; VOC hit of 225 ppm at 7 ft

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
1			Z2-EU33B-101			Dropped										K-1004-J Lab South Class 1 SU; confirmatory sample (RAD18) (dropped per FCN-ETTP-Zone2-020)
1			Z2-EU33B-102			Dropped										K-1004-J Lab South Class 1 SU; confirmatory sample (RAD19) (dropped per FCN-ETTP-Zone2-020)
1	4/4/07	Z2-33	Z2-EU33B-103	584879	2445854	0-0.5 ft, one-point soil sample		1			1					K-1004-J Lab South Class 1 SU; confirmatory sample (RAD20) (sample location removed during RA)
1			Z2-EU33B-104			Dropped										K-1004-J Lab South Class 1 SU; confirmatory sample (RAD21) (dropped per FCN-ETTP-Zone2-020)
1	9/26/06	Z2-33	Z2-EU33B-105	584778	2445823	0-1 ft, one-point soil sample		1			1					K-1004-J Lab South Class 1 SU systematic grid sample location
1	4/4/07	Z2-33	Z2-EU33B-106	584887	2445852	0-0.5 ft, one-point soil sample	1	1			1					K-1004-J Lab South Class 1 SU systematic grid sample location; highest RAD reading around cesium tank (sample location removed during RA)
1			Z2-EU33B-107			Dropped										K-1004-J Lab South Class 1 SU; collected at highest RAD reading around cesium tank (dropped per FCN-ETTP-Zone 2-020)
1	7/10/06	Z2-33	Z2-EU33B-108	585132	2445639	0-1 ft, one-point soil sample		1			1					K-1015 Class 1 SU; confirmatory sample (KAH-SS-B12) (sample location removed during RA)
1	7/10/06	Z2-33	Z2-EU33B-109	585133	2445637	0-1 ft, one point soil sample		1			1					K-1015 Class 1 SU; confirmatory sample (KAH-SS-B13) (sample location removed during RA)
3	4/19/07	Z2-33	Z2-EU33B-113	584927	2445579	Soil collected at same depth as base of acid dilution pit (~6 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit SW of K-1004-D; sample collected outside pit on the downgradient side (southwest of pit)
3	4/19/07	Z2-33	Z2-EU33B-114	584927	2445579	Soil collected at first saturated zone below acid dilution pit. (~22 ft bgs)	1	1	1	1	1	1	1		S	Co-located with acid dilution pit SW of K-1004-D; sample collected outside pit on the downgradient side (southwest of pit)
3	4/17/07	Z2-33	Z2-EU33B-116	584618	2445756	Soil collected at same depth as base of acid dilution pit. (~8-9 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC East; sample collected outside pit on the downgradient side (southwest of pit)
3	4/17/07	Z2-33	Z2-EU33B-117	584618	2445756	Soil collected at first saturated zone below acid dilution pit. (~20 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC East; sample collected outside pit on the downgradient side (southwest of pit)
3	4/18/07	Z2-33	Z2-EU33B-119	584690	2445709	Soil collected at same depth as base of acid dilution pit (~8-9 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC East Center. Sample collected outside the pit on the downgradient side (SW of pit)
3	4/18/07	Z2-33	Z2-EU33B-120	584690	2445709	Soil to be collected at first saturated zone below acid dilution pit (~12 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC East Center; sample collected outside pit on the downgradient side (southwest of pit)
3	4/17/07	Z2-33	Z2-EU33B-122	584528	2445774	Soil collected at same depth as base of acid dilution pit (~8-9 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC South; sample collected outside pit on the downgradient side (southwest of pit)
3	4/17/07	Z2-33	Z2-EU33B-123	584528	2445774	Soil collected at first saturated zone below acid dilution pit (~12 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC South; sample collected outside pit on the downgradient side (southwest of pit)
3	4/18/07	Z2-33	Z2-EU33B-125	584595	2445589	Soil collected at same depth as base of acid dilution pit (~8-9 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC West; sample collected outside pit on the downgradient side (southwest of pit) (sample location removed during RA)

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
3	4/18/07	Z2-33	Z2-EU33B-126	584595	2445589	Soil collected at first saturated zone below acid dilution pit (~13 ft bgs)	1	1	1	1	1	1	1			Co-located with acid dilution pit K-1004 ABC West; sample collected outside pit on the downgradient side (southwest of pit) (sample location removed during RA)
3	4/9/07	Z2-33	Z2-EU33B-128	584448	2445374	Grab sample		1			1					Confirmation sample for radium and thorium collected at north sump location in basement of K-1006; sample Z2-EU33B-327 collected on 7/14/06 exceeded Max RL for Ra/Th decay series
1	4/4/07	Z2-33	Z2-EU33B-129	584891	2445855	0-0.5 ft, four-point composite sample		1	1	1	1	1	1		D	K-1004-J Lab South Class 1 SU; step-out located inside RAB defined by BAR survey (sample location removed during RA)
1	4/4/07	Z2-33	Z2-EU33B-130	584887	2445845	0-0.5 ft, four-point composite sample		1			1					K-1004-J Lab South Class 1 SU; step out located outside RAB defined by BAR survey.
3	5/11/07	Z2-33	Z2-EU33B-131	584571	2445597	Soil collected at same depth as base of acid dilution pit (7.8-8.0 ft bgs)		1					1			Co-located with acid dilution pit K-1004 ABC West and step outs from sample location Z2-EU33B-126
3	5/11/07	Z2-33	Z2-EU33B-132	584571	2445597	Soil collected at first saturated zone below acid dilution pit (13.0-13.5 ft)		1					1		D	Co-located with acid dilution pit K-1004 ABC West and step outs from sample location Z2-EU33B-126
3	5/10/07	Z2-33	Z2-EU33B-137	584577	2445586	Soil collected at same depth as base of acid dilution pit (8-8.2 ft bgs)		1					1			Co-located with acid dilution pit K-1004 ABC West and step outs from sample location Z2-EU33B-126; DPT refusal at 10 ft (no VOC detections)
3	5/10/07	Z2-33	Z2-EU33B-138	584577	2445586	Soil collected at first saturated zone below acid dilution pit (17.0-17.2 ft)		1					1			Co-located with acid dilution pit K-1004 ABC West and step outs from sample location Z2-EU33B-126.
3	5/10/07	Z2-33	Z2-EU33B-140	584583	2445576	Soil collected at same depth as base of acid dilution pit (8-8.2 ft bgs)		1					1			Co-located with acid dilution pit K-1004 ABC West and step outs from sample location Z2-EU33B-126; DPT refusal at 17.2 ft (no VOC detections)
3	5/10/07	Z2-33	Z2-EU33B-141	584583	2445576	Soil collected at first saturated zone below acid dilution pit (9.2-9.4 ft bgs)		1					1			Co-located with acid dilution pit K-1004 ABC West and step outs from sample location Z2-EU33B-126.
1	7/11/06	Z2-33	Z2-EU33B-220	585142	2445644	0-1 ft, one-point soil sample	1	1			1					K-1015 Class 1 SU; confirmatory sample (Z2-EU33-2019); sample location removed during RA
2	7/11/06	Z2-33	Z2-EU33B-221	585050	2445638	0-1 ft, one-point soil sample	1	1			1					KAH-SS-B22 Class 2 SU; confirmatory sample (KAH-SS-B22)
2	7/7/06	Z2-33	Z2-EU33B-222	584866	2445674	1.5-3.5 ft, one-point soil sample	1	1			1					KAH-SS-S31 Class 2 SU; confirmatory sample (KAH-SS-S31).
3	4/5/07	Z2-33	Z2-EU33B-223	585150	2445642	Sediment in East Pit		1	1	1	2					Sediment collected from the bottom of K-1015 Laundry Pit (east side); additional sample for U-series analysis collected on 7/12/07 (sample location removed during RA)
3	4/5/07	Z2-33	Z2-EU33B-225	585148	2445632	Sediment in West Pit		1	1	1	2					Sediment collected from the bottom of K-1015 Laundry Pit (southwest side); additional sample for U-series analysis collected on 7/12/07 (sample location removed during RA)
3	4/5/07	Z2-33	Z2-EU33B-227	585141	2445634	Sediment in Southwest Pit		1	1	1	2					Sediment collected from the bottom of K-1015 Laundry Pit (southwest side); additional sample for U-series analysis collected on 7/12/07 (sample location removed during RA)
3	4/19/07	Z2-33	Z2-EU33B-229	585139	2445627	Soil collected at same depth as base of pit (13-14 ft bgs)	1	1	1	1	1		1			Sample collected outside K-1015 Laundry Pit on downgradient side (southwest of pit)
3	4/19/07	Z2-33	Z2-EU33B-230	585139	2445627	Soil collected at first saturated zone below pit (22-23 f bgs)	1	1	1	1	1		1			Sample collected outside K-1015 Laundry Pit on downgradient side (southwest of pit)
3	4/13/07	Z2-33	Z2-EU33B-232	584818	2446364	0-10 ft, three-interval composite sample	1	1	1	1		1			D	K-1044 FFA Site

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
3	4/13/07	Z2-33	Z2-EU33B-233	584928	2446290	0-10 ft, three-interval composite sample	1	1	1	1		1				K-1044 FFA Site
3	7/18/07	Z2-33	Z2-EU33B-235	585151	2445620	Solid sample from Manhole 57				1	1					K-1015-A Laundry Pit; uranium series sampling; sample was 5-point composite from within the manhole; material consists of brick and concrete
3	7/26/06	Z2-33	Z2-EU33B-301	585184	2445632	0-2.5 ft, two-interval composite soil 0-0.5 and 0.5-2.0 ft	1	1			1					Collected in the K-1015 Laundry Pedestal (southwest); concrete not collected because no concrete present in pedestal pit (refusal at 2.5 ft)
3	7/26/06	Z2-33	Z2-EU33B-302	585198	2445641	0-0.5 ft, one-point concrete sample					1					Collected in the K-1015 Laundry Pedestal (east central); refusal at 9.5 ft
						0-9.5 ft, two-interval composite soil 0.5-2.0 ft and 6.1-9.5 ft	1	1			1					
3	7/26/06	Z2-33	Z2-EU33B-303	585184	2445643	0-0.7 ft, one-point concrete sample					1					Collected in the K-1015 Laundry Pedestal (southeast); beta/gamma reading of 27,949 dpm from 0-0.7 ft (refusal at 9.5 ft)
						0-9.5 ft, two-interval composite soil 0.7-2.2 ft and 2.2-3.7 ft	1	1			1					
1	7/10/06	Z2-33	Z2-EU33B-306	585148	2445580	0-10 ft, two-interval composite soil 0.75-2.25 ft and 8.5-10.0 ft (asphalt surface 1 in.)	1	1	1	1	1	1				K-1015 Class 1 SU; collected west of K-1015 pit near drain lines
1	7/11/06	Z2-33	Z2-EU33B-307	585154	2445652	0-10 ft, three-interval composite soil 0-0.5, 0.5-2, 4.5-6.0 ft	1	1	1	1	1	1				K-1015 Class 1 SU; collected east of K-1015 Laundry Pit near drain lines
1	7/10/06	Z2-33	Z2-EU33B-308	585154	2445609	0-10 ft, two-interval composite soil 0.4-1.9 ft and 8.5-10.0 ft (asphalt surface 1 in.)	1	1	1		1					K-1015 Class 1 SU; collected west of K-1015 Laundry Pit (closer than 306)
1	7/11/06	Z2-33	Z2-EU33B-309	585119	2445626	0-10 ft, three-interval composite soil 0-0.5, 0-0.5, 0-0.5, 0.5-2, 5.5-7.0 ft	1	1	1		1					K-1015 Class 1 SU; collected southwest of K-1015 Laundry Pit
3	6/29/06	Z2-33	Z2-EU33B-310	584933	2445577	4-7 ft, one-point sediment sample		1	1	1	1	1	1			Collected in sediments in dilution pit southwest of K-1004-D; high PID hit 102 ppm; high RAD reading 6800 dpm (sample location removed during RA)
3	7/7/06	Z2-33	Z2-EU33B-311	584930	2445565	0-10 ft, three-interval composite soil 0-0.5, 0-0.5, 0-0.5, 0.5-2, 4.7-6.2 ft	1	1	1	1	1	1	1		D	Collected southwest of dilution pit (southwest of K-1004-D)
3		Z2-33	Z2-EU33B-312			Not collected										Would have been sediment from dilution pit K-1004 ABC East; pit filled with construction debris
3	7/26/06	Z2-33	Z2-EU33B-313	584695	2445710	5-7 ft, one-point sediment sample		1	1	1	1	1	1			Collected in sediments from dilution pit K-1004-ABC East Center; high PID hit 3500 ppm (sample location removed during RA)
3	6/29/06	Z2-33	Z2-EU33B-314	584545	2445765	6-7 ft, one-point composite sediment sample		1	1	1	1	1	1			Collected in sediments from dilution pit K-1004 ABC South; high PID hit 107 ppm (sample location removed during RA)
3	7/5/06	Z2-33	Z2-EU33B-315	584526	2445758	0-10 ft, three-interval composite soil 0-0.5, 0.5-2, 7.0-8.5 ft	1	1	1	1	1	1	1		S	Collected southwest of dilution pit K-1004 ABC South
3	6/29/06	Z2-33	Z2-EU33B-316	584591	2445593	6.75-7 ft, one point sediment sample		1	1	1	1	1	1			Collected in sediments from dilution pit K-1004ABC West; high PID hit 102 ppm (sample location removed during RA)
3	7/12/06	Z2-33	Z2-EU33B-317	585191	2445481	0-1 ft, four-point soil composite sample		1		1						Collected at K-700-A-13 substation
3	7/11/06	Z2-33	Z2-EU33B-320	585025	2445717	0-1 ft, four-point soil composite sample	1	1		1						Collected at K-700-A-17 substation
3	7/7/06	Z2-33	Z2-EU33B-323	584602	2445636	0-1 ft, four-point soil composite sample		1		1						Collected at K-700-A-74 substation

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
3	7/6/06	Z2-33	Z2-EU33B-325	584871	2445590	0-1 ft, four-point soil composite sample		1	1	1		1				Collected at K-1004-F facility
3	7/12/06	Z2-33	Z2-EU33B-326	584791	2445357	0-0.3 ft, five-point composite sediment sample		1	1	1		1				Collected in sediments at northwest corner of K-1003 (current storage area for Eagle)
3	7/14/06	Z2-33	Z2-EU33B-327	584448	2445374	1.0-1.5 ft, one-point sediment sample		1	1	1	1	1	1			Collected in sediments at K-1006 sump in basement, north
3	7/17/06	Z2-33	Z2-EU33B-328	584448	2445373	2.7-3 ft, one-point sediment sample		1	1	1	1	1	1			Collected in sediments at K-1006 sump in basement, south
3	8/23/06	Z2-33	Z2-EU33B-329	584869	2445593	0-0.25 ft, one-point concrete sample			1	1	1	1		1		K-1004-F Slab; pesticides analyzed
3	8/23/06	Z2-33	Z2-EU33B-330	584873	2445608	0-0.25 ft, one-point concrete sample			1	1	1	1		1		K-1004-F Slab; pesticides analyzed
3	8/23/06	Z2-33	Z2-EU33B-331	584863	2445605	0-0.25 ft, one-point concrete sample			1	1	1	1		1		K-1004-F Slab; pesticides analyzed
3	8/23/06	Z2-33	Z2-EU33B-332	584855	2445610	0-0.25 ft, one-point concrete sample			1	1	1	1		1		K-1004-F Slab; pesticides analyzed
3	10/5/06	Z2-33	Z2-EU33B-333	584626	2446050	0.9-2.7 ft and 3.5-9.4 ft, two discrete intervals	2	2	2	2	2	2	2			Gravel Wash Area reported rinsing of filters in this area; RAD reading 224 cpm at 9.7 ft; sample location removed during RA
3	9/29/06	Z2-33	Z2-EU33B-334	584616	2446008	7.95-8 ft, one-point composite sediment sample		1	1	1	1	1	1			Brick-lined storm drain catch basin adjacent to Gravel Wash Area; high RAD reading 431 cpm
2	9/29/06	Z2-33	Z2-EU33B-335	584605	2445901	8-10 ft, one-point composite sediment sample		1	1	1	1	1	1		D	Acid Dilution Pit south of K-1004-L; pH of 5; high PID reading 4940 ppm; RAD reading 322 cpm (sample location removed during RA)
3	10/3/06	Z2-33	Z2-EU33B-336	584743	2445898	0-0.25 ft, one-point concrete sample			1	1	1					Bottle Area near K-1004-L; low water/sediment accumulation point
3	9/25/06	Z2-33	Z2-EU33B-337	584698	2445937	0-0.25 ft, one-point concrete sample			1	1	1	1				Acid Spill Area on K-1004-L Pad; stain on wall; collected concrete sample below bottom of pipe where rust staining was evident (sample location removed during D&D)
3	9/27/06	Z2-33	Z2-EU33B-338	584631	2446077	0-0.25 ft, one-point concrete sample			1	1	1					K-1004-M Drainage Trench; located on south side of K-1004-M slab (concrete and sediment sample locations removed during D&D)
						0-0.05 ft, one-point sediment sample		1	1	1	1	1	1		MS/MSD	
3	10/3/06	Z2-33	Z2-EU33B-339	584708	2446148	0-0.25 ft, one-point asphalt sample					1					Asphalt area near southeast corner of K-1004-L; elevated RAD readings on asphalt surface; B,g meter reading 909 cpm (sample location removed during D&D)
3	9/25/06	Z2-33	Z2-EU33B-340	584745	2445912	0-0.25 ft, one point concrete sample			1	1						Green-stained concrete in former equipment storage room adjacent to northwest bottle area on K-1004-L Pad (sample location removed during D&D)
3	9/26/06	Z2-33	Z2-EU33B-341	584657	2446190	0-0.25 ft, one-point sediment sample		1	1	1	1	1	1			Sediment accumulation point in concrete-lined ditch near the east end of K-1004-L area; B,g meter reading 298 cpm (sample location removed during D&D)
3	9/26/06	Z2-33	Z2-EU33B-342	584854	2445928	0-0.25 ft, one-point composite sediment sample		1			1					Sediment accumulation point downgradient of truck wash contamination area; located adjacent to a storm drain catch basin surrounded by straw bales
3	9/25/06	Z2-33	Z2-EU33B-343	584723	2445921	0-0.25 ft, one-point concrete sample			1							Stained concrete in former equipment room #10 on K-1004-L Pad; reported chromic acid spill in this room (sample location removed during D&D)
3	10/3/06	Z2-33	Z2-EU33B-344	584744	2446157	0-0.25 ft, one-point concrete sample			1		1					Mercury spill location at K-1004-L pad; no staining evident on concrete; concrete broken in area; B,g meter reading 3495 cpm at surface (concrete sample location removed during D&D; soil sample location remains)
						0.6-2.6ft, one-point soil sample	1	1	1						S	

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
3	9/27/06	Z2-33	Z2-EU33B-345	584655	2446100	0-0.25 ft, one-point concrete sample			1	1	1					K-1004-M Drainage Trench; located on north side of K-1004-M slab (concrete and sediment sample locations removed during D&D)
						0-0.25 ft, one-point sediment sample		1	1	1	1	1	1			
3	10/3/06	Z2-33	Z2-EU33B-346	584672	2446106	0-0.25 ft, one-point concrete sample					1					Elevated RAD reading area in broken concrete/ashpalt area at K-1004-L pad; elevated readings from soil beneath cracked concrete/asphalt; B,g meter reading 1448 cpm at surface; Ludlum hit of 1037 cpm at 0.3 ft, 481 cpm at 3.5 ft, 340 cpm at 7.2 ft, and 472 cpm at 7.8 ft; PID hit 170 at 4.8 ft (concrete sample location removed during D&D; soil sample location remains)
						0.45-1.95 ft and 5.5-7.0 ft, two-point composite soil sample	1	1	1	1	1	1	1			
3	9/26/06	Z2-33	Z2-EU33B-347	584640	2446096	0-0.25 ft, one-point concrete sample					1					Former fixed CA near southwest corner of K-1004-M pad (sample location removed during D&D)
3	9/25/06	Z2-33	Z2-EU33B-348	584665	2446023	0-0.25 ft, one-point concrete sample					1					Located between cells 3 and 4 in concrete-lined trench on K-1004-L Pad; high RAD reading of 11000 cpm during walkover survey (sample location removed during D&D)
3	9/25/06	Z2-33	Z2-EU33B-349	584664	2446017	0-0.25 ft, one-point concrete sample					1					Located between cells 3 and 4 in concrete-lined trench on K-1004-L Pad; high RAD reading of 600 cpm during walkover survey; located approximately 5 ft south of Z2-EU33B-348 (sample location removed during D&D)
2	9/25/06	Z2-33	Z2-EU33B-350	584644	2445982	0-0.25 ft, one-point concrete sample					1					Located at south end of cell 6 on K-1004-L Pad; high RAD reading of 1148 cpm during walkover survey; highest reading is in small 2-in. depression in concrete (sample location removed during D&D)
3	9/25/06	Z2-33	Z2-EU33B-351	584676	2446041	0-0.25 ft, one-point concrete sample				1	1					Located at north end of cell 2 on K-1004-L Pad; high RAD reading of 16,751 cpm during walkover survey; red 1-in. surface cover on concrete that is oily and also across other five cells (sample location removed during D&D)
3	10/4/06	Z2-33	Z2-EU33B-352	584669	2446007	0-0.25 ft, one-point concrete sample					1					Located in northeast corner of cell 4 of K-1004-L pad; high RAD reading during walkover survey; concrete is severely broken and has accumulated sediment in cracks; soil collected up to 2 ft below base of foundation (concrete sample location removed during D&D; soil sample location remains)
						0.9-2.9 ft, one-point soil sample	1	1	1	1	1	1				
2	9/25/06	Z2-33	Z2-EU33B-353	584645	2446020	0-0.25 ft, one-point concrete sample				1	1					Located at south end of concrete trench between cells 3 and 4 on K-1004-L Pad; dark oily staining is evident on wall below end of trench; high RAD reading of 2248 cpm (sample location removed during D&D)
3	10/4/06	Z2-33	Z2-EU33B-354	584688	2445911	0-0.8 ft, one-point soil sample	1	1	1	1						Located at base of former elevator shaft on K-1004-L pad; location is approximately 3 ft × 3 ft and there is no visible concrete; area is filled with soil (sample location removed during D&D)
2	9/29/06	Z2-33	Z2-EU33B-355	584668	2445935	11.95-12.0 ft, one-point sediment sample			1	1	1	1	1			Twelve-ft steel pipe flush with lower floor at K-1004-L; pipe is approximately 12 ft deep with water visible 3 ft from surface; bright yellow paint visible on concrete surrounding pipe (sample location removed during D&D.)

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory						Splits/ duplicates	Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other		
2	10/3/06	Z2-33	Z2-EU33B-356	584758	2446074	0.1-1.1 ft, one-point soil sample	1	1	1	1	1	1	1		D	Located at base of stairway on exterior of north side of K-1004-L foundation; area is depressed and filled with sediment; asphalt appears broken; Ludlum hits of 563 cpm at 0.2 ft and 349 cpm at 0.35 ft (sample location removed during D&D)
3	10/3/06	Z2-33	Z2-EU33B-357	584760	2446125	0.1-1.7 ft, one-point soil sample	1	1		1		1				Oil stain area adjacent to edge of building slab on north side of K-1004-L; oil staining evident and broken oil pig is lying near stain (sample location removed during D&D)
3	10/3/06	Z2-33	Z2-EU33B-358	584711	2446132	0-1.2 ft, one-point sediment sample	1	1	1	1	1	1	1			Twelve-in. steel pipe flush with main floor of K-1004-L pad; pipe is filled with sediment/soil; high RAD readings encountered during walkover survey; sediment only floating on top of pipe; pipe is filled with water; location Z2-EU33B-355 is same type of pipe used for barrier material storage (sample location removed during D&D)
2	10/4/06	Z2-33	Z2-EU33B-359	584627	2446032	0-1.2 ft, one-point soil sample	1	1	1	1	1	1	1			Gravel Wash Area reported rinsing of filters in area; high RAD hit of 4825 cpm at 0.5 ft; additional TCLP analysis for Pb being analyzed on 12/06/06 (sample location removed during RA)
3	10/4/06	Z2-33	Z2-EU33B-360	584620	2446017	0.4-2.8 ft, one-point soil sample	1	1	1	1	1	1	1			Gravel Wash Area reported rinsing of filters in area (sample location removed during RA)
3	10/4/06	Z2-33	Z2-EU33B-361	584625	2446003	0-10 ft two-interval composite soil (0.2-1.7 ft and 7.0-8.5 ft); discrete VOCs from 6.5-7.0 ft; discrete RAD from 3.5-5.1 ft	1	1	1	1	1	1	1		S	Gravel Wash Area reported rinsing of filters in area; collected just outside of deep basin, close to foundation; high RAD hit of 259 cpm at 5.9 ft (sample location removed during RA)
3	10/6/06	Z2-33	Z2-EU33B-362	584590	2446093	0-1 ft four-point composite soil sample		1	1	1	1	1	1		MS/MSD	Bottle Wash CA South of K-1004-L slab
3	10/6/06	Z2-33	Z2-EU33B-363	584813	2445937	0-1 ft four-point composite soil sample		1		1	1					Truck Wash CA North of K-1004-L slab
3	10/5/06	Z2-33	Z2-EU33B-364	584717	2446203	2.3-2.5 ft one-point sediment sample		1	1	1	1	1	1			Located in a storm drain catch basin downgradient of sediment accumulation point (sample location Z2-EU33B-341) that had elevated radiological readings encountered during facility assessments
3	10/5/06	Z2-33	Z2-EU33B-365	584610	2445919	4.9-5 ft one-point sediment sample		1	1	1	1	1	1			Sediment collected from manhole east of acid dilution pit south of K-1004-L; drain lines from building evident.
3	3/8/07	Z2-33	Z2-EU33B-368	584627	2446032	0-0.5 ft, one-point soil sample		1			1					Fourteen-day TAT on uranium isotopes; sample location at center of Gravel Wash Area excavation near former location Z2-EU33B-359 (sample collected from excavator bucket)
3	1/30/07	Z2-33	Z2-EU33B-369	584637	2446032	0-0.33 ft, one-point soil sample		1			1					Fourteen-day TAT on uranium isotopes; sample location on northern boundary of Gravel Wash Area excavation
3	1/30/07	Z2-33	Z2-EU33B-370	584625	2446044	0-0.33 ft, one-point soil sample		1			1					Fourteen-day TAT on uranium isotopes; sample location on eastern boundary of Gravel Wash Area excavation
3	1/30/07	Z2-33	Z2-EU33B-371	584613	2446033	0-0.33 ft, one-point soil sample		1			1					Fourteen-day TAT on uranium isotopes; sample location on southern boundary of Gravel Wash Area excavation
3	3/8/07	Z2-33	Z2-EU33B-372	584621	2446019	0-0.5 ft, one-point soil sample		1			1					Fourteen-day TAT on uranium isotopes; sample location on western boundary of Gravel Wash Area excavation; sample collected from excavator bucket

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
2	5/24/07	Z2-33	Z2-EU33B-373	584543	2445350	One point sediment sample (0-3.5 ft)		1	1	1	1	1	1			Collected in sediments in acid drain pit west of K-1006; black sediment, heavy sheen visible; high PID reading of 1919 ppm (sample location removed during RA)
2	5/24/07	Z2-33	Z2-EU33B-374	584535	2445349	Soil collected at same depth as base of acid drain pit (12-14 ft bgs)	1	1	1	1	1	1	1			Collect soil on groundwater downgradient side (southwest) of Acid Drain Pit west of K-1006; refusal at 14 ft (weathered limestone); no elevated PID readings
3	9/18/07	Z2-33	Z2-EU33B-377	584591	2445591	Five-point composite sample (10.0-10.5 ft)	1	1	1	1	1					Confirmation sampling of soil located below K-1004 ABC dilution pit west; location removed during RA
						10.0-10.5 ft one-point soil sample	1	1					1			
3	9/19/07	Z2-33	Z2-EU33B-378	584695	2445704	5.5-6.0 ft soil sample	1	1	1	1	1					Confirmation soil sample below removed inlet pipe associated with K-1004 ABC East Center dilution pit; inlet pipe removed due to elevated sample results from sample Z2-EU33B-241
3	10/1/07	Z2-33	Z2-EU33B-379	584545	2445768	6.0-6.5 ft soil sample	1	1	1	1	1	1				Confirmation sample of inlet pipe associated with K-1004 ABC South dilution pit
3	11/13/07	Z2-33	Z2-EU33B-380	584891	2445860	0.0-0.5 ft six-point composite soil sample	1	1			1					Cesium-137 confirmation sampling at K-1004-J Lab Class 1 SU; two soils from each of three soil excavations were composited into one sample
3	10/4/07	Z2-33	Z2-EU33B-381	584606	2445902	12.5-13.0 ft composite soil sample	1	1	1	1	1		1			Soil confirmation sample collected from soils below bottom of acid dilution pit south of K-1004-L; confirmation sample required due to D&D crew having to break pit apart in place during pit removal
3	10/18/07	Z2-33	Z2-EU33B-382	585147	2445638	14.0-14.5 ft composite soil sample	1	1	1	1	1	1	1			Confirmation soil sample collected below K-1015-A Laundry Pit; sample collected due to in-place break up of pit concrete prior to concrete removal (per Core Team concurrence); sample would not have been collected if pit could have been removed in one piece
3	11/13/07	Z2-33	Z2-EU33B-383	584589	2445589	12.0-12.5 ft composite soil sample		1					1			Composite soil sample collected below K-1004 ABC dilution pit west; second confirmation sample due to sample Z2-EU33B-377 having Carbon Tet exceedance (additional soil removal took place prior to this confirmation sample); bedrock encountered at approximately 12.5 ft bgs, staining still visible at bedrock; PID = 0 ppm, carbon tetrachloride Drager tube reading < 0.1 ppm; soil stained in a grey/green/black mixture of colors; sewage odor in stained soil
						DVS sampling total	**66**	**110**	**87**	**90**	**105**	**70**	**54**	**4**	**17**	
Historical samples																
3	3/1/98	Z2-33	414	584940	2446336	2-4 ft bgs, one-point soil sample			1			1				
3	3/1/98	Z2-33	415	584852	2446386	2-4 ft bgs, one-point soil sample			1			1				
3	3/1/98	Z2-33	416	584870	2446439	2-4 ft bgs, one-point soil sample			1			1				
3	3/2/98	Z2-33	424	585157	2445656	3-5 ft and 10-12 ft bgs, two discrete soil samples			2	2	2		2			K-1015-A Laundry Pit
3	3/2/98	Z2-33	425	585131	2445630	3-5 ft and 10-12 ft bgs, two discrete soil samples			2	2	2		2			K-1015-A Laundry Pit

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory						Splits/ duplicates	Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other		
3	2/1/00	Z2-33	K1004D-S1	585111	2445610	Surface soil sample			1	1		1	1			K-1004-D facility; pesticide analysis
3	2/1/00	Z2-33	K1004D-S2	584962	2445576	Surface soil sample			1	1		1	1			K-1004-D facility; pesticide analysis
3	2/1/00	Z2-33	K1004D-S3	584953	2445742	Surface soil sample			1	1		1	1			K-1004-D facility; pesticide analysis
3	2/3/00	Z2-33	K1006-01	584643	2445418	Surface soil sample			1	1	1	1	1			K-1006 facility; pesticide analysis
3	2/3/00	Z2-33	K1006-02	584473	2445518	Surface soil sample			1	1	1	1	1			K-1006 facility; pesticide analysis
3	2/3/00	Z2-33	K1006-03	584424	2445445	Surface soil sample			1	1	1	1	1			K-1006 facility; pesticide analysis
1	5/29/96	Z2-33	KAH-SS-B12	585132	2445639	Surface soil sample					1					K-1015 Class 1 SU; sample location removed during RA
1	5/31/96	Z2-33	KAH-SS-B13	585133	2445636	Surface soil sample					1					K-1015 Class 1 SU; sample location removed during RA
2	5/29/96	Z2-33	KAH-SS-B22	585050	2445638	Surface soil sample					1					KAH-SS-B22 Class 2 SU
3	3/16/96	Z2-33	KAH-SS-S11	585133	2445650	Surface soil sample					1					K-1015-A Laundry Pit
3	3/16/96	Z2-33	KAH-SS-S21	585023	2445730	Surface soil sample					1					
2	3/16/96	Z2-33	KAH-SS-S31	584866	2445674	Surface soil sample					1					KAH-SS-S31 Class 2 SU
3	3/16/96	Z2-33	KAH-SS-S41	585010	2445681	Surface soil sample					1					K-1004-D facility
2	3/16/96	Z2-33	KAH-SS-S61	584545	2445784	Surface soil sample					1					K-1004 Drain Line Class 2 SU
2	3/16/96	Z2-33	KAH-SS-S71	584760	2445563	Surface soil sample					1					K-1004 Drain Line Class 2 SU
3	3/16/96	Z2-33	KAH-SS-S81	584529	2445339	Surface soil sample					1					K-1006 facility
1	7/20/94	Z2-33	RAD18	584881	2445880	Surface soil sample					1					K-1004-J Lab South Class 1 SU; sample location removed during RA
1	7/20/94	Z2-33	RAD19	584881	2445840	Surface soil sample					1					K-1004-J Lab South Class 1 SU; sample location removed during RA
1	7/20/94	Z2-33	RAD20	584882	2445853	Surface soil sample					1					K-1004-J Lab South Class 1 SU; sample location removed during RA
1	7/20/94	Z2-33	RAD21	584888	2445863	Surface soil sample					1					K-1004-J Lab South Class 1 SU; sample location removed during RA
3	8/3/05	Z2-33	Z2EU33-K1004D			Sewer ejector sump pit sediment			1	1	1	1				DRO/GRO; TCLP metal
3	10/3/05	Z2-33	Z2-EU33-2001	584932	244550	0-10 ft and 10-14 ft bgs, two composite samples			2	2						K-1205-A facility
3	10/3/05	Z2-33	Z2-EU33-2002	584909	2445493	0-10 ft and 10-14 ft bgs, two composite soil samples			2	2						K-1205-A facility
3	10/3/05	Z2-33	Z2-EU33-2003	584908	2445518	0-10ft and 10-14 ft bgs, two composite soil samples			2	2						K-1205-A facility
3	9/6/05	Z2-33	Z2-EU33-2004	585066	2445570	0-6 ft bgs, composite concrete sample			1	1	1	1		1		K-1004-D facility; pesticide analysis
3	9/6/05	Z2-33	Z2-EU33-2005	584978	2445579	0-6 ft bgs, composite concrete sample			1	1	1	1		1		K-1004-D facility; pesticide analysis
3	9/6/05	Z2-33	Z2-EU33-2006	584925	2445658	0-6 ft bgs, composite concrete sample			1	1	1	1		1		K-1004-D facility; pesticide analysis
3	9/7/05	Z2-33	Z2-EU33-2007	585056	2445581	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1004-D facility
	10/4/05					0.6-2.6 ft bgs, one-point soil sample			1	1	1	1	1			

Table A.2. (continued)

SU class	Date sampled	EU	Location ID	Location		Sample interval	Screening		Off-site laboratory							Comments and notes
				Northing	Easting		RAD	VOC	Metals	PCB	RAD	SVOC	VOC	Other	Splits/ duplicates	
3	9/7/05	Z2-33	Z2-EU33-2008	585091	2445599	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1004-D facility
	10/4/05					0.5-2.5 ft bgs, one-point soil sample			1	1	1					
3	9/7/05	Z2-33	Z2-EU33-2009	585013	2445636	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1004-D facility
	10/4/05					0.5-2.5 ft bgs, one-point soil sample			1	1	1					
3	9/7/05	Z2-33	Z2-EU33-2010	584965	2445622	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1004-D facility
	10/4/05					0.6-2.6 ft bgs, one-point soil sample			1	1						
3	9/7/05	Z2-33	Z2-EU33-2011	584958	2445657	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1004-D facility
	10/4/05					0.5-2.5 ft bgs, one-point soil sample			1	1						
3	9/29/05	Z2-33	Z2-EU33-2012	584652	2446276	0-8 ft bgs, composite soil sample			1	1	1	1	1	1		K-1004-P facility; DRO and GRO analyses
3	9/29/05	Z2-33	Z2-EU33-2013	584643	2446276	0-10 ft and 10-14 ft bgs, two composite soil samples			2	2				2		K-1004-P facility; DRO and GRO analyses
3	9/8/05	Z2-33	Z2-EU33-2014	585177	2445590	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1015 Laundry facility
	10/5/05					0.4-2.1 ft bgs, one-point soil sample			1	1	1	1	1			
3	9/8/05	Z2-33	Z2-EU33-2015	585210	2445632	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1015 Laundry facility
	10/5/05					0.4-2.3 ft bgs, one-point soil sample			1	1						
3	9/8/05	Z2-33	Z2-EU33-2016	585199	2445626	0-3 ft bgs, one-point concrete sample			1	1	1	1				K-1015 Laundry facility; sample location removed during D&D
	10/5/05					0.5-2.5 ft bgs, one-point soil sample			1	1						
3	9/8/05	Z2-33	Z2-EU33-2017	585175	2445631	0-6 ft bgs, composite concrete sample			1	1	1	1				K-1015 Laundry facility
	10/5/05					0.5-2.5 ft bgs, one-point soil sample			1	1						
3	10/4/05	Z2-33	Z2-EU33-2018	585135	2445626	0-10 ft and 10-14 ft bgs, two composite soil samples			2	2	2	2	2			K-1015-A Laundry Pit
1	10/5/05	Z2-33	Z2-EU33-2019	585142	2445644	0-10 ft and 10-14 ft bgs, two composite soil samples			2	2	1	1				K-1015 Class 1 SU; sample location removed during D&D
1	9/19/05	Z2-33	Z2-EU33-2026	584834	2445841	0-3 ft bgs, one-point concrete sample			1	1	1	1				K-1004 J Lab South Class 1 SU
1	9/19/05	Z2-33	Z2-EU33-2027	584807	2445854	0-3 ft bgs, one-point concrete sample			1	1	1	1				K-1004 J Lab South Class 1 SU
1	10/26/05	Z2-33	Z2-EU33B-110	584899	2445870	0-10 ft bgs, composite soil sample			1	1	1	1				K-1004 J Lab South Class 1 SU; sample location removed during RA
1	10/26/05	Z2-33	Z2-EU33B-111	584892	2445856	0-2 ft bgs, one-point soil sample			1	1	1	1	1			K-1004 J Lab South Class 1 SU; sample location removed during RA
3	8/3/05	Z2-33	Z2EU33B-K1004D	585091	2445705	5-5.5 ft bgs, one-point sediment			1	1	1	1		1		K-1004-D facility; DRO and GRO analyses; sediment from sewer ejector sump pit
						Historical sampling total			**53**	**50**	**46**	**33**	**16**	**10**		

D = duplicate
DRO = diesel range organics
DVS = Dynamic Verification Strategy
EU = exposure unit
GRO = gasoline range organics
ID = identification
MS/MSD = matrix spike/matrix spike duplicate
PCB = polychlorinated biphenyl
RAD = radiological
S = split
SU = soil unit
SVOC = semivolatile organic compound
TAT = turnaround time
VOC = volatile organic compound

Table A.3. EU Z2-33 sample locations removed during remedial actions and D&D

Location identified in TM	Remedial action or D&D location name	Sample location(s) removed during remedial action or D&D	Sample locations representative of conditions following remedial action or D&D
EU33D-318 Dilution Pit southwest of K-1004-D	Z2-EU33B-310	Z2-EU33B-310	Z2-EU33B-113, Z2-EU33B-114 (>10 ft), Z2-EU33B-311
EU33D-329 K-1004-A, B, C Dilution Pit West	Z2-EU33B-316	Z2-EU33B-125, Z2-EU33B-126 (>10 ft), Z2-EU33B-316, Z2-EU33B-377 (>10 ft)	Z2-EU33B-131, Z2-EU33B-137, Z2-EU33B-140, Z2-EU33B-141, Z2-EU33B-383 (> 10 ft)
EU33D-330 K-1004A, B, C Dilution Pit South	Z2-EU33B-314	Z2-EU33B-314	Z2-EU33B-122, Z2-EU33B-123 (> 10 ft), Z2-EU33B-315, Z2-EU33B-379
EU33D-331 K-1004-A, B,C Dilution Pit East	Z2-EU33B-312	Z2-EU33B-312 (sample not collected)	Z2-EU33B-116, Z2-EU33B-117 (> 10 ft)
EU33D-332 K-1004-A, B, C Dilution Pit East Center	Z2-EU33B-313	Z2-EU33B-313	Z2-EU33B-119, Z2-EU33B-120 (> 10 ft), Z2-EU33B-378
EU33D-333 Gravel wash area south of the K-1004-L pad	None given	Z2-EU33B-333, Z2-EU33B-359, Z2-EU33B-360, Z2-EU33B-361	Z2-EU33B-368, Z2-EU33B-369, Z2-EU33B-370, Z2-EU33B-371, Z2-EU33B-372
EU33D-335 Acid dilution pit south of K-1004-L-	Z2-EU33B-335	Z2-EU33B-335	Z2-EU33B-365, Z2-EU33B-381 (> 10 ft)
EU33D-336 Bottle Area	None given	Z2-EU33B-336	Same as for K-1004-L
K-1004-F Facility	None given	Z2-EU33B-329, Z2-EU33B-330, Z2-EU33B-331, Z2-EU33B-332	Z2-EU33B-325
K-1004-L Facility (where concrete sample locations were removed, co-located soil/sediment locations remain at Z2-EU33B-344, Z2-EU33B-346, Z2-EU33B-352)	None given	Z2-EU33B-337, Z2-EU33B-339, Z2-EU33B-340, Z2-EU33B-341, Z2-EU33B-343, Z2-EU33B-344, Z2-EU33B-346, Z2-EU33B-348, Z2-EU33B-349, Z2-EU33B-350, Z2-EU33B-351, Z2-EU33B-352, Z2-EU33B-353, Z2-EU33B-354, Z2-EU33B-355 (>10 ft), Z2-EU33B-356, Z2-EU33B-357, Z2-EU33B-358	Z2-EU33B-344, Z2-EU33B-346, Z2-EU33B-352, Z2-EU33B-362, Z2-EU33B-363, Z2-EU33B-364
K-1004-M	None given	Z2-EU33B-338, Z2-EU33B-345, Z2-EU33B-347	Same as for K-1004-L
K-1006 Facility (acid drain pit)	Z2-EU33B-373	Z2-EU33B-373	Z2-EU33B-374 (> 10 ft)
K-1015 Laundry Facility (where concrete sample locations were removed, co-located soil/sediment locations remain at Z2-EU33-2014, Z2-EU33-2015, Z2-EU33-2016, Z2-EU33-2017, Z2-EU33B-302, Z2-EU33B-303)	None given	Z2-EU33-2014, Z2-EU33-2015, Z2-EU33-2016, Z2-EU33-2017, Z2-EU33B-302, Z2-EU33B-303	Z2-EU33-2014, Z2-EU33-2015, Z2-EU33-2016, Z2-EU33-2017, Z2-EU33B-301, Z2-EU33B-302, Z2-EU33B-303

Table A.3. (continued)

Location identified in TM	Remedial action or D&D location name	Sample location(s) removed during remedial action or D&D	Sample locations representative of conditions following remedial action or D&D
K-1015-A Laundry Pit FFA Site	None given	KAH-SS-B12, KAH-SS-B13, Z2-EU33-2019, Z2-EU33B-108, Z2-EU33B-109, Z2-EU33B-220, Z2-EU33B-223, Z2-EU33B-225, EU33B-227	424, 425, KAH-SS-S11, Z2-EU33-2018, Z2-EU33B-229 (> 10 ft), Z2-EU33B-235, Z2-EU33B-306, Z2-EU33B-307, Z2-EU33B-308, Z2-EU33B-309, Z2-EU33B-382 (> 10 ft)
K-1015 Class 1 SU	None given	KAH-SS-B12, KAH-SS-B13, Z2-EU33-2019, Z2-EU33B-108, Z2-EU33B-109, Z2-EU33B-220	424, 425, KAH-SS-S11, Z2-EU33-2018, Z2-EU33B-229 (> 10 ft), Z2-EU33B-306, Z2-EU33B-307, Z2-EU33B-308, Z2-EU33B-309
K-1004-J Lab South Class 1 SU	None given	RAD18, RAD19, RAD20, RAD21, Z2-EU33B-103, Z2-EU33B-106, Z2-EU33B-110, Z2-EU33B-111, Z2-EU33B-129	Z2-EU33-2026, Z2-EU33-2027, Z2-EU33B-105, Z2-EU33B-130, Z2-EU33B-380

D&D = decontamination and decommissioning
EU = exposure unit
FFA = Federal Facility Agreement
SU = soil unit
TM = technical memorandum

Table A.4. EU Z2-33 data summary for soil samples collected from 0 to 10 ft below ground surface[a]

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Inorganics (mg/kg)													
Aluminum	69/69	2,520J	29,400	K1004D-S3	12,209		NA		NA	100,000	0/69	40,300	0/69
Antimony	49/59	0.031J	19	Z2EU33-K1004D	0.748		NA		NA	408.8	0/59	1.52	4/59
Arsenic	69/69	1.2	93.1	Z2-EU33B-327	7.64	900	0/69	300	0/69	15.9	4/69	14.95	4/69
Barium	69/69	19	346	Z2-EU33B-327	95.9		NA		NA	66,577	0/69	124.93	11/69
Beryllium	68/69	0.12J	10.7	414	1.08	6000	0/69	2,000	0/69	1,941	0/69	2.2	3/69
Boron	31/58	0.83J	163J	Z2-EU33B-334	8.69		NA		NA	100,000	0/58		NA
Cadmium	66/69	0.028J	24.2	Z2-EU33B-327	1.78		NA		NA	451	0/69	0.22U	42/69
Calcium	69/69	767J	291,000J	Z2-EU33B-364	21,866		NA		NA		NA	2,400	57/69
Chromium	69/69	9.8J	238J	Z2-EU33B-327	31.5		NA		NA	640	0/69	44.88	7/69
Cobalt	69/69	2.2J	283J	Z2-EU33M-212	17.1		NA		NA	133,310	0/69	42	1/69
Copper	69/69	3.8J	24,000J	Z2-EU33B-365	409		NA		NA	40,877	0/69	22.48	24/69
Iron	69/69	9230J	510,000J	Z2EU33-K1004D	50,009		NA		NA	100,000	4/69	58,600	5/69
Lead	69/69	3.7	1,300	Z2EU33-K1004D	81.5		NA		NA	800	1/69	37.91	22/69
Lithium	51/58	3	51.5	Z2-EU33B-327	13.4		NA		NA	20,439	0/58	48.94	1/58
Magnesium	69/69	430J	59,600J	Z2-EU33B-364	4,929		NA		NA		NA	3,300	18/69
Manganese	69/69	115J	4,350	K1004D-S3	1,050		NA		NA	19,458	0/69	2,200	5/69
Mercury	57/68	0.012J	30	Z2EU33-K1004D	1.12	1800	0/68	600	0/68	307	0/68	0.17	25/68
Molybdenum	57/58	0.16J	29.4J	Z2-EU33B-334	2.29		NA		NA	5,110	0/58		NA
Nickel	69/69	4.9	452	K1004D-S3	37.9		NA		NA	20,439	0/69	26.07	18/69
Potassium	69/69	260J	3230	K1006-01	1133		NA		NA		NA	5,074.69	0/69
Selenium	35/69	0.13J	14J	Z2EU33-K1004D	1.45		NA		NA	5,110	0/69	1.47	10/69
Silver	40/69	0.072J	130	Z2EU33-K1004D	8.43		NA		NA	5,110	0/69	0.6U	9/69
Sodium	56/69	15.9	1260	Z2-EU33B-334	99.6		NA		NA		NA	497	1/69
Thallium	37/69	0.075J	0.49J	Z2-EU33B-116	0.228		NA		NA	67.5	0/69	0.4U	3/69
Uranium	58/58	0.57	692J	Z2-EU33B-334	17.8		NA		NA	204	1/58		NA
Vanadium	69/69	5.4J	75J	Z2-EU33B-116	26.8		NA		NA	1,022	0/69	65.47	2/69
Zinc	69/69	13	1,600	Z2EU33-K1004D	126		NA		NA	100,000	0/69	89.7	17/69
Other organics (mg/kg)													
Diesel Range Organics	1/3	7,500	7,500	Z2EU33-K1004D	7,500		NA		NA		NA		NA
Gasoline Range Organics	1/3	0.47J	0.47J	Z2EU33-K1004D	0.47		NA		NA		NA		NA
Organics, pesticides, and PCBs (ug/kg)													
4,4'-DDD	0/6	ND	ND		ND		NA		NA	100,000	0/6		NA
4,4'-DDE	1/6	150	150	K1004D-S3	150		NA		NA	70,000	0/6		NA
4,4'-DDT	4/6	19J	230J	K1004D-S1	145		NA		NA	70,000	0/6		NA
Aldrin	0/6	ND	ND		ND		NA		NA	1,000	0/6		NA
alpha-BHC	0/6	ND	ND		ND		NA		NA	3,600	0/6		NA
alpha-Chlordane	1/6	8.5J	8.5J	K1004D-S1	8.5		NA		NA	65,000	0/6		NA
beta-BHC	0/6	ND	ND		ND		NA		NA	13,000	0/6		NA
delta-BHC	0/6	ND	ND		ND		NA		NA		NA		NA
Dieldrin	0/6	ND	ND		ND		NA		NA	1,100	0/6		NA
Endosulfan I	0/6	ND	ND		ND		NA		NA	3,700,000	0/6		NA
Endosulfan II	0/6	ND	ND		ND		NA		NA	3,700,000	0/6		NA
Endosulfan sulfate	1/6	250J	250J	K1004D-S1	250		NA		NA	3,700,000	0/6		NA
Endrin	3/6	20J	230J	K1004D-S2	112		NA		NA	180,000	0/6		NA
Endrin aldehyde	0/6	ND	ND		ND		NA		NA	180,000	0/6		NA
Endrin ketone	0/6	ND	ND		ND		NA		NA	180,000	0/6		NA
gamma-Chlordane	1/6	6J	6J	K1004D-S1	6		NA		NA	65,000	0/6		NA
Heptachlor	1/6	6.5J	6.5J	K1004D-S1	6.5		NA		NA	3,800	0/6		NA
Heptachlor epoxide	3/6	3.5J	9.5J	K1004D-S2	7.07		NA		NA	1,900	0/6		NA

Table A.4. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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^{-6} or HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Lindane	0/6	ND	ND		ND		NA		NA	17,000	0/6		NA
Methoxychlor	0/6	ND	ND		ND		NA		NA	3,100,000	0/6		NA
PCB-1016	0/67	ND	ND		ND	100,000	0/67	10,000	0/67	37,000	0/67		NA
PCB-1221	0/67	ND	ND		ND	100,000	0/67	10,000	0/67	7,436	0/67		NA
PCB-1232	0/67	ND	ND		ND	100,000	0/67	10,000	0/67	7,436	0/67		NA
PCB-1242	0/67	ND	ND		ND	100,000	0/67	10,000	0/67	7,436	0/67		NA
PCB-1248	0/67	ND	ND		ND	100,000	0/67	10,000	0/67	7,436	0/67		NA
PCB-1254	13/67	21	23,000J	Z2-EU33B-327	2,391	100,000	0/67	10,000	1/67	7,436	1/67		NA
PCB-1260	7/67	6.1J	920J	Z2-EU33B-334	168	100,000	0/67	10,000	0/67	7,436	0/67		NA
Polychlorinated biphenyl	12/59	6.1J	23,000J	Z2-EU33B-327	2,407	100,000	0/59	10,000	1/59	7,436	1/59		NA
Toxaphene	0/6	ND	ND		ND		NA		NA	16,000	0/6		NA
Radionuclides (pCi/g)													
Actinium-228	32/32	0.64	2.45	Z2-EU33-2009	1.38		NA		NA	11,900	0/32		NA
Alpha activity	42/42	3.67	332	Z2-EU33B-334	35.9		NA		NA		NA		NA
Beta activity	42/42	3.5J	331	Z2-EU33B-327	43.2		NA		NA		NA		NA
Bismuth-212	4/4	1.05	3.13J	Z2-EU33-2012	1.62		NA		NA	370,000	0/4		NA
Bismuth-214	28/28	0.279	1.21J	Z2-EU33B-122	0.785		NA		NA	134,000	0/28		NA
Cesium-134	0/7	ND	ND		ND		NA		NA	2.59	0/7		NA
Cesium-137	18/55	0.117J	5.41	Z2-EU33B-130	1.08	20	0/55	2	3/55	1.13	4/55		NA
Chromium-51	1/1	1.3J	1.3J	Z2-EU33B-119	1.3		NA		NA		NA		NA
Cobalt-57	0/7	ND	ND		ND		NA		NA	144	0/7		NA
Cobalt-60	0/55	ND	ND		ND		NA		NA	0.6	0/55		NA
Lead-210	2/2	1.8	2.3	Z2-EU33B-342	2.05		NA		NA		NA		NA
Lead-212	41/41	0.173	1.76	Z2-EU33B-122	1.17		NA		NA	61,300	0/41		NA
Lead-214	40/40	0.177	1.58J	Z2-EU33B-122	0.878		NA		NA	756,000	0/40		NA
Neptunium-237	6/50	0.1044J	1.43	Z2-EU33B-327	0.646	50	0/50	5	0/50	2.72	0/50		NA
Plutonium-238	1/8	0.1392J	0.1392J	KAH-SS-S71	0.139		NA		NA	160	0/8		NA
Plutonium-239	1/7	0.4482	0.4482	KAH-SS-B22	0.448		NA		NA	144	0/7		NA
Potassium-40	41/44	3.8	54.5	Z2-EU33-2008	18.9		NA		NA	2.73	41/44	32.12	3/44
Protactinium-233	1/1	0.65	0.65	Z2-EU33B-327	0.65		NA		NA		NA		NA
Protactinium-234m	7/15	12.4	253	Z2-EU33B-334	72.6		NA		NA	250,000,000	0/15		NA
Ra/Th decay series[d]	50/50	0	41.6	Z2-EU33B-327	1.51	15	2/50	5	2/50		NA		NA
Radium-226[e]	34/36	0.26	2.18	Z2-EU33B-327	0.899		NA		NA	0.26	34/36	1.25	2/36
Radium-228	15/15	0.64	1.87	Z2-EU33B-301 Z2-EU33B-327	1.28		NA		NA		NA		NA
Scandium-46	1/1	0.191J	0.191J	Z2-EU33-2014	0.191		NA		NA		NA		NA
Technetium-99	12/54	0.092J	267	Z2-EU33B-327	29.8		NA		NA	8,960	0/54		NA
Thallium-208	38/38	0.263	0.806	KAH-SS-B22	0.453		NA		NA	368,000	0/38		NA
Thorium-228[e]	51/53	0.17	3.85	Z2-EU33B-327	1.32		NA		NA	0.18	50/53	1.86	3/53
Thorium-230[e]	50/53	0.452	40.5	Z2-EU33B-327	2.55		NA		NA	202	0/53	1.2	28/53
Thorium-232[e]	51/53	0.21J	4.29	Z2-EU33B-327	1.29		NA		NA	0.18	51/53	1.95	2/53
Thorium-234	18/51	1.3	237	Z2-EU33B-334	27.5		NA		NA	32,800	0/51		NA
Total Activity	2/2	27.7	29.3J	K1006-01	28.5		NA		NA		NA		NA
Uranium-234	58/59	0.735	227	Z2-EU33B-334	12.8	7,000	0/59	700	0/59	332	0/59		NA
Uranium-235	39/60	0.0331J	11.5	Z2-EU33B-334	0.969	80	0/60	8	1/60	3.98	2/60		NA
Uranium-238	59/59	0.321	244	Z2-EU33B-334	11.1	500	0/59	50	2/59	18	7/59	1.47	33/59
Semivolatile organics (ug/kg)													
1,2,4-Trichlorobenzene	1/63	15,000J	15,000J	Z2-EU33B-327	15,000		NA		NA	215,925	0/63		NA
1,2-Dichlorobenzene	1/63	83J	83J	Z2-EU33B-327	83		NA		NA	600,000	0/63		NA
1,3-Dichlorobenzene	0/63	ND	ND		ND		NA		NA	600,000	0/63		NA
1,4-Dichlorobenzene	1/63	160J	160J	Z2-EU33B-327	160		NA		NA	78,665	0/63		NA

Table A.4. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
2,3,4,6-Tetrachlorophenol	0/41	ND	ND		ND		NA		NA	18,468,189	0/41		NA
2,4,5-Trichlorophenol	0/50	ND	ND		ND		NA		NA	61,560,629	0/50		NA
2,4,6-Trichlorophenol	0/50	ND	ND		ND		NA		NA	61,561	0/50		NA
2,4-Dichlorophenol	0/50	ND	ND		ND		NA		NA	1,846,819	0/50		NA
2,4-Dimethylphenol	0/50	ND	ND		ND		NA		NA	12,312,126	0/50		NA
2,4-Dinitrophenol	0/47	ND	ND		ND		NA		NA	1,231,213	0/47		NA
2,4-Dinitrotoluene	0/51	ND	ND		ND		NA		NA	25,348	0/51		NA
2,6-Dinitrotoluene	0/51	ND	ND		ND		NA		NA	25,348	0/51		NA
2-Chloronaphthalene	0/51	ND	ND		ND		NA		NA	23,382,732	0/51		NA
2-Chlorophenol	0/50	ND	ND		ND		NA		NA	235,768	0/50		NA
2-Methyl-4,6-dinitrophenol	0/49	ND	ND		ND		NA		NA	61,561	0/49		NA
2-Methylnaphthalene	7/51	45J	11,000	Z2-EU33B-334	1,758		NA		NA	187,691	0/51		NA
2-Methylphenol	0/50	ND	ND		ND		NA		NA	30,780,315	0/50		NA
2-Nitrobenzenamine	0/51	ND	ND		ND		NA		NA	1,830,232	0/51		NA
2-Nitrophenol	0/50	ND	ND		ND		NA		NA		NA		NA
3,3'-Dichlorobenzidine	0/50	ND	ND		ND		NA		NA	38,304	0/50		NA
3-Methylphenol	0/11	ND	ND		ND		NA		NA	30,780,315	0/11		NA
3-Nitrobenzenamine	0/51	ND	ND		ND		NA		NA	18,468	0/51		NA
4-Bromophenyl phenyl ether	1/51	97J	97J	K1004D-S1	97		NA		NA		NA		NA
4-Chloro-3-methylphenol	0/50	ND	ND		ND		NA		NA		NA		NA
4-Chlorobenzenamine	0/51	ND	ND		ND		NA		NA	2,462,425	0/51		NA
4-Chlorophenyl phenyl ether	0/51	ND	ND		ND		NA		NA		NA		NA
4-Methylphenol	0/31	ND	ND		ND		NA		NA	3,100,000	0/31		NA
4-Nitrobenzenamine	0/51	ND	ND		ND		NA		NA	184,648	0/51		NA
4-Nitrophenol	0/50	ND	ND		ND		NA		NA		NA		NA
Acenaphthene	8/51	27J	38,000	Z2-EU33B-334	4,930		NA		NA	29,219,327	0/51		NA
Acenaphthylene	9/51	47J	1400	Z2-EU33B-325	306		NA		NA	29,219,327	0/51		NA
Aniline	0/42	ND	ND		ND		NA		NA	3,024,031	0/42		NA
Anthracene	12/51	46J	82,000	Z2-EU33B-334	7,253		NA		NA	100,000,000	0/51		NA
Benz(a)anthracene	26/51	46J	190,000	Z2-EU33B-334	7,910		NA		NA	21,096	1/51		NA
Benzenemethanol	0/41	ND	ND		ND		NA		NA	100,000,000	0/41		NA
Benzo(a)pyrene	26/51	45J	170,000	Z2-EU33B-334	7,129		NA		NA	2,110	3/51		NA
Benzo(b)fluoranthene	27/51	48J	170,000	Z2-EU33B-334	7045		NA		NA	21,096	1/51		NA
Benzo(ghi)perylene	22/51	42J	92,000	Z2-EU33B-334	4,690		NA		NA	29,126,201	0/51		NA
Benzo(k)fluoranthene	22/51	57J	170,000	Z2-EU33B-334	8,234		NA		NA	210,962	0/51		NA
Benzoic acid	1/41	5,500	5,500	Z2-EU33B-327	5,500		NA		NA	100,000,000	0/41		NA
Bis(2-chloroethoxy)methane	0/51	ND	ND		ND		NA		NA		NA		NA
Bis(2-chloroethyl) ether	0/51	ND	ND		ND		NA		NA	5,755	0/51		NA
Bis(2-chloroisopropyl) ether	0/51	ND	ND		ND		NA		NA	73,518	0/51		NA
Bis(2-ethylhexyl)phthalate	14/51	44J	66,000J	Z2-EU33B-327	6,916		NA		NA	1,231,213	0/51		NA
Butyl benzyl phthalate	6/51	49J	29,000J	Z2-EU33B-327	8,060		NA		NA	100,000,000	0/51		NA
Carbazole	12/51	41J	53,000	Z2-EU33B-334	4,636		NA		NA	861,849	0/51		NA
Chrysene	28/51	44J	220,000	Z2-EU33B-334	8,450		NA		NA	2,109,623	0/51		NA
Dibenz(a,h)anthracene	11/51	50J	23,000	Z2-EU33B-334	2,312		NA		NA	2,110	1/51		NA
Dibenzofuran	6/51	55J	23,000	Z2-EU33B-334	4,108		NA		NA	1,563,342	0/51		NA
Diethyl phthalate	0/51	ND	ND		ND		NA		NA	100,000,000	0/51		NA
Dimethyl phthalate	0/51	ND	ND		ND		NA		NA	100,000,000	0/51		NA
Di-n-butyl phthalate	2/39	110J	1,200J	Z2-EU33B-327	655		NA		NA	61,560,629	0/39		NA
Di-n-octylphthalate	2/51	120J	1,400	Z2-EU33B-327	760		NA		NA	24,624,252	0/51		NA
Diphenylamine	0/6	ND	ND		ND		NA		NA	15,000,000	0/6		NA
Diphenyldiazene	0/30	ND	ND		ND		NA		NA	156,700	0/30		NA

Table A.4. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Fluoranthene	30/51	67J	500,000	Z2-EU33B-334	17,850		NA		NA	22,000,353	0/51		NA
Fluorene	11/51	48J	29,000	Z2-EU33B-334	3,310		NA		NA	26,281,433	0/51		NA
Hexachlorobenzene	1/51	340J	340J	Z2-EU33B-327	340		NA		NA	10,773	0/51		NA
Hexachlorobutadiene	0/63	ND	ND		ND		NA		NA	184,682	0/63		NA
Hexachlorocyclopentadiene	0/50	ND	ND		ND		NA		NA	3,658,717	0/50		NA
Hexachloroethane	0/51	ND	ND		ND		NA		NA	615,606	0/51		NA
Indeno(1,2,3-cd)pyrene	22/51	49J	77,000	Z2-EU33B-334	4012		NA		NA	21,096	1/51		NA
Isophorone	0/51	ND	ND		ND		NA		NA	5,119,795	0/51		NA
m+p Methylphenol	1/27	450J	450J	Z2-EU33B-334	450		NA		NA		NA		NA
Naphthalene	9/63	9.4	31,000	Z2-EU33B-334	5438		NA		NA	187,691	0/63		NA
Nitrobenzene	0/51	ND	ND		ND		NA		NA	102,935	0/51		NA
N-Nitrosodimethylamine	0/30	ND	ND		ND		NA		NA	338	0/30		NA
N-Nitroso-di-n-propylamine	0/51	ND	ND		ND		NA		NA	2,462	0/51		NA
N-Nitrosodiphenylamine	1/45	17J	17J	Z2-EU33-2012	17		NA		NA	3,517,750	0/45		NA
Pentachlorophenol	1/50	74J	74J	K1004D-S2	74		NA		NA	89,982	0/50		NA
Phenanthrene	24/51	45J	370,000	Z2-EU33B-334	16,358		NA		NA	29,126,201	0/51		NA
Phenol	1/50	260J	260J	Z2-EU33B-334	260		NA		NA	100,000,000	0/50		NA
Pyrene	30/51	43J	340,000	Z2-EU33B-334	12,260		NA		NA	29,126,201	0/51		NA
Pyridine	0/42	ND	ND		ND		NA		NA	615,606	0/42		NA
Volatile organics (ug/kg)													
(1,1-Dimethylethyl)benzene	0/12	ND	ND		ND		NA		NA	390,000	0/12		NA
(1-Methylpropyl)benzene	0/12	ND	ND		ND		NA		NA	220,000	0/12		NA
1,1,1,2-Tetrachloroethane	0/12	ND	ND		ND		NA		NA	72,755	0/12		NA
1,1,1-Trichloroethane	1/32	4,300	4,300	Z2-EU33B-113	4,300		NA		NA	1,200,000	0/32		NA
1,1,2,2-Tetrachloroethane	0/31	ND	ND		ND		NA		NA	9,294	0/31		NA
1,1,2-Trichloro-1,2,2-trifluoroethane	2/14	21	150	Z2-EU33B-113	85.5		NA		NA	5,600,000	0/14		NA
1,1,2-Trichloroethane	1/32	7.4	7.4	Z2-EU33B-113	7.4		NA		NA	16,050	0/32		NA
1,1-Dichloroethane	1/32	480	480	Z2-EU33B-113	480		NA		NA	1,738,654	0/32		NA
1,1-Dichloroethene	1/32	320	320	Z2-EU33B-113	320		NA		NA	413,325	0/32		NA
1,1-Dichloropropene	0/12	ND	ND		ND		NA		NA		NA		NA
1,2,3-Trichlorobenzene	0/12	ND	ND		ND		NA		NA		NA		NA
1,2,3-Trichloropropane	0/12	ND	ND		ND		NA		NA	760	0/12		NA
1,2,4-Trimethylbenzene	0/12	ND	ND		ND		NA		NA	170,272	0/12		NA
1,2-Dibromo-3-chloropropane	0/12	ND	ND		ND		NA		NA	11,000	0/12		NA
1,2-Dibromoethane	0/12	ND	ND		ND		NA		NA	630	0/12		NA
1,2-Dichloroethane	1/32	11	11	Z2-EU33B-113	11		NA		NA	6,035	0/32		NA
1,2-Dichloroethene	0/2	ND	ND		ND		NA		NA	150,000	0/2		NA
1,2-Dichloropropane	0/32	ND	ND		ND		NA		NA	7,422	0/32		NA
1,2-Dimethylbenzene	0/18	ND	ND		ND		NA		NA	420,000	0/18		NA
1,3,5-Trimethylbenzene	0/12	ND	ND		ND		NA		NA	69,712	0/12		NA
1,3-Dichloropropane	0/12	ND	ND		ND		NA		NA	360,521	0/12		NA
1-Chloro-4-methylbenzene	0/12	ND	ND		ND		NA		NA		NA		NA
1-chlorohexane	0/12	ND	ND		ND		NA		NA		NA		NA
1-Methyl-4-(1-methylethyl)benzene	0/12	ND	ND		ND		NA		NA		NA		NA
2,2-Dichloropropane	0/12	ND	ND		ND		NA		NA		NA		NA
2-Butanone	1/32	16J	16J	Z2-EU33-217	16		NA		NA	113,264,388	0/32		NA
2-Hexanone	0/32	ND	ND		ND		NA		NA		NA		NA
2-Methoxy-2-methylpropane	0/12	ND	ND		ND		NA		NA	700,000	0/12		NA
4-Methyl-2-pentanone	0/32	ND	ND		ND		NA		NA	47,001,434	0/32		NA

Table A.4. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Acetone	4/32	10J	64	Z2-EU33B-113	38.5		NA		NA	54,320,986	0/32		NA
Benzene	2/32	2.2J	3.5J	Z2-EU33B-346	2.85		NA		NA	14,094	0/32		NA
Bromobenzene	0/12	ND	ND		ND		NA		NA	92,152	0/12		NA
Bromochloromethane	0/12	ND	ND		ND		NA		NA		NA		NA
Bromodichloromethane	0/32	ND	ND		ND		NA		NA	18,306	0/32		NA
Bromoform	0/32	ND	ND		ND		NA		NA	2,181,998	0/32		NA
Bromomethane	0/32	ND	ND		ND		NA		NA	13,078	0/32		NA
Butylbenzene	0/12	ND	ND		ND		NA		NA	240,000	0/12		NA
Carbon disulfide	1/32	6.9	6.9	Z2-EU33B-113	6.9		NA		NA	720,000	0/32		NA
Carbon tetrachloride	3/32	1.2J	3J	Z2-EU33B-328	2.27		NA		NA	5,493	0/32		NA
Chlorobenzene	0/32	ND	ND		ND		NA		NA	530,466	0/32		NA
Chloroethane	0/32	ND	ND		ND		NA		NA	64,855	0/32		NA
Chloroform	2/32	3.9J	41	Z2-EU33B-113	22.5		NA		NA	4,698	0/32		NA
Chloromethane	0/32	ND	ND		ND		NA		NA	155,746	0/32		NA
cis-1,2-Dichloroethene	7/31	1.2J	570	Z2-EU33B-137	98.3		NA		NA	146,301	0/31		NA
cis-1,3-Dichloropropene	0/32	ND	ND		ND		NA		NA	17,645	0/32		NA
Cumene	0/12	ND	ND		ND		NA		NA	520,000	0/12		NA
Dibromochloromethane	0/32	ND	ND		ND		NA		NA	25,543	0/32		NA
Dibromomethane	0/12	ND	ND		ND		NA		NA	233,550	0/12		NA
Dichlorodifluoromethane	0/12	ND	ND		ND		NA		NA	308,058	0/12		NA
Ethylbenzene	2/32	7.4	30J	Z2-EU33B-327	18.7		NA		NA	395,000	0/32		NA
Iodomethane	0/12	ND	ND		ND		NA		NA		NA		NA
M + P Xylene	0/20	ND	ND		ND		NA		NA	420,000	0/20		NA
Methylene chloride	3/32	7.1	40	Z2-EU33B-113	26.0		NA		NA	205,265	0/32		NA
o-Chlorotoluene	0/12	ND	ND		ND		NA		NA	560,010	0/12		NA
Propylbenzene	0/12	ND	ND		ND		NA		NA	240,000	0/12		NA
Styrene	0/32	ND	ND		ND		NA		NA	1,700,000	0/32		NA
Tetrachloroethene	3/32	2.3J	26J	Z2-EU33B-327	12		NA		NA	13,086	0/32		NA
Toluene	7/32	1J	30	Z2-EU33B-113	14.3		NA		NA	520,000	0/32		NA
Total Xylene	2/12	18	290J	Z2-EU33B-327	154		NA		NA	420,000	0/12		NA
trans-1,2-Dichloroethene	3/30	1.7J	2.5J	Z2-EU33B-137	2.17		NA		NA	234,823	0/30		NA
trans-1,3-Dichloropropene	0/32	ND	ND		ND		NA		NA	17,645	0/32		NA
Trichloroethene	7/33	1.9J	580	Z2-EU33B-113	108		NA		NA	1,147	0/33		NA
Trichlorofluoromethane	0/12	ND	ND		ND		NA		NA	1,276,074	0/12		NA
Vinyl acetate	0/12	ND	ND		ND		NA		NA	1,396,422	0/12		NA
Vinyl chloride	3/32	8.2	37J	Z2-EU33-217	20.7		NA		NA	7,461	0/32		NA

[a]Stations in summary include 414, 415, 416, 424, 425, K1004D-S1, K1004D-S2, K1004D-S3, K1006-01, K1006-02, K1006-03, KAH-SS-B22, KAH-SS-S11, KAH-SS-S21, KAH-SS-S31, KAH-SS-S41, KAH-SS-S61, KAH-SS-S71, KAH-SS-S81, Z2-EU33-2001, Z2-EU33-2002, Z2-EU33-2003, Z2-EU33-2007, Z2-EU33-2008, Z2-EU33-2009, Z2-EU33-201, Z2-EU33-2010, Z2-EU33-2011, Z2-EU33-2012, Z2-EU33-2013, Z2-EU33-2014, Z2-EU33-2015, Z2-EU33-2016, Z2-EU33-2017, Z2-EU33-2018, Z2-EU33-202, Z2-EU33-203, Z2-EU33-204, Z2-EU33-205, Z2-EU33-210, Z2-EU33-211, Z2-EU33-215, Z2-EU33-216, Z2-EU33-217, Z2-EU33B-105, Z2-EU33B-113, Z2-EU33B-116, Z2-EU33B-119, Z2-EU33B-122, Z2-EU33B-128, Z2-EU33B-130, Z2-EU33B-131, Z2-EU33B-137, Z2-EU33B-140, Z2-EU33B-141, Z2-EU33B-221, Z2-EU33B-222, Z2-EU33B-232, Z2-EU33B-233, Z2-EU33B-301, Z2-EU33B-302, Z2-EU33B-303, Z2-EU33B-306, Z2-EU33B-307, Z2-EU33B-308, Z2-EU33B-309, Z2-EU33B-311, Z2-EU33B-315, Z2-EU33B-317, Z2-EU33B-320, Z2-EU33B-323, Z2-EU33B-325, Z2-EU33B-326, Z2-EU33B-327, Z2-EU33B-328, Z2-EU33B-334, Z2-EU33B-342, Z2-EU33B-344, Z2-EU33B-346, Z2-EU33B-352, Z2-EU33B-362, Z2-EU33B-363, Z2-EU33B-364, Z2-EU33B-365, Z2-EU33B-368, Z2-EU33B-369, Z2-EU33B-370, Z2-EU33B-371, Z2-EU33B-372, Z2-EU33B-378, Z2-EU33B-379, Z2-EU33B-380, Z2EU33-K1004D, Z2-EU33M-206, Z2-EU33M-207, Z2-EU33M-208, Z2-EU33M-209, Z2-EU33M-212, Z2-EU33M-213, and Z2-EU33M-214.

[b]Values in these columns are for detected results; non-detects are not included.

[c]"J" validation qualifier signifies analyte was positively identified and result is approximate concentration in the sample.

[d]Ra/Th (radium/thorium) decay series results are calculated values for each sample based on detections of radium-226, thorium-230, and thorium-232 as discussed in the Zone 2 ROD.

[e]These radionuclides are not included in aggregate risk calculations for the EU. Instead, human health risk effects of these radionuclides (thorium-228 is included in the thorium-232 decay series) are evaluated with the Ra/Th decay series RLs as discussed in the Zone 2 ROD.

EU = exposure unit
NA = not applicable
ND = not detected
PCB = polychlorinated biphenyl
PRG = preliminary remediation goal
RL = remediation level
ROD = record of decision

Table A.5. EU Z2-33 concrete data summary[a]

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Inorganics (mg/kg)													
Aluminum	10/10	3,600	17,000	Z2-EU33-2004	8,100		NA		NA	100,000	0/10	40,300	0/10
Antimony	8/10	0.018J	0.26J	Z2-EU33-2011	0.063		NA		NA	408.8	0/10	1.52	0/10
Arsenic	10/10	2.3	4.9	Z2-EU33-2027	3.2	900	0/10	300	0/10	15.9	0/10	14.95	0/10
Barium	10/10	25J	210	Z2-EU33-2004	84.6		NA		NA	66,577	0/10	124.93	3/10
Beryllium	10/10	0.29	3.1	Z2-EU33-2006	1.06	6,000	0/10	2,000	0/10	1,941	0/10	2.2	3/10
Boron	10/10	5.1	17	Z2-EU33-2006	8.82		NA		NA	100,000	0/10		NA
Cadmium	10/10	0.23	13	Z2-EU33-2006	3.47		NA		NA	451	0/10	0.22U	10/10
Calcium	10/10	71,000	210,000	Z2-EU33-2006	131,700		NA		NA		NA	2,400	10/10
Chromium	10/10	7J	17J	Z2-EU33-2010	11.3		NA		NA	640	0/10	44.88	0/10
Cobalt	10/10	2.1J	8.1J	Z2-EU33-2007	4.37		NA		NA	133,310	0/10	42	0/10
Copper	10/10	5.2	52	Z2-EU33-2008	14.4		NA		NA	40,877	0/10	22.48	2/10
Iron	10/10	4,700	11,000	Z2-EU33-2009	7,610		NA		NA	100,000	0/10	58,600	0/10
Lead	10/10	3.5J	37	Z2-EU33-2011	15.1		NA		NA	800	0/10	37.91	0/10
Lithium	10/10	3.5	20	Z2-EU33-2004	8.84		NA		NA	20,439	0/10	48.94	0/10
Magnesium	10/10	1,700J	63,000	Z2-EU33-2006 Z2-EU33-2006 Z2-EU33-2026	31,990		NA		NA		NA	3,300	8/10
Manganese	10/10	130J	780J	Z2-EU33-2006	402		NA		NA	19,458	0/10	2,200	0/10
Mercury	6/6	0.12J	0.55J	Z2-EU33-2008	0.353	1,800	0/6	600	0/6	307	0/6	0.17	5/6
Molybdenum	4/10	1.2	2.2	Z2-EU33-2007	1.55		NA		NA	5,110	0/10		NA
Nickel	10/10	5	16J	Z2-EU33-2007 Z2-EU33-2010	11		NA		NA	20,439	0/10	26.07	0/10
Potassium	10/10	780	3,600	Z2-EU33-2006	1504		NA		NA		NA	5,074.69	0/10
Selenium	1/10	0.47J	0.47J	Z2-EU33-2004	0.47		NA		NA	5,110	0/10	1.47	0/10
Silver	2/10	0.1J	0.11J	Z2-EU33-2008	0.105		NA		NA	5,110	0/10	0.6U	0/10
Sodium	10/10	180	820	Z2-EU33-2004	371		NA		NA		NA	497	2/10
Thallium	10/10	0.019J	0.067	Z2-EU33-2027	0.030		NA		NA	67.5	0/10	0.4U	0/10
Total Uranium	1/1	197	197	Z2-EU33B-235	197		NA		NA	204	0/1		NA
Uranium	10/10	0.56	4.2	Z2-EU33-2004	1.75		NA		NA	204	0/10		NA
Vanadium	10/10	7.3J	11	Z2-EU33-2026 Z2-EU33-2027	8.77		NA		NA	1,022	0/10	65.47	0/10
Zinc	10/10	12	1,900J	Z2-EU33-2006	383		NA		NA	100,000	0/10	89.7	4/10
Organics, pesticides, and PCBs (ug/kg)													
4,4'-DDD	0/3	ND	ND		ND		NA		NA	100,000	0/3		NA
4,4'-DDE	0/3	ND	ND		ND		NA		NA	70,000	0/3		NA
4,4'-DDT	0/3	ND	ND		ND		NA		NA	70,000	0/3		NA
Aldrin	0/3	ND	ND		ND		NA		NA	1,000	0/3		NA
alpha-BHC	0/3	ND	ND		ND		NA		NA	3,600	0/3		NA
alpha-Chlordane	0/3	ND	ND		ND		NA		NA	65,000	0/3		NA
beta-BHC	0/3	ND	ND		ND		NA		NA	13,000	0/3		NA
delta-BHC	0/3	ND	ND		ND		NA		NA		NA		NA
Dieldrin	0/3	ND	ND		ND		NA		NA	1,100	0/3		NA
Endosulfan I	0/3	ND	ND		ND		NA		NA	3,700,000	0/3		NA
Endosulfan II	0/3	ND	ND		ND		NA		NA	3,700,000	0/3		NA
Endosulfan sulfate	0/3	ND	ND		ND		NA		NA	3,700,000	0/3		NA
Endrin	0/3	ND	ND		ND		NA		NA	180,000	0/3		NA
Endrin aldehyde	0/3	ND	ND		ND		NA		NA	180,000	0/3		NA
Endrin ketone	0/3	ND	ND		ND		NA		NA	180,000	0/3		NA
gamma-Chlordane	0/3	ND	ND		ND		NA		NA	65,000	0/3		NA

Table A.5. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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^{-6} or HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Heptachlor	0/3	ND	ND		ND		NA		NA	3,800	0/3		NA
Heptachlor epoxide	0/3	ND	ND		ND		NA		NA	1,900	0/3		NA
Lindane	0/3	ND	ND		ND		NA		NA	17,000	0/3		NA
Methoxychlor	0/3	ND	ND		ND		NA		NA	3,100,000	0/3		NA
PCB-1016	0/11	ND	ND		ND	100,000	0/11	10,000	0/11	37,000	0/11		NA
PCB-1221	0/11	ND	ND		ND	100,000	0/11	10,000	0/11	7,436	0/11		NA
PCB-1232	0/11	ND	ND		ND	100,000	0/11	10,000	0/11	7,436	0/11		NA
PCB-1242	0/11	ND	ND		ND	100,000	0/11	10,000	0/11	7436	0/11		NA
PCB-1248	0/11	ND	ND		ND	100,000	0/11	10,000	0/11	7,436	0/11		NA
PCB-1254	8/11	42J	51,000	Z2-EU33-2004	12,025	100,000	0/11	10,000	0/11	7,436	3/11		NA
PCB-1260	3/11	6.9J	39	Z2-EU33B-235	20.0	100,000	0/11	10,000	0/11	7,436	0/11		NA
Polychlorinated biphenyl	10/11	6.9J	51,000	Z2-EU33-2004	9,626	100,000	0/11	10,000	0/11	7,436	3/11		NA
Toxaphene	0/3	ND	ND		ND		NA		NA	16,000	0/3		NA
Radionuclides (pCi/g)													
Alpha activity	7/10	1.34	8.86	Z2-EU33-2004	5.24		NA		NA		NA		NA
Beta activity	6/10	2	8.66	Z2-EU33-2010	5.94		NA		NA		NA		NA
Bismuth-214	3/3	1.23J	1.46J	Z2-EU33-2005	1.31		NA		NA	134,000	0/3		NA
Cesium-137	0/10	ND	ND		ND	20	0/10	2	0/10	1.13	0/10		NA
Cobalt-60	0/10	ND	ND		ND		NA		NA	0.6	0/10		NA
Lead-212	8/8	0.275	0.939	Z2-EU33-2006	0.467		NA		NA	61,300	0/8		NA
Lead-214	4/4	0.526J	1.41J	Z2-EU33-2006	0.984		NA		NA	756,000	0/4		NA
Neptunium-237	0/10	ND	ND		ND	50	0/10	5	0/10	2.72	0/10		NA
Potassium-40	8/9	3.8	9.32	Z2-EU33-2011	6.25		NA		NA	2.73	8/9	32.12	0/9
Ra/Th decay series[4]	10/10	0	1.61	Z2-EU33-2004	0.295	15	0/10	5	0/10		NA		NA
Radium-226[5]	9/10	0.163	1.27	Z2-EU33-2004	0.544		NA		NA	0.26	6/10	1.25	1/10
Technetium-99	0/10	ND	ND		ND		NA		NA	8,960	0/10		NA
Thorium-228[5]	7/10	0.464	1.08	Z2-EU33-2005	0.731		NA		NA	0.18	7/10	1.86	0/10
Thorium-230[5]	6/10	0.558J	2.81	Z2-EU33-2004	1.42		NA		NA	202	0/10	1.2	3/10
Thorium-232[5]	9/10	0.179	1.34	Z2-EU33-2004	0.722		NA		NA	0.18	8/10	1.95	0/10
Thorium-234	0/10	ND	ND		ND		NA		NA	32,800	0/10		NA
Uranium-234	11/11	0.392J	387	Z2-EU33B-235	36.1	7000	0/11	700	0/11	332	1/11		NA
Uranium-235	4/11	0.136	18.6	Z2-EU33B-235	4.8	80	0/11	8	1/11	3.98	1/11		NA
Uranium-238	11/11	0.288	63.3	Z2-EU33B-235	6.40	500	0/11	50	1/11	18	1/11	1.47	2/11
Semivolatile organics (ug/kg)													
1,2,4-Trichlorobenzene	0/10	ND	ND		ND		NA		NA	215,925	0/10		NA
1,2-Dichlorobenzene	0/10	ND	ND		ND		NA		NA	600,000	0/10		NA
1,3-Dichlorobenzene	0/10	ND	ND		ND		NA		NA	600,000	0/10		NA
1,4-Dichlorobenzene	0/10	ND	ND		ND		NA		NA	78,665	0/10		NA
2,3,4,6-Tetrachlorophenol	0/10	ND	ND		ND		NA		NA	18,468,189	0/10		NA
2,4,5-Trichlorophenol	0/10	ND	ND		ND		NA		NA	61,560,629	0/10		NA
2,4,6-Trichlorophenol	0/10	ND	ND		ND		NA		NA	61,561	0/10		NA
2,4-Dichlorophenol	0/10	ND	ND		ND		NA		NA	1,846,819	0/10		NA
2,4-Dimethylphenol	0/10	ND	ND		ND		NA		NA	12,312,126	0/10		NA
2,4-Dinitrophenol	0/10	ND	ND		ND		NA		NA	1,231,213	0/10		NA
2,4-Dinitrotoluene	0/10	ND	ND		ND		NA		NA	25,348	0/10		NA
2,6-Dinitrotoluene	0/10	ND	ND		ND		NA		NA	25,348	0/10		NA
2-Chloronaphthalene	0/10	ND	ND		ND		NA		NA	23,382,732	0/10		NA
2-Chlorophenol	0/10	ND	ND		ND		NA		NA	235,768	0/10		NA
2-Methyl-4,6-dinitrophenol	0/10	ND	ND		ND		NA		NA	61,561	0/10		NA
2-Methylnaphthalene	0/10	ND	ND		ND		NA		NA	187,691	0/10		NA
2-Methylphenol	0/10	ND	ND		ND		NA		NA	30,780,315	0/10		NA

Table A.5. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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^{-6} or HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
2-Nitrobenzenamine	0/10	ND	ND		ND		NA		NA	1,830,232	0/10		NA
2-Nitrophenol	0/10	ND	ND		ND		NA		NA		NA		NA
3,3'-Dichlorobenzidine	0/10	ND	ND		ND		NA		NA	38,304	0/10		NA
3-Methylphenol	0/10	ND	ND		ND		NA		NA	30,780,315	0/10		NA
3-Nitrobenzenamine	0/10	ND	ND		ND		NA		NA	18,468	0/10		NA
4-Bromophenyl phenyl ether	0/10	ND	ND		ND		NA		NA		NA		NA
4-Chloro-3-methylphenol	0/10	ND	ND		ND		NA		NA		NA		NA
4-Chlorobenzenamine	0/10	ND	ND		ND		NA		NA	2,462,425	0/10		NA
4-Chlorophenyl phenyl ether	0/10	ND	ND		ND		NA		NA		NA		NA
4-Nitrobenzenamine	0/10	ND	ND		ND		NA		NA	184,648	0/10		NA
4-Nitrophenol	0/10	ND	ND		ND		NA		NA		NA		NA
Acenaphthene	1/10	120J	120J	Z2-EU33-2007	120		NA		NA	29,219,327	0/10		NA
Acenaphthylene	0/10	ND	ND		ND		NA		NA	29,219,327	0/10		NA
Aniline	0/10	ND	ND		ND		NA		NA	3,024,031	0/10		NA
Anthracene	1/10	210J	210J	Z2-EU33-2007	210		NA		NA	100,000,000	0/10		NA
Benz(a)anthracene	2/10	190J	550J	Z2-EU33-2007	370		NA		NA	21,096	0/10		NA
Benzenemethanol	0/10	ND	ND		ND		NA		NA	100,000,000	0/10		NA
Benzo(a)pyrene	2/10	160J	340J	Z2-EU33-2007	250		NA		NA	2,110	0/10		NA
Benzo(b)fluoranthene	2/10	320J	500J	Z2-EU33-2007	410		NA		NA	21,096	0/10		NA
Benzo(ghi)perylene	0/10	ND	ND		ND		NA		NA	29,126,201	0/10		NA
Benzo(k)fluoranthene	5/10	230J	420J	Z2-EU33-2007	306		NA		NA	210,962	0/10		NA
Benzoic acid	0/10	ND	ND		ND		NA		NA	100,000,000	0/10		NA
Bis(2-chloroethoxy)methane	0/10	ND	ND		ND		NA		NA		NA		NA
Bis(2-chloroethyl) ether	0/10	ND	ND		ND		NA		NA	5,755	0/10		NA
Bis(2-chloroisopropyl) ether	0/10	ND	ND		ND		NA		NA	73,518	0/10		NA
Bis(2-ethylhexyl)phthalate	4/10	160J	510J	Z2-EU33-2010	280		NA		NA	1,231,213	0/10		NA
Butyl benzyl phthalate	2/10	240J	430J	Z2-EU33-2007	335		NA		NA	100,000,000	0/10		NA
Carbazole	1/10	150J	150J	Z2-EU33-2007	150		NA		NA	861,849	0/10		NA
Chrysene	2/10	290J	570J	Z2-EU33-2007	430		NA		NA	2109,623	0/10		NA
Dibenz(a,h)anthracene	0/10	ND	ND		ND		NA		NA	2,110	0/10		NA
Dibenzofuran	0/10	ND	ND		ND		NA		NA	1,563,342	0/10		NA
Diethyl phthalate	0/10	ND	ND		ND		NA		NA	100,000,000	0/10		NA
Dimethyl phthalate	0/10	ND	ND		ND		NA		NA	100,000,000	0/10		NA
Di-n-butyl phthalate	3/10	140J	590J	Z2-EU33-2004	323		NA		NA	61,560,629	0/10		NA
Di-n-octylphthalate	0/10	ND	ND		ND		NA		NA	24,624,252	0/10		NA
Diphenyldiazene	0/10	ND	ND		ND		NA		NA	156,700	0/10		NA
Fluoranthene	3/10	170J	1,500J	Z2-EU33-2007	673		NA		NA	22,000,353	0/10		NA
Fluorene	1/10	110J	110J	Z2-EU33-2007	110		NA		NA	26,281,433	0/10		NA
Hexachlorobenzene	0/10	ND	ND		ND		NA		NA	10,773	0/10		NA
Hexachlorobutadiene	0/10	ND	ND		ND		NA		NA	184,682	0/10		NA
Hexachlorocyclopentadiene	0/10	ND	ND		ND		NA		NA	3,658,717	0/10		NA
Hexachloroethane	0/10	ND	ND		ND		NA		NA	615,606	0/10		NA
Indeno(1,2,3-cd)pyrene	0/10	ND	ND		ND		NA		NA	21,096	0/10		NA
Isophorone	0/10	ND	ND		ND		NA		NA	5,119,795	0/10		NA
Naphthalene	0/10	ND	ND		ND		NA		NA	187,691	0/10		NA
Nitrobenzene	0/10	ND	ND		ND		NA		NA	102,935	0/10		NA
N-Nitrosodimethylamine	0/10	ND	ND		ND		NA		NA	338	0/10		NA
N-Nitroso-di-n-propylamine	0/10	ND	ND		ND		NA		NA	2,462	0/10		NA
N-Nitrosodiphenylamine	0/10	ND	ND		ND		NA		NA	3,517,750	0/10		NA
Pentachlorophenol	0/10	ND	ND		ND		NA		NA	89,982	0/10		NA
Phenanthrene	2/10	120J	1,200J	Z2-EU33-2007	660		NA		NA	29,126,201	0/10		NA

Table A.5. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Phenol	2/10	96J	170J	Z2-EU33-2010	133		NA		NA	100,000,000	0/10		NA
Pyrene	3/10	150J	1,100J	Z2-EU33-2007	533		NA		NA	29,126,201	0/10		NA
Pyridine	0/10	ND	ND		ND		NA		NA	615,606	0/10		NA

[a]Stations in summary include Z2-EU33-2004, Z2-EU33-2005, Z2-EU33-2006, Z2-EU33-2007, Z2-EU33-2008, Z2-EU33-2009, Z2-EU33-2010, Z2-EU33-2011, Z2-EU33-2026, Z2-EU33-2027, and Z2-EU33B-235.
[b]Values in these columns are for detected results; non-detects are not included.
[c]"J" validation qualifier signifies analyte was positively identified and result is approximate concentration in sample.
[d]Ra/Th (radium/thorium) decay series results are calculated values for each sample based on detections of radium-226, thorium-230, and thorium-232 as discussed in the Zone 2 ROD.
[e]These radionuclides are not included in aggregate risk calculations for EU. Instead, human health risk effects of these radionuclides (thorium-228 is included in thorium-232 decay series) are evaluated with Ra/Th decay series RLs as discussed in Zone 2 ROD.

EU = exposure unit
NA = not applicable
ND = not detected
PCB = polychlorinated biphenyl
PRG = preliminary remediation goal
RL = remediation level
ROD = record of decision

Table A.6. EU Z2-33 data summary for soil samples collected from ≥ 10 ft below ground surface[a]

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Inorganics (mg/kg)													
Aluminum	16/16	7,500	22,000	Z2-EU33-2013	15,199		NA		NA	100,000	0/16	40,300	0/16
Antimony	11/16	0.035J	0.68J	425	0.211		NA		NA	408.8	0/16	1.52	0/16
Arsenic	16/16	1.7	9.1	Z2-EU33-2013	4.9	900	0/16	300	0/16	15.9	0/16	14.95	0/16
Barium	16/16	32.1J	170J	Z2-EU33B-229	83.0		NA		NA	66,577	0/16	124.93	3/16
Beryllium	16/16	0.34	2.5	Z2-EU33B-230	1.42	6,000	0/16	2,000	0/16	1,941	0/16	2.2	2/16
Boron	14/14	0.82J	3.3J	Z2-EU33B-230	2.09		NA		NA	100,000	0/14		NA
Cadmium	12/16	0.18	2.5	Z2-EU33-2001	0.836		NA		NA	451	0/16	0.22U	9/16
Calcium	16/16	920	18,000	Z2-EU33B-123	4,968		NA		NA		NA	2,400	9/16
Chromium	16/16	13	130	Z2-EU33B-123	32.0		NA		NA	640	0/16	44.88	2/16
Cobalt	16/16	4.5	23	Z2-EU33-2001 Z2-EU33B-374	15.1		NA		NA	133,310	0/16	42	0/16
Copper	16/16	4.2J	34J	Z2-EU33-2013	19.7		NA		NA	40,877	0/16	22.48	6/16
Iron	16/16	21,000J	66,000	Z2-EU33-2013	45,844		NA		NA	100,000	0/16	58,600	3/16
Lead	16/16	9.9	61	Z2-EU33B-123	23.6		NA		NA	800	0/16	37.91	1/16
Lithium	13/14	5.6	22J	Z2-EU33B-230	11.4		NA		NA	20,439	0/14	48.94	0/14
Magnesium	16/16	262	3,200	Z2-EU33B-229	1,268		NA		NA		NA	3,300	0/16
Manganese	16/16	150	1,800	Z2-EU33-2002	700		NA		NA	19,458	0/16	2,200	0/16
Mercury	16/16	0.032J	0.55J	Z2-EU33B-123	0.114	1,800	0/16	600	0/16	307	0/16	0.17	1/16
Molybdenum	12/14	0.2J	0.66J	Z2-EU33B-123	0.389		NA		NA	5110	0/14		NA
Nickel	16/16	4.6	31	Z2-EU33B-114	18.8		NA		NA	20,439	0/16	26.07	4/16
Potassium	16/16	450	1,800	Z2-EU33B-230	1206		NA		NA		NA	5,074.69	0/16
Selenium	11/16	1.1J	4.2	Z2-EU33B-123 Z2-EU33B-230	2.7		NA		NA	5,110	0/16	1.47	10/16
Silver	2/16	0.32J	2.1	Z2-EU33B-123	1.21		NA		NA	5,110	0/16	0.6U	1/16
Sodium	9/16	26J	92J	Z2-EU33B-381	53.4		NA		NA		NA	497	0/16
Thallium	15/16	0.13J	1.4	424	0.303		NA		NA	67.5	0/16	0.4U	1/16
Uranium	14/14	0.33	15	Z2-EU33B-123	1.87		NA		NA	204	0/14		NA
Vanadium	16/16	23J	49J	Z2-EU33B-123	31.2		NA		NA	1,022	0/16	65.47	0/16
Zinc	16/16	11	105	424	52.6		NA		NA	100,000	0/16	89.7	1/16
Other organics (mg/kg)													
Diesel Range Organics	0/1	ND	ND		ND		NA		NA		NA		NA
Gasoline Range Organics	0/1	ND	ND		ND		NA		NA		NA		NA
Organics, pesticides, and PCBs (ug/kg)													
PCB-1016	0/16	ND	ND		ND	100,000	0/16	10,000	0/16	37,000	0/16		NA
PCB-1221	0/16	ND	ND		ND	100,000	0/16	10,000	0/16	7,436	0/16		NA
PCB-1232	0/16	ND	ND		ND	100,000	0/16	10,000	0/16	7,436	0/16		NA
PCB-1242	0/16	ND	ND		ND	100,000	0/16	10,000	0/16	7,436	0/16		NA
PCB-1248	0/16	ND	ND		ND	100,000	0/16	10,000	0/16	7,436	0/16		NA
PCB-1254	1/16	60	60	Z2-EU33B-123	60	100,000	0/16	10,000	0/16	7,436	0/16		NA
PCB-1260	2/16	19J	20J	Z2-EU33B-117	19.5	100,000	0/16	10,000	0/16	7,436	0/16		NA
Polychlorinated biphenyl	3/14	19J	60	Z2-EU33B-123	33	100,000	0/14	10,000	0/14	7,436	0/14		NA
Radionuclides (pCi/g)													
Actinium-228	10/10	0.963J	1.52J	Z2-EU33B-381	1.29		NA		NA	11,900	0/10		NA
Alpha activity	11/11	4.2J	8	Z2-EU33B-123	5.59		NA		NA		NA		NA
Beta activity	10/11	3.63	6.13	Z2-EU33B-114	4.70		NA		NA		NA		NA
Bismuth-212	2/2	3.32J	3.88J	Z2-EU33B-230	3.6		NA		NA	370,000	0/2		NA
Bismuth-214	8/8	0.521J	0.847J	Z2-EU33B-123	0.694		NA		NA	134,000	0/8		NA
Cesium-137	0/13	ND	ND		ND	20	0/13	2	0/13	1.13	0/13		NA

Table A.6. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Cobalt-60	1/13	0.272J	0.272J	Z2-EU33B-230	0.272		NA		NA	0.6	0/13		NA
Europium-152	1/1	1.08J	1.08J	Z2-EU33B-120	1.08		NA		NA	0.73	1/1		NA
Lead-212	11/11	0.887	1.59	Z2-EU33-2018	1.23		NA		NA	61,300	0/11		NA
Lead-214	11/11	0.519J	0.952J	Z2-EU33B-110	0.710		NA		NA	756,000	0/11		NA
Neptunium-237	0/11	ND	ND		ND	50	0/11	5	0/11	2.72	0/11		NA
Potassium-40	11/11	11.2	32.2	Z2-EU33B-230	20.4		NA		NA	2.73	11/11	32.12	1/11
Ra/Th decay series[4]	11/11	0	0.35	Z2-EU33B-114	0.111	15	0/11	5	0/11		NA		NA
Radium-226[5]	2/2	0.749	1.03J	Z2-EU33B-110	0.890		NA		NA	0.26	2/2	1.25	0/2
Technetium-99	0/13	ND	ND		ND		NA		NA	8,960	0/13		NA
Thallium-208	11/11	0.308	0.68J	Z2-EU33B-114	0.419		NA		NA	368,000	0/11		NA
Thorium-228[5]	13/13	1.02	2.07	Z2-EU33B-123	1.45		NA		NA	0.18	13/13	1.86	2/13
Thorium-230[5]	13/13	0.494	1.55	Z2-EU33B-114	1.12		NA		NA	202	0/13	1.2	5/13
Thorium-232[5]	13/13	0.775	1.72	Z2-EU33B-114	1.32		NA		NA	0.18	13/13	1.95	0/13
Thorium-234	0/10	ND	ND		ND		NA		NA	32,800	0/10		NA
Uranium-234	13/13	0.628	4.37	Z2-EU33B-120	1.50	7,000	0/13	700	0/13	332	0/13		NA
Uranium-235	6/13	0.107J	0.144J	Z2-EU33B-117	0.121	80	0/13	8	0/13	3.98	0/13		NA
Uranium-238	13/13	0.313	2.95	Z2-EU33B-123	1.18	500	0/13	50	0/13	18	0/13	1.47	2/13
Semivolatile organics (ug/kg)													
1,2,4-Trichlorobenzene	0/19	ND	ND		ND		NA		NA	215,925	0/19		NA
1,2-Dichlorobenzene	0/19	ND	ND		ND		NA		NA	600,000	0/19		NA
1,3-Dichlorobenzene	0/19	ND	ND		ND		NA		NA	600,000	0/19		NA
1,4-Dichlorobenzene	0/19	ND	ND		ND		NA		NA	78,665	0/19		NA
2,3,4,6-Tetrachlorophenol	0/7	ND	ND		ND		NA		NA	18,468,189	0/7		NA
2,4,5-Trichlorophenol	0/7	ND	ND		ND		NA		NA	61,560,629	0/7		NA
2,4,6-Trichlorophenol	0/7	ND	ND		ND		NA		NA	61,561	0/7		NA
2,4-Dichlorophenol	0/7	ND	ND		ND		NA		NA	1,846,819	0/7		NA
2,4-Dimethylphenol	0/7	ND	ND		ND		NA		NA	12,312,126	0/7		NA
2,4-Dinitrophenol	0/7	ND	ND		ND		NA		NA	1,231,213	0/7		NA
2,4-Dinitrotoluene	0/7	ND	ND		ND		NA		NA	25,348	0/7		NA
2,6-Dinitrotoluene	0/7	ND	ND		ND		NA		NA	25,348	0/7		NA
2-Chloronaphthalene	0/7	ND	ND		ND		NA		NA	23,382,732	0/7		NA
2-Chlorophenol	0/7	ND	ND		ND		NA		NA	235,768	0/7		NA
2-Methyl-4,6-dinitrophenol	0/7	ND	ND		ND		NA		NA	61,561	0/7		NA
2-Methylnaphthalene	0/7	ND	ND		ND		NA		NA	187,691	0/7		NA
2-Methylphenol	0/7	ND	ND		ND		NA		NA	30,780,315	0/7		NA
2-Nitrobenzenamine	0/7	ND	ND		ND		NA		NA	1,830,232	0/7		NA
2-Nitrophenol	0/7	ND	ND		ND		NA		NA		NA		NA
3,3'-Dichlorobenzidine	0/7	ND	ND		ND		NA		NA	38,304	0/7		NA
3-Methylphenol	1/7	130J	130J	Z2-EU33B-374	130		NA		NA	30,780,315	0/7		NA
3-Nitrobenzenamine	0/7	ND	ND		ND		NA		NA	18,468	0/7		NA
4-Bromophenyl phenyl ether	0/7	ND	ND		ND		NA		NA		NA		NA
4-Chloro-3-methylphenol	0/7	ND	ND		ND		NA		NA		NA		NA
4-Chlorobenzenamine	0/7	ND	ND		ND		NA		NA	2,462,425	0/7		NA
4-Chlorophenyl phenyl ether	0/7	ND	ND		ND		NA		NA		NA		NA
4-Nitrobenzenamine	0/7	ND	ND		ND		NA		NA	184,648	0/7		NA
4-Nitrophenol	0/7	ND	ND		ND		NA		NA		NA		NA
Acenaphthene	0/7	ND	ND		ND		NA		NA	29,219,327	0/7		NA
Acenaphthylene	0/7	ND	ND		ND		NA		NA	29,219,327	0/7		NA
Aniline	0/7	ND	ND		ND		NA		NA	3,024,031	0/7		NA
Anthracene	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Benz(a)anthracene	0/7	ND	ND		ND		NA		NA	21,096	0/7		NA

Table A.6. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Benzenemethanol	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Benzo(a)pyrene	0/7	ND	ND		ND		NA		NA	2,110	0/7		NA
Benzo(b)fluoranthene	0/7	ND	ND		ND		NA		NA	21,096	0/7		NA
Benzo(ghi)perylene	0/7	ND	ND		ND		NA		NA	29,126,201	0/7		NA
Benzo(k)fluoranthene	0/7	ND	ND		ND		NA		NA	210,962	0/7		NA
Benzoic acid	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Bis(2-chloroethoxy)methane	0/7	ND	ND		ND		NA		NA		NA		NA
Bis(2-chloroethyl) ether	0/7	ND	ND		ND		NA		NA	5,755	0/7		NA
Bis(2-chloroisopropyl) ether	0/7	ND	ND		ND		NA		NA	73,518	0/7		NA
Bis(2-ethylhexyl)phthalate	1/7	39J	39J	Z2-EU33-2018	39		NA		NA	1,231,213	0/7		NA
Butyl benzyl phthalate	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Carbazole	0/7	ND	ND		ND		NA		NA	861,849	0/7		NA
Chrysene	0/7	ND	ND		ND		NA		NA	2,109,623	0/7		NA
Dibenz(a,h)anthracene	0/7	ND	ND		ND		NA		NA	2,110	0/7		NA
Dibenzofuran	0/7	ND	ND		ND		NA		NA	1,563,342	0/7		NA
Diethyl phthalate	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Dimethyl phthalate	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Di-n-butyl phthalate	0/7	ND	ND		ND		NA		NA	6,1560,629	0/7		NA
Di-n-octylphthalate	0/7	ND	ND		ND		NA		NA	2,4624,252	0/7		NA
Diphenyldiazene	0/7	ND	ND		ND		NA		NA	156,700	0/7		NA
Fluoranthene	0/7	ND	ND		ND		NA		NA	22,000,353	0/7		NA
Fluorene	0/7	ND	ND		ND		NA		NA	26,281,433	0/7		NA
Hexachlorobenzene	0/7	ND	ND		ND		NA		NA	10,773	0/7		NA
Hexachlorobutadiene	0/19	ND	ND		ND		NA		NA	184,682	0/19		NA
Hexachlorocyclopentadiene	0/7	ND	ND		ND		NA		NA	3,658,717	0/7		NA
Hexachloroethane	0/7	ND	ND		ND		NA		NA	615,606	0/7		NA
Indeno(1,2,3-cd)pyrene	0/7	ND	ND		ND		NA		NA	21,096	0/7		NA
Isophorone	0/7	ND	ND		ND		NA		NA	5,119,795	0/7		NA
Naphthalene	0/19	ND	ND		ND		NA		NA	187,691	0/19		NA
Nitrobenzene	0/7	ND	ND		ND		NA		NA	102,935	0/7		NA
N-Nitrosodimethylamine	0/7	ND	ND		ND		NA		NA	338	0/7		NA
N-Nitroso-di-n-propylamine	0/7	ND	ND		ND		NA		NA	2,462	0/7		NA
N-Nitrosodiphenylamine	0/7	ND	ND		ND		NA		NA	3,517,750	0/7		NA
Pentachlorophenol	0/7	ND	ND		ND		NA		NA	89,982	0/7		NA
Phenanthrene	0/7	ND	ND		ND		NA		NA	29,126,201	0/7		NA
Phenol	0/7	ND	ND		ND		NA		NA	100,000,000	0/7		NA
Pyrene	0/7	ND	ND		ND		NA		NA	29,126,201	0/7		NA
Pyridine	0/7	ND	ND		ND		NA		NA	615,606	0/7		NA
Volatile organics (ug/kg)													
(1,1-Dimethylethyl)benzene	0/13	ND	ND		ND		NA		NA	390,000	0/13		NA
(1-Methylpropyl)benzene	0/13	ND	ND		ND		NA		NA	220,000	0/13		NA
1,1,1,2-Tetrachloroethane	0/13	ND	ND		ND		NA		NA	72,755	0/13		NA
1,1,1-Trichloroethane	1/15	96	96	Z2-EU33B-114	96		NA		NA	1,200,000	0/15		NA
1,1,2,2-Tetrachloroethane	0/15	ND	ND		ND		NA		NA	9,294	0/15		NA
1,1,2-Trichloro-1,2,2-trifluoroethane	1/15	2.5J	2.5J	Z2-EU33B-114	2.5		NA		NA	5,600,000	0/15		NA
1,1,2-Trichloroethane	0/15	ND	ND		ND		NA		NA	16,050	0/15		NA
1,1-Dichloroethane	1/15	42	42	Z2-EU33B-114	42		NA		NA	1,738,654	0/15		NA
1,1-Dichloroethene	2/15	3.1J	37	Z2-EU33B-114	20.1		NA		NA	413,325	0/15		NA
1,1-Dichloropropene	0/13	ND	ND		ND		NA		NA		NA		NA
1,2,3-Trichlorobenzene	1/13	2.7J	2.7	Z2-EU33B-117	2.7		NA		NA		NA		NA

Table A.6. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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^{-6} or HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
1,2,3-Trichloropropane	0/13	ND	ND		ND		NA		NA	760	0/13		NA
1,2,4-Trimethylbenzene	0/12	ND	ND		ND		NA		NA	170,272	0/12		NA
1,2-Dibromo-3-chloropropane	0/13	ND	ND		ND		NA		NA	11,000	0/13		NA
1,2-Dibromoethane	0/13	ND	ND		ND		NA		NA	630	0/13		NA
1,2-Dichloroethane	0/15	ND	ND		ND		NA		NA	6,035	0/15		NA
1,2-Dichloroethene	0/2	ND	ND		ND		NA		NA	150,000	0/2		NA
1,2-Dichloropropane	0/15	ND	ND		ND		NA		NA	7,422	0/15		NA
1,2-Dimethylbenzene	0/13	ND	ND		ND		NA		NA	420,000	0/13		NA
1,3,5-Trimethylbenzene	0/13	ND	ND		ND		NA		NA	69,712	0/13		NA
1,3-Dichloropropane	0/13	ND	ND		ND		NA		NA	360,521	0/13		NA
1-Chloro-4-methylbenzene	0/13	ND	ND		ND		NA		NA		NA		NA
1-chlorohexane	0/13	ND	ND		ND		NA		NA		NA		NA
1-Methyl-4-(1-methylethyl)benzene	0/13	ND	ND		ND		NA		NA		NA		NA
2,2-Dichloropropane	0/13	ND	ND		ND		NA		NA		NA		NA
2-Butanone	0/15	ND	ND		ND		NA		NA	113,264,388	0/15		NA
2-Hexanone	0/15	ND	ND		ND		NA		NA		NA		NA
2-Methoxy-2-methylpropane	0/13	ND	ND		ND		NA		NA	700,000	0/13		NA
4-Methyl-2-pentanone	0/15	ND	ND		ND		NA		NA	4,7001,434	0/15		NA
Acetone	1/15	110	110	Z2-EU33B-383	110		NA		NA	54,320,986	0/15		NA
Benzene	0/15	ND	ND		ND		NA		NA	14,094	0/15		NA
Bromobenzene	0/13	ND	ND		ND		NA		NA	92,152	0/13		NA
Bromochloromethane	0/13	ND	ND		ND		NA		NA		NA		NA
Bromodichloromethane	0/15	ND	ND		ND		NA		NA	18,306	0/15		NA
Bromoform	0/15	ND	ND		ND		NA		NA	2,181,998	0/15		NA
Bromomethane	0/15	ND	ND		ND		NA		NA	13,078	0/15		NA
Butylbenzene	0/13	ND	ND		ND		NA		NA	240,000	0/13		NA
Carbon disulfide	1/15	12	12	Z2-EU33B-383	12		NA		NA	720,000	0/15		NA
Carbon tetrachloride	1/15	6.7	6.7	Z2-EU33B-123	6.7		NA		NA	5,493	0/15		NA
Chlorobenzene	0/15	ND	ND		ND		NA		NA	530,466	0/15		NA
Chloroethane	0/15	ND	ND		ND		NA		NA	64,855	0/15		NA
Chloroform	2/15	3.8J	140	Z2-EU33B-383	71.9		NA		NA	4,698	0/15		NA
Chloromethane	0/15	ND	ND		ND		NA		NA	155,746	0/15		NA
cis-1,2-Dichloroethene	3/13	9.8	1300	Z2-EU33B-383	441		NA		NA	146,301	0/13		NA
cis-1,3-Dichloropropene	0/15	ND	ND		ND		NA		NA	17,645	0/15		NA
Cumene	0/13	ND	ND		ND		NA		NA	520,000	0/13		NA
Dibromochloromethane	0/15	ND	ND		ND		NA		NA	25,543	0/15		NA
Dibromomethane	0/13	ND	ND		ND		NA		NA	233,550	0/13		NA
Dichlorodifluoromethane	0/13	ND	ND		ND		NA		NA	308,058	0/13		NA
Ethylbenzene	0/15	ND	ND		ND		NA		NA	395,000	0/15		NA
Iodomethane	0/13	ND	ND		ND		NA		NA		NA		NA
M + P Xylene	0/15	ND	ND		ND		NA		NA	420,000	0/15		NA
Methylene chloride	0/15	ND	ND		ND		NA		NA	205,265	0/15		NA
o-Chlorotoluene	0/13	ND	ND		ND		NA		NA	560,010	0/13		NA
Propylbenzene	0/13	ND	ND		ND		NA		NA	240,000	0/13		NA
Styrene	0/15	ND	ND		ND		NA		NA	1,700,000	0/15		NA
Tetrachloroethene	1/15	29	29	Z2-EU33B-383	29		NA		NA	13,086	0/15		NA
Toluene	3/15	2.6J	24	425	9.87		NA		NA	520,000	0/15		NA
trans-1,2-Dichloroethene	1/13	11	11	Z2-EU33B-383	11		NA		NA	234,823	0/13		NA
trans-1,3-Dichloropropene	0/15	ND	ND		ND		NA		NA	17,645	0/15		NA
Trichloroethene	3/15	29	300J	Z2-EU33B-381	166		NA		NA	1,147	0/15		NA

Table A.6. (continued)

Analyte	Frequency of detect	Minimum detect[b,c]	Maximum detect[b,c]	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 HI = 1)	Frequency of detects exceeding PRG limit	Background concentration	Frequency of detects exceeding background
Trichlorofluoromethane	0/13	ND	ND		ND		NA		NA	1,276,074	0/13		NA
Vinyl acetate	0/13	ND	ND		ND		NA		NA	1,396,422	0/13		NA
Vinyl chloride	2/15	3.7J	120	Z2-EU33B-383	61.9		NA		NA	7,461	0/15		NA

[a]Stations in summary include 424, 425, Z2-EU33-2001, Z2-EU33-2002, Z2-EU33-2003, Z2-EU33-2013, Z2-EU33-2018, Z2-EU33B-110, Z2-EU33B-114, Z2-EU33B-117, Z2-EU33B-120, Z2-EU33B-123, Z2-EU33B-132, Z2-EU33B-138, Z2-EU33B-229, Z2-EU33B-230, Z2-EU33B-374, Z2-EU33B-381, Z2-EU33B-382, and Z2-EU33B-383.
[b]Values in these columns are for detected results; non-detects are not included.
[c]"J" validation qualifier signifies analyte was positively identified and result is approximate concentration in sample.
[d]Ra/Th (radium/thorium) decay series results are calculated values for each sample based on detections of radium-226, thorium-230, and thorium-232 as discussed in the Zone 2 ROD.
[e]Radionuclides are not included in aggregate risk calculations for EU. Instead, human health risk effects of these radionuclides (thorium-228 is included in thorium-232 decay series) are evaluated with Ra/Th decay series RLs as discussed in Zone 2 ROD.

EU = exposure unit
NA = not applicable
ND = not detected
PCB = polychlorinated biphenyl
PRG = preliminary remediation goal
RL = remediation level
ROD = record of decision