Environmental Restoration
University of California
Environmental Restoration Project, MS M992
Los Alamos, New Mexico 87545
505-667-0808/FAX 505-665-4747

U. S. Department of Energy
Los Alamos Area Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
505-667-7203/FAX 505-665-4504

HSWA LANL 2/1086/15
LA-UR-98-4675

1998
RECEIVED

Date: September 30, 1998
Refer to: EM/ER:98-400

Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87501

SUBJECT: SUBMITTAL OF VCA COMPLETION REPORT FOR PRS 15-012(b) (FORMER OU 1086, FU 2) TO PROVIDE INFORMATION AND DOCUMENTATION OF TECHNICAL AND REGULATORY COMPLETION

Dear Mr. Garcia:

Enclosed please find the Certification and two copies of the Voluntary Corrective Action Completion Report for Potential Release Site 15-012 (b), which are being submitted to the New Mexico Environment Department to provide information and documentation of technical and regulatory completion.

If you have any questions or comments, please contact Victoria George at (505) 665-6953.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/DB/rfr

Enclosures: (1) Certification
(2) Two VCA Completion Reports for PRS 15-012(b) (Former OU 1086, FU 2)

4233

Cy (w/ encs.):
J. McCann, CST-7, MS E525
R. Michelotti, CST-7, MS E525
D. Neleigh, EPA, R.6, 6PD-N
J. Newlin, CST-7, MSSS M992
C. Rodriguez, CIO/ER, MS M992
T. Taylor, LAAO, MS A316
T. Trujillo, DOE-AL, MS A906
J. White, ESH-19, MS K490
S. Dinwiddie, NMED-HRMB
M. Leavitt, NMED-GWQB
J. Parker, NMED-HRMB
G. Saums, NMED-SWQB
S. Yanicak, NMED-AIP, MS J993
RPF, MS M707, Work Package 306

Cy (w/o encs.):
T. Baca, EM, MS J591
D. Boak, TSA-10, MS M992
T. Fogg, ICF-Kaiser, MS M892
T. George, EM/ER, MS M992
R. Hutton, SAIC, MS J521
M. Kirsch, EM/ER, MS M992
T. Longo, DOE-HQ, EM-453
D. McInroy, EM/ER, MS M992
J. Mose, LAAO, MS A316
H. Orr, EM/ER, MS M992
S. Rae, ESH-18, MS K497
G. Rael, DOE-AL, MS A906
J. Vozella, LAAO, MS A316
EM/ER File (CT # C284), MS M992
EM/ER File, MS M992

LA-UR-98-4075
September 30, 1998

Voluntary Corrective Action Report for Potential Release Site

15-012(b)
Wash Area

Environmental Restoration Project
A Department of Energy Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY
Los Alamos, NM 87545

Data disks included with this document

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.

Voluntary Corrective Action Report for Potential Release Site

15-012(b)
Wash Area

Produced by the Remedial Actions Focus Area

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the Regents of the University of California, the United States Government nor any agency thereof, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the Regents of the University of California, the United States Government, or any agency thereof.

Los Alamos National laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness. By acceptance of this article, the publisher recognizes that the U.S. government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy.

Voluntary Corrective Action Completion Report

TABLE OF CONTENTS

EXECUTIVE SUMMARY iii

1.0 INTRODUCTION 1

2.0 SITE CHARACTERIZATION PRIOR TO VCA 3

2.1 Summary 3

2.2 Description and Operational History 4
2.2.1 Site Description 4
2.2.2 Operational History 8

2.3 Investigatory Activities 8
2.3.1 Summary 8
2.3.2 Previous Investigations 8
2.3.3 Preliminary Conceptual Model 8
2.3.4 Field Investigation and Data Evaluation 9
2.3.4.1 Summary 9
2.3.4.2 Field Investigation 9
2.3.4.3 RFI Data Review 9
2.3.5 Revised Site Conceptual Model After RFI 15
2.3.5.1 Nature and Extent of Contamination 15
2.3.5.2 Environmental Fate 16

2.4 RFI Site Assessments 17
2.4.1 Summary 17
2.4.2 Screening Assessments 18
2.4.2.1 Human Health 18
2.4.2.2 Ecological 20

3.0 REMEDIAL ACTIVITIES AND RESULTS OF SAMPLING 20

3.1 Cleanup Levels 20

3.2 Remedial Implementation 21

3.3 Confirmatory Sampling Results 26
3.3.1 Confirmatory Sampling Data Review 26
3.3.2 Revised Site Conceptual Model As Influenced By The VCA Confirmatory Sampling 33
3.3.2.1 Nature and Extent of Contamination 33
3.3.2.2 Environmental Fate 33
3.3.3 Confirmatory Sampling Site Assessments 34
3.3.3.1 Summary 34
3.3.3.2 Human Health Screening Assessment 34
3.3.3.3 Ecological Screening Assessment 37
3.3.3.4 Surface Water Assessment 40
3.3.3.5 Groundwater Assessment 40
3.3.3.6 Underground Storage Tanks 40
3.3.3.7 Other Assessments 40
3.3.4 Conclusions and Recommendations 40

4.0 WASTE MANAGEMENT 41

5.0 REFERENCES 42

APPENDIX A LIST OF ACRONYMS AND GLOSSARY A-1
APPENDIX B OPERATIONAL AND ENVIRONMENTAL SETTING B-1
APPENDIX C RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES C-1
APPENDIX D ANALYTICAL SUITES AND RESULTS D-1
APPENDIX E STATISTICAL ANALYSES E-1
APPENDIX F RISK ASSESSMENT CALCULATIONS F-1
APPENDIX G RELEVANT DOCUMENTS G-1
APPENDIX H COMPARISON OF ANTICIPATED AND ACTUAL COSTS H-1
APPENDIX I VCA PLAN FOR PRS 15-012(b) I-1
APPENDIX J PHOTOGRAPHS FOR PRS 15-012(b) J-1
APPENDIX K MEMO FROM ROGER LONDON K-1

LIST OF FIGURES

Figure 1.0-1. Site map of TA-15 and PRS 15-012(b) 2
Figure 2.2-1. Location of bermed area at PRS 15-012(b). 5
Figure 2.2-2. Location of PRSs in the vicinity of PRS 15-012(b). 7
Figure 2.3-2. RFI sample locations and results above background. 10
Figure 3.2-1 PRS 15-012(b), Site map of confirmatory sample locations. 22
Figure 3.2-2. 40ft x 80ft grid used for field screening of 15-012(b) and surrounding area. 25
Figure 3.3-1. PRS 15-012(b), Site map of confirmatory sample locations with detected analytes. 27

LIST OF TABLES

Table 2.3-1 PRS 15-012(b) Summary of Samples Collected For Fixed Laboratory Analysis 9
Table 2.3-a1 PRS 15-012(b) Frequency of Detected Inorganic Chemicals 11
Table 2.3-a2 PRS 15-012(b) Inorganic Chemicals With Concentrations at or Exceeding Background Values 12
Table 2.3-a3 PRS 15-012(b) Results of Rfi Inorganic Data Review 14
Table 2.3-b1 PRS 15-012(b) Frequency of Detected Radionuclides 15
Table 2.3-b2 PRS 15-012(b) Radionuclides Detected in the Wash Area 15
Table 2.3-b3 PRS 15-012(b) Results of Rfi Radionuclide Data Review 15
Table 2.4-b1 PRS 15-012(b) Comparison of Noncarcinogenic Chemicals to Sal 18
Table 2.4-b2 PRS 15-012(b) Comparison of Radionuclides to Sal 19
Table 3.1-1 PRS 15-012(b) Cleanup Levels for Individual Copcs 21
Table 3.2-1 PRS 15-012(b) Summary of Samples Collected During the VCA For Fixed-Laboratory Analysis 23
Table 3.3-a1 PRS 15-012(b) Frequency of Detected Inorganic Chemicals 28
Table 3.3-a2 PRS 15-012(b) Inorganic Chemicals With Concentrations at or Exceeding Background Values 30
Table 3.3-a3 PRS 15-012(b) Results of Inorganic Data Review 30
Table 3.3-b1 PRS 15-012(b) Frequency of Detected Radionuclides 31
Table 3.3-b2 PRS 15-012(b) Radionuclides With Concentrations at or Exceeding Background Values/Fallout Concentrations 32
Table 3.3-b3 PRS 15-012(b) Results of Radionuclide Data Review 32
Table 3.3.3-b1 PRS 15-012(b) Comparison of Copcs to Industrial Cleanup Levels 35
Table 3.3.3.3-b1 PRS 15-012(b) Summary of Hazard Quotient Analysis 38
Table 4.0-1 Waste Types and Volumes 41

EXECUTIVE SUMMARY

This Voluntary Corrective Action (VCA) Completion Report describes the results of investigation and remediation of PRS 15-012(b), a HSWA SWMU at Los Alamos National Laboratory (LANL). The investigation and remediation of this PRS is in accordance with the Hazardous and Solid Wastes Amendments of 1984 and follows the requirements in Module VIII of LANL's Hazardous Waste Facility Permit.

PRS 15-012(b) was a soil-bermed wash out area approximately 63 ft by 20 ft by 1.5 ft high. In this area, LANL personnel used water to wash out debris remaining in 6-ft diameter heavy-walled steel spheres used for explosive devise containment testing. The wash area was located on DOE-owned land and removed from private access roads. The PRS was entirely contained within LANL's Technical Area 15, which is a high-security, controlled access facility. Unauthorized personnel entry is not permitted.

The wash area was in use from the late 1970s until the 1980s. An RFI was conducted in 1994 and found that uranium, beryllium, lead, cadmium, copper, and mercury were above background. HE was not detected by field screening methods. A human health screening assessment identified antimony, beryllium, lead and uranium as chemicals of potential concern (COPCs). Based upon these results, a VCA, which included additional sampling to more completely determine nature and extent of contamination, was proposed for this site in a meeting with NMED in January 1997. Verbal approval to proceed with the proposed remediation was received from NM ED at that meeting.

The remediation at PRS 15-012(b) was completed in August of 1997. The soil of the wash area and berm was removed and properly disposed. After removal, confirmatory soil samples were collected at locations corresponding to areas where the largest amounts of soil were removed based on field screening for uranium during the excavation. Soil samples were collected and analyzed for metals, high explosives, and isotopic uranium by an off-site analytical laboratory. Additional samples to confirm the lack of contamination outside the former berm area, to bound the vertical extent of contamination at one sample location, and to improve detection limits for antimony analysis were collected in July and August 1998.

The results of the laboratory analysis of soil after the VCA confirmed that the site had been characterized and remediated, and that the nature and extent of site contamination had been defined. The assessment of confirmatory samples did not identify any COPCs or chemicals of potential ecological concern COPECs, which indicated that there was no potential for unacceptable risk to human health and the environment at this PRS. The site also has no impacts to surface water and groundwater.

The area has been regraded with base course and is expected to be used as a parking lot or for equipment storage. Based on the results of the remedial activities, the site is proposed for no further action (NFA) under Criterion 5, "The SWMU has been characterized or remediated in accordance with current applicable state or federal regulations and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use."

VOLUNTARY CORRECTIVE ACTION COMPLETION REPORT FOR POTENTIAL RELEASE SITE 15-012(b), WASH AREA

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multi-disciplinary research facility owned by the Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 miles northeast of Albuquerque and 20 miles northwest of Santa Fe. The Laboratory site covers 43 square miles of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons containing ephemeral and intermittent streams that run from west to east. Mesa tops range in elevation from approximately 6,200 ft to 7,800 ft. The eastern portion of the plateau stands 300 to 900 ft above the Rio Grande.

The Laboratory's Environmental Restoration (ER) Project is involved in a national effort by DOE to clean up facilities that were formerly involved in weapons production. The goal of the ER Project is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve that goal, the ER Project is currently investigating sites potentially contaminated by past Laboratory operations.

This investigation and remediation, including sampling and analysis, was conducted under the requirements of the Resource Conservation and Recovery Act (RCRA).

The sites under investigation are either solid waste management units (SWMUs) or areas of concern (AOCs). In the LANL ER Project, SWMUs and AOCs are collectively referred to as potential release sites (PRSs).

For PRS 15-012(b), the investigation and remediation was conducted in accordance with the Hazardous and Solid Wastes Amendments (HSWA) of 1984 and follows the requirements in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, ER ID 01585). Module VIII was issued to the Laboratory by the U.S. Environmental Protection Agency (EPA) on May 23, 1990, and modified on May 19, 1994.

Radionuclides are regulated under DOE Order 5400.5 Radiation Protection of the Public and the Environment (proposed rule 10 CFR 843.5 in FR 16268). In this report, PRS 15-012(b) has a radioactive component.

PRS 15-012(b) is located at LANL in Technical Area (TA) 15 directly south of Building TA-15-376. Figure 1.0-1 shows the location of TA-15 at the Laboratory and the location of PRS 15-012(b). The PRS consisted of a soil-bermed area, approximately 63 ft by 20 ft by 1.5 ft high. In this area, the explosives groups (DX Division) used water to wash out debris from vessels used for explosives device testing from the late 1970s until the 1980s. These vessels, heavy-walled steel spheres (diameter 6 ft), were used to contain explosive device tests and any debris remaining after the testing (explosion). Finding of metals and uranium in the soil within the wash area is consistent with contaminants found at noncontained firing sites within TA-15.

The RCRA Facility Investigation (RFI) was conducted in the summer of 1994. Results of soil analysis showed that uranium, beryllium, lead, cadmium, copper, and mercury were detected above background. A human health screening assessment identified antimony, beryllium, lead, and uranium as chemicals of potential concern (COPCs).

Based on RFI results, PRS 15-012(b) was recommended for a voluntary corrective action (VCA) for the following reasons:

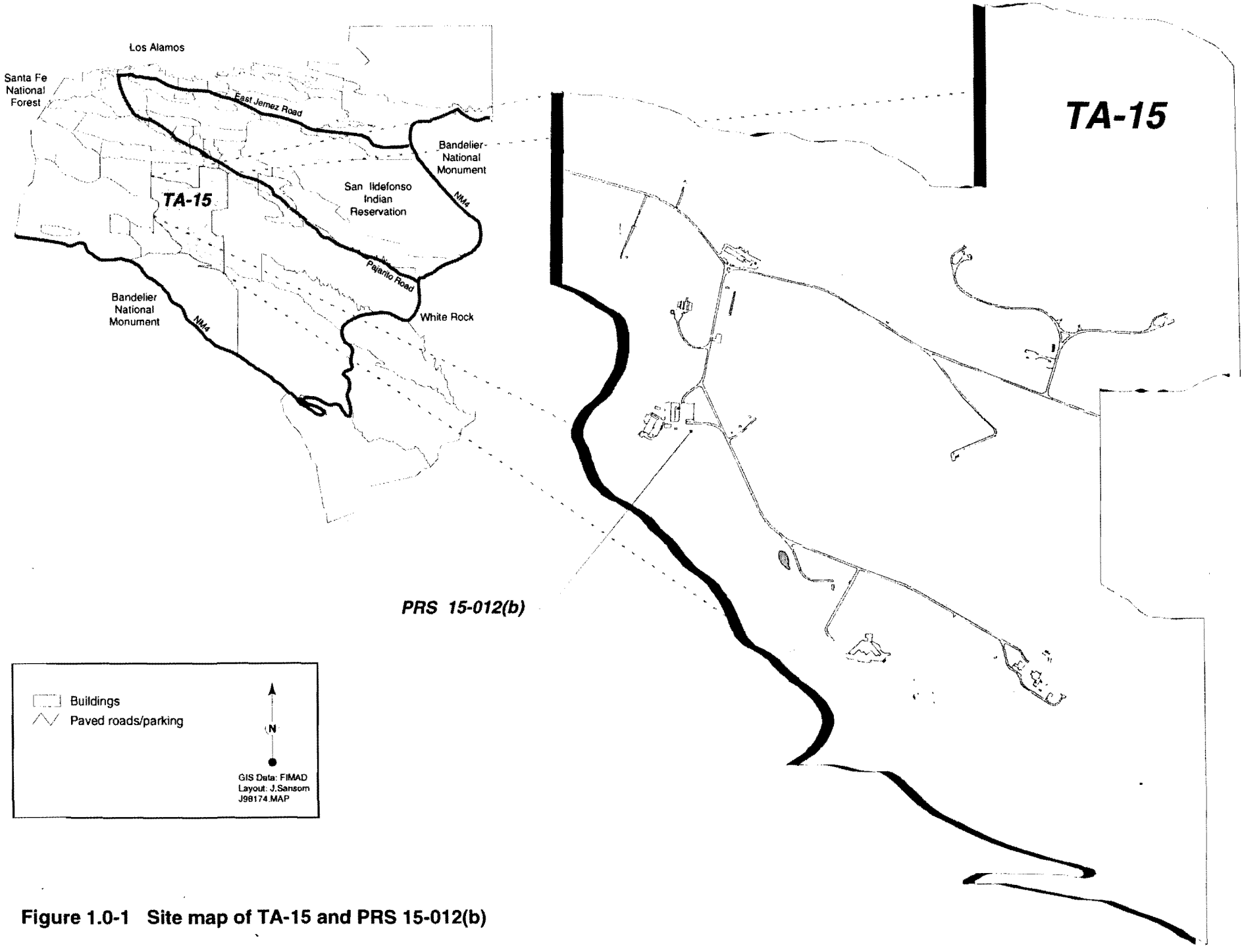


Figure 1.0-1 Site map of TA-15 and PRS 15-012(b)

- the COPCs were detected inside the wash area and in the earthen berm surrounding the wash area;
- removing the contaminated soils would ensure that the contaminants would not migrate off the site;
- the nature and extent of soil contamination, which was not determined during the RFI, could easily be determined by sampling in conjunction with the VCA;
- the proposed remedy (removing contaminated soils) was appropriate and final,
- removal could be completed quickly;
- the remedy was final;
- the land use was industrial; and
- treatment, storage, and disposal (TSD) facilities existed for the amount of waste generated.

The VCA Plan for PRS 15-012(b) was presented to the New Mexico Environment Department (NMED) in January 1997, and verbal approval to proceed was received at that meeting. The detailed VCA Plan was written in the summer of 1997 (see Appendix I).

This VCA completion report describes the contaminated soil removal, the confirmatory soil sampling, and sampling of surrounding soil. The remediation was completed in late August 1997. Additional sampling to bound the extent of any contamination was completed in summer 1998. This VCA completion report is divided into five sections. Section 1 is the introduction. Section 2 presents the information known about the site, including the previous RFI investigation completed prior to the VCA. Section 3 describes the derivation of the cleanup levels, the remedial activities completed, and presents the results of the samples collected after remediation. Section 4 describes the waste management activities, including waste types, volumes, and disposition. Section 5 contains references.

More detailed information is provided in the attached appendices. Appendix A contains a list of acronyms and a glossary of terms. Current and historical land use of TA-15 (which includes PRS 15-012[b]) is discussed in detail in Appendix B-1.0, Operational History and Land Use. Appendices B-2.0 through B-6.0 include a detailed discussion of the climate, geology, hydrology, ecological resources, and cultural resources for TA-15. Appendix C includes the complete quality assurance/quality control (QA/QC) results. Appendix D provides an abridged version of the data for the investigation/remediation. The complete data set has been submitted to the Administrative Authority (AA) in electronic format. Appendix E provides details about statistical calculations. Appendix F provides the risk assessment calculations. Appendix G-1.0 summarizes the administrative history of PRS 15-012(b). Appendix H contains the before and after cost comparison for completing of the VCA. Appendix I is a copy of the VCA Plan for PRS 15-012(b). Appendix J contains photographs of the VCA activities. Appendix K contains a memo from Roger London regarding past activities at PRS 15-012(b).

2.0 SITE CHARACTERIZATION PRIOR TO VCA

2.1 Summary

PRS 15-012(b) consisted of a soil-bermed area approximately 63 ft by 20 ft, with a berm 1.5 ft high. In this area, large, thick-walled steel spheres, which contained explosives tests, were washed out with water. The debris remaining from the tests and the wash water from the cleaning were deposited in the bermed area. The washed spheres were stored off site at the boneyard, PRS 15-001. The potential contaminants at the site were uranium, beryllium, and lead. Any high explosives (HE) were expected to be completely consumed during the testing (LANL 1993, ER ID 20946; page 7-8).

The RFI was completed in 1994. It was designed to determine if the area encompassed by the earthen berm was contaminated from sphere-washing operations. Details of the RFI approach are included in Section 2.3.3, Preliminary Conceptual Model. Three surface and three subsurface samples were submitted to the fixed analytical laboratory as required by the RFI Work Plan (LANL 1993, ER ID 20946). The samples were selected based on field analysis, using x-ray fluorescence (XRF) to identify uranium and lead, and laser-induced breakdown spectroscopy (LIBS) to identify beryllium. Results of the field investigation are included in Section 2.3.4. The analytical results were consistent with the preliminary

conceptual model in that uranium, lead, and beryllium were detected above background in the surface and subsurface soils. In addition, copper and mercury were detected above background and antimony had detection limits above background. No HEs were detected in the surface or subsurface soils using the HE spot test. Samples were not collected from outside the bermed area during the RFI, and therefore extent was not determined at this PRS. Full details are included in Section 2.3.5, Revised Site Conceptual Model.

A human health screening assessment was conducted on the results of the RFI. The screening assessment identified antimony, beryllium, lead, and uranium as COPCs. The results are included in Section 2.4.2.1, Human Health Screening Assessment. An ecological screening assessment was conducted on the wash area using an ecological screening methodology in place at that time (ER Project 1995, ER ID 50294). The results are not included in this report because the methodology used was not sufficient to evaluate potential ecological impacts.

The RFI data were adequate to determine the nature of inorganic contamination at the site. Sampling to determine the extent of contamination and the presence of HE were not conducted during the initial characterization. The determination of extent and HE concentrations was one of the objectives of the sampling conducted as part of the VCA activities. Human health and ecological screening assessments using current and appropriate methodologies were conducted as part of the VCA activities. Section 3, Remedial Activities and Results of Sampling, presents details of the VCA.

2.2 Description and Operational History

PRS 15-012(b) (the wash area) is a SWMU listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit.

2.2.1 Site Description

Physical Description

PRS 15-012(b) consisted of a soil-bermed area approximately 63 ft by 20 ft with a berm 1.5 ft high. The PRS is located on Phermex Mesa, approximately 1000 ft east of Cañon de Valle. The wash area was located near the western edge of TA-15, approximately 20-ft southeast of Building TA-15-285 and directly south of Building TA-15-376 (Figure 2.2-1). Both the SWMU report (LANL 1990, ER ID 7511) and the Comprehensive Environmental Assessment and Response Program (CEARP) report (DOE 1987, ER ID 8657) stated that contaminated vessels were washed out with water in a bermed area near Building TA-15-285. Potential contaminants of concern included uranium, beryllium, and lead.

Figure 2.2-1 shows the location of the wash area in relation to other structures and a parking lot in the area. None of these structures are expected to have had any influence on PRS 15-012(b), with the possible exception of potential run-on from the parking area and roof of Building TA-15-376 to the base of the berm.

Land Use

TA-15 is an industrial area consisting of a number of firing sites used extensively since 1944 for research and explosive testing of weapon design components. PRS 15-012(b) is part of the industrial complex at TA-15 and is expected to be used as a parking area for facility vehicles and/or equipment storage. LANL does not anticipate any change from the industrial use for the TA and the PRS for the operational life of the Laboratory, as described in the LANL Land Use Plan (LANL 1995, ER ID 57224). PRS 15-012(b) is entirely inside the boundaries of TA-15, which is a high-security, controlled-access facility. It has 24-hour security guards at the restricted access points and chain link fences topped with barbed wire surrounding the entire area. Access is restricted to authorized personnel only.

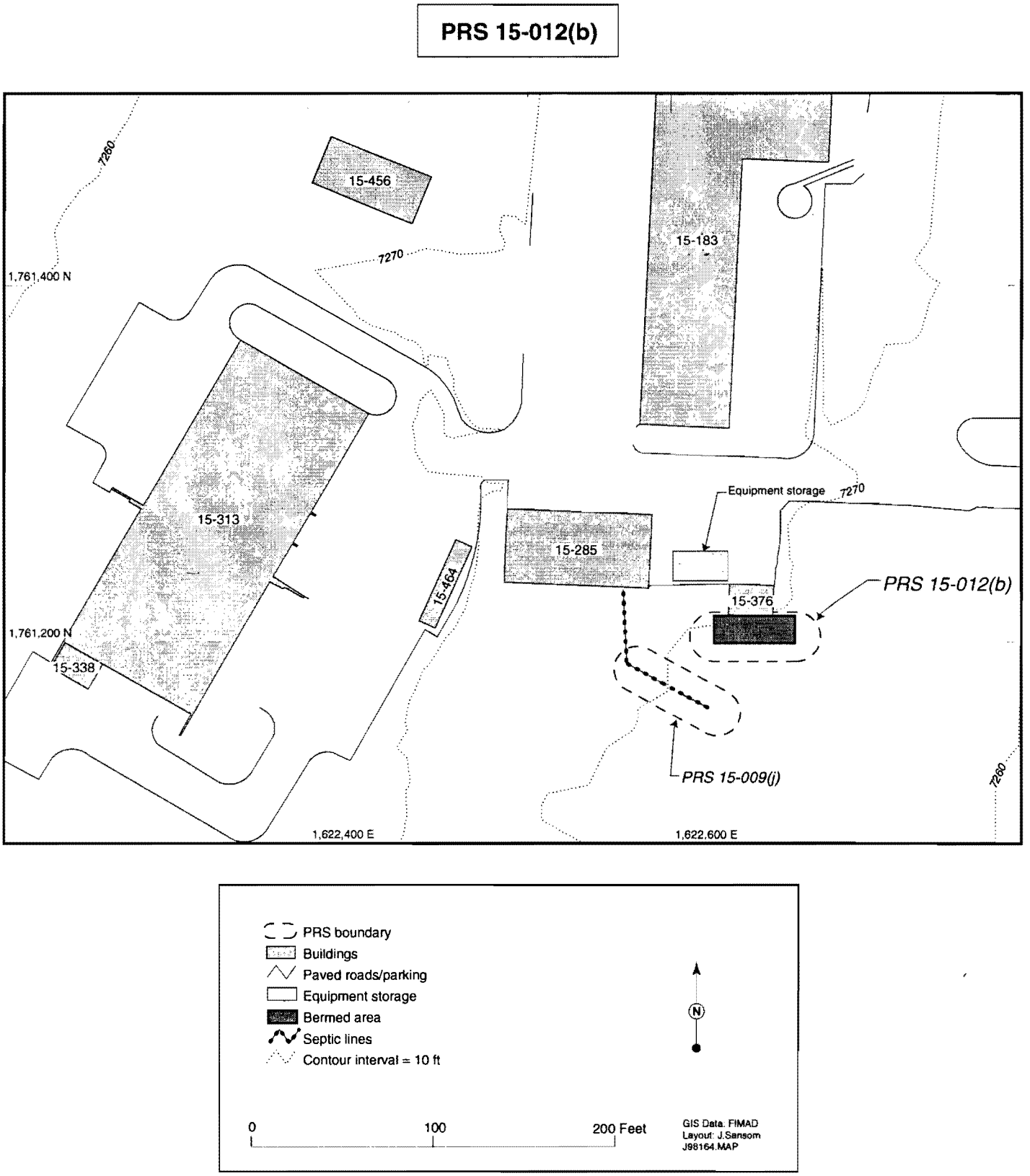


Figure 2.2-1. Location of PRS 15-012(b).

Relation to Other PRSs

As shown in Figure 2.2-2, there are other PRSs in the vicinity of PRS 15-012(b). PRS 15-009(j) was a septic tank located approximately 25-50 ft west of the wash area. This septic tank received wastewater from Building 15-285 and either was emptied or discharged to seepage pits. Although the wash area was slightly downgradient from the septic system at 15-009(j), the potential releases from 15-009(j) were subsurface and the chemicals detected in the soil and tuff at this PRS were VOCs rather than the inorganics and uranium detected at 15-012(b). In addition, the septic tank has been removed as part of a separate VCA. Firing Site A-B [PRSs 15-004(b,c)] was located approximately 400-500ft east/southeast of the wash area. This site, which was downgradient from the wash area, has been characterized and remediated and did not influence PRS 15-012(b). PRS C-15-002 was a pile of dirt resulting from the excavation of the area where Building 15-285 was built. This excavated dirt pile was located south of the building and, southwest of the wash area, and was removed in 1996. It did not influence the wash area and was recommended for NFA in the RFI Work Plan. The other PRSs in the general area are either behind buildings or at a distance and did not influence PRS 15-012(b).

Environment

The surface soil at PRS 15-012(b) is listed as Carjo Loam (see Appendix B). The depth to consolidated tuff in this area of the Laboratory is greater than 6 ft, based on the hand augering conducted during the VCA at PRS 15-009(j), which is about 50 ft southeast of this PRS. The surface slope is listed in the AP 4.5 assessment as less than 10%, and is away from Cañon de Valle toward the east.

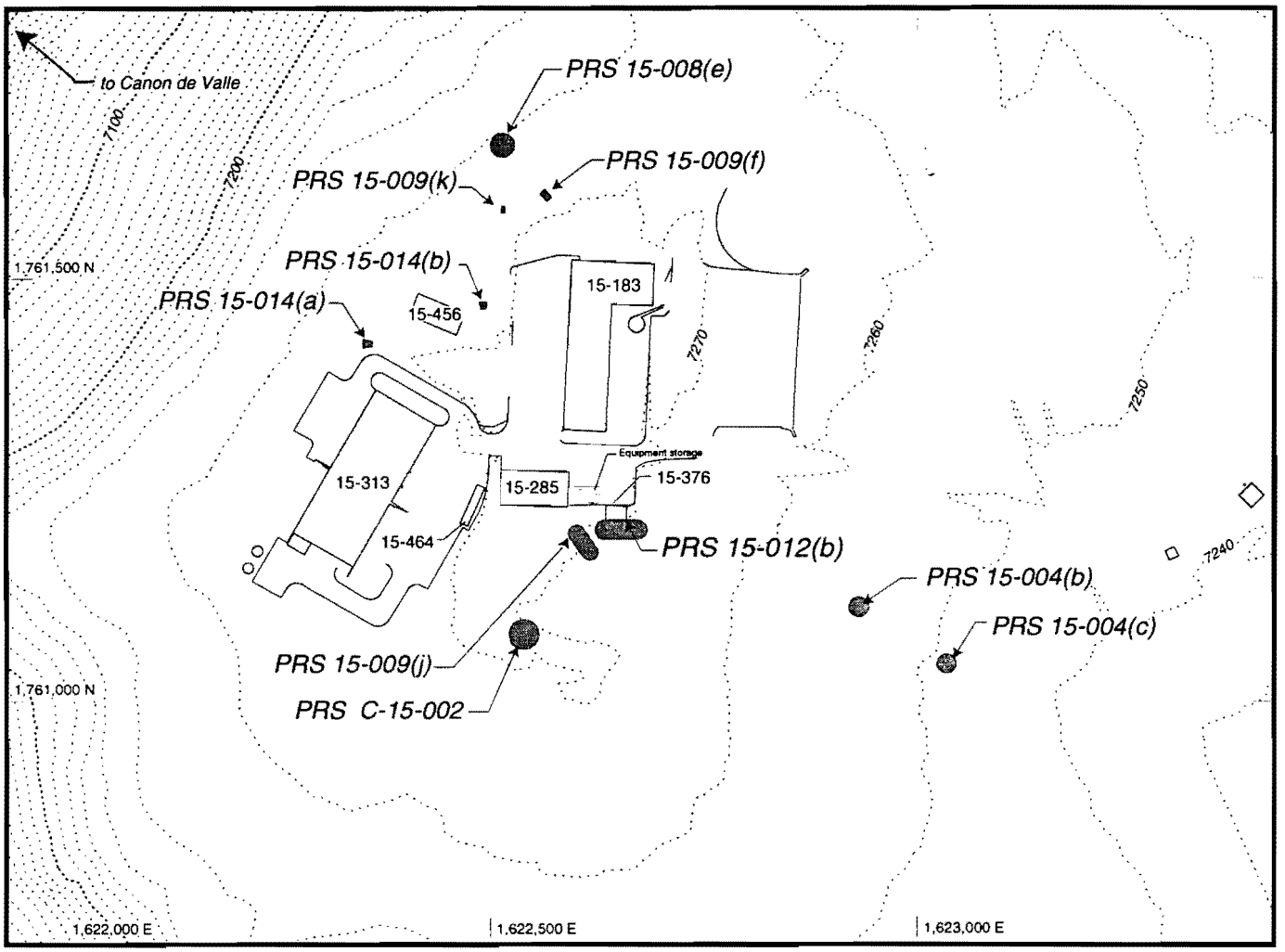
Prior to the VCA, the site was primarily grasslands. The surrounding area is a combination of developed, industrial areas (parking and storage) to the north, and grasslands with scattered pinon-juniper to the south. The AP-4.5 assessment (conducted in August 1997) estimated percent groundcover as 0-25%, and the ecological scoping listed the vegetative cover as 10% following the VCA. There was no potential for stormwater run-on to reach the interior of the wash area because the site was surrounded by an earthen berm. There were no visible signs of erosion or channelization at the site, no evidence of runoff, and no trash. The AP4.5 erosion matrix score was 15.3, with score of 13.0 for ground and canopy cover (Appendix B).

Stormwater runoff in the area around PRS 15-012(b) drains into the Potrillo Canyon watershed area. There are no wetlands, springs, or streams affected by PRS 15-012(b). A search of Facility for Information Management, Analysis, and Display (FIMAD) showed two springs within TA-15, Hollow Spring in Cañon de Valle, and WC 6.25 Spring, slightly downgradient from the confluence of Cañon de Valle and Water Canyon. Hollow Spring is approximately 1275 ft north of PRS 15-012(b), and spring WC 6.25 is approximately 4200-ft southeast of PRS 15-012(b). Neither of these springs are in Potrillo Canyon. There are no water wells in TA-15, nor are any groundwater or surface water monitoring stations present. The depth to the regional aquifer is estimated to vary from about 875 ft to over 1100 ft (LANL 1993, ER ID 20946; section 3.5.3.2).

Cultural and Biological Resources

Appendix E of the RFI Work Plan (reproduced here as Appendix B-5.0) lists species of potential concern that might be present within TA-15. The cultural survey from the RFI Work Plan (reproduced here as Appendix B-6.0) lists archeological sites at TA-15, 80 of which are described as being "eligible for inclusion on the National Register." A site-specific review of PRS 15-012(b) (Appendix B-5.1) lists it as being entirely within a T&E species habitat buffer zone. The Ecological Scoping Checklist is included in Appendix F. A site-specific review of PRS 15-012(b) (Appendix B-6.0-1) lists it as being within 150 ft or more of cultural sites. The RFI activities at the PRS did not affect the archeological sites or the T&E habitat because of the time of year when the work was performed and because there are no cultural resources in the immediate vicinity of the PRS itself.

PRS 15-012(b)



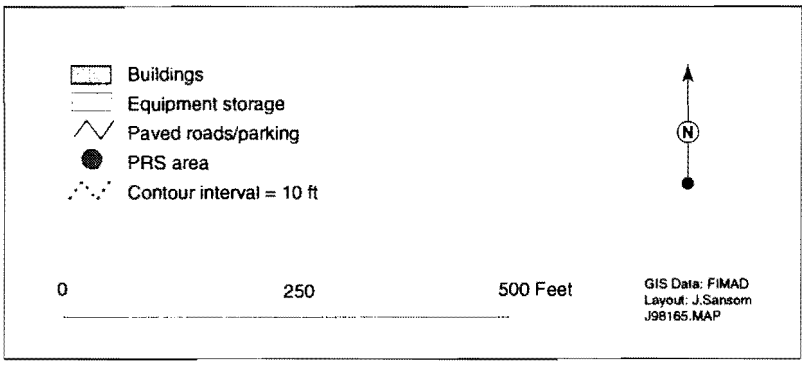


Figure 2.2-2. Location of PRSs in the vicinity of PRS 15-012(b).

2.2.2 Operational History

PRS 15-012(b) was in use from the late 1970s until the early 1980s. It was abandoned in-place and fenced off as a radiological control area. During operation, the wash area received debris and wash water from the process of cleaning large metal spheres used in explosive device testing. The area did not overflow during working operations or rain events (London, 1998, ER ID 59359; Appendix K). There are no records on the amount of debris deposited in the wash area. Once deposited in the wash area the material was not recovered or reused.

2.3 Investigatory Activities

2.3.1 Summary

Section 2.3 describes the investigatory activities for PRS 15-012(b), including previous investigations (Section 2.3.2), the preliminary conceptual model that guided the RFI fieldwork (Section 2.3.3), and the RFI field activities (Section 2.3.4.2). A review of the RFI data is also presented (Section 2.3.4.3), followed by a description of how the conceptual model was revised based on information obtained during the RFI (Section 2.3.5).

2.3.2 Previous Investigations

The wash area was surveyed prior to the RFI with hand-held radiation meters and was found to be radioactively contaminated (LANL 1993, ER ID 20946). However, the levels detected were not quantified. This information supported the assumption that uranium was a primary contaminant of the area from the site activities.

2.3.3 Preliminary Conceptual Model

PRS 15-012(b) was a soil-bermed area located southeast of Building TA-15-285 bordered on the north by an asphalt parking lot and an active storage area. Within this bermed area, the explosives groups (DX Division) used water to rinse out heavy-walled steel spheres, suspended from a crane, that were used to contain explosive tests. The debris and wash water from the cleaning process were deposited within the bermed area. The debris would contain several metals as COPCs: uranium, beryllium, and lead. Because the tests were designed to fully consume the high explosives and no visible pieces were observed, HE were not considered COPCs.

Because the site was surrounded by an earthen berm, most or all of the wash water and debris from the steel spheres should have been confined within the bermed area. The ground has a slight gradient to the east (1-2%) with no visible signs of erosion or channelization. There is little evidence of shallow perched or alluvial aquifers within this portion of TA-15, and the regional aquifer is approximately 875 ft to 1100 ft beneath TA-15.

The fate and distribution of chemicals in the environment are determined by several variables that can interact in numerous ways, including the physicochemical properties of the individual chemical, and the physical transport systems, such as rainwater or snow melt runoff. The physicochemical properties such as water solubility, soils adsorption, and vaporization are all important in determining the routes by which a metal can be distributed throughout the environment. In general, metallic cations are strongly adsorbed to soil, particles, especially if the soil is not too acid (Brady 1974, ER ID 58203; page 565). Adsorption to particulate matter is a major mechanism by which chemicals are removed from solution and is dependent upon the type of soil. Vaporization from soil and water is a function of the vapor pressure of a chemical, as well as temperature, degree of adsorption, soil properties, and soil water content. (Klaassen et. al, 1986, ER ID 59093; page 827-828). Metals, however, are not among the volatile or semivolatile chemicals. Therefore, inorganic chemicals would most likely be bound to the soil and move in the system via transport of soil particles by water as opposed to move in the air due to volatilization or move in the water as dissolved chemicals. Based on this information and the site conditions at this PRS, it appears unlikely that the contamination present at the site would have been transported off-site.

Investigatory Approach

Based on the site conditions and the unlikely potential for contaminants to migrate off-site, surface (0-6 inches) and subsurface (18-24 inches) samples were collected during the RFI within the bermed area. The subsurface samples were collected directly beneath the surface samples because of the wash water's tendency to pool and settle. Soil samples with the highest concentrations of radionuclides or metals (as determined by field analysis) were analyzed by off site analytical laboratories. The RFI sampling did not investigate the area outside the berm because it was assumed from the operational history that the highest concentrations of materials would be within the bermed area.

2.3.4 Field Investigation and Data Evaluation

2.3.4.1 Summary

Section 2.3.4 describes the RFI field investigation and data evaluation for PRS 15-012(b). The field investigation is discussed in Section 2.3.4.2, and the data review is included in Section 2.3.4.3. Figure 2.3-2 shows the location of the analytes detected in the wash area.

2.3.4.2 Field Investigation

The following information is a summary of Section 4.6.2, pages 4-86 to 4-87 of the RFI Report for OU 1086 (ER Project 1995, ER ID 50294).

The objectives of the RFI sampling were to determine the nature, concentrations, and vertical extent of the COPCs. Six sampling locations were chosen based on field radiation screening in accordance with the RFI Work Plan (LANL 1993, ER ID 20946). Samples were obtained from the surface and subsurface depths at these six locations. The samples were submitted to a mobile chemistry laboratory for field analysis of uranium, lead, and beryllium. Six samples (surface and subsurface) from three sampling locations with the highest field analytical results were selected for submittal to off site fixed laboratories for analysis of target analyte list (TAL) metals and uranium. (Table 2.3-1).

TABLE 2.3-1
PRS 15-012(b)
SUMMARY OF SAMPLES COLLECTED FOR FIXED LABORATORY ANALYSIS

Location ID	Sample ID	Sample Type	Depth (in)	Media	TAL Metals	Uranium
15-2529	AAB3408	Grab	0-6	Soil	18688*	31639
15-2529	AAB3416	Grab	18-24	Soil	18688	31639
15-2527	AAB3407	Grab	0-6	Soil	18688	31639
15-2527	AAB3417	Grab	18-24	Soil	18688	31639
15-2526	AAB3406	Grab	0-6	Soil	18688	31639
15-2526	AAB3415	Grab	18-24	Soil	18688	31639

* Number in the cells for each analytical suite are request numbers

2.3.4.3 RFI Data Review

(a) Inorganic Chemical Comparison With Background

Six soil samples were collected from the wash area [PRS 15-012(b)] during the RFI and sent to an off-site analytical laboratory for analysis of TAL metals and uranium. The analytical data from the RFI are presented in Appendix D-2.0.

A quality assurance/quality control (QA/QC) assessment of the data from the inorganic and uranium analyses was conducted. The data quality evaluation indicated that there were no QA/QC issues

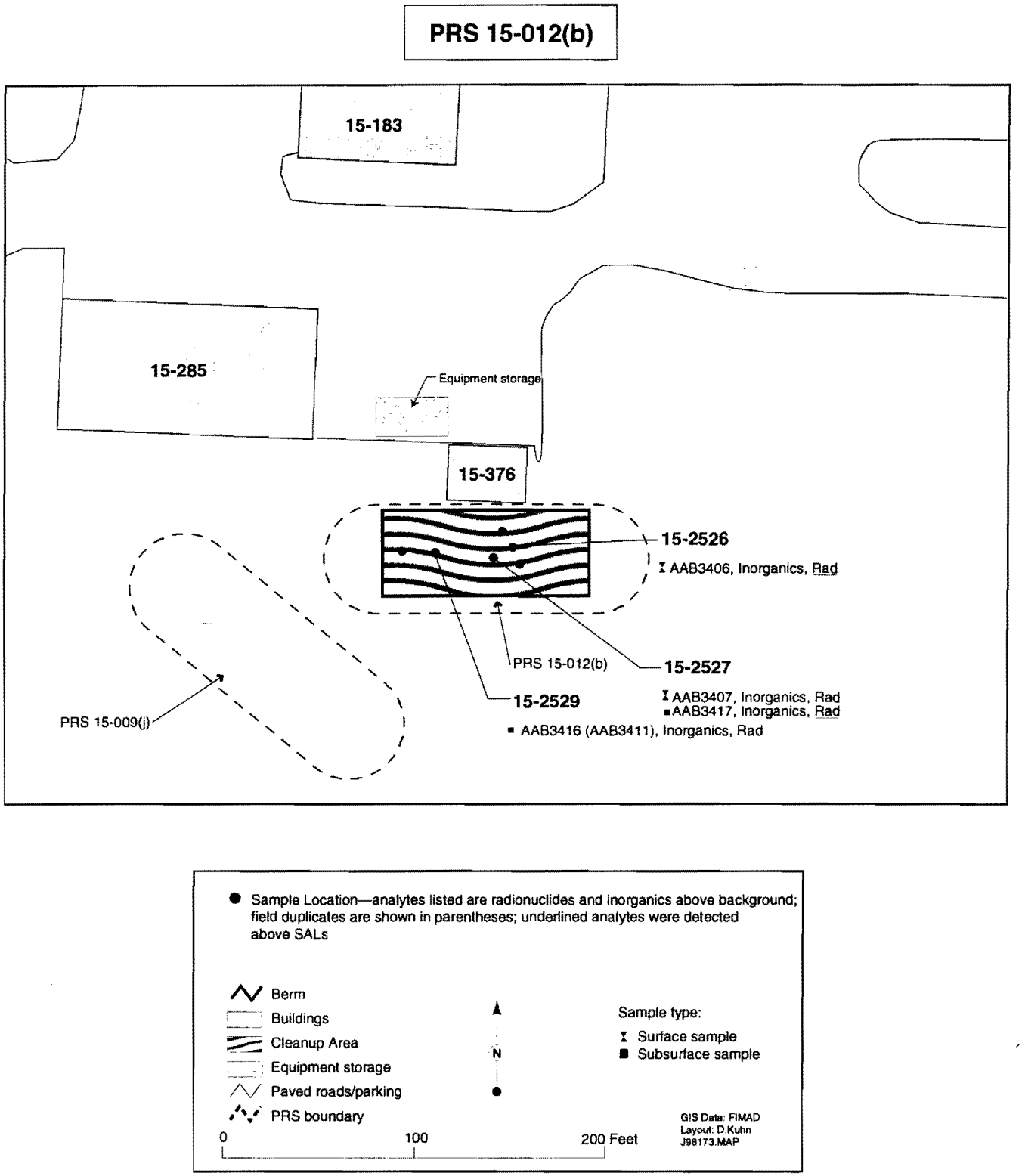


Figure 2.3-2. RFI sample locations and results above background.

associated with the data set and that the data are usable. The inorganic and uranium data were either qualified as U (undetected) or no qualifiers were necessary.

The background values (BVs) used in the background comparisons were values for soil because samples were collected from above the tuff. Uranium was analyzed by kinetic phosphorescence analysis (KPA). Because it was unknown whether the preparation method for the analyses involved partial or total digestion of the sample, the uranium data were compared to the BV for partial digestion (1.82 mg/kg), which is the lower BV for total uranium. The BVs for soil were obtained from "Inorganic and Radionuclide Background Data for Soils, Sediments, and Bandelier Tuff at LANL" (LANL 1998, ER ID 58093). The analytical and sample preparation methods used in analyzing the samples collected during the RFI were comparable to the methods used to determine the background data set with the following exceptions. The antimony, cadmium, and cobalt site data produced by inductively coupled plasma emission spectroscopy (ICPES) resulted in elevated detection limits compared to the background data, which were produced by inductively coupled mass spectroscopy (ICPMS).

The frequencies of detection and the reported range of concentrations for detected inorganics and uranium analyzed at PRS 15-012(b) are summarized in Table 2.3-a1. Also included is a summary of those inorganics that were reported as undetected (i.e., less than the estimated detection limit), but had detection limits above the BV. The table only includes data for detected analytes and those analytes with detection limits greater than BVs, while nondetected analytes are included in Appendix D-2.0. Eighteen inorganics were detected in at least one soil sample. Six inorganics (beryllium, cadmium, copper, lead, mercury, and uranium) were detected above the soil BVs. Cadmium and mercury were also undetected but had detection limits above the BVs in four samples and one sample, respectively (Table 2.3-a1). The other inorganics were either undetected with detection limits below the BVs or detected below the soil BVs in the samples collected from the wash area. Two inorganics (antimony and cobalt) were undetected in all of the soil samples, but had detection limits above their respective soil BVs in six samples and one sample, respectively (Table 2.3-a1). The elevated detection limits were the result of the analytical methods [ICPES and cold vapor atomic absorption (CVAA)] and were not the result of matrix interference or sample dilution.

TABLE 2.3-a1
PRS 15-012(b)
FREQUENCY OF DETECTED INORGANIC CHEMICALS

Analyte	Media	Number of Samples Analyzed	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Values[b]
Aluminum	Soil	6	6	18400 - 25700	29200	0/6
Antimony	Soil	6	0	[3.9 - 4.1]	0.83	DL>BV[c]
Arsenic	Soil	6	6	3.3 - 4.6	8.17	0/6
Barium	Soil	6	6	193 - 224	295	0/6
Beryllium	Soil	6	6	1.3 - 27.6	1.83	4/6
Cadmium	Soil	6	2	[0.68] - 1.3	0.4	2/6 DL>BV[c] (for 4 of 6 results)
Calcium	Soil	6	6	2500 - 3050	6120	0/6
Chromium	Soil	6	6	10.3 - 13.6	19.3	0/6
Cobalt	Soil	6	0	[7.2 - 8.9]	8.64	DL>BV[c] (for 1 of 6 results)
Copper	Soil	6	6	10.8 - 61.1	14.7	3/6
Iron	Soil	6	6	13200 - 16900	21500	0/6
Lead	Soil	6	6	14.6 - 180	22.3	4/6

TABLE 2.3-a1
PRS 15-012(b)
FREQUENCY OF DETECTED INORGANIC CHEMICALS
(Concluded)

Analyte	Media	Number of Samples Analyzed	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Values[b]
Magnesium	Soil	6	6	2380 - 3050	4610	0/6
Manganese	Soil	6	6	451 - 536	671	0/6
Mercury	Soil	6	1	[0.11] - 0.16	0.1	1/6 DL>BV[c] (for 5 of 6 results)
Nickel	Soil	6	6	9.9 - 12.5	15.4	0/6
Potassium	Soil	6	6	2590 - 2890	3460	0/6
Vanadium	Soil	6	6	23 - 31	39.6	0/6
Uranium	Soil	6	6	3.9 - 272	1.82	6/6
Zinc	Soil	6	6	31.9 - 38.5	48.8	0/6

[a] Values in square brackets indicate nondetected results.
[b] Value is the ratio of the number of detects exceeding the BV to the number of analyses.
[c] Detection limit for this analyte exceeded the background value.

The samples in which inorganics were detected or had detection limits above their BVs are presented in Table 2.3-a2. The inorganics that were either detected below their BVs or had detection limits less than their BVs were not evaluated further. Because the RFI sample data sets did not have enough samples to do a statistical comparison to the background data sets, the site data were compared to the range of BVs for the inorganics detected above background. The comparison of the detected concentrations of beryllium, copper, lead, and uranium to the ranges of BVs for each inorganic indicated that 2-6 concentrations were outside of the range of soil BVs (0.09 - 3.95 mg/kg, 0.6 - 16 mg/kg, 4 - 28 mg/kg, and 0.2 - 3.6 mg/kg, respectively). A comparison of the detected concentrations and reported detection limits for cadmium to the range of detected values and nondetects in the background data set indicated that the cadmium values were within the range of detected BVs (0.6 - 2.6 mg/kg) and the range of detection limits (0.4 - 2.3 mg/kg). Similarly, the high detection limit for cobalt (8.9 mg/kg) in one sample was within the range of detected values in the background data set for this inorganic (1 - 9.5 mg/kg). Comparison of the reported detection limits for antimony to the range of nondetects in the background data set for this inorganic indicated that the antimony detection limits were outside the range of nondetected values (0.2 - 1.5 mg/kg). Mercury, which does not have a background data set, cannot be evaluated in this fashion. Therefore, based on the comparison to background, antimony, beryllium, copper, lead, mercury, and uranium were identified as COPCs (Table 2.3-a3) and carried forward to the screening evaluation, Section 2.4, Site Assessments.

TABLE 2.3-a2
PRS 15-012(b)
INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES[a]

Analyte	Location ID	Sample ID	Sample Concentration (mg/kg)[b]	Background Value (mg/kg)	Media	Depth (in)
Antimony	15-2526	AAB3406	3.9(U)	0.83	Soil	0-6
	15-2526	AAB3415	3.9(U)		Soil	18-24
	15-2527	AAB3407	3.9(U)		Soil	18-24
	15-2527	AAB3417	4.1(U)		Soil	0-6

TABLE 2.3-a2
PRS 15-012(b)
INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES[a]
(Concluded)

Analyte	Location ID	Sample ID	Sample Concentration (mg/kg)[b]	Background Value (mg/kg)	Media	Depth (in)
Antimony	15-2529	AAB3408	4.1(U)	0.83	Soil	18-24
	15-2529	AAB3416	4.1(U)		Soil	0-6
Beryllium	15-2526	AAB3406	8.2	1.83	Soil	0-6
	15-2527	AAB3407	2.7		Soil	18-24
	15-2527	AAB3417	27.6		Soil	0-6
	15-2529	AAB3416	6.3		Soil	18-24
Cadmium	15-2526	AAB3406	1.3	0.4	Soil	0-6
	15-2526	AAB3415	0.92(U)		Soil	18-24
	15-2527	AAB3407	0.99(U)		Soil	18-24
	15-2527	AAB3417	0.81(U)		Soil	0-6
	15-2529	AAB3408	1.2		Soil	18-24
	15-2529	AAB3416	0.68(U)		Soil	0-6
Cobalt	15-2529	AAB3408	8.9(U)	8.64	Soil	18-24
Copper	15-2526	AAB3406	27.4	14.7	Soil	0-6
	15-2527	AAB3417	61.1		Soil	0-6
	15-2529	AAB3416	22		Soil	0-6
Lead	15-2526	AAB3406	27.3	22.3	Soil	0-6
	15-2527	AAB3407	23.8		Soil	18-24
	15-2527	AAB3417	180		Soil	0-6
	15-2529	AAB3416	104		Soil	0-6
Mercury	15-2526	AAB3406	0.11(U)	0.1	Soil	0-6
	15-2526	AAB3415	0.11(U)		Soil	18-24
	15-2527	AAB3407	0.16		Soil	18-24
	15-2527	AAB3417	0.12(U)		Soil	0-6
	15-2529	AAB3408	0.12(U)		Soil	18-24
	15-2529	AAB3416	0.12(U)		Soil	0-6
Uranium	15-2526	AAB3406	172.5	1.82	Soil	0-6
	15-2526	AAB3415	4.1		Soil	18-24
	15-2527	AAB3407	53		Soil	18-24
	15-2527	AAB3417	272		Soil	0-6
	15-2529	AAB3408	3.9		Soil	18-24
	15-2529	AAB3416	90		Soil	0-6

[a] Descriptions of the analytical methods used for this PRS can be found in Appendix C-1, Table C-1.0-1. Detection limits can be found in Appendix D-1, Table D-1.0-1.
[b] Data qualifiers are defined in the Glossary, Appendix A-2.

TABLE 2.3-a3
PRS 15-012(b)
RESULTS OF RFI INORGANIC DATA REVIEW

Analyte	Media	Result	Rationale
Antimony	Soil	Retained	Not detected in any sample. Retained as COPC because sample detection limits exceeded BV and above the upper end of the range of nondetected values in the background data set.
Beryllium	Soil	Retained	Retained as COPC because four sample values exceeded the BV.
Cadmium	Soil	Eliminated	Eliminated because the detected values and the reported detection limits were within the range of detected and nondetected values in the background data set.
Cobalt	Soil	Eliminated	Not detected in any sample. Eliminated as COPC because sample detection limits fall within the range of concentrations in the background data set.
Copper	Soil	Retained	Retained as COPC because three sample values exceeded the BV.
Lead	Soil	Retained	Retained as COPC because four sample values exceeded the BV.
Mercury	Soil	Retained	Retained as COPC because one sample value and five detection limits exceeded the BV.
Uranium	Soil	Retained	Retained as COPC because six sample values exceeded the BV.

Radionuclide Comparison with Background/Fallout Radionuclide Concentrations

Six soil samples were collected during the RFI from the wash area at PRS 15-012(b) in order to determine if contamination was present. All samples were sent to an off-site analytical laboratory for analysis of uranium. The analytical data from the RFI are presented in Appendix D-2.0.

A QA/QC assessment on the data associated with the uranium analyses was conducted. The data quality evaluation indicated that there were no QA/QC issues associated with the data set and that the data are usable. The uranium data were not qualified because no qualifiers were necessary.

The BVs used in the background comparisons were values for soil. Uranium was analyzed by KPA and it was unknown whether the preparation method for the analyses involved partial or total digestion of the sample. As a result, the uranium data were compared to the BV for partial digestion (1.82 mg/kg), which is the lower BV for total uranium. The BVs for the soil were obtained from "Inorganic and Radionuclide Background Data for Soils, Sediments, and Bandelier Tuff at LANL" (Ryti 1998, ER ID 58093). The methods used in analyzing the samples collected during the RFI were comparable to the methods used to determine the background data set.

The frequency of detection and the reported range of concentrations for uranium analyzed at PRS 15-012(b) are summarized in Table 2.3-b1. Comparison of the detected concentrations of uranium to the range of BVs indicated that all six concentrations exceeded the range of soil BVs (0.2 - 3.6 mg/kg) (Table 2.3-b2). Therefore, based on the comparison to background, uranium was identified as a radionuclide COPC (Table 2.3-b3) and carried forward to the screening evaluation, Section 2.4, Site Assessments.

TABLE 2.3-b1
PRS 15-012(b)
FREQUENCY OF DETECTED RADIONUCLIDES

Analyte	Media	Number of Samples Analyzed	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)[a]	Frequency of Detects Above Background Values[b]
Uranium	Soil	6	6	3.9 - 272	1.82	6/6

[a] The BV for uranium is the value for partial sample digestion.
[b] Value is the ratio of the number of detects exceeding the BV to the number of analyses.

TABLE 2.3-b2
PRS 15-012(b)
RADIONUCLIDES DETECTED IN THE WASH AREA

Analyte	Location ID	Sample ID	Sample Concentration (mg/kg)	Background Value (mg/kg)	Media	Depth (in)
Uranium	15-2526	AAB3406	172.5	1.82	Soil	0-6
	15-2526	AAB3415	4.1		Soil	18-24
	15-2527	AAB3407	272		Soil	0-6
	15-2527	AAB3417	53		Soil	18-24
	15-2529	AAB3408	90		Soil	0-6
	15-2529	AAB3416	3.9		Soil	18-24

TABLE 2.3-b3
PRS 15-012(b)
RESULTS OF RFI RADIONUCLIDE DATA REVIEW

Analyte	Media	Result	Rationale
Uranium	Soil	Retained	Retained as COPC because six sample values exceeded the BV.

(b) Evaluation of Organic Chemicals

Laboratory analyses for HEs were not conducted as part of the RFI because they were not identified as potential contaminants in the RFI Work Plan (LANL 1993, ER ID 20941).

(d) Other Applicable Data

XRF and LIBS were used to select samples for laboratory analysis. The data are presented in Appendix D. Correlation between the field analytical and laboratory results was good. (See Appendix C).

2.3.5 Revised Site Conceptual Model After RFI

2.3.5.1 Nature and Extent of Contamination

Based on the RFI sampling results, there were no modifications to the preliminary conceptual model (Section 2.3.3). The purpose of the RFI was to determine whether the area encompassed by the earthen berm was contaminated from the washing operations. The sampling for laboratory analysis was confined to the floor of the sunken bermed area and included surface (0-6 in.) and subsurface (18-24 in.) samples. The analytical results were consistent with the preliminary conceptual model in that beryllium, lead, and uranium were detected above background in the surface and subsurface soils. In addition, copper, and mercury were detected above background as well. Overall, the COPC concentrations decreased with

depth, except for mercury at one location. In screening the site for radioactivity, higher levels were detected in the berm than were detected in the floor of the sunken area. Samples were not collected from the berm and outside the bermed area, and HE was not analyzed by the analytical laboratory during the RFI.

2.3.5.2 Environmental Fate

The RFI sampling of PRS 15-012(b) identified five inorganic chemicals (beryllium, copper, lead, mercury, and uranium) as being present above the BVs. The fate and distribution of these chemicals in the environment are determined by chemical-specific properties, geochemistry of the contaminated media (i.e., soil), and physical transport systems such as runoff, which are described under Section 2.3.3, Preliminary Conceptual Model.

The soil in the area of PRS 15-012(b) is Carjo Loam (see Appendix B to this document and Appendix B to the RFI Work Plan, ER ID 20946), which consists of moderately deep, well-drained soils that formed in material weathered from tuff. These soils are found on nearly level to moderately sloping mesa tops near the Jemez Mountains. Carjo Loam exhibits medium water capacity, medium runoff, slow permeability, and moderate water erosion potential. The soil pH, which is a key factor affecting the ability of these inorganics to adsorb to soil, ranges from neutral at depths less than 51 cm to mildly alkaline at depths of 51-64 cm. Because metals and uranium are not very mobile relative to water (Dragun 1988, ER ID57645); page 158) the extent of contamination would be expected to remain close to the source. Specific details of mobilization are described below.

Beryllium

In most types of soil, beryllium is expected to be tightly adsorbed because it displaces divalent cations that share common sorption sites. Due to its similarity to aluminum, beryllium can be expected to adsorb onto clay surfaces at low pHs and it might remain precipitated as insoluble complexes at higher pHs. At high soil pH, the mobility of beryllium might increase due to formation of soluble polynuclear hydroxide complexes. As a result, beryllium does not dissolve in water but remains bound to soil. Beryllium is, therefore, expected to have limited mobility in soil and is very unlikely to leach from the soil to contaminate the groundwater. (ATSDR 1993a, ER ID 59088)

Copper

Most copper deposited in the soil will be strongly adsorbed and remain in the upper few centimeters of soil. The movement of copper is determined by a variety of physical and chemical interactions with the soil components. In general, copper will adsorb to organic matter, carbonate minerals, clay minerals, or hydrous iron and manganese oxides. Sandy soils with low pH have the greatest potential for leaching. In most temperate soils, the pH, organic matter, and ionic strength of the soil solutions are key factors affecting adsorption. Copper binds to soil much more strongly than other divalent cations and the distribution in the soil solution is less affected by pH than other metals. Consequently, if the soil pH is high, most soils will tie up relatively large quantities of copper and transport would primarily be by movement of soil particles by water (i.e., erosion). (ATSDR 1990a, ER ID 59090)

Lead

Most lead is retained strongly in soil, and very little is transported into surface water or groundwater. Lead is strongly sorbed to organic matter in soil, and although not subject to leaching, it can enter surface waters as a result of erosion of lead-containing soil particulates. Lead can be converted to lead sulfate at the soil surface, and lead sulfate is relatively soluble compared with lead carbonate or phosphate. Lead can also be immobilized by ion exchange with hydrous oxides or clays or by chelation with humic or fulvic acids in the soil. Lead complexes and precipitates in soil and their transformation depend on the soil type. In soil with high organic matter content and a pH of 6-8, lead can form insoluble organic lead complexes. If the soil has less organic matter at the same pH, hydrous lead oxide complexes might form or lead might precipitate out with carbonate or phosphate ions. The downward movement of lead from soil to

groundwater by leaching is very slow under most natural conditions except for highly acidic situations. The conditions that induce leaching are the presence of lead in soil at concentrations that either approach or exceed the cation exchange capacity of the soil, the presence of materials in soil that are capable of forming soluble chelates with lead, and a decrease in the pH of the leaching solution. Leaching of soluble lead from contaminated soil to groundwater can be minimized by the presence of lead carbonate in the soil and maintaining a soil pH of 8-10. (ATSDR 1993b, ER ID 59089)

Mercury

Inorganic mercury compounds added to soil react quickly with the organic matter and clay minerals to form insoluble compounds. Because inorganic mercury sorbed onto particulate material is not readily desorbed, leaching is a relatively insignificant transport process in soils. However, surface runoff is an important mechanism for moving mercury from soil to water, particularly for soils with high humic content. Inorganic mercury can be transformed in the environment to methylmercury by microorganisms present in the soil. This form of mercury is accumulated to a greater extent in biological tissues than the inorganic forms of mercury. The conditions for methylation are strict, and they occur only under a narrow acidic pH range. The rate of methylation also depends on redox potential, composition of microbial populations, availability of mercuric mercury (Hg^{2+}), and temperature. (ATSDR 1993c, ER ID 59091)

Uranium

Uranium's mobility in soil and its transport to other media depend primarily on the properties of the soil such as pH, redox potential, concentration of complexing anions, and sorption properties. The sorption to most soils is such that uranium might not leach readily from the soil surface to groundwater, particularly in soils containing clay and iron oxide. In most soils, uranium might be sorbed due to adsorption or chemisorption or ion exchange or a combination of mechanisms. Any soil property that alters the sorption mechanism will also alter uranium's mobility in soil. Mobility in most soil is minimal when conditions for neutral hydroxy formation is maximal. Anionic complexes of uranium can form at pHs greater than 6 and in the presence of high carbonate or hydroxide concentrations. The mobility of the anionic uranium complexes depends on the nature of the soil; decrease in sorption in soil with little anion-exchange capacity might increase mobility, whereas high anion-exchange capacity might decrease mobility. Uranium mobility has also been increased due to the formation of soluble complexes with chelating agents produced by microorganisms in the soil. (ATSDR 1990b, ER ID 59092)

Summary

Based on the soil type at PRS 15-012(b) and the description of environmental fate and transport presented above, it appears unlikely that the inorganics detected above background at this PRS would have the potential to migrate off-site or leach to groundwater. All of the metals are relatively insoluble and adsorb to particulates, particularly to the clay minerals that are characteristic of this soil family. This, coupled with the medium water capacity, medium runoff, slow permeability, and moderate water erosion potential for Carjo Loam limits, the movement of material is limited. In addition, solubility of these inorganics increases under acidic conditions, while the soil pH for Carjo loam ranges from neutral to mildly alkaline (approximately pH 7-9). Under these conditions, the cations will be bound to soil particles, be relatively immobile, and make downward movement to groundwater unlikely. The presence of an earthen berm around the contaminated area and the relatively level terrain (<10% slope) also inhibited material transport via surface runoff.

2.4 RFI Site Assessments

2.4.1 Summary

A human health screening assessment was conducted based on the results of the RFI. It identified antimony, beryllium, lead, and uranium as COPCs at the wash area. An ecological screening assessment was conducted on the wash area using an ecological screening methodology in place at that time. The results of that screening are not presented in this report because it did not adequately determine potential

ecological impacts (ER Project 1995, ER ID 50294). The PRS was remediated during the VCA to address the contamination identified by the RFI. Human health and ecological screening assessments using the current and appropriate methodologies were conducted as part of the VCA activities.

A LANL-ER-AP-4.5 surface water assessment was also conducted for PRS 15-012(b). The results of this assessment indicate low erosion potential (see Appendix B-4.2.1). No groundwater issues have been identified at the site.

A UST assessment was not performed because there are no USTs at PRS 15-012(b).

2.4.2 Screening Assessments

2.4.2.1 Human Health

(a) Scoping

The PRS is located on DOE-owned land and is removed from public access roads. It lies within the secured boundaries of TA-15, which results in limited and monitored access and egress. The current and future expected land use is industrial. The PRS is adjacent to Building 15-376 and an asphalt parking lot. The individual likely to be exposed would be a Laboratory worker, with exposure occurring via the ingestion, inhalation, and dermal contact pathways.

The human health assessment was based on RFI data and procedures in place at the time. It did not include any VCA data, but triggered the VCA.

(b) Screening Evaluation

The COPCs identified by the data review of the inorganic, organic, and radionuclide sample results [Sections 2.3.4.3 (a), (b), (c)] were compared to screening action levels (SALs) to determine if the chemicals were present at concentrations of potential concern. The SALs used in these comparison are based on a residential scenario calculated using the most current guidance, assumptions, and information provided in *Region 9 Preliminary Remediation Goals 1998* (EPA 1998). The screening evaluation is based on the guidance provided by EPA Region 6 and NMED. The maximum concentration of each COPC was compared to the SAL for radionuclides, the SAL for Class A, B1, or B2 carcinogens, 10X the SAL, for Class C carcinogens, and 0.1 SAL for noncarcinogens if two or more noncarcinogenic COPCs were present.

Based on the BV comparison, six noncarcinogenic COPCs (antimony, beryllium, copper, lead, mercury, and uranium) were carried forward to the screening assessment. Antimony was undetected in all of the soil samples, while mercury was undetected in all but one sample. Beryllium, copper, lead, and uranium were the only other inorganic COPCs detected in the soil above their BVs. Table 2.4-b1 presents the comparison of the maximum concentration of noncarcinogenic COPCs to 0.1 SAL. Copper and mercury were below 0.1 SAL and were eliminated as noncarcinogenic COPCs. Antimony was undetected but had detection limits above 0.1 SAL, and beryllium, lead, and uranium were detected above 0.1 SALs.

TABLE 2.4-b1
PRS 15-012(b)
COMPARISON OF NONCARCINOGENIC CHEMICALS TO SAL

Analyte	Location ID	Sample ID	Media	Depth (in)	Maximum Sample Values (mg/kg)[a]	SAL (mg/kg)	0.1 SAL (mg/kg)
Antimony	15-2527	AAB3417	Soil	0-6	4.1(U)	30	3.0
Beryllium	15-2527	AAB3417	Soil	0-6	27.6	150	15
Copper	15-2527	AAB3417	Soil	0-6	61.1	2800	280

TABLE 2.4-b1
PRS 15-012(b)
COMPARISON OF NONCARCINOGENIC CHEMICALS TO SAL
(Concluded)

Analyte	Location ID	Sample ID	Media	Depth (in)	Maximum Sample Values (mg/kg)[a]	SAL (mg/kg)	0.1 SAL (mg/kg)
Lead	15-2527	AAB3417	Soil	0-6	180	400	40
Mercury	15-2527	AAB3407	Soil	18-24	0.16	22	2.2
Uranium	15-2527	AAB3417	Soil	0-6	272	230	23

[a] Data qualifiers are defined in the Glossary, Appendix A-2.

One radionuclide COPC, uranium, was carried forward from the data review. It was detected in six soil samples above the BV. Isotopic uranium was not analyzed for in any of the samples, so the isotopic ratio could not be determined. However, historical information indicated that only depleted uranium (DU) was used in the explosives testing (London 1998, ER ID 59359; Appendix K). Therefore, the RFI uranium data were compared to the SAL for DU (130 mg/kg) (Table 2.4-b2). Because the maximum detected concentration was approximately twice the SAL, uranium was retained as a COPC.

TABLE 2.4-b2
PRS 15-012(b)
COMPARISON OF RADIONUCLIDES TO SAL

Analyte	Location ID	Sample ID	Media	Depth (ft)	Maximum Sample Value (mg/kg)	SAL (mg/kg)
Uranium	15-2527	AAB3417	Soil	0-6	272	130[a]

[a] The SAL is for depleted uranium.

Carcinogenic COPCs were not identified in the data review of the RFI.

(c) Uncertainty Analysis

The screening assessment is a conservative comparison of the maximum concentrations detected at the site to SALs based on a residential exposure scenario. As presented in the scoping section [Section 2.4.2.1 (a)], this PRS is currently and will remain under Laboratory control. Therefore, the present and future land use for PRS 15-012(b) is industrial. The potentially exposed individual would be a Laboratory worker. Because the exposure frequency and duration for a worker (250 days and 25 years, respectively) are less than for a resident (350 days and 30 years, respectively), the screening assessment is an overestimate of the potential risk from exposure to the COPCs.

Although antimony was not detected in the soil from the wash area during the RFI, the reported detection limits were greater than 0.1 SAL. Facility personnel at TA-15 have indicated that antimony was not used in the experiments conducted inside the steel spheres and, could not therefore be introduced to the soil at the wash area from the washing sphere process (London 1998, ER ID 59359; Appendix K). However, because the detection limits for antimony were elevated by the analytical method, antimony was identified as a COPC to be addressed as part of the VCA.

The available toxicity information [reference doses (RfDs)] for antimony, copper, lead, mercury, and uranium are only for the ingestion of soil, while beryllium has toxicity information for the ingestion and inhalation exposure pathways. Antimony, copper, lead, mercury, and uranium do not have RfDs available for the inhalation pathway and none of the COPCs have RfDs for the dermal pathway. Route extrapolation from the oral to inhalation pathways is not performed for inorganics due to portal of entry effects and known differences in absorption efficiency for the two routes of exposure. Therefore, the

inhalation exposure pathway was not included in calculating the SALs for antimony, copper, lead, mercury, and uranium. In addition, there is much uncertainty regarding the determination of hazards associated with skin contact with soils. It is assumed that dermal toxicity values can be extrapolated from oral values. In doing so, complete (100%) oral absorption was assumed in calculating the SALs for all six COPCs (EPA 1998, ER ID 58751). Therefore, the oral RfDs were used as the dermal RfDs in the SAL calculations.

(d) Interpretation

Antimony, beryllium, lead, and uranium were either detected in the surface soil from the wash area or had detection limits above 0.1 SALs and were therefore identified as COPCs. Based on the results of the RFI, these COPCs might pose an unacceptable risk to human health. In addition, because the extent of lateral contamination from the wash area had not been determined and HE had not been analyzed, further sampling was warranted.

The RFI data were adequate to determine if the wash area was contaminated. However, the extent of any potential contamination beyond the bermed area was not defined during the RFI sampling. The VCA was designed to remediate the area within the berm as well as the berm itself. Both field analysis and laboratory analysis samples were collected from within the wash area following remediation. Additional samples were collected from the area outside of the bermed area after the VCA to determine the lateral extent of any potential contamination (see Section 3.3.3.2, Human Health Screening Assessment).

2.4.2.2 Ecological

An ecological screening assessment was conducted during the RFI using a methodology that was in place at the time. The site was reassessed for potential ecological impacts using the current screening assessment methodology (Kelly et al. 1998, ER ID 57916) as part of the VCA, as described in Section 3.3.3.3, Ecological Screening Assessment.

3.0 REMEDIAL ACTIVITIES AND RESULTS OF SAMPLING

The remedial action for this PRS consisted of removing the contaminated soils from the wash area and the surrounding area, collecting samples to determine the extent of contamination, and collecting samples to confirm the cleanup goals were met. The remediation was accomplished using a backhoe with a front-end loader to remove the contaminated soil and place it into roll-off bins.

3.1 Cleanup Levels

Because of the current and future land use for the area in which the PRS is located, an industrial exposure scenario is the most appropriate for determining the potential risk posed by contaminants. The most likely exposed individual under this scenario would be a Laboratory worker with potential exposure from ingestion, inhalation, and dermal contact. The noncarcinogenic industrial cleanup levels for antimony, beryllium, lead, and uranium for the wash area were calculated using the most current toxicity values, standard default values, and equation available (EPA 1998, ER ID 58751). The values, parameters, and equation used are provided in Appendix F-1.0. The industrial cleanup level for depleted uranium was derived using the RESRAD 5.7 computer model, which includes the most current exposure parameters. The computer printouts of the RESRAD calculations are provided in Appendix F-1.0. The industrial cleanup levels for antimony, beryllium, lead, and uranium are presented in Table 3.1-1. The individual cleanup levels for antimony, beryllium, and lead were employed because the target organs and/or toxicity endpoints were different for the noncarcinogenic COPCs; therefore, there should not be any toxicity interactions among the noncarcinogenic COPCs. According to the IRIS database, antimony affects longevity, blood glucose levels, and cholesterol; beryllium causes lesions in the small intestine; and lead causes neurological effects via the blood. The industrial radiological cleanup level presented for depleted uranium was employed because the value is lower than the industrial cleanup level for noncarcinogenic effects. In addition, the cleanup levels based on a residential scenario are provided in Table 3.1-1 for comparison.

Based on the RFI sample results, the maximum detected concentrations of the COPCs did not exceed the current industrial cleanup levels for this PRS. However, the extent of contamination was not determined during the RFI, and field analysis with XRF and a pancake probe indicated potentially higher

TABLE 3.1-1
PRS 15-012(b)
CLEANUP LEVELS FOR INDIVIDUAL COPCS

COPC	Maximum Sample Values (mg/kg)	Industrial Cleanup Levels (mg/kg)		Residential Cleanup Levels (mg/kg)	Rationale
Antimony	4.1(U)	750		30	Noncarcinogen (based on a hazard quotient of 1.0)
Beryllium[a]	27.6	3400	11	150	Noncarcinogen (based on a hazard quotient of 1.0)
Lead	180	1000		400	Noncarcinogen (based on a hazard quotient of 1.0)
Uranium	272	5100		230	Noncarcinogen (based on a hazard quotient of 1.0)
Uranium (depleted)	272	1090		394	Radionuclide (based on a dose limit of 15 mrem/yr)

[a] The industrial cleanup levels for beryllium are the current (1998) value using the most recent toxicity information and default values (EPA 1998 ER ID 58751) and based on a hazard quotient of 1.0 versus the cleanup value proposed in the VCA Plan based on a cancer risk of 10^{-5}, respectively.

concentrations of uranium in the earthen berm. In addition, the cleanup level of 11 mg/kg for beryllium based on a cancer risk of 10^{-5} proposed at the time of the VCA (September 1997) was much lower than the current industrial cleanup level of 3400 mg/kg based on a hazard quotient of 1.0 (EPA 1998, ER ID 58751). This is because the toxicity for beryllium was re-evaluated by the EPA and it was determined to be a noncarcinogen for the ingestion and dermal pathways and a carcinogen only for the inhalation of fumes. Although the site was remediated under a proposed cleanup level of 11 mg/kg for beryllium, the inhalation of fumes is not relevant for the exposure scenario at this PRS because there is no mechanism for producing fumes. Therefore, the revised cleanup level (3400 mg/kg) is also presented in the above table. The confirmatory sampling of this PRS indicated that beryllium was detected below background following the VCA activities at the wash area (see Section 3.3, Confirmatory Sampling Results below).

3.2 Remedial Implementation

Summary

Field activities began on August 20, 1997. Weeds were removed from the site and roll-off bins were staged outside the work area. The site was divided into grids, and surface and subsurface soil samples were collected and field screened in each grid location on August 21 and 22, 1997, to determine roughly the number of roll-off bins necessary to contain the removed soil. Contaminated soils (including the berm) were removed from the site and placed in roll-off bins from August 25 through August 27, 1997. Confirmatory samples were collected on August 28, 1997, after soil was removed and to analyze for inorganics and isotopic uranium at an off site analytical laboratory. Additional confirmatory samples were collected in October 1997, to analyze for HE. The HE samples were necessary to determine if HE or its residue was present on site. Waste characterization sampling was conducted on September 9, 1997. In July 1998, samples were collected to confirm the absence of contamination outside the former bermed area as well as to obtain lower detection limits for antimony. Additional antimony samples were collected because previous analytical methods did not use acceptable detection limits. Figure 3.2-1 shows the site boundaries, the area remediated, and the confirmatory sampling locations. Table 3.2-1 is a list of samples collected during the VCA effort.

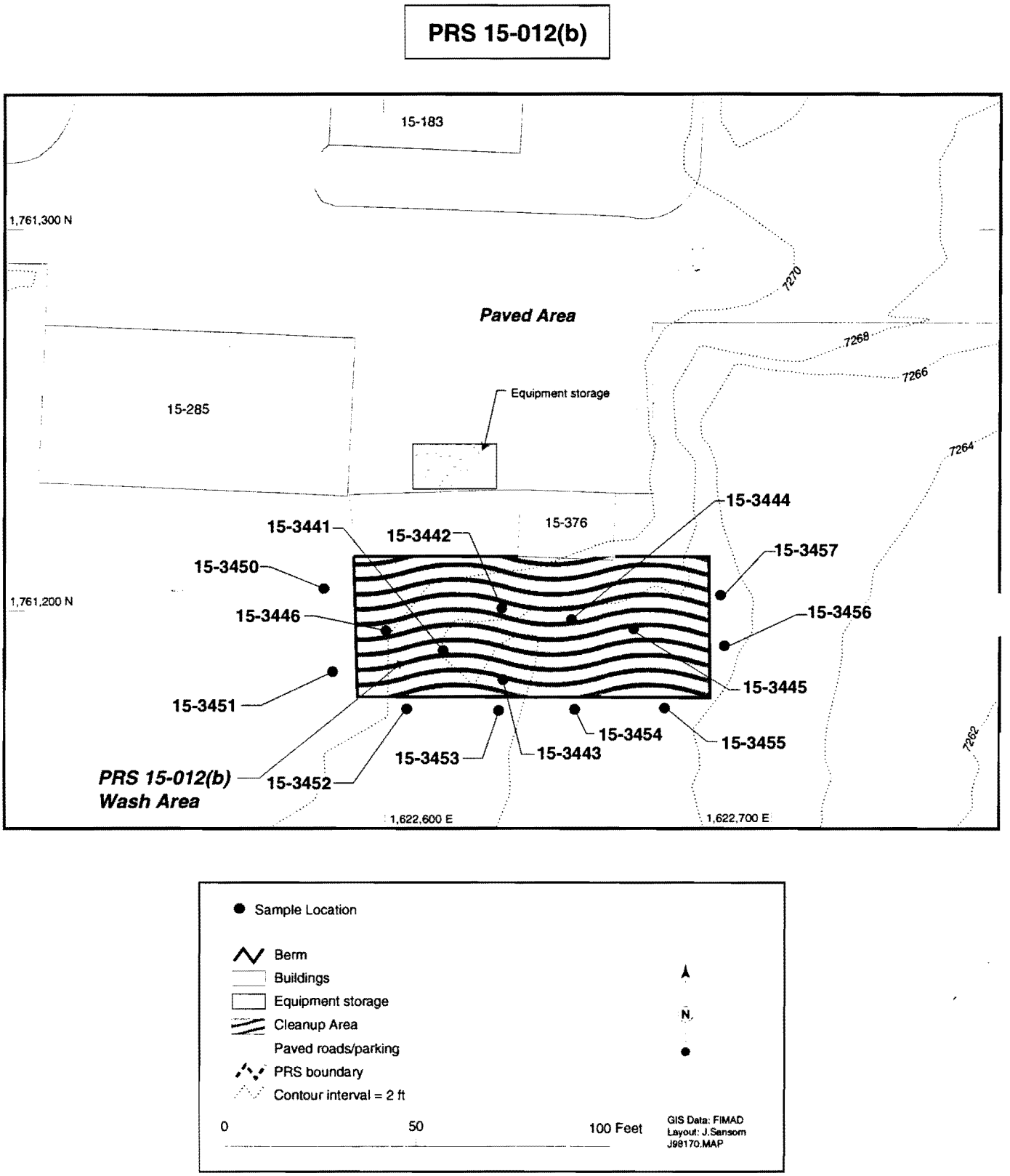


Figure 3.2-1 PRS 15-012(b), Site map of confirmatory sample locations

TABLE 3.2-1
PRS 15-012(b)
SUMMARY OF SAMPLES COLLECTED DURING THE VCA FOR FIXED-LABORATORY ANALYSIS

Location ID	Sample ID	Sample Type	Depth (in.)	Media	TAL Metals	Isotopic Uranium	HE	Antimony
Inorganic and Uranium Confirmatory Samples								
15-3441	0215-97-0105	Grab	0-6	Surface soil	3642R*	3643R	N/A	N/A
15-3442	0215-97-0106	Grab	0-6	Surface soil	3642R	3643R	N/A	N/A
15-3443	0215-97-0107	Grab	0-6	Surface soil	3642R	3643R	N/A	N/A
15-3444	0215-97-0108	Grab	0-6	Surface soil	3642R	3643R	N/A	N/A
15-3445	0215-97-0109	Grab	0-6	Surface soil	3642R	3643R	N/A	N/A
15-3446	0215-97-0110	Grab	0-6	Surface soil	3642R	3643R	N/A	N/A
15-3446	0215-97-0111	Dup	0-6	Surface soil	3642R	3643R	N/A	N/A
HE Confirmatory Samples								
15-3441	0215-97-0126	Grab	0-6	Surface soil	N/A	N/A	3764R	N/A
15-3442	0215-97-0127	Grab	0-6	Surface soil	N/A	N/A	3764R	N/A
15-3443	0215-97-0128	Grab	0-6	Surface soil	N/A	N/A	3764R	N/A
15-3444	0215-97-0129	Grab	0-6	Surface soil	N/A	N/A	3764R	N/A
15-3445	0215-97-0130	Grab	0-6	Surface soil	N/A	N/A	3764R	N/A
15-3446	0215-97-0131	Grab	0-6	Surface soil	N/A	N/A	3764R	N/A
15-3446	0215-97-0132	Dup	0-6	Surface soil	N/A	N/A	3764R	N/A
Extent Samples								
15-3450	RE-15-98-0001	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3450	RE-15-98-0002	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3451	RE-15-98-0003	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3451	RE-15-98-0004	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3452	RE-15-98-0005	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3452	RE-15-98-0006	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3453	RE-15-98-0007	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3453	RE-15-98-0008	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3454	RE-15-98-0009	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3454	RE-15-98-0010	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3455	RE-15-98-0011	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3455	RE-15-98-0012	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3456	RE-15-98-0013	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3456	RE-15-98-0014	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3457	RE-15-98-0015	Grab	0-6	Surface soil	4400R	4401R	4399R	N/A
15-3457	RE-15-98-0016	Grab	18-24	Subsurface soil	4400R	4401R	4399R	N/A
15-3445	RE-15-98-0017	Grab	30-36	Subsurface soil	4400R	4401R	4399R	N/A
15-3445	RE-15-98-0018	Grab	54-60	Subsurface soil	4400R	4401R	4399R	N/A
Antimony Reanalysis								
15-3441	RE-15-98-0019	Grab	0-6	Surface soil	N/A	N/A	N/A	4475R
15-3442	RE-15-98-0020	Grab	0-6	Surface soil	N/A	N/A	N/A	4475R
15-3443	RE-15-98-0021	Grab	0-6	Surface soil	N/A	N/A	N/A	4475R
15-3444	RE-15-98-0022	Grab	0-6	Surface soil	N/A	N/A	N/A	4475R
15-3445	RE-15-98-0023	Grab	0-6	Surface soil	N/A	N/A	N/A	4475R
15-3446	RE-15-98-0024	Grab	0-6	Surface soil	N/A	N/A	N/A	4475R

N/A Not Applicable
* Numbers in the cells for each analytical suite are request numbers.

Details of Remedial Activities

The vegetation in the proposed cleanup area was removed prior to conducting remedial activities. A health and safety screening was performed, which consisted of a radiological field walk-over survey and HE soil spot testing. The radiological field walk-over survey was performed prior to intrusive work (using a pancake probe); no radioactivity was detected above the health and safety action level of 5,000 dpm/100 cm^2, as referenced in the radiological work permit (RWP). Prior to collecting waste screening samples, surface soil samples were collected and field analyzed for HE, using the LANL DX Division Field Spot Test Kit, to ensure personnel safety. All 40 HE spot test results were negative.

The site, including the berm and surrounding area, was divided into 8-ft-square grids (see Figure 3.2-2). The field screening grid layout consisted of 40 individual grids in a 4 x 10 configuration encompassing an area of 40 ft x 80 ft.

Field screening was conducted and visual observations were made and these were used to determine the approximate extent of contamination and to estimate the volume of waste to be generated. The center of each grid was sampled at two depths (0-6 in and 18-24) and field screened for uranium and radioactivity, for a total of 80 samples. The soil samples were screened in the field using both a Ludlum 2121 with a 2x2 sodium iodide detector to determine the radioactivity of the sample in pCi/g and an XRF meter to determine the concentration of uranium. During sampling activities, DU was visible in grids 25, 15, 26, and 16. Based on these results, it was determined that considerable oxidized DU existed in the soil matrix (similar to firing sites).

With the results of the field screening and the observation of visible DU at the site, the cleanup criterion used in the field was to remove the radioactively-contaminated soil to background levels, using field instruments (pancake probe) to guide the removal. The decision to remove contaminated soil to near background level proved to be reasonable. Based on field observation, once the visible DU was removed, very little further excavation (typically less than 4 inches in depth) was required to reduce the residual radioactivity to near background. With this conservative approach, it was assumed based on the RFI results that the beryllium and lead in the soil would also be removed to below the respective cleanup levels because the highest detected concentrations of these COPCs were in the same samples. This assumption was also based on the relatively strong adsorption of inorganics to soil particles as described in the revised conceptual model, Section 2.3.2, and subsequently verified by the confirmatory samples that detected beryllium and lead below background, Section 3.3.1(a).

The contaminated soil was removed so as to minimize contaminating clean areas, the personnel, and the equipment (backhoe). The following procedure was used throughout the remediation:

- All excavations started at the south side (clean area) of the areas to be remediated (grids 31 through 40) and proceeded to the north (contaminated area), one grid at a time (thus the backhoe drove only over clean soil during the remediation).
- The soil in each grid was monitored continuously by a radiological control technician (RCT) during excavation using a pancake probe.
- The RCT directed the backhoe to remove the contaminated soil, and resurveyed the area with the pancake probe.
- The RCT determined if the area was clean or contaminated, and redirected the backhoe operator to dig deeper or move north. This continued until the radioactivity within the grid was reduced to near background levels as measured by the pancake probe.

The entire site (40 ft x 80 ft screening grid) was identified as having radioactivity above background. The remediation started at grid 31 (southwest corner), where the top 4 inches of soil was removed. As the excavation proceeded northward, the depth of excavation increased to approximately 12 inches until the northern edge of grid 1 (northwest corner) was reached and no radioactivity above background was detected. Grids 32 to 2, 33 to 3, and 34 to 4 proceeded in this manner, with the depth of excavation varying between 12 and 18 inches. During the remediation of grid number 11, a small amount of radioactive ash was discovered mixed with the soil adjacent to a tree stump approximately 6 inches below grade that necessitated removing both the stump and the surrounding soil. Thus, grid number 11 was expanded approximately 4 ft to the west (Figure 3.2-2). After the section from grid 34 to 4 was excavated, the remediation effort was moved to the southeast corner because DU was present in large amounts in the soil matrix. This allowed the remediation team to work from a less contaminated area toward a more contaminated area, thus reducing the spread of contaminants. Grids 40 to 10, 39 to 9, and 38 to 8 were then excavated. The depth of excavation varied from 8 inches toward the east (with isolated areas excavated to 18 inches) to 24 inches to the west. The excavation continued at grids 37 to 7, 36 to 6, and 35 to 5. These grids contained large amounts of visible DU in the soil matrix. The depth of the excavation in this area varied from 24 inches at the north and south perimeters to 36 inches toward the center.

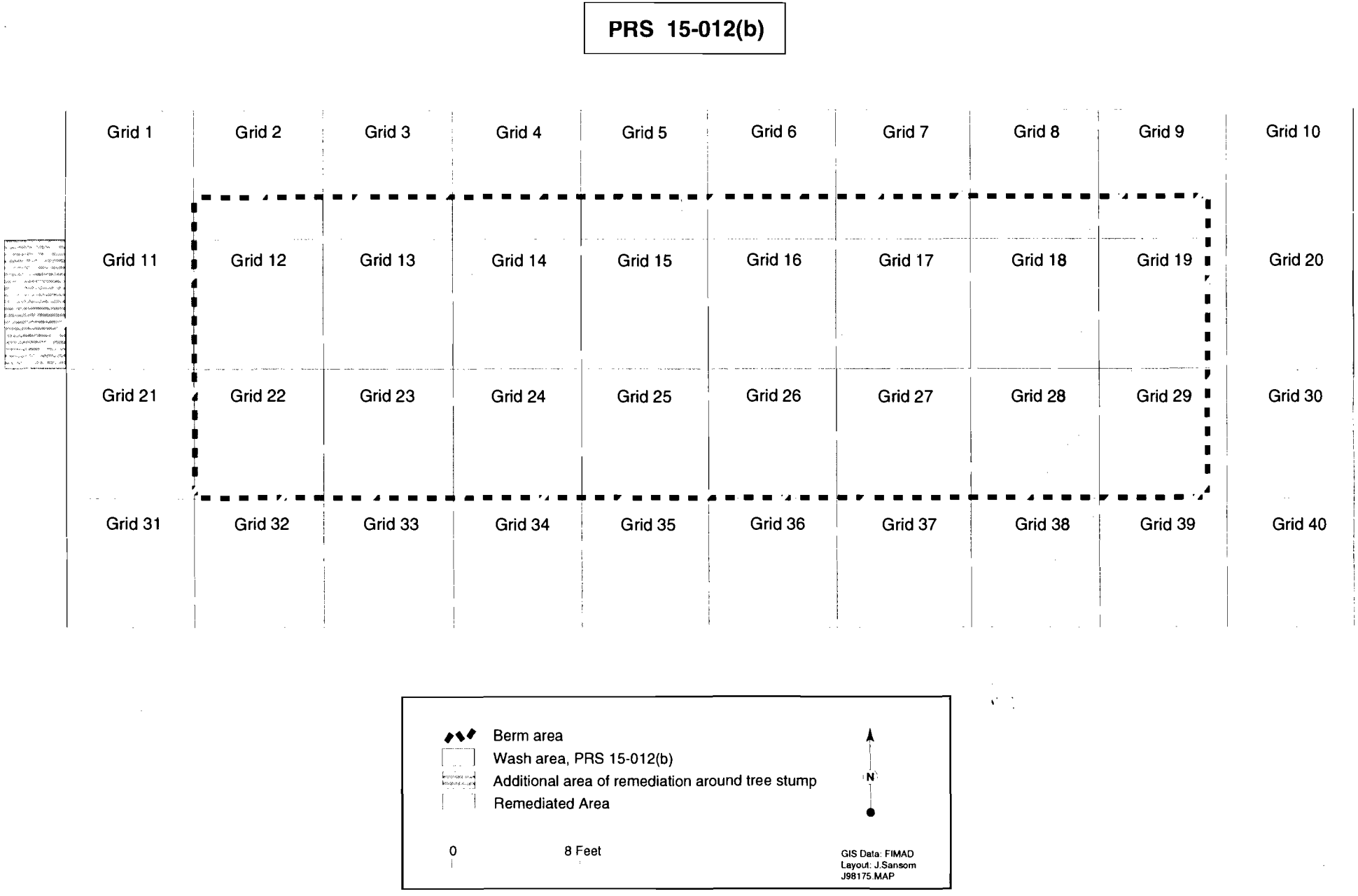


Figure 3.2-2. 40ft x 80ft grid used for field screening of PRS 15-012(b) and surrounding area

During the remediation, the soil berm around the wash area was also removed and placed in the roll-off bins.

After the contaminated soil was removed, a walk-over radiological survey was conducted using a pancake probe at the remediated site, plus an additional 20 ft to the south, east, and west of the site. A radiological survey was not conducted to the north because Building TA-15-376 and an asphalt parking log are located there and no radioactivity was expected. No radioactivity was detected above background readings.

Approximately 128 cubic yards of contaminated soil was removed and placed in 8 roll-off bins. The final VCA site activity consisted of regrading the area with clean base course, which consisted of small cobbles/pebbles and dirt. During excavation, dust was suppressed using a pressurized water sprayer.

A deviation from the VCA Plan involved an enlargement of the size of the grid used for the initial site characterization sampling. The site was divided into 8-ft-square grids (the size of the front-end loader bucket), rather than the 5-ft-square grids described in the VCA Plan (Appendix I). This deviation had no impact on the remediation of this PRS.

3.3 Confirmatory Sampling Results

The confirmatory samples were collected from those locations within the remediated area that had the most extensive excavation as guided by the presence of radioactivity. These locations and the analytes detected are presented in Figure 3.3-1. The confirmatory sample locations and requested analytical suites for each sample are presented in Table 3.2-1. Fourteen confirmatory soil samples, including two field duplicates, were collected from six sample locations within PRS 15-012(b) following the removal of the contaminated soil. All samples were collected from the remaining surface soil (0-6 in.) following removal of the contaminated soil. Seven samples were analyzed for TAL metals and isotopic uranium, the other seven samples were analyzed for HE. All samples were analyzed by off-site analytical laboratories. Subsequent to the VCA activities in the fall of 1997, the same confirmatory sample locations from within the remediated area were re-sampled and re-analyzed for antimony in the summer of 1998 because of the elevated detection limits. In addition, 16 confirmatory samples were collected from outside the perimeter of the wash area (approximately 1ft beyond the base course) at 0-6 inches and 18-24 inches to confirm that no lateral contamination existed. Two additional confirmatory samples were collected at depths of approximately 3 ft and 6 ft from sample location 15-3445 to determine vertical extent of DU because DU was detected above the BV at this location during the original confirmatory sampling.

3.3.1 Confirmatory Sampling Data Review

(a) Inorganic Chemical Comparison With Background

The inorganic fixed analytical data from the VCA are presented in Appendix D-2.0. Although analysis was only for isotopic uranium in the confirmatory samples, the total uranium concentrations in mg/kg were estimated by adding up the isotopic activity values and then dividing the uranium value in pCi/g by the specific activities of the isotopic mixtures; either 0.7 for natural uranium or 0.4 for DU assuming secular equilibrium. Based on the isotopic ratios for uranium, both natural uranium and DU were detected in the confirmatory samples. The natural uranium was indicative of normal background, while DU was indicative of residual contamination. The total uranium values were calculated in order to compare the estimated concentrations to the industrial cleanup level for noncarcinogenic effects.

A QA/QC assessment on the data from the inorganic analyses was conducted. Antimony data from the re-analysis of the samples collected around the perimeter of the PRS and from the re-sampling and re-analysis of the confirmatory samples collected from within the remediated area were qualified as RPM, based on low matrix spike recoveries. The qualifier indicated that the matrix spike recoveries were below

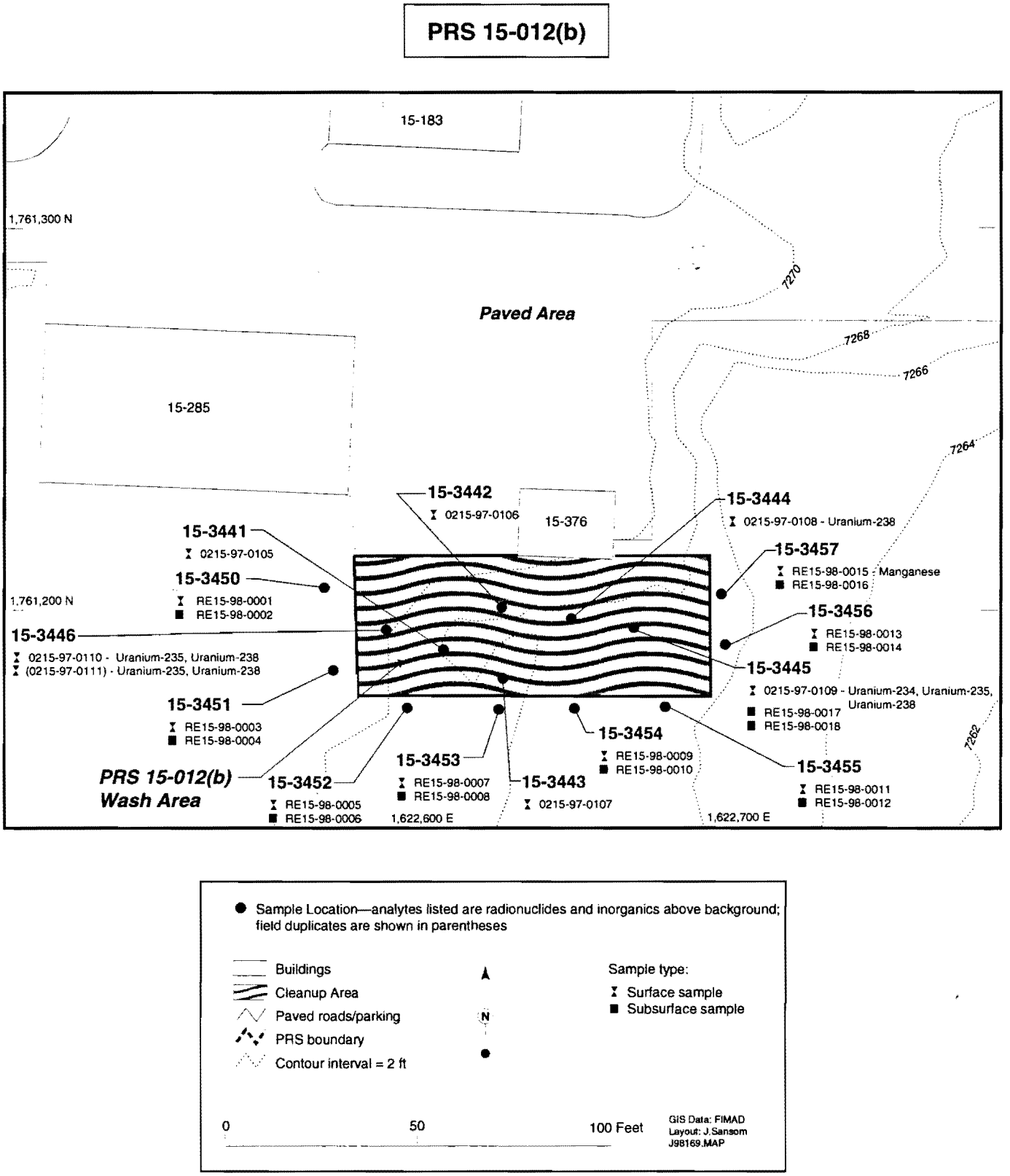


Figure 3.3-1 PRS 15-012(b), Site map of confirmatory sample locations with detected analytes

the acceptable limit (30%) and required further review of the data, i.e., a focused validation (EPA 1994, ER ID 48640). The focused validation of the antimony data and the re-analysis of a subset of the above samples resulted in acceptable matrix spike recoveries and a justification for changing the RPM qualifier to UJ (see Appendix C-2.2 for a detailed discussion of the focused validation). Based on the data quality evaluation, the antimony data were considered to be nondetects with detection limits below the background values and are considered to be usable for this report. Barium was qualified as J- based on matrix spike recovery and potentially biased low. Manganese and mercury were qualified as P (professional judgement required) in 18 samples due to high relative percent differences (RPDs) in the laboratory duplicate sample. Further review of this data found that the sample values should not be qualified because the RPDs were less than the EPA control limit for soil of ±35% (EPA 1994, ER ID 48640). Selenium was detected in the preparation blank associated with 18 samples. The sample values of eight samples were less than 5x the blank value and were qualified as U (undetected). Selenium was reported as undetected in the other 10 samples and was not affected by the blank contamination.

The data qualified as UJ or J- are considered to be estimated values because the associated QC data did not meet specifications. The qualification of the data as either UJ or J- indicates uncertainty in the reported concentration, but not in the identity of the analytes. The Risk Assessment Guidance for Superfund, Part A (EPA 1989, ER ID 8020) and the Guidance for Data Usability in Risk Assessment (Park A) (EPA 1992, ER ID 54947) states that these data can and should be used in a risk assessment in the same manner as data with no qualification, provided the uncertainty associated with the data is noted.

The BVs used in the background comparisons were values for soil. Isotopic uranium was analyzed by alpha spectroscopy. Because the preparation method for this analysis involved total digestion of the sample, the calculated uranium data were compared to the BV for total digestion (5.4 mg/kg). The BVs for soil were obtained from "Inorganic and Radionuclide Background Data for Soils, Sediments, and Bandelier Tuff at LANL" (LANL 1998, ER ID 58093). The analytical and sample preparation methods used in analyzing the samples collected during the VCA were comparable to the methods used to determine the background data set with the following exceptions. The antimony and cadmium data from the remediated area produced by ICPES resulted in elevated detection limits compared to the background data, which were produced by ICPMS.

The frequencies of detection and the reported range of concentrations for inorganics and uranium at PRS 15-012(b) during the VCA are summarized in Table 3.3-a1. Also included is a summary of those inorganics that were reported as undetected (i.e., less than the estimated detection limit), but had detection limits above the BV. The table only includes data for detected analytes and those analytes with detection limits greater than BVs, while nondetected analytes are included in Appendix D-2.0. Nineteen inorganics and uranium were detected in the soil samples. Of these detected analytes, only manganese and uranium were detected at or above the BVs in one sample and four samples, respectively (Table 3.3-a1). The other inorganics were either undetected or detected below the soil BVs in the samples collected from within and around the wash area. Two inorganics (antimony and cadmium) were undetected in the soil samples, but had detection limits above their respective soil BVs in seven samples (Table 3.3-a1). The remediated area was subsequently re-sampled at the same confirmatory sample locations and re-analyzed for antimony in order to obtain lower detection limits from the off-site analytical laboratory. The elevated detection limits were the result of the analytical methods (ICPES and CVAA) and not the result of matrix interference or sample dilution.

TABLE 3.3-a1
PRS 15-012(b)
FREQUENCY OF DETECTED INORGANIC CHEMICALS

Analyte	Media	Number of Samples Analyzed	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Values[b]
Aluminum	Soil	25	25	6240 - 18100	29200	0/25
Antimony	Soil	31	0	[0.16 - 5.3]	0.83	DL>BV[c]

TABLE 3.3-a1
PRS 15-012(b)
FREQUENCY OF DETECTED INORGANIC CHEMICALS
(Concluded)

Analyte	Media	Number of Samples Analyzed	Number of Detects	Concentration Range[a] (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Values[b]
Arsenic	Soil	25	25	0.97 – 3.4	8.17	0/25
Barium	Soil	25	25	120 - 255	295	0/25
Beryllium	Soil	25	25	0.71 - 1.8	1.83	0/25
Cadmium	Soil	25	0	[0.02 - 0.53]	0.4	DL>BV[c] (for 7 of 25 results)
Calcium	Soil	25	25	2000 - 5010	6120	0/25
Chromium	Soil	25	25	5 - 9.2	19.3	0/25
Cobalt	Soil	25	25	4.1 - 9.0	8.64	0/25
Copper	Soil	25	25	4.9 - 9.4	14.7	0/25
Iron	Soil	25	25	7220 - 17400	21500	0/25
Lead	Soil	25	25	12.2 - 21.8	22.3	0/25
Magnesium	Soil	25	25	1400 - 2610	4610	0/25
Manganese	Soil	25	25	278 - 696	671	1/25
Mercury	Soil	25	20	0.01 - 0.072	0.1	0/25
Nickel	Soil	25	25	5.5 - 9.3	15.4	0/25
Potassium	Soil	25	25	1290 - 2430	3460	0/25
Selenium	Soil	25	8	[0.2] - 0.49	1.52	0/25
Sodium	Soil	25	25	67.1 - 424	915	0/25
Uranium	Soil	25	25	2.6 - 40	5.4	4/25
Vanadium	Soil	25	25	13.0 - 23.6	39.6	0/25
Zinc	Soil	25	25	16.3 - 40.7	48.8	0/25

[a] Values in square brackets indicate nondetected results.
[b] Value is the ratio of the number of detects exceeding the BV to the number of analyses.
[c] The detection limit for this analyte exceeded the background value for soil.

The samples in which inorganics and uranium were detected or had detection limits at or above their BVs are presented in Table 3.3-a2. The inorganics that were either detected below their BVs or had detection limits less than their BVs were not evaluated further. The reported detection limits of antimony for the original confirmatory samples (4.9 - 5.3 mg/kg) were outside the range of nondetected values in the background data set (0.2 - 1.5 mg/kg). However, the re-sampling of the same confirmatory sample locations and the re-analysis for antimony found that this inorganic was undetected with lower detection limits (0.15 - 0.16 mg/kg) that were less than the BV of 0.83 mg/kg. A focused validation of the antimony data and the re-analysis of a subset of the samples confirmed that the antimony data were nondetects with detection limits less than the BV (see Appendix C-2.2).

The VCA sample data set has enough samples to conduct statistical comparisons with the background data sets. The statistical comparisons employed four tests; Wilcoxon Rank Sum, Gehan, Quantile, and Slippage Tests. The statistical comparisons of the cadmium site data were done two ways; one using all of the background data set (detected and nondetects) and the other using only the nondetects in the background data set (Appendix E). All four statistical tests found that the cadmium detection limits in the site data set were not statistically different from the detection limits in the background data set (Appendix E). For manganese, two of the four statistical tests found that the manganese site data was not significantly different from the background data set (Appendix E). However, the range of detected concentrations for manganese (278 - 696 mg/kg) was within the range of values in the background data

set (76 - 1100 mg/kg) (Appendix E). Statistical comparisons of the site uranium data to the background data indicated that the site data were not different from the background data (Appendix E). However, DU was detected at a concentration of 40 mg/kg in one (0-6 in.) sample (0215-97-0109) within the wash area that was above the range of detected values in the background data set and exceeded the BV of 5.4 mg/kg (Table 3.3-b2). Therefore, based on the comparison with background, DU was not eliminated as a COPC (Table 3.3-b3) and required further evaluation, Section 3.3.3, Site Assessments. Additional depth sampling at this location; 30-36 in. (sample RE15-98-0017) and 54-60 in. (sample RE15-98-0018) showed only natural uranium at concentrations 3.0 and 1.9 mg/kg, respectively, which were below the BV of 5.4 mg/kg. Thus, the vertical extent of the uranium contamination was defined. The other inorganics, cadmium and manganese, were similar to background and eliminated from further evaluation (Table 3.3-a3).

TABLE 3.3-a2
PRS 15-012(b)
INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES[A]

Analyte	Location ID	Sample ID	Sample Concentration (mg/kg)[b]	Background Value (mg/kg)	Media	Depth (in)
Antimony	15-3442	0215-97-0106	4.7(U)	0.83	Soil	0-6
	15-3443	0215-97-0107	5.1(U)		Soil	0-6
	15-3444	0215-97-0108	5.2(U)		Soil	0-6
	15-3445	0215-97-0109	5.3(U)		Soil	0-6
	15-3446	0215-97-0110	5.0(U)		Soil	0-6
	15-3446	0215-97-0111[c]	4.9(U)		Soil	0-6
Cadmium	15-3441	0215-97-0105	0.49(U)	0.4	Soil	0-6
	15-3442	0215-97-0106	0.47(U)		Soil	0-6
	15-3443	0215-97-0107	0.51(U)		Soil	0-6
	15-3444	0215-97-0108	0.52(U)		Soil	0-6
	15-3445	0215-97-0109	0.53(U)		Soil	0-6
	15-3446	0215-97-0110	0.5(U)		Soil	0-6
	15-3446	0215-97-0111[c]	0.49(U)		Soil	0-6
Manganese	15-3457	RE15-98-0015	696	671	Soil	0-6
Uranium	15-3445	0215-97-0109	40	5.4	Soil	0-6
	15-3446	0215-97-0111[c]	5.4		Soil	0-6
	15-3450	RE15-98-0001	7.0		Soil	0-6
	15-3455	RE15-98-0011	5.4		Soil	0-6

[a] Descriptions of the analytical methods used for this PRS can be found in Appendix D-1. Detection limits can be found in Appendix D-1.
[b] Data qualifiers are defined in the Glossary, Appendix A-2.
[c] Sample 0215-97-0111 is a field duplicate of sample 0215-97-0110.
[d] The total uranium sample values in mg/kg were estimated by adding up the isotopic activity values and then dividing the uranium value in pCi/g by either 0.7 for natural uranium or 0.4 for depleted uranium.

TABLE 3.3-a3
PRS 15-012(b)
RESULTS OF INORGANIC DATA REVIEW

Analyte	Media	Result	Rationale
Antimony	Soil	Eliminated	Not detected in any sample. Eliminated as COPC because sample detection limits were less than the BV following re-sampling and re-analysis of the same confirmatory sample locations within the remediated area. A focused validation of the antimony data confirmed that the sample results were nondetects with detection limits less than the BV.

TABLE 3.3-a3
PRS 15-012(b)
RESULTS OF INORGANIC DATA REVIEW
(Concluded)

Analyte	Media	Result	Rationale
Cadmium	Soil	Eliminated	Not detected in any sample. Eliminated because the reported detection limits were within the range of detected and nondetected values in the background data set.
Manganese	Soil	Eliminated	Eliminated because the detected concentrations were within the range of detected values in the background data set.
Uranium	Soil	Retained	Retained as COPC because one sample value of depleted uranium within the remediated area exceeded the BV.

(b) Radionuclide Comparison with Background/Fallout Radionuclide Concentrations

The radionuclide fixed analytical data from the VCA are presented in Appendix D-2.0. A QA/QC assessment on the data associated with the isotopic uranium analyses was conducted. The data quality evaluation indicated that there were no QA/QC issues associated with the data set and that the data are usable. The isotopic uranium data were either qualified as U (undetected) or no qualifiers were necessary.

The BVs used in the background comparisons were values for soil. Isotopic uranium was analyzed by alpha spectroscopy. The BVs for the soil were obtained from "Inorganic and Radionuclide Background Data for Soils, Sediments, and Bandelier Tuff at LANL" (LANL 1998, ER ID 58093). The analytical and sample preparation methods used in analyzing the samples collected during the RFI were comparable to the methods used to determine the background data set. The total uranium values were calculated in order to compare the estimated concentrations to the industrial cleanup level for radionuclides.

The frequency of detection and the reported range of concentrations for isotopic uranium and uranium at PRS 15-012(b) during the VCA are summarized in Table 3.3-b1. The soil samples were not analyzed for any other radionuclides. Although total uranium was not analyzed for in the confirmatory samples, the total uranium concentrations in mg/kg were estimated by adding up the isotopic activity values and then dividing the uranium value in pCi/g by the specific activities of the isotopic mixtures; either 0.7 for natural uranium or 0.4 for depleted uranium assuming secular equilibrium. Based on the isotopic ratios for uranium, both natural uranium and DU were detected in the confirmatory samples. The natural uranium was indicative of background, while DU was indicative of residual contamination.

TABLE 3.3-b1
PRS 15-012(b)
FREQUENCY OF DETECTED RADIONUCLIDES

Analyte	Media	Number of Samples Analyzed	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Values[a]
Uranium-234	Soil	25	25	0.5 - 2.54	2.59	0/25
Uranium-235	Soil	25	15	[0.03] - 0.25	0.2	2/25
Uranium-238	Soil	25	25	1.0 - 13.2	2.29	4/25
Uranium	Soil	25	25	2.6 – 40[b]	5.4[b]	2/25

[a] Value is the ratio of the number of detects exceeding the BV to the number of analyses.
[b] Total uranium concentration range and background value are in mg/kg.

Based on the isotopic ratios for uranium, it was determined that natural uranium (U-238:U-234 approximately 1:1) was present in six of the seven confirmatory samples within the remediated area and

DU (U-238:U-234 approximately 10:1) was present in one of the seven confirmatory samples (sample location 15-3445 and sample number 0215-97-0109) within the remediated area (Table 3.3-b2). Within the wash area, uranium-234 was detected below the soil BV of 2.59 pCi/g in all seven confirmatory samples, uranium-235 was detected slightly above the soil BV of 0.2 pCi/g in one of seven confirmatory samples, and uranium-238 was detected above the soil BV of 2.29 pCi/g in three of seven confirmatory samples. The isotopic uranium site data sets were statistically compared to the background data sets using the Wilcoxon Rank Sum, Gehan, Quantile, and Slippage Tests (Appendix E). All four statistical tests found that the isotopic uranium site data sets were not statistically different from the background data sets (Appendix E). Statistical comparisons of the site uranium data to the background data also indicated that the site data were not different from the background data. However, DU was detected at a concentration of 40 mg/kg in only one sample (0215-97-0109) within the wash area and was above the range of detected values in the background data set and exceeded the BV of 5.4 mg/kg (Table 3.3-b2). Therefore, based on the comparison to background, DU was identified as a COPC within the remediated area (Table 3.3-b3) and

TABLE 3.3-b2
PRS 15-012(b)
RADIONUCLIDES WITH CONCENTRATIONS AT OR EXCEEDING BACKGROUND VALUES/FALLOUT CONCENTRATIONS

Analyte	Location ID	Sample ID	Sample Concentration (pCi/g)[b]	Background Value (pCi/g)	Media	Depth (in)
Uranium-235	15-3445	0215-97-0109	0.23	0.2	Soil	0-6
	15-3450	RE15-98-0001	0.25		Soil	0-6
Uranium-238	15-3444	0215-97-0108	2.6	2.29	Soil	0-6
	15-3445	0215-97-0109	13.2		Soil	0-6
	15-3446	0215-97-0111[c]	2.6		Soil	0-6
	15-3450	RE15-98-0001	2.7		Soil	0-6
Uranium[d]	15-3445	0215-97-0109	40	5.4	Soil	0-6
	15-3446	0215-97-0111[c]	5.4		Soil	0-6
	15-3450	RE15-98-0001	7.0		Soil	0-6
	15-3455	RE15-98-0011	5.4		Soil	0-6

[a] Descriptions of the analytical methods used for this PRS can be found in Appendix D-1. Detection limits can be found in Appendix D-1.
[b] Data qualifiers are defined in the Glossary, Appendix A-2.
[c] Sample 0215-97-0111 is a field duplicate of sample 0215-97-0110.
[d] Uranium concentrations and BV are in mg/kg.

TABLE 3.3-b3
PRS 15-012(b)
RESULTS OF RADIONUCLIDE DATA REVIEW

Analyte	Media	Result	Rationale
Depleted Uranium	Soil	Retained	Retained as COPC because one sample value within the remediated area exceeded the BV.

required further evaluation, Section 3.3.3, Site Assessments. In addition, by retaining the elevated DU concentration, the highest uranium-238 and uranium-235 concentrations were also evaluated further.

The isotopic ratios indicated that only natural uranium was present outside of the remediated area and at depth below the sample location where elevated DU was detected (sample location 15-3345)

(Figure 3.3-1). Around the perimeter of the wash area, uranium-234 was detected below the soil BV in all 16 samples, while uranium-235 and uranium-238 were detected slightly above the BVs in only one surface soil sample (Table 3.3-b2). As described above, the statistical comparison to background indicated that the isotopic uranium data were not statistically different from background data set (Appendix E). The uranium-234, uranium-235, and uranium-238 were either undetected or detected below the BVs in all samples collected outside of the remediated area from 18-24 in. and at depths of approximately 3 ft and 6 ft below the elevated uranium concentration within the remediated area (sample location 15-3445). Uranium was detected at or slightly above the BV of 5.4 mg/kg at two sample locations (15-3450 and 15-3455) around the perimeter of the wash area at 0-6 in. (Table 3.3-b2). Uranium was detected below the BV in all samples collected outside of the remediated area from 18-24 in. and at depths of approximately 3 ft and 6 ft below the elevated uranium concentration within the remediated area (sample location 15-3445). These results indicated that the contamination of PRS 15-012(b) was limited in its extent and was confined to the wash area.

(c) Evaluation of Organic Chemicals

The HE fixed analytical data from the VCA are presented in Appendix D-2.0. A QA/QC assessment of the data associated with the HE analyses was conducted and indicated that there were no QA/QC issues associated with the data set and that the data are usable. The HE data were either qualified as U (undetected) or no qualifiers were necessary.

HEs were not detected in the soil collected from within and around the wash area following the VCA and were not evaluated further.

(d) Other Applicable Data

No other data were collected and used to determine if the remediation of PRS 15-012(b) was successful.

3.3.2 Revised Site Conceptual Model As Influenced By The VCA Confirmatory Sampling

The site conceptual model presented in Section 2.3.5 did not change based on the results of the VCA confirmatory sampling.

3.3.2.1 Nature and Extent of Contamination

The COPC (DU) remaining following site remediation was one of the COPCs identified as a result of the RFI. The other RFI COPCs, antimony, beryllium, copper, and lead, were either undetected or detected below the BVs following VCA activities.

The confirmatory sampling determined that the contamination detected during the RFI was confined to the earthen berm and the area within the berm. Sample data for the area around the perimeter of the wash area indicated that inorganics were either undetected or detected below the BVs, and HE was undetected. Uranium was detected either below the BV, at the BV, or slightly above the BV. In addition, the samples collected at depth (3 ft and 6 ft) below the elevated DU sample location within the wash area did not detect inorganics or uranium above the BVs.

3.3.2.2 Environmental Fate

The potential for transport of uranium off-site or leaching to groundwater remains unlikely following remediation. The only difference between the site before and after the VCA is that instead of being surrounded by an earthen berm, the site is now covered by several inches or feet of base course. This cover would further inhibit the potential migration of uranium via surface runoff or leaching.

3.3.3 Confirmatory Sampling Site Assessments

3.3.3.1 Summary

The concentrations of COPCs retained as a result of the RFI and remaining in the soil at PRS 15-012(b) following site remediation were compared to their risk-based industrial cleanup levels. This comparison indicated that these COPCs were either undetected, detected at concentrations below the BVs, or detected at concentrations below the cleanup levels. In addition, an evaluation of the potential ecological impacts of analytes remaining in the soil following remediation was conducted for this PRS. The evaluation found that uranium was detected at only one location at a concentration that exceeded a hazard quotient of 1.0 for several receptors. However, further evaluation indicated that this isolated uranium concentration decreased to background concentrations, and did not pose an unacceptable ecological risk. The additional sampling around the perimeter of the PRS indicated that the elevated concentration of uranium was confined to the wash area.

3.3.3.2 Human Health Screening Assessment

An evaluation of the human health cleanup levels is presented below. The assessment follows the Hazardous and Radioactive Materials Bureau (HRMB) Risk-Based Decision Tree (NMED 1998, ER ID 57761) and appropriate EPA guidance (EPA 1998, ER ID 58751).

(a) Scoping

The PRS is located on DOE-owned land and is removed from public access roads. It lies within the secured boundaries of TA-15, which results in limited and monitored access and egress. The land is currently and will in the future be used exclusively for Laboratory operations, i.e., industrial land use. The PRS is located near Building 15-285 and adjacent to an active, outdoor equipment storage area. The facility intends to use the area for parking vehicles and storage. As a result, an industrial exposure scenario is appropriate for determining whether the site has been successfully remediated. Under this scenario, the likely exposed individual is a Laboratory worker with potential exposure occurring via the ingestion, inhalation, and dermal pathways.

(b) Screening Evaluation

The data review of the inorganic, organic, and radionuclide confirmatory sample results [Sections 3.3.1 (a), (b), (c)] indicated that DU was present at a concentration above the BV at one sample location. The other COPCs from the RFI, antimony, beryllium, copper, and lead, were either undetected with detection limits below the BVs, or detected at concentrations below the BVs. The detected concentration of DU was compared to industrial cleanup levels to determine if there was a potential unacceptable risk to human health (Table 3.3.3-b1) following remediation. Because DU was the only COPC above the BV remaining at the site, the individual cleanup levels did not require adjustment to account for potential toxicity interactions among noncarcinogenic COPCs.

The industrial cleanup level for uranium related to systemic effects (5100 mg/kg) was calculated using the most current toxicity value from the IRIS database, standard default values, and equation available (EPA 1998, ER ID 58751) (see Section 3.1, Cleanup Levels and Appendix F-1.0). The estimated concentrations of uranium ranged from 2.6 to 40 mg/kg within the wash area, from 2.3 to 7.0 mg/kg around the perimeter of the wash area, and were 3.0 mg/kg at 3 ft and 1.9 mg/kg at 6 ft from sample location 15-3445. These concentrations were more than two to three orders of magnitude below the industrial cleanup level for systemic effects and do not pose a potential unacceptable risk to human health either within or around the wash area for this scenario (Table 3.3.3-b1).

The industrial cleanup levels for radiological uranium (DU) were derived using the RESRAD 5.7 computer model, which includes the most current exposure parameters (see Section 3.1, Cleanup Levels and Appendix F-1.0). The cleanup levels were calculated by inputting into the RESRAD model the individual

isotopic activities for DU. The individual isotopic activities for 1.0 pCi/g were approximately 0.085 pCi/g for uranium-234, 0.014 pCi/g for uranium-235, and 0.901 pCi/g for uranium-238. The model calculations resulted in a maximum total dose in mrem/yr/pCi/g for DU based on the industrial exposure scenario and the pathways associated with the scenario. In order to determine the allowable level of uranium equivalent to a dose of 15 mrem/yr, this value (15 mrem/yr) was divided by the maximum total dose of 0.034 mrem/yr/pCi/g for DU. The result was the uranium activity concentration in pCi/g that represents the industrial cleanup level for DU at the PRS. The uranium industrial cleanup level in pCi/g was subsequently converted to mg/kg by dividing the uranium activity concentration by 0.4 for DU, which is an approximate of the specific activity of the isotopic mixtures. The uranium industrial cleanup level in mg/kg is presented in Table 3.3.3-b1.

The uranium concentrations (derived by adding up the isotopic activity values) from within the wash area ranged from 2.6 to 5.3 mg/kg for natural uranium and was 40 mg/kg for DU. These concentrations were either below the BV or more than an order of magnitude below the industrial cleanup level for DU (Table 3.3.3-b1). Therefore, the uranium concentrations remaining in the soil following remediation of

TABLE 3.3.3-b1
PRS 15-012(b)
COMPARISON OF COPCS TO INDUSTRIAL CLEANUP LEVELS

Analyte	Location ID	Sample ID	Media	Depth (in)	Sample Values (mg/kg)[a]	SALs (mg/kg)	Industrial Cleanup Levels (mg/kg)
Uranium	15-3445	0215-97-0109	Soil	0-6	40	230	5100
	15-3446	0215-97-0111[b]	Soil	0-6	5.4		
	15-3450	RE15-98-0001	Soil	0-6	7.0		
	15-3455	RE15-98-0011	Soil	0-6	5.4		
Uranium (depleted)	15-3445	0215-97-0109	Soil	0-6	40	130	1090[c]

[a] The total uranium sample values in mg/kg were estimated by adding up the isotopic activity values and then dividing the uranium value in pCi/g by either 0.7 for natural uranium or 0.4 for depleted uranium.
[b] Sample 0215-97-0111 is a field duplicate of sample 0215-97-0110.
[c] Cleanup level for depleted uranium in mg/kg was derived using RESRAD 5.7.

PRS 15-012(b) do not pose a potential unacceptable risk to human health for an industrial exposure scenario. The concentrations of uranium around the perimeter of the wash area ranged from 2.3 to 7.0 mg/kg, while the concentrations of uranium at depth from sample location 15-3445 were 3.0 mg/kg at 3 ft and 1.9 mg/kg at 6 ft (Table 3.3.3-b1). These concentrations were below the BV [see Section 3.3.1(b), Radionuclide Comparison with Background/Fallout Radionuclide Concentration].

(c) Uncertainty Analysis

The data are adequate to determine the presence of contamination at this PRS. Some of the inorganic data were potentially biased low resulting in some estimated concentrations for some analytes. The potentially low bias did not affect the results of the data review and the screening assessment (see Appendix C-2.2). Some of the antimony data were potentially biased low because of unacceptable matrix spike recoveries. As a result, it was uncertain whether the potentially low biased detection limits were less than the BV. A focused validation of the antimony data confirmed that the data were nondetects and the detection limits were below the BV (see Appendix C-2.2). The uncertainty associated with the qualified antimony data is tempered by the fact that facility personnel have confirmed that antimony was never

used in any of the experiments conducted in the steel spheres rinsed out in the wash area (London 1998, ER ID 59359). Therefore, the available data and site information for antimony at PRS 15-012(b) indicated that this metal was not present at this site above background.

The available systemic toxicity information (RfD) for uranium is only for the ingestion of soil. No information is available for the inhalation or dermal pathways. Route extrapolation from the oral to inhalation pathway is not performed for inorganics due to portal of entry effects and known differences in absorption efficiency for the two routes of exposure. Therefore, the inhalation exposure pathway was not included in calculating of the systemic industrial cleanup levels for uranium. In addition, there is much uncertainty regarding the determination of hazards associated with skin contact with soils. It is assumed that dermal toxicity values can be extrapolated from oral values. In doing so, complete (100%) oral absorption was assumed in calculating the systemic industrial cleanup levels for uranium (EPA 1998, ER ID 58751). Therefore, the oral RfD of 0.003 mg/kg-d for uranium was used as the dermal RfD in the calculation (Appendix F).

The concentrations of total uranium used in the data review and comparison to cleanup levels are estimates based on the isotopic activities of individual isotopes. Because the concentrations were not analytically derived there is no QA/QC information regarding accuracy and precision. In addition, other isotopes of uranium (e.g., uranium-233 and uranium-236) might be present in minute amounts and were not taken into account in estimating the total uranium values.

The soil cleanup levels derived using the RESRAD computer model are intended to represent worst-case on-site exposure conditions for each exposure scenario. In general, the parameters used in the RESRAD model calculations were RESRAD default or EPA default values designed to provide a conservative representation of site conditions. Laboratory/site-specific values were also included for the following parameters: area of contamination, depth of contamination, density of contaminated zone, and mass loading for inhalation. In addition, the default values used were generally at the lower end of the range of values (i.e., more conservative) suggested for that parameter (DOE 1993, ER ID 59177). As a result, the RESRAD calculations probably result in an overestimation of the level required to protect human health under a particular exposure scenario.

The dose conversion factors (DCFs) used in evaluating radionuclide doses are also associated with assumptions that might contribute to uncertainty. Separate DCFs exist for internal and external exposure to radiation and do not evaluate the effects of radiation on children. Because children have different ratios of organ weight to body mass than adults, a child might have different sensitivities to the effects of radiation. Although external DCFs are applicable to both men and women, internal DCFs are based on radiation effects for an adult male. Gender differences that contribute to the uncertainty when applying internal DCFs to women include the potential differences in sensitivity of reproductive organs and effects related to pregnancy and lactation. The appropriate exposure scenario for PRS 15-012(b) is industrial and, therefore, would not have a child as a potentially exposed individual. However, the scenario might include a pregnant female worker among the potentially exposed individuals.

Despite the uncertainties inherent in the RESRAD model, the cleanup levels derived for each exposure scenario are protective of potentially exposed individuals, primarily due to the conservative nature of the parameters. In addition, the comparison to cleanup levels was made using the maximum detected concentrations rather than an upper confidence limit of the mean to ensure that the worst-case site exposure conditions were met by the cleanup levels generated by the model. Furthermore, the cleanup levels were based on a target dose limit of 15 mrem/yr, which satisfies the "as low as reasonably achievable" (ALARA) principle to ensure that radiation dose is minimized, which is less than the DOE dose limit of 100 mrem/yr (proposal rule 10 CFR 843.5 in FR 16268).

(d) Interpretation

Total uranium was detected at or above the BV in four confirmatory soil samples following the VCA at PRS 15-012(b). Based on the results of the comparison to industrial cleanup levels, the detected concentrations above the BV do not pose an unacceptable risk to human health. The other COPCs

(antimony, beryllium, copper, and lead) identified by the RFI were either undetected or detected below the BVs following site remediation. Therefore, the VCA was successful in reducing the concentrations of COPCs to concentrations below the human health risk-based cleanup levels for a Laboratory worker under an industrial exposure scenario.

3.3.3.3 Ecological Screening Assessment

An ecological assessment of the PRS following remediation is presented below. The assessment follows the Hazardous and Radioactive Materials Bureau (HRMB) Risk-Based Decision Tree (NMED 1998, ER ID 57761) and is based on the approach presented in Kelly et al. (1998, ER ID 57916).

(a) Scoping

The ecological scoping checklist for PRS 15-012(b) is provided in Appendix F-2.0. The PRS was a wash area located adjacent to Building 15-285 and was covered with grass prior to the VCA, i.e., vegetative class was grassland. The vegetative class for this site is currently bare ground (base course) surrounded by a grassy field with some scattered pinon/juniper trees (nearest tree approximately 100 yards away). The outer perimeter (approximately 400 yards from the site) of the area is ponderosa pine. The site is located on the mesa top within TA-15 approximately ¼ mile east of Cañon de Valle with a slope of <10% and little or no potential for erosion.

PRS 15-009(j) was a septic tank located approximately 25-50 ft west of the wash area. This septic tank received wastewater from Building 15-285 and either was emptied or discharged to seepage pits. Although the wash area was slightly downgradient from the septic system at 15-009(j), the potential releases from 15-009(j) were subsurface and the chemicals detected in the soil and tuff at this PRS were VOCs rather than inorganics and uranium at 15-012(b). In addition, the septic tank has been removed as part of a separate VCA. Firing Site A-B [PRSs 15-004(b,c)] was located approximately 400-500 ft east/southeast of the wash area. This site, which was downgradient from the wash area, has been characterized and remediated and did not influence PRS 15-012(b). Therefore, these PRSs were not aggregated. PRS C-15-002 was a pile of dirt resulting from the excavation of the area where Building 15-285 was built. This excavated dirt pile was located south of the building and, southwest of the wash area, and was removed in 1996. It did not influence the wash area and was recommended for NFA in the RFI Work Plan. The other PRSs in the general area are either behind buildings or at a distance and did not influence PRS 15-012(b).

The Laboratory's Ecology Group (ESH-20) indicated that this area is on the edge of the Mexican Spotted Owl "Area of Interest, Buffer Zone". Buffer Zones are areas where activities could have Core Zone (areas potentially containing owls or suitable habitat) influence, but are not protected to the extent that Core Zones are. However, the PRS is adjacent to a fully-industrialized area, including administrative buildings, laboratories, and storage areas actively used by the facility and does not provide any habitat for this species. Although the surface around the site might be visited by small mammals, the PRS is currently cleared, graded, and covered by several inches of base course (cobble/gravel and clean fill). It does not, therefore, provide habitat or forage for ecological receptors, and the potential for off-site transport is minimal or non-existent. The site has not been revegetated because the facility intends to use the area to park vehicles and for storage.

The ecological pathways conceptual exposure model (EPCEM) is presented in Appendix F-2.0 as part of the ecological scoping checklist. Because the site has been cleared and covered by a layer of base course, there are no major or minor pathways to terrestrial ecological receptors. Unlikely pathways include exposure to dust resulting from burrowing activities, root uptake, and external irradiation (Appendix F-2.0). There are no exposure pathways for aquatic receptors.

(b) Ecological Evaluation

The purpose of the ecological screening assessment is to identify chemicals of potential ecological concern (COPECs) and not to calculate risk. The screening assessment approach is based on calculating hazard quotients (HQs) and/or hazard indices (HIs) as outlined in Kelly et al. (1998, ER ID 57916). A value greater than 1.0 is an indicator of potential risk and identifies the chemical as a COPEC. It is intended to be a conservative approach designed to minimize the chance of missing an analyte that potentially creates an ecological risk. The HQ/HI analysis is based on the maximum detected concentration for each analyte identified as a COPC in the data review (Section 3.3.1). The maximum concentration is compared to the ecological screening level (ESL) for the ecological receptors identified for screening. Currently, there are eight terrestrial ecological receptors for which screening criteria have been developed (Kelly et al, 1998, ER ID 57916). They include a plant, an invertebrate, deer mouse, vagrant shrew, American robin, desert cottontail, American kestrel, and red fox.

The ESLs for surface soil are currently under development and have been derived using methods from Kelly et al. (1998, ER ID 57916). The ESLs are currently unpublished and have not yet been approved by NMED. However, their publication is forthcoming as part of a toxicological database being developed by the LANL ER Project Ecological Risk Team.

Ecological scoping of this site following removal of the contaminated soil indicated that ecological impacts were not likely. The COPCs identified by the RFI (antimony, beryllium, lead, and uranium) were either undetected or detected at concentrations below the BVs, except for DU at one sample location (Tables 3.3-a1 and 3.3.3-b1). Uranium-234, uranium-235, and uranium-238 were detected either approximately at or above the BVs in the surface soil within the remediated area (Table 3.3.3-b1). The isotopes are listed as potential bioaccumulating chemicals in Table 1 of the ecological scoping checklist (Appendix F-2.0). Comparison of the maximum detected concentration of the individual isotopes to the ESLs resulted in maximum HQs of 0.025 for uranium-234, 0.002 or uranium-235, and 0.12 for uranium-238 (Table 3.3.3.3-b1). These HQs indicated that there is little potential ecological impact from the individual isotopes of uranium at this site. In addition, there is little or no potential for the isotopic uranium to migrate off-site. However, because all three isotopes were detected at the sampling location, the potential exposure would be to total uranium as well as the individual isotopes. Therefore, it was appropriate to evaluate the potential ecological effect of total uranium on receptors at this PRS. The uranium concentration detected at the one sample location was equivalent to 40 mg/kg (value was estimated by adding up the isotopic activity values and then dividing the uranium value in pCi/g by 0.4 for DU). This uranium concentration was above the ESLs for the generic plant (5 mg/kg), the American robin (30.9 mg/kg), deer mouse (29.2 mg/kg), and vagrant shrew (28.1 mg/kg), which resulted in HQs of 8.0, 1.3, 1.4, and 1.4, respectively (Table 3.3.3.3-b1). Therefore, DU was identified as a COPEC by the ecological screening assessment at PRS 15-012(b) and required further evaluation.

TABLE 3.3.3.3-b1
PRS 15-012(b)
SUMMARY OF HAZARD QUOTIENT ANALYSIS

Analyte	Location ID	Sample ID	Media	Maximum Sample Value (pCi/g)	ESL (pCi/g)	Most Sensitive Receptors	HQs
Uranium-234	15-3445	0215-97-0109	Soil	2.54	100	Invertebrate	0.025
Uranium-235	15-3445	0215-97-0109	Soil	0.23	110	Invertebrate and Shrew	0.002
Uranium-238	15-3445	0215-97-0109	Soil	13.2	110	Invertebrate and Shrew	0.12
Uranium	15-3445	0215-97-0109	Soil	40 mg/kg	5 mg/kg	Plant	8

(c) Uncertainty Analysis

The criterion used during site remediation was to remove the radioactively contaminated soil to reach background levels using a pancake probe to guide the process. This decision was based on the RFI data and observations of visible uranium in the soil. Typically during the VCA, once the visible uranium was removed little additional excavation of soil was required to obtain readings near background. The RFI data indicated that the contaminants were collocated, i.e., the highest beryllium and lead concentrations were detected at the same locations as the highest uranium concentrations, and it was assumed removing soil based on elevated uranium levels would concurrently address elevated inorganic concentrations. This assumption was validated by the inorganic confirmatory sample results [Section 3.3.1(a)]. The locations from which the confirmatory samples were collected within the wash area were biased to those locations where the most soil was removed during the VCA. Therefore, the confirmatory sampling was designed to capture the maximum concentrations of COPCs remaining in the soil following remediation.

Toxicity information for uranium is available for the plant, deer mouse, vagrant shrew, desert cottontail, robin, kestral, and red fox, but not for the invertebrate receptor. The available ESLs were considered to be adequate to determine whether there was the potential for an ecological impact because several trophic levels were represented by the toxicity data.

The uncertainty associated with the plant ESL for uranium was high because the value was based on one study using a species (swiss chard) that is not native to the area. In addition, the value is extrapolated from a lowest observed adverse effect concentration (LOAEC), rather than an experimentally determined no observed adverse effect concentration (NOAEC). Further uncertainty related to the potential plant toxicity of uranium at this PRS involves the availability of the uranium and the proposed use of the site by the facility. The wash area has been cleared, graded, and covered by at least 8 inches, and in some places several feet, of base course (clean fill consisting of cobble, gravel, and dirt) and has not been revegetated. Although invasive plants (i.e., weeds) have begun to inhabit the area, the availability of the uranium to the plants is limited due to the layer of fill material. In addition, the facility has indicated that it intends to use the area to park vehicles and/or for equipment storage. Observations have noted vehicle tracks and other indications that the site has been used for these purposes. The site is also influenced by the activities in the adjacent buildings and storage areas. Therefore, the potential ecological impact of the elevated uranium concentration to plants is probably mitigated by the current and future site conditions as well as influences from other activities near the site.

The ESLs for the vertebrate terrestrial receptors were based on similar species and derived from an experimentally determined NOAEC. However, the assumptions used in the ESL derivations were conservative and not necessarily representative of actual conditions. For example, it was assumed that the organisms spend 100% of the time in the area rather than a fraction of time that would normally be the case. The home range for the short-tailed shrew (assumed to be similar for the vagrant shrew) is approximately ½ - 1 acre and the deer mouse is approximately ½ - 3 acres, according to Burt and Grossenheider (1976, ER ID 59097). On the other hand, the American robin has a home range of approximately 0.4 acres for nestlings and approximately 2.0 acres for fledglings (EPA 1993, ER ID 59109). Although the PRS area is approximately 1260 ft^2 (0.03 acres), the elevated uranium concentration was detected at only one location within the wash area and was bounded within an area of approximately 500 ft^2. This smaller area corresponds to approximately 0.01 acres or approximately 0.3 - 2% of the home range of the shrew or mouse and 0.5 - 2.5% of the home range of the robin. Therefore, it is more representative of actual conditions to average the detected uranium concentrations across the PRS rather than assume exposure to the maximum concentration 100% of the time within the PRS. The average concentration of the confirmatory sample results for uranium is 9 mg/kg, which results in an HQ of approximately 0.3 for the deer mouse, vagrant shrew, and robin. The other PRSs within the home range of these receptors [15-009(j) and 15-004(a,b)] have been remediated and do not contribute to the potential exposure to uranium for these organisms. Furthermore, the covering of the site with base

course, the current and future site conditions, and the influences from other activities near the PRS would probably restrict receptors' use of the area.

(d) Interpretation

The VCA remediation of the wash area reduced the number and concentrations of contaminants from that found during the original RFI. Although uranium was detected at or above the BV for soil at four locations within and around the perimeter of the wash area, the detected concentrations were equivalent to or less than the ESLs for terrestrial vertebrate receptors. The uncertainty analysis indicated that site conditions and Laboratory use of the area would preclude any potential ecological impacts to plants from residual uranium levels in the soil. In addition, the uncertainty analysis indicated that a more realistic approach to potential exposure of terrestrial vertebrate receptors to the elevated uranium concentration demonstrated that there was no ecological impact from uranium. It is, therefore, concluded that there is not an unacceptable ecological risk at PRS 15-012(b) following the VCA.

3.3.3.4 Surface Water Assessment

The AP-4.5 assessment erosion matrix score for PRS 15-012(b) was a combined 15.3: 8.3 out of 43 for site setting (reflecting the very gradual slope and 25-75% ground cover); 0.0 for runoff; and 7 for run on (due to proximity to parking lot/structures). This low score reflects a very small potential for the site to adversely affect surface water. The complete AP 4.5 assessment is included in Appendix B-4.2.1 of this document.

3.3.3.5 Groundwater Assessment

No groundwater samples were collected from PRS 15-012(b). Data from matrices other than water are presented in Section 2.3.4.3, Data Review, and Appendix D-2.0, Analytical Results. Because the regional aquifer at TA-15 is at a depth of approximately 875 to 1100 ft below the ground surface (LANL 1993, ER ID 20946) and the vertical extent of contamination was determined, groundwater samples did not need to be collected.

3.3.3.6 Underground Storage Tanks

There are no underground storage tanks associated with this PRS.

3.3.3.7 Other Assessments

There were no additional assessments conducted as part of this VCA.

3.3.4 Conclusions and Recommendations

PRS 15-012(b) has been characterized and remediated and the nature and extent of site contamination defined. The site assessment of the confirmatory sample results from PRS 15-012(b) did not identify any COPCs or COPECs. This indicates there is no potential for unacceptable risk to human health and the environment at this PRS. The site had an erosion matrix score of 15.3 and a surface water run-off score of zero based on the AP 4.5 assessment, which indicates that there is a low potential for erosion. The site has been remediated and should therefore have no impacts to surface water and groundwater. The area where the remediation occurred has been regraded with base course and is expected to be used as a parking lot or an equipment storage area. Therefore, based on the results of the remedial activities, the site is proposed for no further action (NFA) under Criterion 5, which states "The SWMU has been characterized or remediated in accordance with current applicable state or federal regulations and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use".

4.0 WASTE MANAGEMENT

Wastes generated during the VCA are indicated in Table 4.0-1.

TABLE 4.0-1
WASTE TYPES AND VOLUMES

ITEM	WASTE TYPE	VOLUME
PPE	Solid low-level radioactive	1 55-gal. drum
Contaminated soil	Solid low-level radioactive	8 roll-off bins (≈128 cu. yds.)
Decontamination liquid	Liquid low-level radioactive	2 55-gal. drums

The volume of personal protective equipment (PPE) generated during this VCA was approximately one 55-gallon drum. The PPE was deemed low-level radioactive waste based on an inspection for visual contamination, field screening for radioactivity, and the analytical results for the roll-off soil samples. The PPE was disposed at TA-54, Area G.

The contaminated soil from the wash area, approximately 128 cubic yards, was removed from the site and placed in 8 roll-off bins as part of the VCA. During the placement of soil into each roll-off bin, a portion of the excavated soil in each backhoe bucket was placed in a stainless-steel bowl, so that when the bin was full the bowl contained a representative composite soil sample. The soil samples for each roll-off were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals, isotopic uranium, isotopic plutonium, tritium, SVOCs, HE, and by gamma spectroscopy. A separate grab sample from each roll-off was also collected and analyzed for VOCs according to procedures in LANL-ER-SOP-06.03. The soil from the roll-off bins was classified as low-level radioactive waste and disposed at TA-54, Area G.

Rinsing PPE and sampling equipment with water and detergent generated decontamination liquids, which were placed in two 55-gallon drums. The liquid waste was sampled and analyzed for TAL metals, isotopic uranium, SVOCs, HE, and by gamma spectroscopy. It was classified as low-level radioactive waste, solidified with Waterworks® (a non-hazardous acrylic polymer), and disposed at TA-54, Area G.

5.0 REFERENCES

The following list includes all of the documents cited in the body and appendixes of this RFI report. The parenthetical information following each reference provides the author, publication date, and ER ID number, and, if applicable, the LANL ER Project Reference Library reference set number and tab number for each document. This information is also included in the citations in the text. This information can be used to locate the documents on this list.

The ER ID number is a number assigned by LANL's ER Project to track material associated with LANL PRSs. This number can be used to locate the actual document at the ER Project's Records Processing Facility. All cited documents are assigned ER ID numbers.

The reference set number and tab number are assigned to locate material in the LANL ER Project Reference Library, which is housed at NMED, HRMB, DOE, and the ER Project Office. This library is a living document that was developed to ensure that the AA has all of the necessary material to review the decisions and actions proposed in documents submitted by the Laboratory's ER Project. Documents previously submitted to the AA and documents that are specific to this RFI report are not included in the Reference Library, and their citations do not include reference set and tab numbers. Documents that are specific to this RFI report are attached in Appendix G-2.0, Referenced Documents.

ATSDR (Agency for Toxic Substances and Disease Registry), April 1993a. "Beryllium," Syracuse Research Corporation/Clement International Corporation Contract No. 205-88-0608 for U.S. Public Health Services (ATSDR 1993a, ER ID 59088)

ATSDR (Agency for Toxic Substances and Disease Registry), April 1993b. "Lead," Clement International Corporation Contract No. 205-88-0608 for U.S. Public Health Services (ATSDR 1993b, ER ID 59089)

ATSDR (Agency for Toxic Substances and Disease Registry), April 1993c. "Mercury," Clement International Corporation Contract No. 205-88-0608 for U.S. Public Health Services (ATSDR 1993c, ER ID 59091)

ATSDR (Agency for Toxic Substances and Disease Registry), December 1990a. "Copper," Syracuse Research Corporation Contract No. 205-88-0608-02 for U.S. Public Health Services (ATSDR 1990, ER ID 59090)

ATSDR (Agency for Toxic Substances and Disease Registry), December 1990b. "Uranium," Syracuse Research Corporation/Clement International Corporation Contract No. 205-88-0608 for U.S. Public Health Services (ATSDR 1990b, ER ID 59092)

Becker, N.M., 1991. "Influence of Hydraulic and Geomorphic Components of a SemiArid Watershed on Depleted Uranium Transport," a thesis submitted in partial fulfillment of the requirements for the degree of doctor of Philosophy (Civil and Environmental Engineering) at the University of Wisconsin, Madison, Wisconsin. (Becker 1991, ER ID 15317)

Brady N. C., 1974. "The Nature and Properties of Soils," 8th Edition, Macmillan Publishing Co. (Brady 1974, ER ID 58203)

Bowen, B. M., May 1990. "Los Alamos Climatology," Los Alamos National Laboratory Report LA-11735-MS, Los Alamos, New Mexico. (Bowen 1990, ER ID 6899)

Buckland, C., June 21, 1965. "Radioactive Contamination Surveys: R-site Structures." Los Alamos Scientific Laboratory memorandum to S. E. Russo from Carl Buckland, Los Alamos NM (Buckland 1965, ER ID 5305)

Burt and Grossenheider, 1976. "A Field Guide to the Mammals North America north of Mexico," Third Edition, Houghton Mifflin Company, (Burt and Grossenheider, 1976, ER ID 59097)

Courtright, W. C., April 13, 1996. "Dumping Materials in the Burning Ground Canyon," Los Alamos Scientific Laboratory memorandum to M. L. Brooks from W. C. Courtright, Los Alamos, New Mexico. (Courtright 1967, ER ID 05350)

Courtwright, W. C., January 6, 1965. "Contamination Survey," Los Alamos Scientific Laboratory memorandum to S. E. Russo from W. C. Courtright, Los Alamos, NM (Courtright 1965, ER ID 5282)

Dahl, D. A., and L. J. Johnson, 1977. "Aerosolized U and Be from LASL Dynamic Experiments," Los Alamos Scientific Laboratory report LA-UR-77-681, Los Alamos, New Mexico (Dahl and Johnson 1977, ER ID 58992)

DOE (US Department of Energy), October 1987. "Phase I. Installation Assessment, Los Alamos National Laboratory," Volumes 1 and 2, (draft), Comprehensive Environmental Assessment and Response Program, Albuquerque Operations Office, Albuquerque, NM (DOE 1987, ER ID 8657)

DOE (US Department of Energy), April 1993, "Data Collection Handbook to Support Modeling the Impacts of radioactive Materials in Soils," Environmental Assessment and Information Sciences Division, Argonne National Laboratory, Argonne Illinois (DOE 1993, ER ID 59177)

Dragun, James, 1988. "The Soil Chemistry of Hazardous Materials", Hazardous Materials Control Research Institute, Silver Spring, Maryland (Dragon, 1988, ER ID Number 57645)

Dransfield, B. J., and J. N. Gardner, May 1985. "Subsurface Geology of the Pajarito Plateau, Española Basin, New Mexico," Los Alamos National Laboratory Report LA-10455-MS, Los Alamos, New Mexico. (Dransfield and Gardner 1985, ER ID 6612)

Environmental Protection Group, December 1990. "Environmental Surveillance at Los Alamos During 1989," Los Alamos National Laboratory Report LA-12000-ENV, Los Alamos, New Mexico. (Environmental Protection Group 1990, ER ID 06995)

Environmental Restoration Project, October 30, 1995. "RFI Report for Field Unit 2 (OU 1086), Potential Release Sites 15-004(b,c), 15-004(a,d), 15-004(f), 15-007(b), 15-008(b), 15-012(b), 15-009(j)," Los Alamos National Laboratory Report LA-UR-95-3738, Los Alamos, New Mexico. (ER Project 1995, ER ID 50294)

EPA (US Environmental Protection Agency), 1989 "Risk Assessment Guidance for Superfund, Part A EPA, Office of Emergency and Remedial Response, Washington DC: EPA/540/1-89/002. (EPA 1989, 0305, ER ID Number 8020)

EPA (US Environmental Protection Agency), April 10, 1990. "United States Environmental Protection Agency, Region 6, Hazardous Waste Permit (Hazardous and Solid Waste Amendments, 1984)", (EPA 1990, ER ID 01585)

EPA (U.S. Environmental Protection Agency), April 1992. "Guidance for Data Usability in Risk Assessment (Part A)," Office of Emergency and Remedial Response, Washington D.C. Publication 92-85.7-09A. (EPA, 1992, ER ID Number 54947)

EPA (US Environmental Protection Agency), December 1993. "Wildlife Exposure Factors," EPA Washington, D.C. (EPA 1993, ER ID 59109)

EPA (US Environmental Protection Agency), December 1, 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-94/012, Washington, DC. (EPA 1994, ER ID 48640)

EPA (US Environmental Protection Agency), February 1, 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA540/R-94/013, Washington, DC. (EPA 1994, ER ID 48639)

EPA (US Environmental Protection Agency), 1994. Statistical methods for Evaluating the Attainment of Cleanup Standards. Volume 3: Reference-Based Standards for Soils and Solid Media, EPA 230-R-94-004, Environmental Statistics and Information Division, Office of Policy, Planning, and Evaluation, Washington DC (EPA 1994, 230-R-94-004).

EPA (US Environmental Protection Agency, 1998. *"Region 9 Preliminary Remediation Goals (PRGs) 1998"*, EPA San Francisco, CA (EPA 1998, ER ID 58751)

Facilities Engineering Division Planning Group (ENG-2), ICF Kaiser Engineers, Inc., and Royston Hanamoto Alley and Abey Landscape Architects/Planners, September 1990. "Los Alamos National Laboratory Site Development Plan Technical Site Information," Los Alamos National Laboratory Report LA-CP-90-405, Los Alamos New Mexico. (Facilities Engineering Division Planning Group et al. 1990, 0655, ER ID 57223)

Gardner, J. N., T. Kolbe, and S. Chang, January 1993. "Geology, Drilling, and Some Hydrologic Aspects of Seismic Hazards Program Core Holes, Los Alamos National Laboratory, New Mexico," Los Alamos National Laboratory Report LA-12460-MS, Los Alamos, New Mexico. (Gardner et al. 1993, ER ID 12582)

Gardner, J.N., and L. House, October 1987. "Seismic Hazards Investigations at Los Alamos National Laboratory, 1984 to 1985, " Los Alamos National Laboratory Report LA011072-MS, Los Alamos, New Mexico. (Gardner and House 1987, ER ID 6682).

Gehan, E. A., 1965. A generalized Wilcoxon test for comparing arbitrarily singly-censored samples, *Biometrika*, **52**:203-223. (Gehan, 19865, ER ID 55611)

Gilbert, R. O.,1987. Statistical Methods for Environmental Pollution Monitoring, Von Nostrand Reinhold Co. Inc., New York. Pgs 247-250. (Gilbert 1987, ER ID 56179)

Graf, William L., October 1975. *"The Impact of Suburbanization on Fluvial Geomorphology," Water Resources Research*, Vol. 11, No. 5. (Graf 1975, ER ID 12465)

Kelly, Elizabeth, Gilbert Gonzales, and Lars Soholt, May 1998. "Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory, Los Alamos, New Mexico LA-UR-1822 (Kelly et al. 1998, ER ID 57916)

Klaassen C. D., Amdur, M. O., and Doull, J., 1986. "Casarett and Doull's Toxicology the Basic Science of Poisons," Third Edition, Macmillan Publishing Co. (Klaassen 1986, ER ID 59093)

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units report," Volumes I through IV, Los Alamos National Laboratory Report LA-UR-90-3400, prepared by International Technology Corporation under Contract 9-XS8-0062R1, Los Alamos, New Mexico. (LANL 1990, ER ID 7511)

LANL (Los Alamos National Laboratory), December 1996. "Installation Work Plan for Environmental Restoration," Revision 6, Los Alamos National Laboratory Report LA-UR-96-4629, Los Alamos, New Mexico. (LANL 1996, ER ID 55574)

LANL (Los Alamos National Laboratory), July 1993. "RFI Work Plan for Operable Unit 1086," Los Alamos National Laboratory Report LA-UR-92-3968, Los Alamos, New Mexico. (LANL 1993, ER ID 20946)

LANL (Los Alamos National Laboratory), November 1995. "Biological and Floodplain/wetland Assessment for Environmental Restoration Program Operable Unit 1086," Los Alamos National Laboratory Report LA-UR-95-649, Los Alamos, New Mexico. (LANL 1995, ER ID 52026)

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work–Analytical Support," Revision 2, RFP No. 9-XS1-Q4257, Los Alamos, New Mexico. (LANL 1995, ER ID 49738)

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory Report LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, ER ID 53450)

LANL (Los Alamos National Laboratory), November 1993. "Installation Work Plan for Environmental Restoration," Revision 3, Vol. 1, Los Alamos National Laboratory report LA-UR-93-3987, Los Alamos, New Mexico. (LANL 1993, ER ID 26077)

LANL (Los Alamos National Laboratory), September 1, 1994. Site Development Plan Annual Update 1995 Los Alamos National Laboratory, Los Alamos, New Mexico LA LP-95-113 (LANL 1995, ER ID 57224)

LANL (Los Alamos National Laboratory), November 1991. "Installation Work Plan for Environmental Restoration," Revision 1, Los Alamos National Laboratory Report LA-UR-91-3310, Los Alamos, New Mexico (LANL 1991, ER ID 07678)

London, Roger, September 9,1998. "PRS 15-012(b) Historical Practices,: Los Alamos National Laboratory memorandum to T. Fogg from Roger London, Los Alamos, NM (London, 1998, ER ID 59359)

McLin, S. G., August 1992. "Determination of 100-Year Floodplain Elevations at Los Alamos National Laboratory," Los Alamos National Laboratory Report LA-12195-MS, Los Alamos, New Mexico. (McLin 1992, ER ID 12014)

NMED (New Mexico Environmental Department) Risk-Based Decision Tree Description, Part of the New Mexico Environment Department Hazardous and Radioactive Materials Bureau RCRA Permits Management Program RPMP Document Requirement Guide (NMED 1998, ER ID 57761)

Nyhan, J. W., and L. J. Lane, May 1986. "Erosion Control Technology: A User's Guide to the Use of the Universal Soil Loss Equation at Waste Burial Facilities," Los Alamos National Laboratory Manual No. LA-10262-M, Los Alamos, New Mexico. (Nyhan and Lane 1986, 0159, ER ID 6539)

Nyhan, J. W., L. W. Hacker, T. E. Calhoun, and D. L. Young, June 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos Scientific Laboratory Report LA-6779-MS, Los Alamos, New Mexico. (Nyhan et al. 1978, ER ID 5702)

Purtymun, W. D., January 1984. "Hydrologic Characteristics of the Main Aquifer in the Los Alamos Area: Development of Ground Water Supplies," Los Alamos National Laboratory Report LA-9957-MS, Los Alamos, New Mexico. (Purtymun 1984, ER ID 6513)

Purtyman and Johansen, 1974. "*General Geohydrogeology of the Pajarito Plateau," New Mexico Geol. Soc. Guidebook, 25th Field Conf., Ghost Ranch, 1974*, pp. 347-349. (Purtyman and Johansen 1974, ER ID 11835)

Purtyman, W. D., and A. K. Stoker, August 1988. "Water Supply at Los Alamos: Current Status of Wells and Future Water Supply," Los Alamos National Laboratory Report LA-11332-MS, Los Alamos, New Mexico. (Purtyman and Stoker 1988, ER ID 06819)

Ryti, R. P. Longmire, D. E. Broxton, May 7, 1998. "Inorganic and Radionuclide Background Data for Soils, Sediments, and Bandelier Tuff at LANL" Los Alamos National Laboratory, Los Alamos, New Mexico (LANL 1998, ER ID 58093)

Smith, R. L., and R. A. Bailey, 1966. "The Bandelier Tuff: A Study of Ash-Flow Eruption Cycles from Zoned Magma Chambers," *Bulletin Volcanologique,* Vol. 29, pp. 83-104. (Smith and Bailey 1966, ER ID 21584)

Steen, C. R., 1982. "Pajarito Plateau Archaeological Surveys and Excavations, II," Los Alamos National Laboratory Report LA-8860-NERP, Los Alamos, New Mexico. (Steen, 1982, ER ID 6056)

Steen, C.R., 1977. "Pajarito Plateau Archaeological Survey and Excavations," Los Alamos Scientific Laboratory Report LASL-77-4, Los Alamos, New Mexico. (Steen 1977, ER ID 7148)

Stoker, A. K., W. D. Purtymun, S. G. McLin, and M. N. Maes, May 1991. "Extent of Saturation in Mortandad Canyon." Los Alamos National Laboratory report LA-UR-91-1660, Los Alamos, New Mexico. (Stoker et al. 1991, ER ID 7530)

Travis, J. R., October 1992. "Atlas of the Breeding Birds of Los Alamos County, New Mexico, Pajarito Ornithological Survey," Los Alamos National Laboratory report LA-12206 Los Alamos, New Mexico (Travis 1992, ER ID 12015)

Weir, J. E., Jr., and W. D. Purtymun, 1962. "Geology and Hydrology of Technical Area 49, Frijoles Mesa, Los Alamos County, New Mexico," US Geological Survey Administrative Release, Albuquerque, New Mexico. (Weir and Purtymun 1962, ER ID 11890)

APPENDIX A LIST OF ACRONYMS AND GLOSSARY

A-1.0 LIST OF ACRONYMS

ALARA	As Low As Reasonably Achievable
AOCs	Areas of Concern
BNM	Bandelier National Monument
BRET	Biological resource evaluation team
BVs	background values
CEARP	Comprehensive Environmental Assessment and Response Program
CFR	Code of Federal Regulations
COPCs	chemicals of potential concern
COPECs	chemicals of potential ecological concern
CVAA	Cold Vapor Atomic Absorption
DAHRT	Dual-Axis Hydrodynamics Radiographic Test (facility)
DCF	Dose Conversion Factor
DOE	Department of Energy
DU	depleted uranium
EDL	estimated detection limit
Eh	Redox potential
EPA	Environmental Protection Agency
EPCEM	ecological pathways conceptual exposure model
EQL	estimated quantitation limit
ER	Environmental Restoration
ESG	Environmental Surveillance Group
ESL	Ecological Screening Level
ES&H	Environment, safety, and health
FIMAD	Facility for Information Management, Analysis, and Display
GFAA	Graphite furnace atomic absorption
GPC	gel permiation chromatography
HE	high explosives
HPLC	High-pressure liquid chromatography
HQ	hazard quotient
HRMB	Hazardous and Radioactive Materials Bureau
HRS	Hazard-ranking system
HSWA	Hazardous and Solid Wastes Amendments
ICPES	Inductively Coupled Plasma Emission Spectroscopy
ICPMS	Inductively Coupled Plasma Mass Spectroscopy
IWP	Installation work plan
KPA	Kinetic Phosphorescence Analysis
LANL	Los Alamos National Laboratory
LCS	Laboratory Control Samples
LIBS	Laser-Induced Breakdown Spectroscopy
LOAEC	Lowest Observed Adverse Effect Concentration
MDL	method detection limit
MOU	Memorandum of understanding
MS/MSD	matrix spike/matrix spike duplicate
NEPA	National Environmental Policy Act
NFA	no further action
NMED	New Mexico Environment Department (New Mexico Environmental Improvement Division before 1991)
NOAEC	No Observed Adverse Effect Concentration
NPDES	National pollutant discharge elimination system

OU	Operable unit
pH	Hydrogen in concentration
PHERMEX	Pulsed, High-Energy, Radiographic Machine Emitting X-rays (facility)
PPE	personal protective equipment
PRSs	potential release sites
QA	Quality assurance
QAPjP	Quality assurance project plan
QA/QC	quality assurance/quality control
Qbt	tuff
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RESRAD	Residual Radioactivity
RfD	reference dose
RFI	RCRA Facility Investigation
RPD	relative percent difference
RPS	Radiation protection standard
RWP	Radiological Work Permit
SALs	screening action levels
SOP	Standard operating procedure
SOW	Statement of work
SVOCs	semivolatile organic compounds
SWMUs	solid waste management units
SWSC	Sanitary Wastewater System Consolidation
T&E	threatened and endangered
TA	Technical Area
TAL	target analyte list
TCLP	Toxic Characteristic Leaching Procedure
TSD	Treatment, storage, disposal
UST	underground storage tank
VCA	voluntary corrective action
VOCs	volatile organic compounds
XRF	X-ray fluorescence

A-2.0 GLOSSARY

Abbreviated method A shortened form of a method. Usually refers to analytical methods that have been modified to require less rigorous sample preparation, analysis conditions or quality control.

Accuracy The extent to which the results of a calculation or measurement approach the true values of the calculated or measured quantities, and are free from error.

Action Level. A value that, when exceeded, will trigger a specified response.

Adsorption The surface retention of solid, liquid, or gas molecules, atoms, or ions by a solid or a liquid, as opposed to absorption, the penetration of substances into the bulk of the solid or liquid.

Aliquot A representative sample of a larger quantity.

Alluvial Said of materials or features deposited by running water.

Alluvial fan A fan-shaped piedmont accumulation of sediment deposited by a stream.

Alluvium Clay, silt, sand, gravel, or other rock materials transported by water and deposited in fairly recent geologic time as sorted or semisorted sediments in riverbeds, flood plains, lake shores, and fans at the base of mountain slopes.

Alpha radiation The form of radiation composed of alpha particles emitted in the radioactive decay of certain nuclides. The least penetrating of the three common types of radiation (alpha, beta, and gamma), it can be blocked by a sheet of paper or the outer dead layer of skin.

Analysis A process used to measure one or more attributes of a sample in a clearly defined, controlled, systematic manner. Often requires treating a sample chemically or physically before measurement.

Analyte The particular chemical or radiochemical species to be identified and/or quantified.

Analytical laboratory data qualifiers Data qualifiers that are attached to sample results by the analytical laboratory that performed the sample analysis.

The following letter qualifier flags are for **inorganic analyses**:

"**U**" The compound was analyzed for but was not detected. The associated numerical value is the estimated detection limit.

"**B**" The reported value was obtained from a reading that was less than the estimated detection limit but greater than or equal to the instrument detection limit.

"**E**" The reported value is estimated because of the presence of interference.

"**M**" Duplicate injection precision was not within control limits.

"**N**" Spiked sample recovery was not within control limits.

"**S**" The reported value was determined by the Method of Standard Additions.

"**W**" Post-digestion spike for GFAA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.

"*****" Duplicate sample analysis was not within control limits.

"+" Correlation coefficient for the Method of Standard Additions is less than 0.995.

The following letter qualifier flags are for **organic analyses**:

"U" The compound was analyzed for but was not detected. The reported numerical value is the estimated quantitation limit.

"J" Indicates an estimated value. The "J" flag is used if the compound is present but the result is less than the sample estimated quantitation limit and greater then the instrument detection limit.

"B" The analyte was found in the associated method blank as well as in the sample.

"E" The concentrations of the analyte exceeded the calibration range of the instrument.

"D" The analyte was identified in an analysis at a secondary dilution factor.

"C" Identification of a pesticide/PCB has been confirmed by GC/MS.

"P" The percent difference between a pesticide/PCB result obtained on the primary and secondary columns was greater than 25%.

"N" There is presumptive evidence of the presence of a tentatively identified compound based on mass spectral matching.

"A" A tentatively identified compound is a suspected aldol-condensation product.

Andesite A fine-grained volcanic rock, chiefly plagioclase and pyroxene.

Anomaly A deviation from normal variations; something that is abnormal.

Applicable, relevant, or appropriate requirement (ARARs) Those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, or that address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Aquifer A permeable body of geologic material capable of yielding groundwater to wells or springs.

Aquitard A low permeability geologic material that does not readily yield groundwater to wells.

Area of concern An area at LANL known or suspected to be contaminated with radionuclides, but not contaminated by hazardous chemicals (or hazardous waste).

Assessment endpoint A quantitative or quantifiable expression of the environmental value considered to be at risk in a risk analysis (i.e. a 25% reduction in fish biomass or local extinction of an avian species).

As low as reasonably achievable (ALARA) An approach to radiation protection to control or manage exposures (both individual and collective to the work force and the general public) and releases of radioactive material to the environment as low as social, technical, economic, practical, and public policy considerations permit. Used in this sense, ALARA is not a dose limit.

Ash-flow tuff A tuff deposited by a hot dense volcanic current. Ash-flow tuff can be either welded or nonwelded.

Background level The naturally occurring concentrations of an inorganic chemical (including naturally occurring radionuclides) in soil.

Background radiation The amount of radioactivity naturally present in the environment, including cosmic rays from space.

Background value (BV) Background values exist for inorganic chemicals and radionuclides. The background values are the upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. In cases where a UTL cannot be calculated, either the detection limit or maximum reported value is used as a BV. Background values are used as simple threshold numbers to identify potentially contaminated site sample results as greater than background levels.

Barrier Any material or structure that prevents or substantially delays movement of solid, liquid, or gaseous phase chemicals in environmental media.

Basalt A hard, dense, dark volcanic rock composed chiefly of plagioclase, augite, olivine, and magnetite.

Baseline level Anthropogenic, non-site related concentrations of a given chemical in the soil. Examples of baseline levels are nuclear fallout and organic chemicals associated with urban activities.

Baseline risk assessment (Also known as ***risk assessment***) A site-specific analysis of the potential adverse effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases. There are four steps in baseline risk assessment: data collection and analysis, exposure assessment, toxicity assessment, and risk characterization.

Bentonite A clay composed of the mineral montmorillonite and variable amounts of magnesium and iron, formed over time by the alteration of volcanic ash. As bentonite can adsorb large quantities of water and expand to several times its normal volume, it is a common additive to drilling mud.

Beta radiation Radioactive transformation of a nuclide in which the nucleus emits a beta particle (electron or positron). Beta radiation can be blocked by an inch of wood or by a thin sheet of aluminum.

Bias (1) The degree to which the value obtained for a measured parameter deviates from the value accepted as the true, or reference, value. (2) A systematic deviation from the true value that remains constant over replicated measurements within the statistical precision of the measurement process.

Blank sample A sample expected to have negligible or unmeasurable amounts of analytes. Results of blank sample analyses indicate whether or not field samples might have been contaminated during one or more steps of the sample collection, transport, storage, preparation and analysis process.

Blind sample See ***Single blind sample*** and ***Double blind sample***.

Breccia Coarse-grained rock consisting of angular fragments cemented together or embedded in a fine-grained matrix.

Caldera A more or less circular volcanic depression, generally on the order of tens of kilometers in diameter, formed during the eruption of large volumes (tens to hundreds of cubic kilometers) of dense rock equivalent, ash flow, and ash fall tuff deposits.

Calibration A process used to identify the relationship between the true, or reference, analyte concentration or other variable and the response of a measurement instrument, chemical analysis method, or other measurement system.

Calibration blank A calibration standard prepared to contain negligible or unmeasurable amounts of analytes. It is used to establish the zero concentration point for analytical measurement calibration.

Calibration standard A sample prepared to contain known amounts of the analytes of interest and of other constituents required for the analysis.

Caliche (Properly called ***pedogenic calcite***, also known as ***calcrete***) An accumulation of calcium carbonate, typically found in the near-surface.

Catchment A structure such as a basin or reservoir, for collecting or draining water; the collecting of water.

Chain of custody An unbroken, documented trail of accountability designed to ensure that the physical integrity of samples, data, and records remains uncompromised.

Chemical Any naturally occurring or man-made substance characterized by a definite molecular composition, including molecules that contain radionuclides.

Chemical of concern A chemical that is identified as a potential risk as the result of performing a site-specific human health or ecological risk assessment.

Chemical of potential concern (COPC) A chemical detected at a site that has the potential to adversely affect human and or ecological receptors due to its concentration, distribution and mechanism of toxicity. The chemical remains a concern until exposure pathways and receptors are evaluated in a site-specific risk assessment.

Cleanup Action undertaken to physically remove or treat a hazardous substance that poses a threat or potential threat to human health and welfare and the environment. Sites are considered cleaned up when EPA removal or remedial programs have no further expectation or intention of returning to the site and threats have been mitigated or do not require further action.

Cleanup levels Media-specific target concentration levels for contaminants that must be met by a selected corrective action. Cleanup levels are established using criteria such as protection of human health and the environment; compliance with regulatory requirements; reduction of toxicity, mobility, or volume through treatment; long- and short- term effectiveness; implementability; cost; and public acceptance.

Code of Federal Regulation (CFR) A codification of all regulations developed and finalized by federal government agencies in the *Federal Register*.

Collocated sample One of two or more samples collected as close together in time and space as the sampling equipment allows so that each sample is expected to be equally representative for a given analyte within the common space and time interval.

Colluvium Rock debris accumulated at the base of a cliff or on a slope principally by the action of gravity.

Comparability A qualitative measure of the degree to which one item or data set can be compared with another.

Composite sample A sample that is formed by combining and homogenizing several grab samples.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. Amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The acts created a special tax that goes into a trust fund, commonly known as Superfund, whose mandate is to investigate

and clean up abandoned or uncontrolled hazardous waste sites that may endanger health or the environment. The EPA is responsible for managing Superfund.

Conceptual model See also ***Site conceptual model.***

Conceptual hydrogeologic model Perception of the occurrence, movement and quality of groundwater in an area and the relationship of groundwater to the surface water, soil water and geologic framework there.

Confluence The place where two or more streams meet; the point where a tributary meets the main stream.

Confined Said of groundwater in an artesian aquifer.

Constituent Any compound or element present in environmental media, including both naturally occurring and anthropogenic elements.

Contaminant Any chemical (including radionuclides) present in environmental media or on structural debris at a concentration that may present a risk to human health or the environment.

Controlled area Any Laboratory area to which access is controlled to protect individuals from exposure to radiation and/or hazardous materials.

Corrective Action A measure taken to rectify conditions adverse to human health or the environment.

Corrective measures study If a RCRA facility investigation indicates that further action is required, a "corrective measures study" is performed to identify and evaluate cleanup alternatives for the release. This study assesses risks to human health and the environment, costs, and other factors such as disposal methods.

Corrective measures implementation (CMI) This third step of the corrective action process includes design, construction, maintenance, and monitoring of the chosen remedy.

Curie A unit of radioactivity defined as that quantity of any radioactive nuclide that has an activity of 3.7×10^{10} disintegrations per second.

Daily Calibration A combination of calibration blank and calibration standard used to determine if the instrument response to analyte concentration is within acceptable bounds relative to the initial calibration. A daily calibration establishes the 24-hour relative response factors on which quantitations are based, thus verifying the satisfactory performance of an instrument on a day-to-day basis.

Data quality assessment A statistical and scientific evaluation of the data set to assess the validity and performance of the data collection design and statistical test, and to establish whether a data set is adequate for its intended use.

Data quality objectives (DQOs) The qualitative and quantitative goals that are developed before sampling begins that clarify the investigation objectives and identify the type, quantity and quality of data needed to support decisions.

Data validation A systematic process that applies a defined set of performance-based criteria to a body of data that may result in qualification of the data. This process is performed independently of the analytical laboratory generating the data set and occurs prior to drawing a conclusion from the data. It may comprise a standardized review (routine validation) and/or a problem-specific review (focused validation) of the data.

Data validator The person who performs data validation in accordance with LANL ER procedures.

Data verification A process of evaluating the completeness, correctness, consistency, and compliance of a laboratory data package against a specified standard or contract. Completeness means all required information is present—both hard copy and electronic. Correctness means the reported results are based on properly documented and correctly applied algorithms. Consistency means that values are the same when they are reported in different reports or are transcribed from one report to another. Compliance means that the data pass numerical QC tests based on parameters or limits specified in a contract or in an auxiliary document.

Decommissioning The permanent removal from service of surface facilities and components only, after facility closure, in accordance with regulatory requirements and environmental policies.

Decontamination The removal of unwanted material from the surface of or from within another material, or the neutralizing of it.

Deferred action Postponement of the selection and implementation of a corrective measure until a future date, usually following decommissioning of an active site.

Detection limit The minimum concentration of a substance that can be measured by an instrument with a specified statistical confidence that the analytical concentration is greater than zero.

Discharge or Hazardous Waste Discharge (As defined under RCRA, 40 CFR 260.10) The accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous waste into or on any land or water.

Disposal The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

U.S. Department of Energy (DOE) The federal agency that sponsors energy research and regulates nuclear materials for weapons production.

Dose The quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body.

Dose equivalent An estimate of the amount of biological damage (in rems) done by the deposition in tissue of a given unit of absorbed radiation dose.

Double blind sample A sample with analyte concentration and sample identity unknown to the analyst.

Duplicate analysis An analysis performed on one of a pair of identically prepared subsamples of the same sample.

Duplicate measurement One of a pair of measurements performed on a prepared sample under identical conditions.

Ecological Screening Level (ESL) An organism's exposure-response threshold for a given chemical constituent. It is the concentration of a substance in a particular medium that corresponds to a hazard quotient (HQ) of 1.0 for a given organism and below which no risk is indicated.

Effluent A liquid discharged as a waste, such as contaminated water from a factory or the outflow from a sewage works; water discharged from a storm sewer or from land after irrigation.

Eolian Pertaining to the wind, especially said of sediment deposition by the wind, of structures such as wind-formed ripple marks, or of erosion accomplished by the wind.

Environmental Assessment (EA) A report that identifies potentially significant environmental impacts from any federally approved or funded project that may change the physical environment. If an EA shows significant impact, an Environmental Impact Statement (EIS) is required.

Environmental Impact Statement A detailed report, required by federal law, on the significant environmental impacts that proposed major federal projects would have on the environment.

Environmental Surveillance The collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media to determine environmental quality of an industry or community. It is commonly performed at sites containing nuclear facilities.

Environmental Protection Agency (EPA) The federal agency responsible for enforcing environmental laws. While state regulatory agencies may be authorized to administer some of this responsibility, EPA retains oversight authority to ensure protection of human health and the environment.

Ephemeral stream Said of a stream or spring that flows only during and immediately after periods of rainfall or snowmelt.

Equipment blank A blank sample that is used to rinse the sample collection equipment and is then transferred to a sampling container. The equipment blank is collected after equipment decontamination is completed but prior to collection of another field sample.

Error Any discrepancy between a computed, observed, or measured quantity and the expected or theoretically correct value of that quantity.

Estimated quantitation limit The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine analytical laboratory operating conditions. Sample estimated quantitation limits are highly matrix-dependent, and the specified estimated quantitation limits might not always be achievable.

Evapotranspiration The combined discharge of water from the earth's surface to the atmosphere by evaporation from lakes, streams, and soil surfaces, and by transpiration from plants.

Exposure unit The bounded area or volume within which a person or other receptor may be exposed to contaminants that have been released to the environment.

Fault A fracture, or zone of fractures, in rock along which there has been vertical or horizontal movement; adjacent rock surfaces are displaced.

Field blank A blank sample either prepared in the field or carried to the sampling site, exposed to sampling conditions (e.g., bottle caps removed, preservatives added), and returned to a laboratory for analysis in the same manner in which environmental samples are analyzed. Used to identify the presence of contamination potentially added during the sampling and analysis process.

Field duplicate A second sample collected as near as possible to the original sample.

Field matrix spike A known amount of a field sample to which a known amount of the target analyte has been added. Used to compute the proportion of added analyte that is recovered upon analysis.

Field reagent blank Same as *field blank*.

Field sample See also *sample*.

Field split A field sample that has been divided in the field into equally representative portions (See also *split sample*).

Flood plain The portion of a river valley that is built of overbank sediment deposited when the river floods.

Focused data validation A technically based analyte-, sample-, and potentially data use-specific process that extends the qualification of data beyond method or contractual compliance and provides a level of confidence that an analyte is present or absent. If the analyte is present, the quality of the quantitation may be obtained through focused validation.

Gamma radiation A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as x-rays and require heavy shieldings, such as concrete or steel, to be blocked.

Geohydrology The science that applies hydrologic methods to the understanding of geologic phenomena.

Grab sample A specimen collected by a single application of a field sampling procedure to a target population, e.g. the surface soil from a single hole collected following the spade and scoop sampling procedure, or a single air filter left in the field for three months.

Groundwater Water in a subsurface saturated zone.

Half-life The time required for one-half of the radioactive atoms initially present in a sample to decay. Each radionuclide has a characteristic half-life ranging from a fraction of a second to thousands of years.

Hazardous and Solid Waste Amendments (HSWA) Amendments to the Resource Conservation and Recovery Act, 1984. HSWA added land disposal restrictions, minimum technology requirements, and expanded corrective action authorities to the RCRA statue.

Hazardous substance (As defined by 40 CFR 302.3) Any substance designated pursuant to 40 CFR 302. 40 CFR 302.4 – Designation of Hazardous Substances:

(a) ***Listed hazardous substances.*** The elements, compounds and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under section 102(a) of the CERCLA.

(b) ***Unlisted hazardous substances.*** A solid waste, defined in 40 CFR 261.2, which is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b), is a hazardous substance under section 101(14) of the CERCLA if it exhibits any of the characteristics identified in 40 CFR 261.20 through 261.24. See Hazardous Waste. **Note:** This definition incorporates by reference, substances listed in CWA sections 311 and 307(a); CAA section 112; RCRA section 3001; and TSCA section 7.

Hazardous waste (As defined by RCRA 40 CFR 261.3) Any solid waste is generally a hazardous waste if it is not excluded from regulation as a hazardous waste, is listed in the regulations as a hazardous waste, exhibits any of the defined characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity), or is a mixture of solid waste and hazardous waste.

Holding time The maximum elapse of time that one can expect to store a sample without unacceptable changes in analyte concentrations. Holding times apply under prescribed storage conditions and deviations in storage conditions may affect the holding time. Extraction Holding Time refers to the time lapse from sample collection to sample preparation; Analytical Holding Time refers to the time lapse between sample preparation and analysis.

Hot pad An area located at an airport, or other terminal of public transportation, that is segregated from the general public for the purposes of loading and unloading hazardous, radiological, and/or biological cargo.

HSWA module A portion of the Laboratory's permit to operate under RCRA that contains requirements specific to Los Alamos National Laboratory. It is this portion of the permit that contains the list of solid waste management units that must be cleaned up in accordance with RCRA procedures.

Hydraulic conductivity The rate at which water moves through a medium in a unit of time under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow.

Hydraulic gradient The rate of change of hydraulic head per unit of distance in the direction of groundwater flow.

Hydraulic head Elevation of the water table or potentiometric surface as measured in a well.

Hydrogeology The science that applies geologic methods to the understanding of hydrologic phenomena.

Hypothesis A proposition stated as a basis for further investigation.

Industrial use scenario Industrial use is the future use scenario in which current Laboratory operations continue. Any necessary remediation involves cleanup to standards designed to ensure a safe and healthy work environment for Laboratory workers.

Infiltration Entry of water into the ground.

Interflow A runoff process that involves lateral subsurface flow in the soil zone.

Injection well A well used for adding water and/or tracers to the saturated zone during well tests of hydrologic behavior.

Initial calibration The process used to establish the relationship between instrument response and analyte concentration at several analyte concentration values to demonstrate that an instrument is capable of acceptable analytical performance.

Initiator A weapons device used as the first element of an explosion, which upon receipt of the proper mechanical or electrical impulse produces a burning or detonating action.

Interim measure The actions used to achieve the goal of stabilization at contaminated sites that present serious and immediate health hazards.

Interference A chemical or physical entity whose influence results in a decrease or increase in the response of an analytical method or other measurement system relative to the response obtained in the absence of the entity.

Intermittent stream Said of a stream that flows only in certain reaches due to losing and gaining characteristics of the channel bed.

Interrupted stream Said of a stream whose flow is discontinuous due to man-made structures.

Institutional controls Controls prohibiting or limiting access to contaminated media; may consist of deed restrictions, use restrictions, permitting requirements, etc.

Laboratory duplicate sample The portions of a sample taken from the same sample container, prepared for analysis and analyzed independently but under identical conditions. Each duplicate sample is expected to be equally representative of the original material.

Land disposal restrictions (LDR) A RCRA program that requires hazardous waste be treated (or meet specified levels for hazardous constituents) before land disposal is allowed. In addition to the disposal prohibition, there are prohibitions and limits in the LDR program regarding the dilution and storage of wastes.

LANL Data validation qualifiers Data qualifiers used in the LANL ER Project baseline validation process are as follows:

"A" Contractually required data are not available for data review and evaluation.

"U" The analyte was analyzed for but not detected.

"J" The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.

"J+" The analyte was positively identified, and the result is likely to be biased high.

"J-" The analyte was positively identified, and the result is likely to be biased low.

"UJ" The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.

"RPM" Without further review of the raw data, the sample results are unusable due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. Presence or absence cannot be verified. Any results qualified as RPM must be evaluated for relevance to data use.

"P" Professional judgement should be applied to using the data in decision-making.

"PM" Professional judgement should be applied to using the data in decision-making. A manual review of raw data is recommended t determine if the defect impacts data use for decision-making.

"R" The data is rejected as a result of major problems with quality assurance/qualify control (QA/QC) parameters.

Leachate A liquid that has percolated through waste, soil or rock material and mobilized chemical species in the process.

Leaching The separation or dissolving out of soluble constituents of a solid material by the natural action of percolating water or by chemicals.

Materials disposal area An area used any time between the beginning of Laboratory operations in the early 1940s and the present for disposing of chemically and/or radioactively contaminated materials.

Matrix See also *sample matrix.*

Matrix Relatively fine material in which coarser fragments or crystals are embedded; also called "ground mass."

Matrix spike An aliquot of sample spiked with a known concentration of target analyte(s). The spiking typically occurs before sample preparation and analysis.

Matrix spike duplicate An intralaboratory duplicate sample spiked with a known amount of target analyte(s). Spiking occurs prior to sample preparation and analysis.

Maximum contaminant level Under the Safe Drinking Water Act, the maximum permissible level of a contaminant in water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards set take into account the feasibility and cost of attaining the standard.

Medium (environmental) Any material capable of absorbing or transporting constituents including tuffs, soils and sediments derived from these tuffs, surface water, groundwater, air, structural surfaces, and debris.

Medium (geological) The solid part of the hydrogeological system; may be unsaturated or saturated.

Method A body of procedures and techniques for systematically performing an activity.

Method blank An analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing and which is prepared and analyzed in the same manner as the corresponding environmental samples. The method blank is used to assess the potential for contamination to the sample during preparation and analysis.

Method detection limit (MDL) The minimum concentration of a substance that can be measured and reported with a known statistical confidence that the analyte concentration is greater than zero. The MDL is determined from analysis of samples of a given matrix type containing the analyte after subjecting the sample to the usual preparation and analyses. The MDL is used to establish detection status.

Migration The movement of inorganic and organic species through unsaturated or saturated materials.

Migration pathway A route (e.g., a stream or subsurface flow path that controls the potential movement of contaminants to environmental receptors (plants, animals, humans).

Mitigation (1) Avoiding an impact altogether by not taking a certain action or parts of an action. (2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation. (3) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment. (4) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action. (5) Compensating for the impact by replacing or providing substitute resources or environments.

Mixed waste Waste that contains both hazardous waste (as defined by RCRA and its amendments) and radioactive waste (as defined by the AEA and its amendments).

Model A mathematical approximation of a physical, biological, or social system.

Monitoring well A well drilled at a specific location on or off a hazardous waste site for the purpose of sampling groundwater or measuring water levels. Typically constructed with a moderate screen interval placed so as to straddle the water table or potentiometric surface associated with the saturated zone of interest.

National Pollutant Discharge Elimination System (NPDES) A federal regulation under the Clean Water Act requiring permits for discharge into surface waterways.

National Priorities List (NPL) EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response using money from the Trust Fund. Updated annually.

No further action (NFA) A decision that no further investigation or remediation is warranted for a PRS, based on risk levels for residential use, recreational use, or industrial use.

Notice of Deficiency (NOD) A notice issued to DOE and the Laboratory by EPA or NMED stating that some aspect(s) of a plan or report does not meet their requirements. The ER Project must then propose a solution acceptable to the EPA/NMED before the plan or report will be approved.

Operable unit (OU) At LANL, one of 24 areas originally established for administering the ER Project. Set up as groups of potential release sites, the OUs were aggregated based on geographic proximity for the purpose of planning and conducting the cleanup effort. As the project matured, it became apparent that 24 were too many to allow efficient communication and to ensure consistency in approach. Therefore, in 1994, the 24 OUs were reduced to six administrative "field units".

Outfall The vent or end of a drain, pipe, sewer, ditch, or other conduit that carries waste water, sewage, storm runoff or other effluent into a stream.

Out of control A condition in which a measured quality control parameter does not meet specified control or acceptance criteria.

Perched groundwater Groundwater that lies above the regional water table and is separated from it by an unsaturated zone.

Percolation Gravity flow of groundwater through the pore spaces in rock or soil below the ground surface.

Perennial Stream Said of a stream or reach that flows continuously throughout the year.

Performance evaluation sample A sample of known composition with respect to selected analytes which, upon analysis, is expected to yield results that fall within a prescribed range. Performance evaluation samples are selected to mimic as closely as possible those matrices representative of environmental samples from a particular location.

Permit modification A process in which changes to requirements of the Laboratory's operating permit is requested by application to the EPA. The process includes a public hearing and a 60-day comment period on the proposed changes.

Piezometer A well drilled for the purpose of measuring hydraulic head or water level; ideally only open at the bottom but usually constructed with a very short screen interval.

Piezometric Surface Also called potentiometric surface. The level to which water will rise in a well tightly cased into an aquifer.

Pollutant Includes, but is not limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring; except that the terms "pollutant or contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under Subparagraphs (A) through (F) of Paragraph (14) and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

Population (statistical) A set of entities or a continuum in a physical, biological or social system of interest, e.g., the residents of Los Alamos County, the water in an alluvial aquifer, or the plants in Pajarito Canyon.

Porosity The ratio of the volume of interstices in rock or soil to its total volume expressed as a percentage or as a fraction.

Porphyritic Said of the texture of an igneous rock in which larger crystals (phenocrysts) are set in a finer ground mass.

Potential release site (PRS) A site suspected of releasing contaminants into the environment. PRS is a generic term that includes SWMUs, hazardous waste sites listed in Module VII of the Laboratory's Hazardous Waste Facility Permit, and sites that have been identified as potentially contaminated by radioactivity.

Precambrian All geologic time prior to the beginning of the Paleozoic era (the Paleozoic began about 600 million years ago), equivalent to about 90% of all geologic time.

Precision A concept used to describe dispersion of measurements with respect to a measure of location or central tendency. Precision may be represented by the inverse of the standard deviation of a set of measurements.

Preliminary assessment The process of collecting and reviewing available information about a known or suspected hazardous waste site or release. The extent of release and degree of threat to human health and the environment are evaluated to determine whether further study is needed and whether the release meets the criteria for a CERCLA-funded removal.

Prepared sample A sample treated in such a manner as to render it amenable to analysis. May include: digestate, distillate, electroplate, extract, filter retentate, filtrate, homogenate, precipitate, pulverized/sieved portion of sample, residue, etc.

Qualifier flag A letter code indicating, on a gross scale, a verifiable or potential data deficiency. Qualifier flags are assigned to data based on the outcome of data validation checks.

Quality assessment sample A sample submitted for analysis, the data from which are used to assess the quality of performance of a sampling or analysis process. May include performance evaluation samples, field duplicates, field blanks, etc.

Quality control (QC) sample A sample which, upon analysis, provides information useful for adjusting, controlling, or verifying continuing acceptability of sampling and/or analysis activities that are in progress.

Quaternary The second period of the Cenozoic Era, following the Tertiary, and including the last 2 – 3 million years.

Radiation Energy emitted in the form of rays or particles that are thrown off by disintegrating atoms. The rays or particles emitted may consist of alpha, beta, or gamma radiation.

Radioactive decay (1) The process whereby radioactive materials undergo a change from one nuclide, element, or state to another, releasing radiation in the process. This action ultimately results in a decrease in the number of radioactive nuclei present in the sample. (2) The spontaneous transformation of one nuclide into a different nuclide or into a different isotope of the same nuclide accompanied by either the emission of particles from the nucleus, nuclear capture or ejection of orbital electrons, or fission.

Radioactive tracer A radioactive material added to, or induced in, a sample for the purpose of monitoring chemical or physical losses of the target analytes. The tracer is assumed to behave in the same manner as that of the target analytes.

Radioactive waste Waste material containing radionuclides, or contaminated by radionuclides.

Radionuclide A nuclide (species of atom) that exhibits radioactivity.

Randomized sample A sampling design where every possible sample has an equal probability of being selected.

RCRA facility assessment (RFA) Usually the first step in the RCRA corrective action process, to identify potential and actual releases from SWMUs and make preliminary determinations about releases, the need for corrective action, and interim measures. The RFA is generally equivalent to the preliminary assessment/site investigation taken under Superfund.

RCRA facility investigation (RFI) The second step of a RCRA corrective action, to gather enough data to fully characterize the nature, extent, and rate of migration of contaminants to determine the appropriate response action. The RFI is generally equivalent to the RI portion of the Superfund process.

Reason code A code used in the ER data validation process to indicate why a qualifier flag has been assigned to a datum.

Receptor A person, plant, animal, or geographical location that is exposed to a chemical or physical agent released to the environment by human activities.

Recharge The process by which water is added to the zone of saturation, either directly from the overlying unsaturated zone or indirectly by way of another material in the saturated zone.

Recreational use scenario Recreational use refers to current and future use scenarios in which cleanup of a PRS is completed to a level that permits the public to safely use it on an intermittent basis for activities such as hiking and camping. The standards are more stringent than they are for the industrial use scenario but not as stringent as those for residential use.

Regulatory standard Media-specific contaminant concentration levels of potential concern that are mandated by federal or state legislation or regulation (e.g., the Safe Drinking Water Act, New Mexico Water Quality Control Commission regulations).

Release Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant), but excludes

(A) any release which results in exposure to persons solely within a workplace, with respect to a claim which such persons may assert against the employer of such persons;

(B) emissions from the engine exhaust of a motor vehicle, rolling, stock, aircraft, vessel, or pipeline pumping station engine;

(C) release of source, byproduct, or special nuclear material from a nuclear incident, as those terms are defined in the Atomic Energy Act, if such release is subject to requirements with respect to financial protection established by the Nuclear Regulatory Commission under Section 170 of such act, or, for the purposes of Section 104 of this title or any other response action, any release of source, byproduct, or special nuclear material from any processing site designated under Section 102(a)(1) or 302(a) of the Uranium Mill Tailings Radiation Control Act of 1978, and (D) the normal application of fertilizer. **[CERCLA 101(22)]**

Relative precision Precision measured relative to a particular value. Relative precision expressed as the relative standard deviation (RSD) may be calculated as the ratio of the standard deviation to the selected value.

Relevant and appropriate requirements Those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

Remediation The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health; the act of restoring a contaminated area to a usable condition based on specified standards.

Remedy or remedial action Those actions consistent with permanent remedy instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment. The term includes, but is not limited to, such actions at the location of the release as storage, confinement, perimeter protection using dikes, trenches, or ditches, clay cover, neutralization, cleanup of released hazardous substances and associated contaminated materials, recycling or reuse, diversion, destruction, segregation of reactive wastes, dredging or excavations, repair or replacement of leaking containers, collection of leachate and run-off, on-site treatment or incineration, provision of alternative water supplies, and any monitoring reasonably required to assure that such actions protect the public health and welfare and the environment. **[CERCLA 101(24)]** Activities conducted at DOE facilities to reduce potential risks to people and/or harm to the environment from radioactive and/or hazardous substance contamination. **(DOE Order 5820.2A)**

Remove or removal The cleanup or removal of released hazardous substances from the environment; such actions as may be necessary taken in the event of the threat of release of hazardous substances into the environment, such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed material, or the taking of such other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment, which may otherwise result from a release or threat of release. **[CERCLA 101 (23)]**

Removal action An immediate action taken over the short term to address a release or threatened release of hazardous substances.

Replicate measurement A re-analysis (remeasurement) of a prepared sample.

Reportable quantity For any CERCLA hazardous substance, the quantity established in Table 302.4 and Appendix B of 40 CFR 302, the release of which requires notification unless federally permitted. **(DOE Order 5000.3A)**

Representativeness The degree to which data accurately and precisely represent a characteristic of a population or an environmental condition.

Residential use scenario The standards for residential use are the most stringent of the three current and future use scenarios being considered by the ER Project and is the level of cleanup EPA is currently specifying for SWMUs located off the Laboratory site and for those released for non-Laboratory use.

Resource Conservation and Recovery Act (RCRA) The RCRA regulations establish a comprehensive hazardous waste management system under the authority of RCRA Subtitle C. RCRA regulates hazardous waste from its point of generation through its point of final disposal. RCRA also regulates solid waste under Subtitle D.

Respond or response (As defined by Section 101 (25) of CERCLA) remove, removal, remedy, or remedial action, including enforcement activities related thereto.

Response action A CERCLA-authorized action at a Superfund site involving either a short-term removal action or a long-term remedial response that may include, but is not limited to, the following activities.

- Removing hazardous materials from a site to an EPA-approved, licensed hazardous waste facility for treatment, containment, or destruction.
- Containing the waste safely on site to eliminate further problems.
- Destroying or treating the waste on site using incineration or other technologies.
- Identifying and removing the source of groundwater contamination and halting further movement of the contaminants.

Restricted Area Any area access to which is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials. "Restricted area" shall not include areas used as residential quarters, although a separate room or rooms in a residential building may be set apart as a restricted area. **(10 CFR 60.2)**

Retardation The act or process that reduces the rate of movement of a chemical substance in water relative to the average velocity of the water. The movement of chemical substances in water can be retarded by adsorption and precipitation reactions, and by diffusion into the pore water of the rock matrix.

Risk A measure of a negative or undesirable impact associated with an event.

Risk assessment see also *Baseline Risk Assessment*

Risk assessment, preliminary A risk assessment conducted using conservative assumptions and scenarios and assuming no mitigating or corrective measures beyond those already in place.

Risk characterization The summarization and integration of the results of toxicity and exposure assessments into quantitative and qualitative expressions of risk. The major assumptions, scientific judgments, and sources of uncertainty related to the assessment are also presented.

Risk management Risk management is the integration of risk characterization with other nonscientific considerations specified in applicable statutes to make and justify regulatory decisions.)

Rinsate Blank See also *Equipment blank*.

Routine analysis The analysis categories of inorganics, metals, organics, radiochemistry and high explosives as defined in the current contract laboratory statement of work.

Routine Data Validation The process of reviewing analytical data relative to quantitative routine acceptance criteria. The objective of routine data validation is two-fold: one objective is to estimate the technical quality of the data relative to minimum national standards adopted by LANL ER; the other objective is to indicate to data users the technical data quality at a gross level by assigning qualifier flags to environmental data whose quality indicators do not meet acceptance criteria.

Sample A portion of a material (e.g., rock, soil, water, air), which, alone or in combination with other samples, is expected to be representative of the material or area from which it is taken. Samples are typically sent to a laboratory for analysis or inspection or are analyzed in the field. When referring to samples of environmental media, the term *field sample* may be used.

Sample matrix In chemical analysis, that portion of a sample which is exclusive of the analytes of interest. Together, the matrix and analytes of interest form the sample.

Screening Action Level (SAL) Medium-specific concentration level for a chemical derived using conservative criteria below which it is generally assumed that there is no potential for unacceptable risk to human health. The derivation of a SAL is based on conservative exposure and land use assumptions. However, if an applicable regulatory standard exists that is less than the value derived by risk-based computations, it will be used for the SAL.

Screening Assessment A process designed to determine whether contamination detected in a particular medium at a site may present a potential unacceptable human health and /or ecological risk. The assessment utilizes screening levels that are either human-health or ecologically-based concentrations derived using chemical specific toxicity information and standardized exposure assumptions below which no additional actions are generally warranted.

Sensitivity An indication of the lowest analyte concentration that can be measured with a specified degree of confidence.

Single blind sample A sample submitted for analysis whose composition is known to the submitter but not to the analyst.

Site characterization The program of exploration and research, both in the laboratory and in the field, undertaken to establish the geological, hydrological, and chemical conditions at a site. Site characterization includes borings, surface excavations, excavation of exploratory shafts, limited subsurface lateral excavations and borings and geophysical testing. **(10 CFR 60.2)**

Site conceptual model A qualitative or quantitative description of sources of contamination, environmental transport pathways for contamination, and biota that may be impacted by contamination (called receptors) and whose relationships describe qualitatively or quantitatively the release of contamination from the sources, the movement of contamination along the pathways to the exposure points, and the uptake of contaminant by the receptors.

Soil gas Those gaseous elements and compounds that occur in the void spaces in rock or soil. Such gases can move through or leave the soil or rock, depending on changes in pressure.

Soil water Water in the unsaturated zone, regardless of whether it occurs in soil or rock.

Solid waste Any discarded material, including any material which is abandoned, recycled, inherently waste-like, or certain military munitions.

Solid waste management unit (SWMU) Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste.

Split sample A sample that has been subdivided into two or more portions expected to be of the same composition. Used to characterize within-sample heterogeneity, sample handling, and measurement variability.

Stakeholder As used in this document, stakeholder refers to any party or agency, whether inside or outside the Laboratory, interested in or affected by Environmental Restoration Project issues and activities.

Standard operating procedure (SOP) A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and is officially approved as the method for performing certain routine or repetitive tasks.

Stratification Classification of the target population into two or more non-overlapping and exhaustive categories (strata) on the basis of characteristics which are known *a priori* for the entire population.

Stratified sample A sample including one or more specimens from each of several subpopulations of the target population. (Note: If the specimens are selected from within each subpopulation using *simple random sampling*, then the sample is called a stratified random sample.)

Stratigraphy The science dealing with the succession, age, composition and history of strata.

Surrogate compound (Surrogate) An organic compound used in the analyses of organic target analytes that is similar in composition and behavior to target analytes but is not normally found in field samples. Surrogates are added to every blank and spike sample to evaluate the efficiency with which analytes are recovered during extraction and analysis.

Target analyte A chemical or parameter, the concentration, mass or magnitude of which is designed to be quantified by use of a particular test method.

Technical area (TA) The Laboratory established technical areas as administrative units for all its operations. There are currently 49 active TAs spread over 43 square miles.

Topography The physical features of a place or region.

Toxic pollutants The 126 individual priority toxic pollutants contained in 65 toxic compounds or classes of compounds (including organic pollutants and metals) adopted by EPA pursuant to Section 307 (a) (1) of the Clean Water Act.

Transmission loss Reduction in surface water flow by seepage into the channel bed.

Transmissivity A measure of the amount of water that can be transmitted horizontally by the full saturated thickness of the aquifer under a hydraulic gradient of 1.

Transport or transportation The movement of a hazardous substance by any mode, including pipeline (as defined in the Pipeline Safety Act), and in the case of hazardous substance which has been accepted for transportation by a common or contract carrier, the term "transport" or "transportation" shall include any stoppage in transit which is temporary, incidental to the transportation movement, and at the ordinary operating convenience of a common or contract carrier, and any such stoppage shall be considered as a continuity of movement and not as the storage of a hazardous substance. **[CERCLA 101(26)]**

Treatment Any method, technique, or process, including elementary neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduced in volume.

Treatment, storage, and disposal facility (TSDF) Any building, structure, or installation where a hazardous waste has been treated, stored, or disposed. TSD facilities are regulated by EPA and states under RCRA.

Trip blank A sample of analyte-free media taken to the sampling site and returned to the analytical laboratory unopened along with samples taken in the field. Used to monitor cross contamination of samples during handling and storage both in the field and in the analytical laboratory.

Tuff A compacted deposit of volcanic ash and dust that contains rock and mineral fragments accumulated during an eruption.

Ultimate disposal The final disposal of hazardous substances resulting from a removal action. It does not include temporary storage or other temporary measures of managing the waste from a removal action.

Unconfined Said of water in a saturated zone that is open to the atmosphere (that is, not beneath a confining bed or under artesian pressure).

Underflow Groundwater flow beneath the bed of a non-flowing stream; such water is often perched in the channel alluvium atop the bedrock surface.

Underground storage tank (As defined in Section 9001(1) of the Solid Waste Disposal Act) The term "underground storage tank" means any one or combination of tanks (including underground pipes connected thereto) which is used to contain an accumulation of regulated substances, and the volume of which (including the volume of the underground pipes connected thereto) is 10% or more beneath the surface of the ground. Such term does not include any

(A) farm or residential tank of 1,100 gallons or less capacity used for storing motor fuel for noncommercial purposes;
(B) tank used for string heating oil for consumptive use on the premises where stored;
(C) septic tank;
(D) pipeline facility (including gathering lines) regulated under
  i) the Natural Gas Pipeline Safety Act of 1968 (49 USC App. 1671 et seq.),
  ii) the Hazardous Liquid Pipeline Safety Act of 1979 (49 USC App. 2001 et seq.), or
  iii) which is an intrastate pipeline facility regulated under state laws comparable to the provisions of law referred to in Clause (i) or (ii) of this subparagraph;
(E) surface impoundment, pit, pond, or lagoon,
(F) storm water or waste water collection system;
(G) flow-through process tank;
(H) liquid trap or associated gathering lines directly related to oil or gas production and gathering operations; or
(I) storage tank situated in an underground area (such as a basement, cellar, mine working, drift, shaft, or tunnel) if the storage tank is situated upon or above the surface of the floor.

Unrestricted area Any area, access to which is not controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials and any area used for residential quarters. **(10 CFR 60.2)**

Unsaturated zone The zone between the land surface and the regional water table. Generally, fluid pressure in this zone is less than atmospheric pressure, and some of the voids may contain air or other gases at atmospheric pressure. Alternatively, the unsaturated zone generally has moisture contents less than saturation.

Water balance The relationship between water input (precipitation) and output (runoff, evapotranspiration, and recharge) in a hydrological system; the portioning of precipitation into these components of the hydrological cycle.

Water content (also gravimetric moisture content) The amount of water in an unsaturated medium, expressed as the ratio of the weight of water in a sample to the weight of the oven-dried sample; often expressed as a percent.

Water table The top of the saturated zone; the water level associated with an unconfined aquifer.

Welded Tuff A volcanic deposit hardened by the action of heat, pressures from overlying material, and hot gases.

APPENDIX B OPERATIONAL AND ENVIRONMENTAL SETTING

APPENDIX B OPERATIONAL AND ENVIRONMENTAL SETTING

The following information was reproduced from: the Executive Summary, page E-2; Chapter 2, pages 2-1 to 2-9; Chapter 3, pages 3-1 to 3-23; and Appendix E, pages E-2 to E-10, of the RFI Work Plan for OU 1086 (LANL 1993, ER ID No. 20946). Certain terminology in the work plan is no longer in use. Therefore, current terms are added in brackets following the out-of-date terms in this quotation.

B-1.0 OPERATIONAL HISTORY AND LAND USE

Technical Area 15, also known as R-Site, occupies a portion of Three-Mile Mesa on Pajarito Mesa near the southwestern boundary of LANL. TA-15 occupies approximately 1200 acres. TA-15 is bounded by TAs 66 and 67 to the north, TAs 14, 16, 37, and 49 to the west and south and TA-36 to the east. The relatively flat surface of Three-Mile Mesa on the Pajarito Plateau encompasses most of TA-15, but steep-walled Water Canyon traverses the southern site boundary and Potrillo Canyon intersects the main portion of Three-Mile Mesa, dividing the Mesa into two firing site areas on PHERMEX Mesa and Mesita del Potrillo. Sections B-2 through B-4 provide additional information on the TA-15 environmental setting. Figure B-1.0-1 shows an aerial view of LANL including TA-15.

Figures B-1.0-2 and B-1.0-3 show the regional location of LANL and the location relative to other LANL sites and perimeter properties. Figure B-1.0-4 shows a site diagram of TA-15 and its associated PRSs, A topographic map of TA-15 is contained in Appendix A of the RFI Work Plan for OU 1086 (LANL 1993, ER ID No. 20946). Detailed engineering drawings, site maps, survey coordinates for shafts and Material Disposal Areas (MDAs) N and Z [SWMU nos. 15-007(a) and 15-007(b), respectively] and other information relevant to the TA-15 RFI are contained in Appendix D of the RFI Work Plan for OU 1086 (LANL 1993, ER ID No. 20946).

Much of TA-15 has been used from the mid-1940's to the present time for explosives experiments. In that capacity, test explosions ranging from a few kilograms of high explosives to as much as 650 kg were conducted in arrangements that duplicate many of the components of a nuclear weapon, with the exception of the fissionable materials. These components sometimes contained multi-kilogram quantities of natural uranium metal, depleted uranium metal, and lesser quantities of beryllium, and other metals. In most cases, the tests were carried out above ground, which resulted in the test materials being scattered over areas with radii up to several hundreds of meters. Based on LANL records, some 75 metric tons of natural and depleted uranium have been expended at the firing sites on TA-15 since the mid-1940's.

History

This section describes the prehistoric use, early use, and LANL acquisition of Three-Mile Mesa and the historical development, environmental monitoring, and hazard ranking of TA-15.

Prehistoric Use

Three-Mile Mesa has seen extensive prehistoric use (Steen 1977, ER ID 7148; Steen, 1982, ER ID 6056). Ruins and artifacts are widespread across the mesa top, including some near PRSs. An archaeological survey, carried out in conjunction with the TA-15 RFI, documents this use and assesses the potential RFI impact on cultural resources (Section B-6.0 of this Appendix). It is expected that a categorical exclusion for TA-15 RFI activities will be issued by the DOE.

Early Uses and LANL Acquisition

Much of the Pajarito Plateau, including present-day TA-15, was part of the Ramon Vigil land grant. In the late 1800s and early 1900s, the Pajarito Plateau, including portions of Three-Mile Mesa, was used for ranching, farming, and/or timber production.

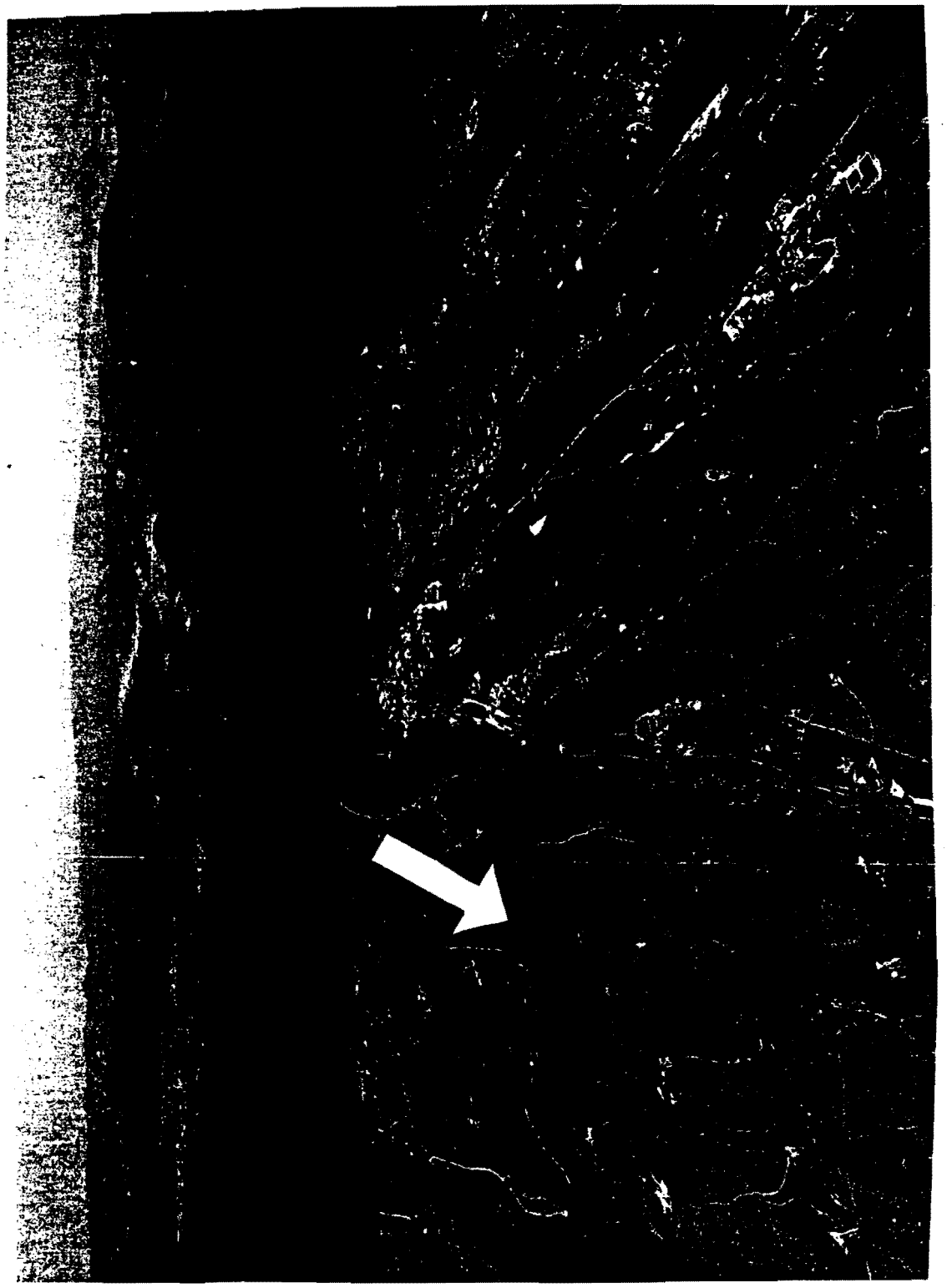


Figure B-1.0-1 Aerial view of Los Alamos, July 1989. TA-15 shown on left side.

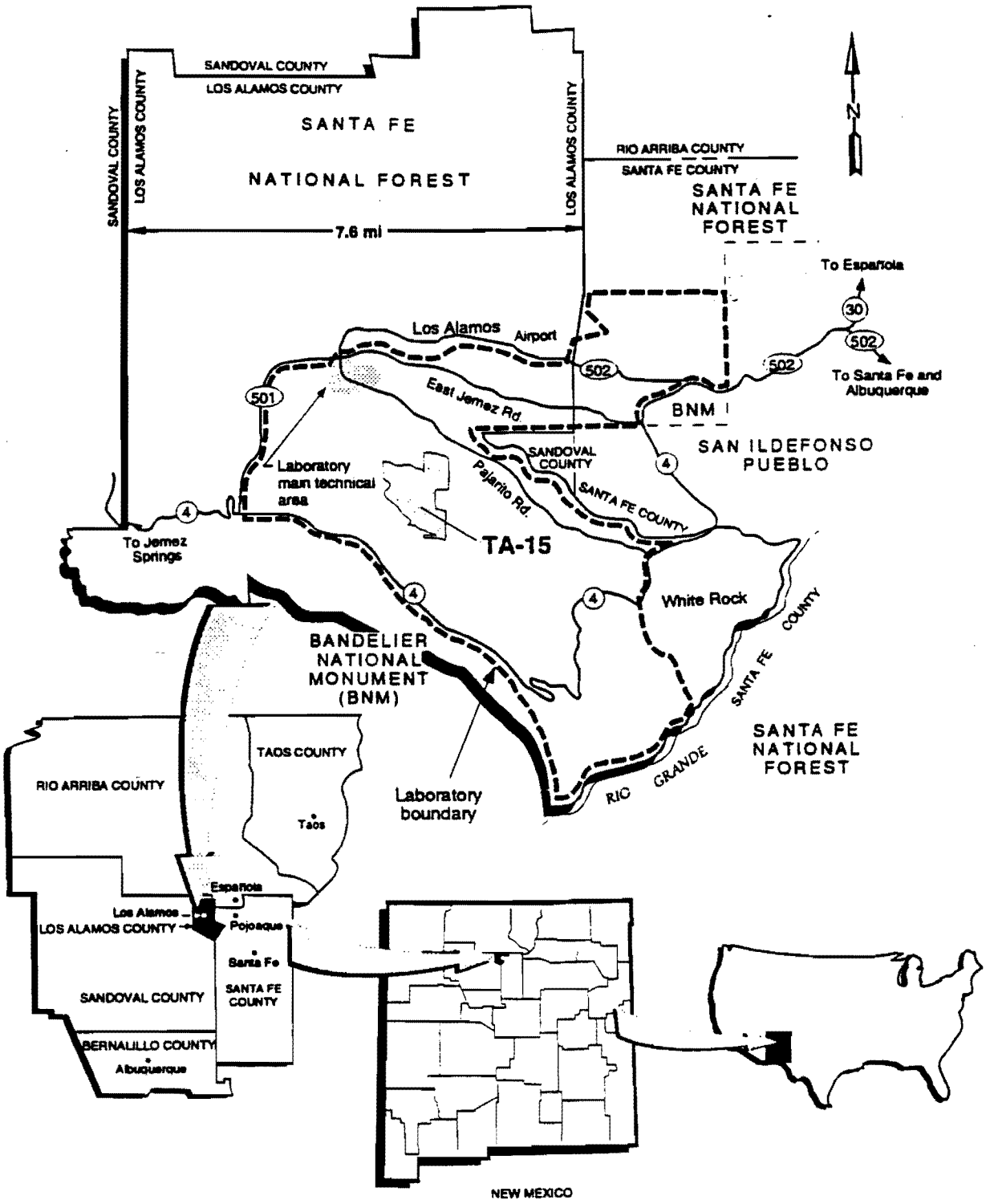


Figure B-1.0-2 Regional location of TA-15

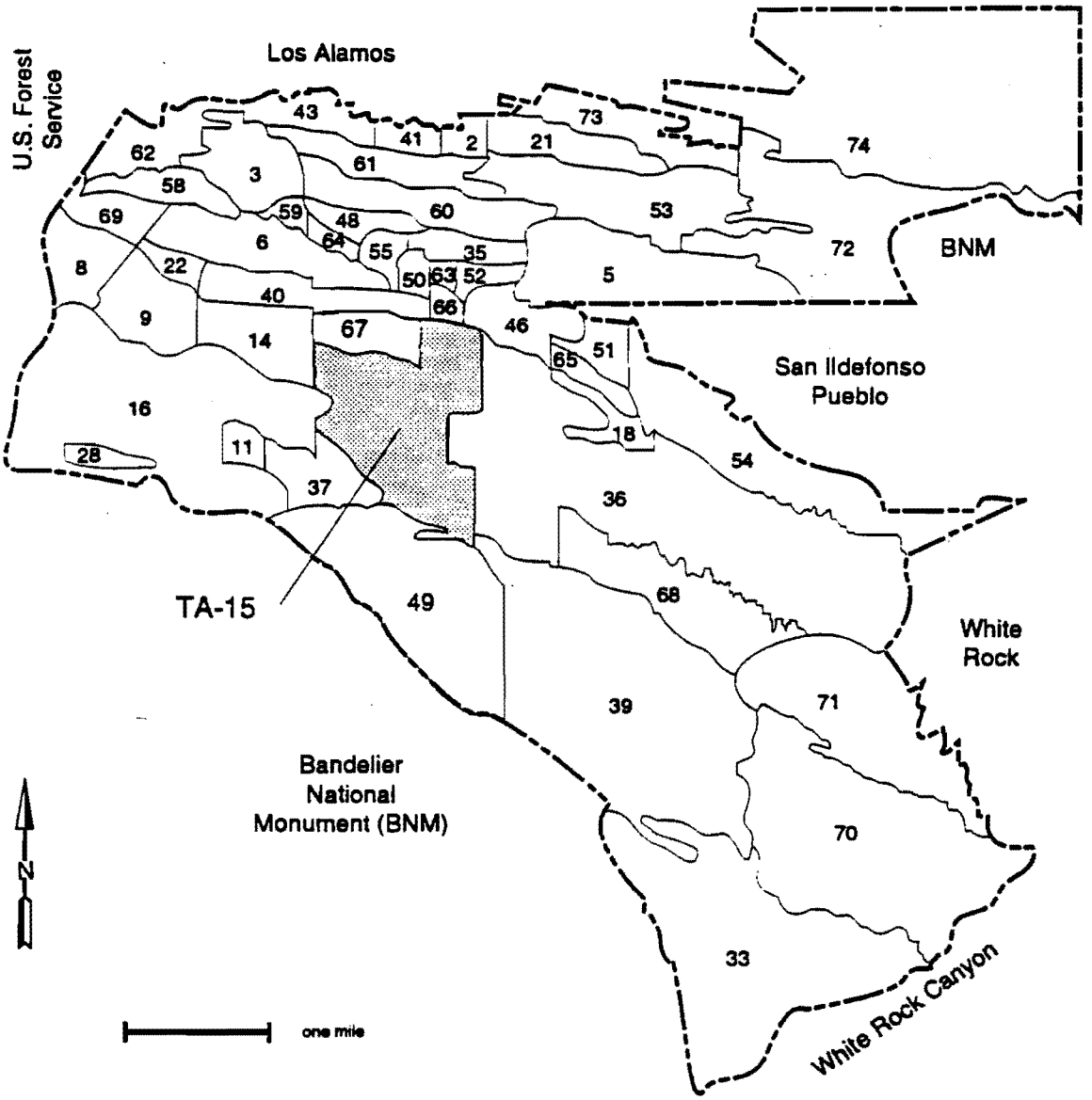


Figure B-1.0-3 **Location of TA-15 in relation to other TAs and landholdings surrounding LANL.**

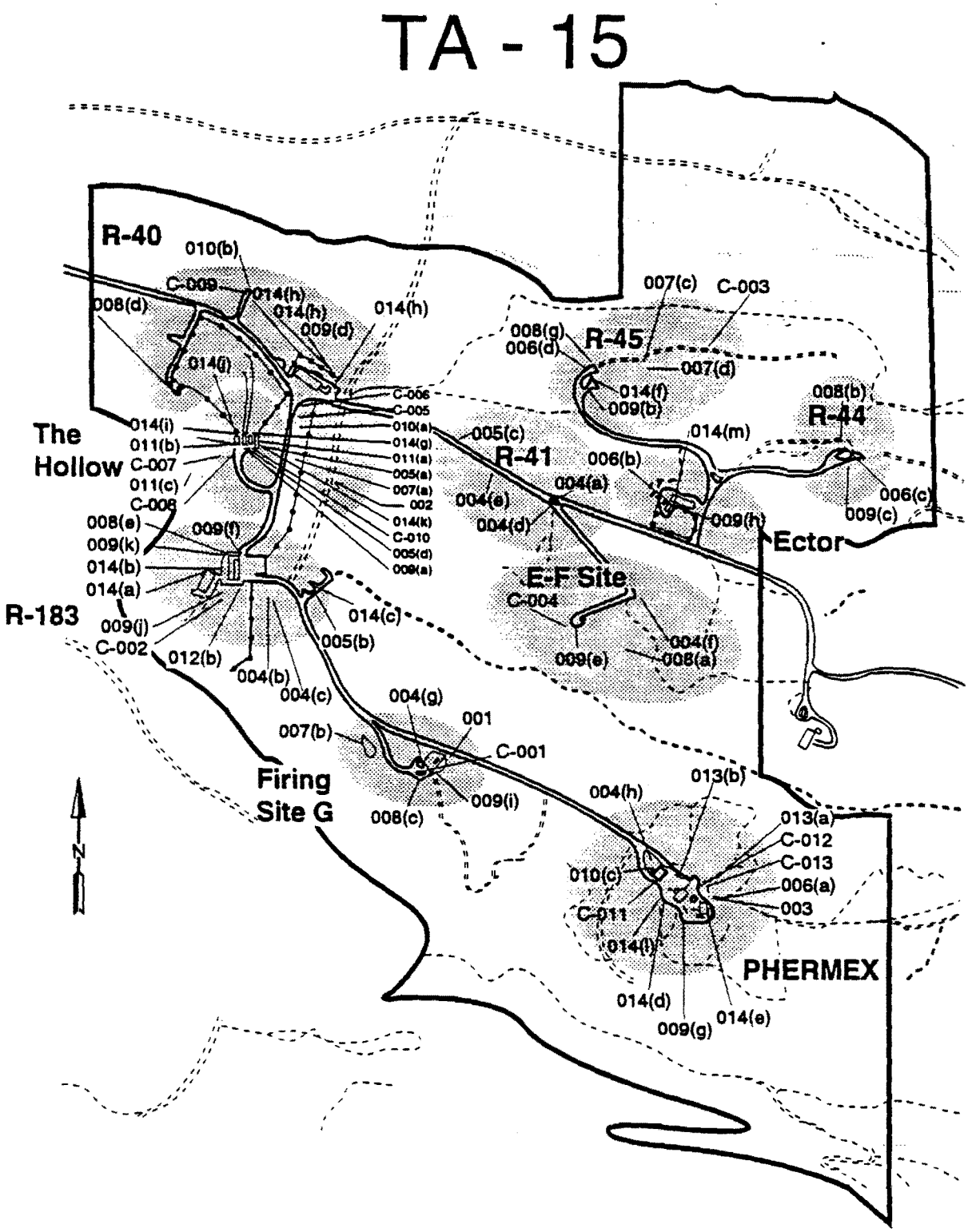


Figure B-1.0-4 TA-15 site diagram showing Potential Release Sites (PRSs).

Three-Mile Mesa was added to the Santa Fe Forest Reserve together with the rest of the Jemez Section in 1915. The area encompassing present-day TA-15 was acquired from the US Forest Service (Santa Fe National Forest) in two parcels. From the time of its acquisition by LANL in the 1945 to the present day, the portion of Three-Mile Mesa that contains TA-15 has encompassed a number of firing sites.

Historical development of TA-15

In 1944 a small control building and two firing sites-one for quantities of high explosives (HEs) up to 50 lb. and the second for larger amounts – were established on TA-15. The exact location of these two firing sites and the types of tests that were carried out have not been determined definitively in a search of the archives, but it is probable that these became Firing Points A and B. Firing Point A was probably in use by the end of 1944, and nearby Firing Point B shortly thereafter. In 1946 the decision was made to make TA-15 into a permanent location for explosive experiments related to the design of nuclear weapons, which could and did involve experiments with up to 2 tons of HEs. By 1947 Firing Points C, D, and E-F were in use. In 1948 Firing Points G and H were added. Firing Points A-H are not used today, and most of the structures associated with these firing sites have been decommissioned and dismantled. The hazardous materials used in these explosion tests, such as uranium, beryllium, and lead, have largely been left in place at the firing sites where the materials were deposited by the explosion or pushed aside to clean the area. Other materials that may have been deposited include steel, aluminum, mercury, boron, cadmium, gold, and tritium, although in very small amounts. Many types of HEs have been used at these sites, and they certainly have left some inorganic residues, but no unexploded HEs have been found in analyses at firing site soils. Firing Point E-F was the most heavily used and contains the largest quantities of hazardous materials. Up to 65 000 kg of uranium and approximately 350 kg of beryllium have been expended in tests at Firing Point E-F.

Areas R-40, R-183, and The Hollow are areas containing office buildings in support of TA-15 operations. (See Figure B-1.0-4). The buildings in The Hollow have been assembled since 1949 and are intimately connected. The buildings at R-40 have been in place since the early 1950s, and those at R-183 since the early 1960s. Related to those buildings and the surrounding areas are a number of PRSs involving septic tanks, sumps, drainage ditches, outfalls, container storage areas, and other operational releases.

In the 1950s, Firing Sites R-44 and R-45 were completed. Since then, these sites have been used for various explosive tests, with R-45 for smaller tests and R-44 for larger tests. Firing Sites R-44 and R-45 were decommissioned in 1995 and are no longer in use.

The PHERMEX facility was built in the early 1960s to perform dynamic radiography of the components of nuclear weapons during the explosion. A second major dynamic radiographic machine named Ector, was installed in the early 1985 for studies similar to those at PHERMEX. A new facility known as DARHT (Dual-Axis Radiographic Hydrodynamics Test) is under construction.

Further details and references on the historical development of operations at TA-15 are given in the description of individual PRSs, Chapters 5-10 of the RFI Work Plan for OU 1086 (LANL 1993, ER ID No. 20946).

Environmental Monitoring at TA-15

A number of different environmental monitoring procedures currently are followed at TA-15. First, all explosive tests on TA-15 are carried out according to approved standard operating procedures (SOPs). In any experiment involving potentially hazardous materials, such as depleted uranium and beryllium, monitoring procedures are called out in the SOP for times during and immediately after the experiments to assure that workers on site may approach the firing pad safely. Second, prior to any construction on TA-15, the area involved in the construction is surveyed with a portable survey instrument capable of detecting gamma rays. As appropriate, solid samples also are taken for analysis of hazardous materials. In addition any construction also must go through an extensive LANL environmental safety and health (ES&H) process. Construction can proceed only if these surveys and sample analysis show that it is safe

to do so. Thirdly, periodic surveys are carried out on active firing sites such as PHERMEX, and Ector to assure that an unexpected build-up of uranium and/or beryllium is not taking place. The last survey was conducted in 1991.

In addition, air samplers and other means for detecting airborne contamination have been deployed during some of the explosions. The information obtained leads to the conclusion that only small amounts of the materials have been aerosolized and carried along with the wind. LANL has used results from these tests to estimate that the maximum amount of uranium and beryllium aerosolized in any test is 10% and 2%, respectively (Dahl and Johnson 1977, ER ID 58992).

In addition, site monitoring has been done at TA-36, the technical area immediately east of TA-15, and results have been reported in LANL's annual environmental sampling reports, which extend back to 1970 (e.g., Environmental Protection Group 1990, ER ID 06995).

Groundwater from two supply wells, PM-2 and PM-4, located in TA-36 (due east of TA-15) has been tested for radioactive and primary and secondary chemical constituents. Contamination has not been detected in the water supply wells in 1990 (Figure B-1.0-5). There are no wells at TA-15 for direct monitoring.

Hazard Ranking of TA-15

In 1987, the EPA and DOE used the EPA Hazard Ranking System (HRS) and the DOE-modified HRS to assess the potential for migration of chemical and radioactive contaminants (DOE 1987, ER ID No. 8657). Despite the existence of uranium and beryllium spread over the surface of some of the firing sites at TA-15, the maximum overall migration mode score of 9.9 and direct contact score of 4.2 reflect low potential for contaminant migration and exposure and are far below the score of 28.5 required by the EPA for the site to be included in the National Priorities List (CERCLA "Superfund" list).

Past Waste Management Practices

Firing site experiments, sanitary wastes, and cleanup wastes at TA-15, together with current conditions in that area, are discussed in the following subsections.

Firing Site Experiments

Because of the remote location of TA-15 in relation to the main population living in Los Alamos County and to the main body of employees working at LANL, the explosions were usually not set off inside containment vessels, but rather in the open air. The by-products of the explosion were allowed to expand freely and to settle back on the ground in the vicinity of the experiment. Each explosion, depending on the amount of HEs, had a hazard radius associated with it in which personnel must be under protective cover during the actual explosion, and this radius was calculated before each experiment. The area on which the main portion of the hazardous material was scattered was much smaller than this administrative hazard radius. After each experiment, the area nearby the center of the explosion was cleared of physical debris to accommodate the next experiment. Periodic surveys were conducted to determine the extent of the most contaminated portion of the firing site. In some of the firing sites, sandbags, (filled with sand or a concrete mixture), and steel blast mats were used to protect nearby buildings. When the sandbags and mats deteriorated, they were removed and replaced with fresh sandbags and mats. In the past, this debris was placed in Material Disposal Area Z (MDA-Z), SWMU 15-007(b) at Firing Site G (DOE 1987, ER ID No. 8657), but this practice was stopped about 1981 when LANL began to truck such debris as low-level radioactive waste to the TA-54 landfill.

Although MDA-Z is no longer used, it has not been covered or reclaimed.

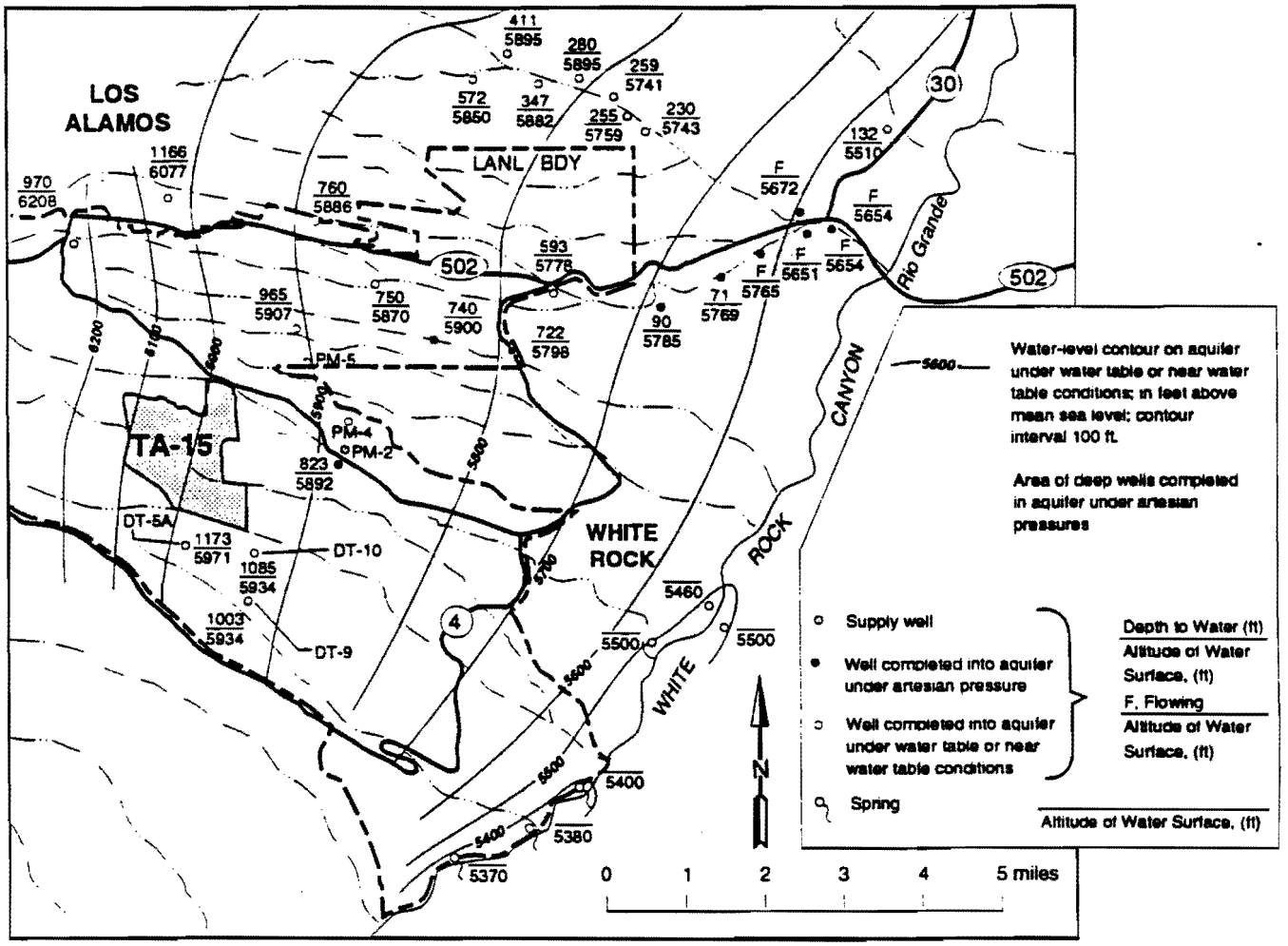


Figure B-1.0-5 **Surface and groundwater sampling locations within and near LANL (Purtymun and Johansen 1974, ER ID 11835)**

Currently the same procedures are used for firing site experiments. However, the size of the shots is dramatically lower. The maximum used [in the last 10 yr.] between 1983-1993 for a single shot is about 45 kg high explosive (HE), well under the limit imposed in 1982 of 67 kg (150 lb.) for the new firing bunkers at R-306 and R-310. The limit at PHERMEX remains 450 kg (1000 lb.).

Sanitary Wastes

The overflow from each sanitary waste line, until the mid 1970s, emptied through an outfall into one of the nearby canyons. In the mid 1970s a sump was constructed in the exit line from five of seven septic tanks, and the outfalls from six of seven septic tanks were plugged. The remaining unplugged outfall [SWMU 15-009(e) receives only sanitary waste. The main use of these septic systems was for the disposal of sanitary sewage. However, there is some evidence that an outfall from one of the buildings (TA-15-40) probably was used to dispose of photographic solutions, and another septic system (shop TA-15-8) probably contains some HEs from machining of HEs there.

Table B-1.0-1 lists the National Pollutant Discharge Elimination System (NPDES) outfalls.

TABLE B-1.0-1
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM OUTFALLS.

Building Number Category	SWMU Number	Type of Discharge	NPDES	
			Serial #	Status
194 04A	15-014(i)	Noncontact cooling water	093	Eliminated 1992
184 04A	15-014(e)	Noncontact cooling water	139	Submitted to EPA 11/87
306 04A	15-014(m)	Noncontact cooling water	143	Submitted to EPA 1 1/87
183 06A	15-014(a)	Photo wastes	123	
202 (CT) 03A	-	Treated cooling water	028	

Cleanup Wastes

Material Disposal Area-N (MDA-N), SWMU 15-007(a) to the south of R-40 was used prior to 1965 for disposal of debris from the dismantlement of structures within TA-15. Whether this material is contaminated with hazardous material is not known. Personnel acquainted with the area believe that the amount of any radioactive material is low because structures were usually surveyed for radioactive contamination before being torn down. In 1967, a major cleanup effort was carried out to remove unused structures. In this case the surveys are well-documented (Courtright 1965, ER ID 5282; Buckland 1965, ER ID 5305 and Courtright 1967, ER ID 05350) and the structures were shown to be free from radioactive and HE contamination. This debris was removed from TA-15.

From approximately 1965 to 1981, construction debris, used sandbags and other shielding from tests at PHERMEX, and other miscellaneous debris were deposited in MDA-Z, SWMU 15-007(b), located on the south mesa of TA-15.

Current Conditions at TA-15

TA-15 is an active technical area of LANL used by one group [(M-4)] DX-4 of the [Explosives Technology and Applications (M)] Dynamic Experiments Division for on-going explosion research. Planning for future LANL use of this area also stipulates that the area will continue to be used for explosion research (Facilities Engineering Division Planning Group et al. 1990, ER ID 57223).

Access to TA-15 is controlled by this DX-4 [M] Division operating group. Because most work on this site is classified, only Q-cleared personnel can routinely enter this site as far as its group office. In addition, permission and control keys must be obtained from [Group M-4, hydrodynamics] DX-4, Field Operations and Experimental Support, before an individual may proceed to the firing sites located beyond the group or engineering offices.

Access to and from Water Canyon and Potrillo Canyon also is controlled by the [M Division Office] DX-4 Group Office, which maintains control of keys to the canyon access road gates.

In the ongoing LANL Environmental Surveillance Program, water samples are collected at least annually from two deep water supply wells located at TA-36 due east of TA-15 and also from three wells at TA-49, due south of TA-15. Sediment stations down-gradient from TA-15 in Water Canyon and Potrillo Canyon are also sampled annually. Air and air radiation monitoring stations are present at TA-49 near the State Road 4 gate and throughout LANL (see Figure B-1.0-6). The environmental measurements obtained from these air monitoring stations, over three decades, have given no evidence that contaminants attributable to past or present TA-15 operations have been transported beyond the technical area boundaries.

The environmental surveillance report for studies in 1989 (Environmental Protection Group 1990, ER ID 06995) indicates that the DOE radiation protection standard (RPS), under which LANL operates, limits incremental radiation doses (effective dose equivalent) to the general public from all LANL operations to 100 mrem/yr from all pathways. In addition, the air pathway exposure route is limited to 10 mrem/yr in accordance with EPA requirements. For comparison, the average background radiation exposure to individuals living in Los Alamos is approximately 336 mrem/yr from all sources (Environmental Protection Group 1990, ER ID 06995). Nearby TA-49 radiation monitoring stations have never measured radioactivity levels more than 1% of applicable DOE or EPA guidelines.

The ESG report for environmental surveillance during 1989 estimates that the maximum incremental risk of cancer from radiation to Los Alamos residents as a result of all 1989 LANL operations is about 1 by 10^{-8} (Environmental Protection Group 1990, ER ID 06995). Of that risk, the contribution from TA-15 is exceedingly small.

Local Populations

Section 2.5 of the IWP describes the population distribution within a 50-mile radius of LANL. The IWP presents a table documenting population density at nine distance intervals for 16 compass directions, based on 1989 projections from 1980 census data. Newer data from the 1990 census give the total number of residents within the 50-mile radius of LANL as 213 000. About 50 people normally reside at Bandelier National Monument (BNM). BNM operates a remote radio transmitter near the main gate to TA-49, but no other use (including hiking trails) is currently made (or is planned) of BNM property south of TA-49 to Frijoles Canyon. Most people at Bandelier are visitors who spend only a few hours there. About 350 000 people visited BNM in 1990.

The two next closest residential communities to TA-15 are located 6 km to the east in White Rock, and the town-site of Los Alamos, which lies approximately 7 km to the north. The 1990 census gives the population of White Rock as 6800 and of Los Alamos as 11 400.

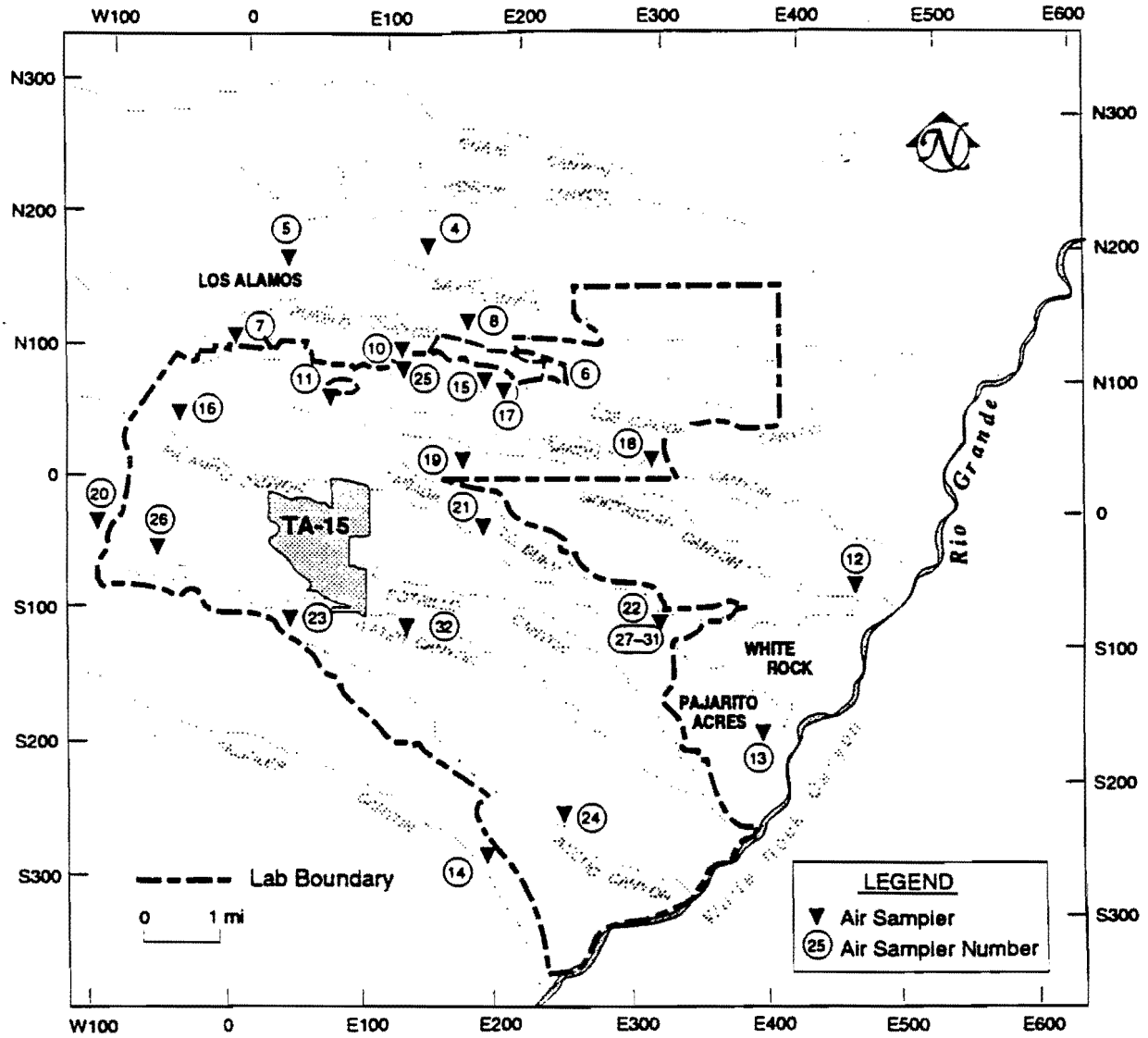


Figure B-1.0-6 **Locations on or near LANL for sampling airborne radionuclides (Environmental Protection Group 1990, ER ID 06995).**

State Road 4 is a publicly accessible road along the southern boundary of TA-49, south of TA-15. According to the LANL's Engineering Division, yearly average traffic on this road is about 700 vehicles per day. The point of closest public approach to a TA-15 PRS (PHERMEX) is about 2 km.

Sources of Information

Available environmental data for TA-15 were acquired by using current standard practices and methods. No attempt has been made to validate these data in the EPA sense of the term. These data are used in this document as a guide to RFI characterization and sampling.

Many key personnel involved in the activities at TA-15 since its beginning in approximately 1944 were interviewed directly. Among these individuals are scientists who carried out experiments at each of the named inactive firing sites located on TA-15 as well as at the current active firing sites.

Other sources of information also have been used.

- LANL's environmental monitoring network. This network includes on-site stations as well as perimeter and regional stations that are not influenced by LANL operations. These studies are reported in annual reports of the environmental surveillance group.
- Special studies conducted at LANL and in the region. Researchers collected environmental data for these studies in areas unaffected by LANL operations. These studies are described in periodic LANL reports.
- General environmental data. These data address the behavior of chemicals, elements, and radionuclides in natural systems. These reports are available in peer-reviewed scientific literature.
- Unpublished internal LANL memoranda, reports, and drawings.
- Published special studies carried out over a period of years on Firing Site E-F.

B-2.0 CLIMATE

Climate is important in terms of contaminant migration because of wind-driven airborne transport and because of the role of surface water in the magnitude and frequency of erosion, as well as its horizontal and vertical transport properties. The local climate at OU 1086 varies only slightly from the Los Alamos area climate as reported in Chapter 2 of the Installation Work Plans (IWP) (LANL 1993, ER ID No. 260771). A major climatalogic data collection station for Los Alamos, which provides the information for this climatologic summary, was located until recently at TA-59. (There are currently four meteorological stations around LANL.) This site was located about 2.5-km northwest and 30.5 m higher in elevation than building TA-15-40 at TA-15. Precipitation on the Pajarito Plateau is strongly correlated with topography and proximity to the Sierra de los Valles. There is a pronounced annual rainfall gradient from west to east, with the largest values on the west end, closest to the Sierra de los Valles the topographic high of the area. Taking into account this factor, we estimate the average annual rainfall at OU 1086 to be about 16 in. annually, or about 2 in. less than the 18 in. reported at TA-59 (Bowen 1990, ER ID 6899). The reason for this difference is that OU 1086 is farther east and topographically lower than TA-59. Lower precipitation is manifested in amounts of both rainfall and snowfall.

LANL currently maintains two climatologic data collection stations near OU 1086. One station is the TA-6 meteorology tower, located about 2.04-km northwest of OU 1086. This tower replaced a station at TA-59 as a primary climatologic reporting station for Los Alamos in January 1990. A second climatologic data collection station is located at TA-49 about 3.72-km southeast of OU 1086 and near LANL boundary with Bandelier National Monument (BNM). This station has been in operation since 1987. Both stations report precipitation, wind direction and speed, relative humidity, temperature, and solar radiation. A third station

that measures precipitation and temperature during nonfreezing days is located about 4.6 km to the east in TA-36.

The predominant prevailing wind direction is from southwest to the northeast (Figure B-2.0-1). Surface winds will vary with the time of day, location on the Plateau, and height above the ground because of the area's complex terrain. When the large-scale wind velocities are relatively low and there is sunshine, a superimposed convective, upslope wind develops over the Plateau (flow from southeast to northwest). During clear, relatively calm nights, the flow direction reverses, and a shallow drainage wind (flow from west to east) can develop down the canyons. These upslope/drainage winds prevail at locations some distance from the Rio Grande and are expected to occur at OU 1086.

It has been observed that the mean maximum temperatures are higher in White Rock than in Los Alamos for all months, and the mean minimum temperatures are generally lower in White Rock. Temperature differences for the mean maximum and mean minimum are usually less than 5•F. Temperatures at OU 1086 are expected to range between the Los Alamos and White Rock values.

B-3.0 GEOLOGY

B-3.1 Geologic Setting

TA-15 occupies roughly a rectangular area, about 2.1 km wide by 2.4 km long (see topographic map in Appendix A of the 1993 RFI Work Plan [LANL 1993, ER ID 20946]). The northern boundary is formed by the stream channels in Pajarito and Three-Mile canyons along TAs-46, 66, and TA-67. The area is bounded on the west by TA-14 and the stream channel of Cañon de Valle along TA-16 and TA-37. TA-49 on the southern margin of Water Canyon forms the southern boundary, and TA-36 forms the eastern boundary. The topography is rugged, characterized by relatively narrow mesa tops separated by elongated canyons; the predominant axis of both mesas and canyons is west-northwest to east-southeast.

Five canyons dissect the operable unit; from north to south they are Pajarito Canyon, Three-Mile Canyon, Potrillo Canyon, Cañon de Valle, and Water Canyon. Water and Pajarito canyons head on the flanks of the Sierra de los Valles. Related to this position, they have relatively large watershed areas compared with other watersheds on the Pajarito Plateau and are the deepest canyons in the operable unit. Cañon de Valle also heads in the Sierra de los Valles but has a smaller watershed area and joins Water Canyon within the boundary of the operable unit. Potrillo and Three-Mile canyons are small canyons heading on the Pajarito Plateau. Potrillo Canyon headwaters are located completely within the operable unit, and Three-Mile Canyon has its headwaters relatively close, but upstream of the operable unit boundaries. Both of these canyons have relatively small watershed areas and are shallower than the other canyons. Three-Mile Canyon joins Pajarito Canyon a short distance downstream from the OU boundary. Potrillo Canyon flows into Water Canyon about 8 km downstream from TA-15. None of these canyons contains perennial flow within this TA.

There is a considerable elevation difference between mesa tops and canyon bottoms, averaging a minimum 30 m vertical drop with a maximum of about 110 m. The maximum elevation of OU 1086 is 2234 m on the mesa west of building TA-15-40, and minimum elevation is 2048 m in Water Canyon. Mesa tops are generally flat and gently slope to the east-southeast. Canyon walls are steep to nearly vertical, ending in large piles of talus at the canyon wall/canyon bottom junction. Canyon bottoms are generally narrow, with steep stream channel gradients.

The entire TA, both mesa tops and canyon bottoms, is situated within the Bandelier Tuff, a thick sequence of volcanic ash flows and ash falls on the Pajarito Plateau. In the absence of additional structures, such as faults and fractures, the horizontal uniformity in rock type implies relative uniformity in surface hydrologic and geologic properties throughout the immediate area.

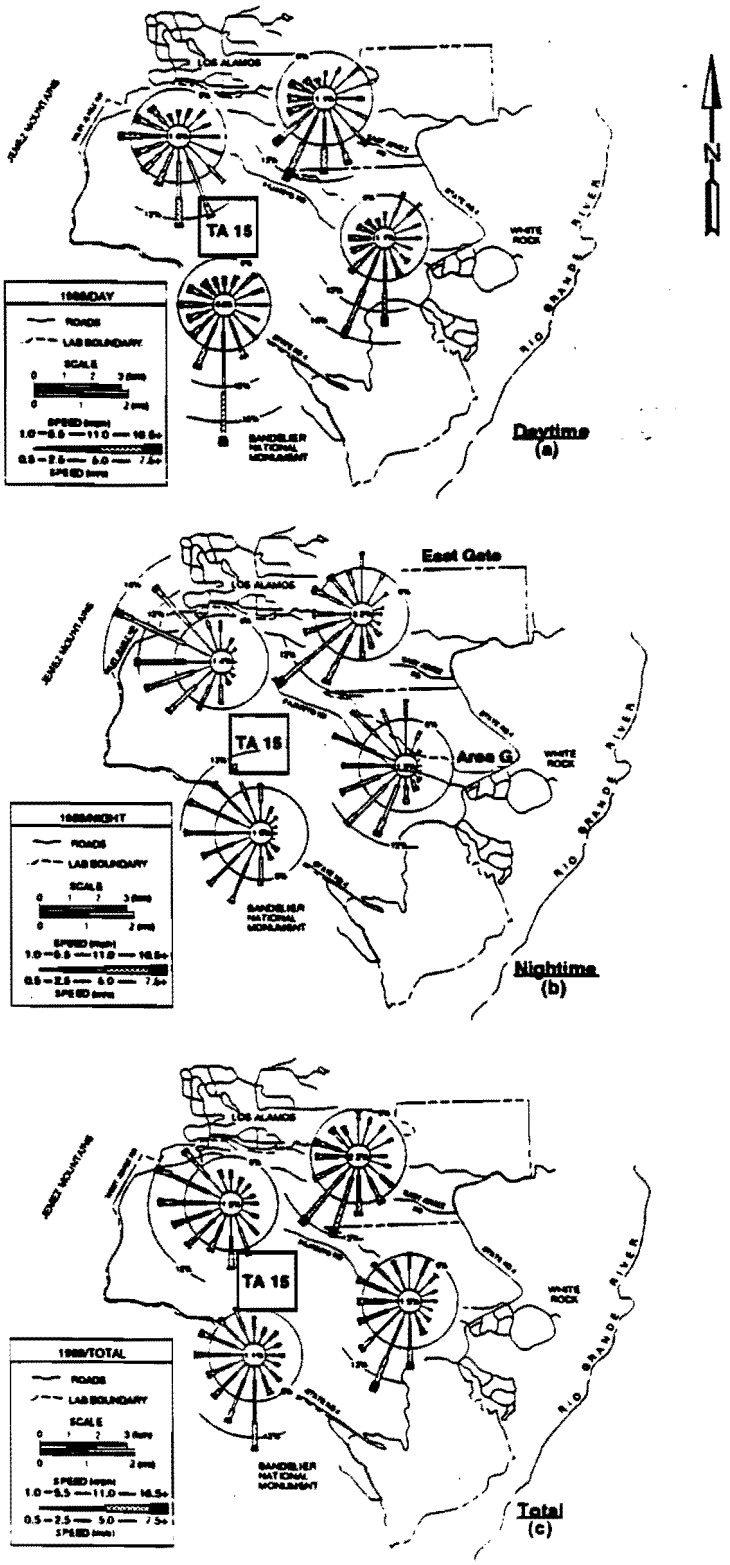


Figure B-2.0-1 **Wind roses at LANL stations during 1989 (from Environmental Protection Group 1990, ER ID 06995).**

Stratigraphy

The mesa surfaces in TA-15 are underlain by the upper member of the Bandelier Tuff. The Bandelier comprises two members: upper, or Tshirege, and lower, or Otowi (Figures B-3.1-1 and B-3.1-2). The younger Tshirege unit is about 1.1 million years old and is separated in time from the Otowi by about 400 000 years. Most of the soils described in Subsection B-3.2 are derived from the Tshirege. The Tshirege forms the canyon walls throughout TA-15 and is the only rock in the stratigraphic column exposed at this site.

The Tshirege (Smith and Bailey 1966, ER ID 21584) consists of multiple flow units of crystal-rich ash-flow tuff and displays significant variations in welding and vapor phase alteration. The Tshirege is underlain by the Tsankawi Pumice Bed (less than 1 m thick) that, in turn, marks the boundary between the Tshirege and the Otowi. The Otowi Member is a nonwelded vitric ash-flow tuff also composed of many units. These two members are separated by an erosion surface that may contain extensive permeable channel gravels and sands (Gardner 1993, ER ID 12582). Total thickness of Bandelier Tuff in the TA-15 area is about 300 m.

Although Cerro Toledo Rhyolite is present in adjacent OUs., it is not present at this OU to our knowledge.

The Bandelier Tuff in the vicinity of TA-15 rests unconformably upon a number of interfingered deposits of Pliocene to Pleistocene epochs. The Tschicoma lobate dacite and andesite lava flows of the Tshicoma Formation from the west interfinger with the Puye Formation. The Puye Formation is derived from the Tschicoma volcanic centers located in the northeastern range of the Jemez Mountains. The Puye Formation consists of stream flow deposits, debris flow deposits, volcanic ash and block flow deposits, and ash fall and pumice fall deposits. The Cerros del Rio basalts, flowing into the area from the east interfinger in turn with these two formations. Water wells indicate that each of these may unconformably contact the Bandelier Tuff under TA-15 (Gardner and House 1987, ER ID 6682).

The Totavi Lentil, a coarse, poorly consolidated channel conglomerate deposited by the ancestral Rio Grande, forms a boundary at the base of the Puye between it and the Santa Fe Group sediments. The Santa Fe Group is a sedimentary rift deposit consisting of fluvial sandstone, siltstone, conglomerates, eolian deposits, ash beds, and lacustrine sediments of Miocene and younger age. The deep groundwater system in the Los Alamos area lies in the Puye and the Santa Fe formations.

Figure B-3,1-2 is a cross section between two wells, PM-4 and DT-5A (see Figure B-1.0-5 for locations). These wells provide some conceptual stratigraphic control for the eastern part of TA-15. No actual stratigraphic control exists between the two wells; therefore, the interfingering of Tschicoma, Puye, and Chino Mesa rocks is shown schematically. The Tshirege is differentiated into subunits for well DT-5A but not for PM-4. As the Tshirege Member encompasses the TA-15 area and is the only rock exposed at the surface, some details of the petrology and stratigraphy of this unit are included in the following discussion.

Weir and Purtymun divide the Tshirege Member into seven units: (Weir and Purtymun 1962, ER ID 11890): 1A, 1B, 2, 3, 4, 5, and 6. The best exposure of these units occurs in Water Canyon in the vicinity of TA-15 and to the south. Unit 1A overlies the Otowi Member. It is a light gray to light pinkish gray, pumiceous, friable rhyolite tuff. It underlays unit 1B, a light gray to light orange rhyolite ash flow tuff containing lenses of rock fragments and pumice. Unit 2 is a hard, welded, light pinkish-gray to purplish-gray rhyolite tuff overlying 1 B. Unit 2 may be divided into subunits 2a and 2b. Unit 2a is a nonwelded, pumice rich tuff and 2b is a moderately to densely welded, tan to brown tuff (Baltz et al.1963, ER ID 8402). This unit is exposed near the bottom of the deepest canyons in the neighborhood of TA-15, i.e., Water Canyon. Unit 3 is a friable, pumiceous, light gray rhyolite tuff. Unit 4 is a moderately welded, cliff-forming, light-pinkish gray rhyolite tuff. Unit 5 (not shown in Figure B-3.1-2) is a thin deposit, possibly of surge material. Unit 6, the uppermost unit, is a moderately welded, pinkish-gray rhyolite tuff. It forms the upper cliff in the Tshirege in the TA-15 area. Detailed petrology of each of these units may be obtained from Weir and Purtymun (Weir and Purtymun 1962, ER ID 11890).

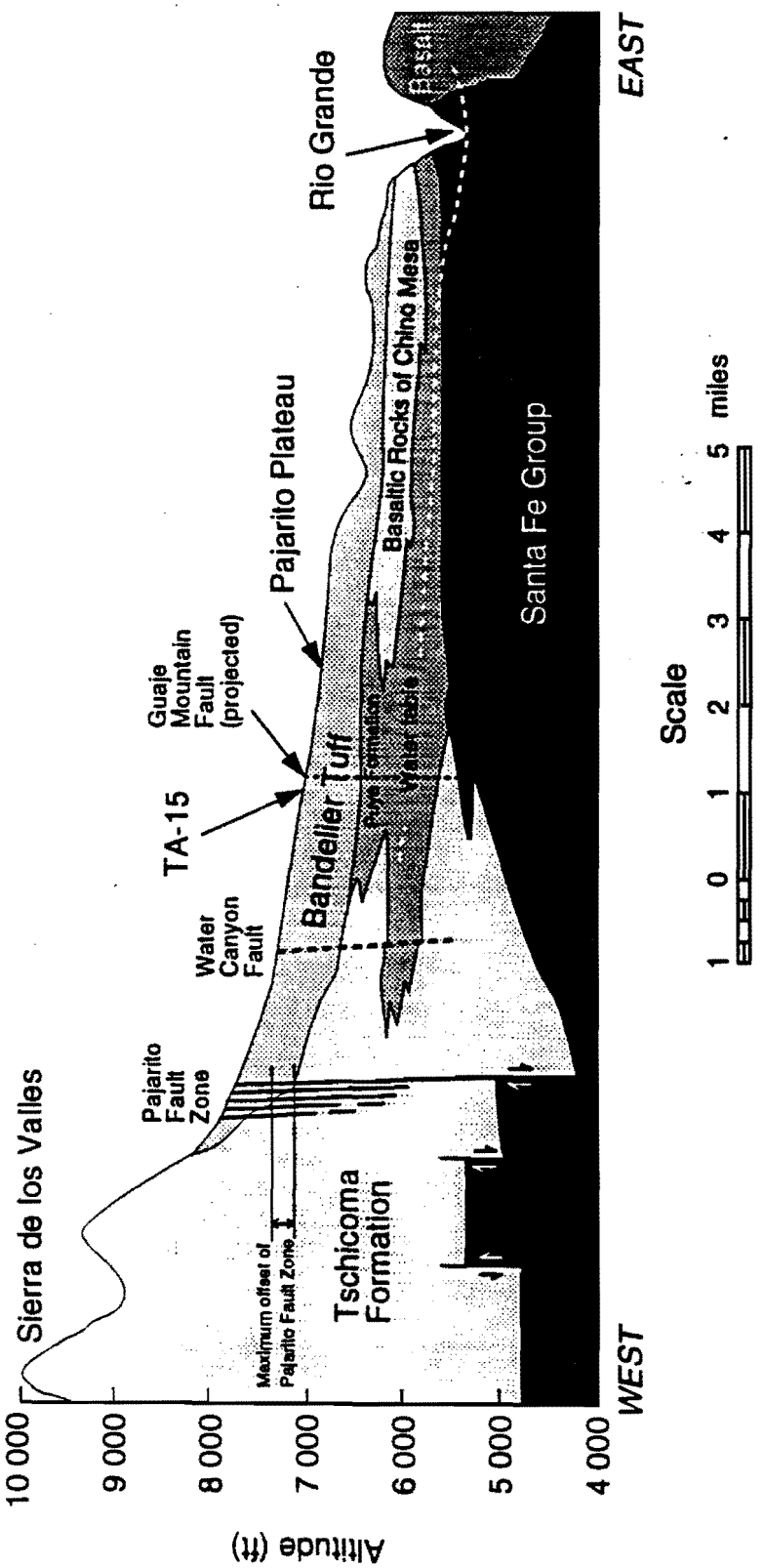


Figure B-3.1-1 **Geologic section showing the location of TA-15 with respect to stratigraphy and structure from the Sierra de los Valles across the Pajarito Plateau to the Rio Grande.**

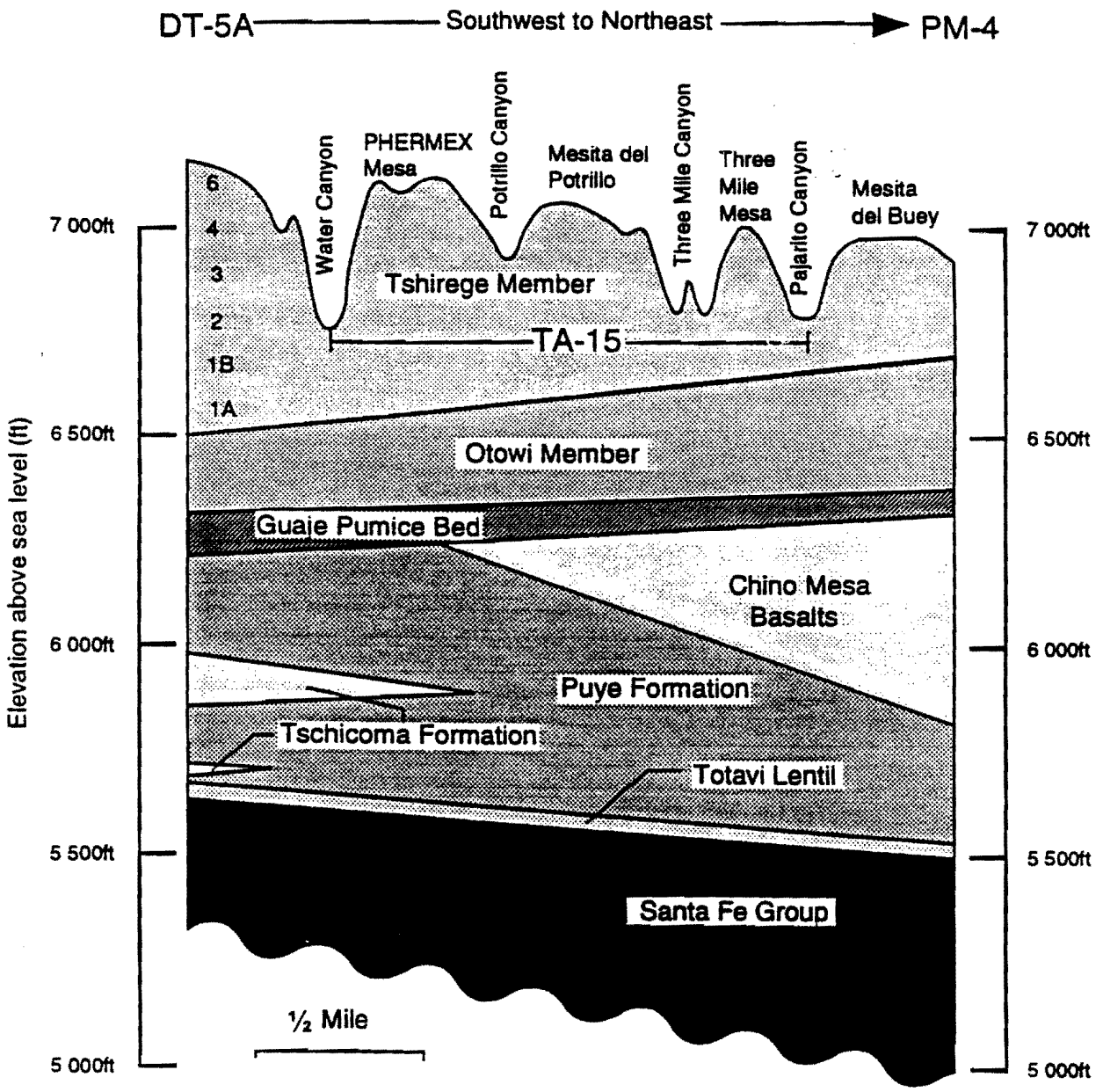


Figure B-3.1-2 Cross section of stratigraphy with accurate topography at TA-15. DT-5 and PM-4 are drill holes on each side of TA-15.

Structure and Seismicity

The Pajarito fault system (Figure B-3.1-3), a feature along the western margin of the Rio Grande rift, is a north-south trending feature 3 to 4 km west of TA-15. The faulting is primarily normal with TA-15 on the down-thrown side. Two northsouth trending faults, the Rendija Canyon fault and Guaje Mountain fault, branch southward from the Pajarito fault system north of the Los Alamos townsite. These faults break Bandelier tuff and recent sediments in the north. Seismic studies show they are present at depth just north of TA-15 (Dransfield and Gardner 1985, ER ID 6612; Gardner and House 1987, ER ID 6682). The fault planes or, perhaps, more feathered fracture patterns may be reasonably thought to lie beneath TA-15. In both cases, the down-thrown side of these faults is to the west. TA-15 lies in a small structural graben. The sharp right lateral turn in Cañon de Valle on the western edge of TA-15 may lie along the surface expression of the Rendija fault zone. An extension of the Guaje Mountain fault zone would pass beneath Mesita del Potrillo as well as PHERMEX Mesa (the mesa on which PHERMEX is located).

B-3.2 Soils

Soil Types and Characteristics

Soil characteristics are not described in any detail in the IWP; therefore, site specific and general information for TA-15 will be presented here. The primary reference for the following is from Nyhan et al. (1978, ER ID 5702). Well-developed soils are located on the level or gently sloping areas of the mesa tops. Formation of such soils with abundant layer lattice clays in such an arid environment as found on the Pajarito Plateau may have taken as much as tens to hundreds of thousands of years.

Characteristics of the various soils are listed in general terms based upon their water-holding capacity, potential for run-off, estimated erosion hazard, and permeability. Water-holding capacity is determined by soil plasticity and available water capacity. Soil plasticity index is the amount of moisture in a soil between two limits: enough for the soil to flow under the slightest applied force and enough for the soil to be rolled onto a wire. Both limits are expressed as a percentage of water content. The second subtracted from the first is the index. Indices range from 5 to 30 (relatively high plasticity).

Available water capacity is expressed in centimeters of water per centimeters of soil. It ranges from 0.02 (gravel) to 0.21 (clay). Run-off is determined by soil properties influenced by the minimum rate of infiltration obtained for a bare soil after prolonged wetting. Soils are grouped (A to D) according to this properly. D indicates highest potential for run-off. Erosion factors K and T are measured for the soil. K is a unitless parameter which is a function of texture, soil structure, permeability, and organic matter content. High silt and sand content, for instance, will make soils more susceptible to erosion. K values range from 0.15 to 0.37 at TA-15. High numbers mean more susceptibility to erosion. Soils at TA-15 appear "moderate" inasmuch as high values for soils are about 0.69. The term T is soil loss tolerance expressed in tons of allowable soil loss/acre/year. These estimated values range from 1 to 5, with larger T values assumed for deeper soils. Wind loss is estimated separately and also calculated in tons/acre/year. Permeability is measured in centimeters per hour and ranges from 0.15 (clay) to greater than 50 (gravel). Other than that for permeability, available measurements are qualitative (imprecise) but yield numbers for relative comparison: low (slow), medium (moderate), or high (fast) in a given category. These more general terms are used in the following description of separate soil units.

Cario loam: Typical of mesa tops, this loam forms from the weathering of tuff on relatively level ground (loam is a rich permeable soil composed of a mixture of clay, silt, sand, and organic matter). A typical mesa-top surface layer is a grayish brown loam with a subsoil that is more clayey. Depth is typically 50 to 100 cm to the tuff interface. Water-holding capacity, run-off, and erosion hazard are medium compared with other soils.

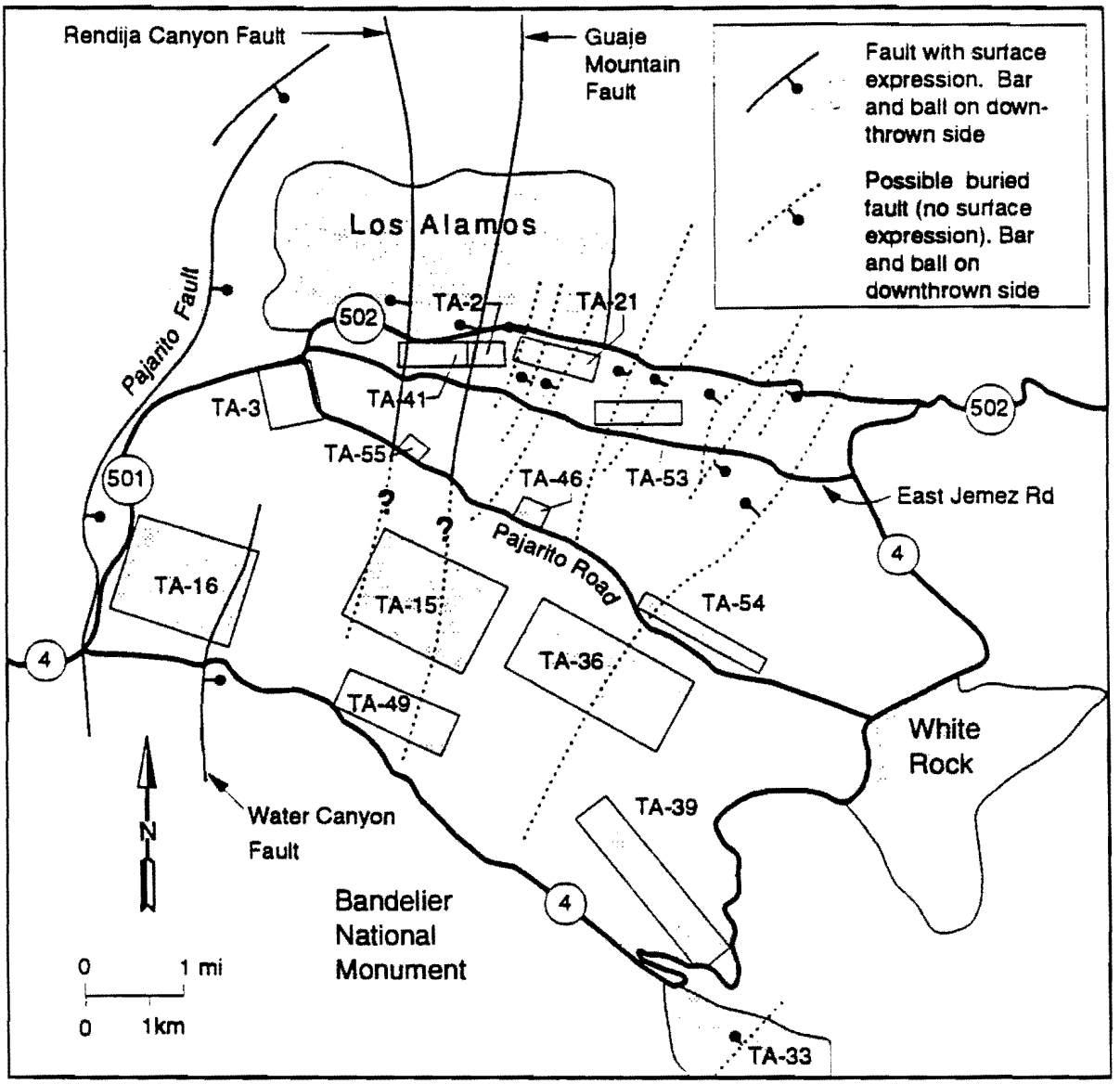


Figure B-3.1-3 **Faults at selected LANL technical areas, Los Alamos, White Rock, and major roads [modified from Dransfield and Gardner (1985, ER ID 6612) and Gardner and House (1987, ER ID 6682)].**

Frijoles loam: Characteristic of soils formed from pumice, this loam forms on level to moderately sloping mesa tops. The soil grades downward from a brown sandy loam, through a clay layer, to a gravely clay (plus or minus sand) loam which contains pumice. Depth to pumice is about 45 cm. Underlying pumice has some clay content. Permeability is low in the loam and fast underneath. Water capacity is low, run-off is medium, and susceptibility to erosion is moderate.

Hackroy loam: This is a shallow soil formed from tuff. Hackroy rock outcrops contain this loam with typically 70% rock (Tshirege Member) outcrop. Hackroy soil is a brown sandy loam grading to gravely or clayey loam with depth. Depths are usually less than 30 cm to tuff. Both units exhibit low permeability and low water capacities. The loam has medium run-off and moderate water erosion hazard. The rock unit has moderate to severe erosion hazard and medium to high run-off.

Nyjack loam: This is soil derived from weathered tuff on level to gently sloping terrains. Brown loam is on the surface, then brown clay. The substratum is gravely sandy loam which may contain 30% pumice. Depth to bedrock is 50 to 100 cm. Water capacity and permeability are medium. Erosion susceptibility is slight.

Pogna loam: Soil is made from tuff on gently to strongly sloping mesa tops. Light brownish gray sandy loam is on the surface over tuff with at most 50-cm depth. Water capacity is low, permeability is moderate, run-off is medium, and water erosion can be moderate.

Seaby loam: Forming on gently to moderately sloping mesas, Seaby loam is also formed on weathered tuff. The surface is a brown sandy loam grading into a brown to strong brown gravely clay loam with 35% to 70% pumice. The substratum is a white gravely pumice with thin layers of brown clay loam. with a total depth of as much as 66 cm. Permeability is moderate in the upper soil and very rapid below. Water capacity is low and erosion rates are moderate.

Tocal loam: This loam is a shallow soil on weathered tuff with gently to moderately sloping aspect. It is a grayish brown, very fine sandy loam with a subsoil of reddish brown clay loam or clay and a substratum of a light brown silt loam. Depth to tuff is 20 to 50 cm. Permeability is moderately low and water capacity is low. Run-off is medium and water erosion is moderate.

Typic eutoboralfs fine: This soil is formed in colluvium and material weathered from tuff. Colluvium is a loose, incoherent deposit at the base of a cliff, usually formed by gravitation. Slopes may be gently to moderately sloping and are usually located downhill from fault zones. The surface layer is a light gray silt loam or loam. The subsoil is a reddish brown, gravely or cobbly clay or clay loam. The depth can be 120 cm and more. Permeability is low; water capacity is slow; run-off is slow to medium; and erosion susceptibility is moderate.

Soil Type Location

Soil in this context will refer to surface deposits which include colluvium and alluvium. Coverage is very variable over TA-15 (see Appendix B of the RFI Work Plan for OU 1086 (LANL 1993, ER ID No. 20946) for soils map) The progression from the north of TA-15 to the south is described in the following paragraphs.

The extreme northern portion of TA-15 starts at the bottom of Pajarito Canyon and consists primarily of rock outcrops which are discussed in Subsection B-3.1, Stratigraphy. The surface of Pajarito Mesa is covered with Frijoles very fine sandy loam. The southern part of this mesa shows exposures of Hackroy rock outcrop complex.

Three-Mile Canyon has steep rocky walls with some gravely sandy loam (Totavi) in the bottom of the canyon. The eastern tip of Three-Mile Mesa exposes Hackroy rock outcrop complex, grading westward into Carjo loam and Pogna sandy loam. Still further to the west lie Seaby loam and the continuation of

Carjo loam. In general, Carjo loam is central to the Mesa throughout its length and is joined by Seaby loam in the west.

The eastern portion of Mesita del Potrillo, which joins Three-Mile Mesa to the west, is covered with Hackroy rock outcrop complex in the extreme eastern edge, grading into Carjo loam, which persists to the western edge of TA-15, where it is joined on the eastern margin of Cañon de Valle by Pogna loam. The northeastern rim of Mesita del Potrillo is covered with Hackroy sandy loam.

The sequence of soils on the land bridge connecting Mesita del Potrillo with the mesa on which PHERMEX is located has the following progression of soils from west to east: Pogna loam, a pod of Frijoles loam, Seaby loam, and Carjo loam, with typic eutroboralfs at the head of Potrillo Canyon. Grading west to east into Potrillo Canyon one finds Tocal loam and, in the bottom of the canyon, Totavi sandy loam.

The center of PHERMEX Mesa is covered by Nyjack loam. This grades to the north to Seaby loam and Hackroy loam on the northeast rim of Potrillo Canyon. Seaby grades to the west and east of PHERMEX site with a small pod of Nyjack located on the extreme eastern edge of TA-15 on this mesa. The northern rim of Water Canyon shows Pogna loam on the west and Hackroy loam on the east. A pod of Seaby loam is located in the bottom of Water Canyon at the eastern edge of TA-15.

B-4.0 HYDROLOGY

B-4.1 Hydrological Conceptual Model

The following section will describe and review the hydrologic behavior of watersheds on the Pajarito Plateau. Much of this information has been summarized from Becker (Becker 1991, ER ID 15317). The term "hydrogeologic model" here is used to describe the hydrologic interactions between the surface and infiltration into the subsurface, including the vadose zone, alluvial, perched, and main aquifers. A brief description of the atmospheric hydrologic processes is included for completeness.

Conceptual Hydrogeologic Model

Precipitation falls on a watershed as snow and as rain. Snowmelt normally produces low discharge rates over several months during the spring. Much of the snow either sublimates or melts and evaporates, or infiltrates into the soil profile before reaching the channel. Infiltration losses occur into the channel bed as well. Forty percent of the annual precipitation falls as rain, primarily during the summer months. For run-off to be produced in the channel, there must be significant rain over a number of consecutive days or a major thunderstorm. This is because of the semiarid soil's requirements for moisture replenishment before overland flow can occur. In the large watersheds (Water Canyon and Pajarito Canyon), very large precipitation events or snowmelt from heavy snowpack can produce channel flow which will persist to the Rio Grande. What is more usual is that, during average-sized rain events or moderate to light snowpack, the channel flow will infiltrate into the channel bed and not produce surface flow the entire length of the watershed. This is also the common occurrence in the smaller watersheds such as Potrillo Canyon.

There is no evidence that saturated conditions extend to the main aquifer and there is also no evidence to suggest that vapor phase transport is a likely pathway for contamination of the main aquifer. It is known, however, that streamflow can recharge shallow alluvial aquifers, such as exist in Pajarito and Mortandad canyons, and streamflow can also recharge deep perched aquifers, as have been identified in Pueblo, Los Alamos, and Sandia canyons.

B-4.2 Surface Water

Surface Water

Surface water hydrology is the science concerned with the transfer of water over the earth's surface. Examination of an equation of the surface water hydrologic budget reveals that water derived from

precipitation does not all appear as streamflow. Precipitation that falls on the ground may go into storage on the surface or into soil and groundwater reservoirs, be taken up by plants and transpired, and evaporate or sublimate back into the atmosphere. Surface water transport almost certainly is one of the predominant mechanisms for redistributing many of the contaminants at OU 1086. Important contaminant transport mechanisms associated with surface water include:

- Erosion and sedimentation (sediment and contaminant accumulation) of soils, rock, waste piles, contaminants on the ground surface, and buried contaminants;
- Infiltration of surface water that may itself be contaminated or movement of precipitation through a contaminated deposit that in turn transmits contamination deeper into the soil/rock profile;
- Movement of contaminants in surface water that discharges in the dissolved, suspended sediment, and bedload phases.

Location of Surface Water at OU 1086

Surface water flow begins with the progressive accumulation of overland flow into rills, rivulets, and small channels, which collect and funnel flow into large-scale, well-defined stream channels of delineated watersheds. Springs and man-made outfalls can also contribute. Four separate watersheds, each with an established stream channel drainage network, are present within OU 1086. These watersheds are Three-Mile Canyon, Potrillo Canyon, Water Canyon, and Canyon de Valle; their locations and boundaries with respect to OU 1086 are shown in Topographic Map Appendix A to the RFI Work Plan for OU 1086 (LANL 1993, ER ID 20946). (A fifth watershed, Pajarito Canyon, received runoff from a small, undeveloped area within OU 1086. Because it is not expected that the watershed will receive any contaminants from OU 1086, it is excluded from further discussion.) All surface water transport of contaminants at OU 1086 ultimately will flow into one of these four canyons.

Examination of the contaminant source term with respect to the watershed boundaries will enable prediction of which canyon will receive contaminants. Three-Mile Canyon flows into Pajarito Canyon; Potrillo Canyon and Cañon de Valle flow into Water Canyon; and Pajarito and Water canyons both are tributaries to the Rio Grande. Streamflow in Three-Mile and Potrillo canyons is ephemeral with flow occurring in response to rainfall and snowmelt events. Flow in Cañon de Valle in the vicinity of OU 1086 may at times be from permitted wastewater discharge and from snowmelt and stormwater run-off. Water Canyon receives flow from springs upstream from West Jemez Road, from permitted wastewater discharge at TA-11, TA-15, and TA-16, and from snowmelt and stormwater nun-off. In years of heavy snow pack, these channels may transport continuous flow during the spring. Intermittent channel flow in response to heavy rainfall occurs during the spring, summer, and fall.

Depth of flow in these channels from snowmelt is generally small, on the order of a few centimeters. Flow from rainfall events can reach depths of 1 m or more. Run-off events of this magnitude can erode and transport large volumes of sediment and contaminants. No direct measurements of flow or sediment discharge have been made in Three-Mile Canyon or Cañon de Valle in the vicinity of OU 1086. Peak discharge measurements in Potrillo Canyon downstream from OU 1086 at OU 1130 were measured as 1.63 m3/s during 1990.

Sedimentation and Erosion

Sediment accumulation and erosion from surface water occurs episodically in response to run-off events, with the greatest amounts occurring during large discharges. Erosion from surface water can expose and transport contaminants from their original disposal location; sedimentation can redeposit the contaminant of interest to another location within a watershed, either within or beyond the LANL boundary. Sediment accumulations in excess of 1 m from a single event have been measured in the active channel in Potrillo Canyon east of OU 1086. There have been no comprehensive sediment budget analyses performed on the Pajarito Plateau.

Erosion is expected to accelerate over areas where the natural soil surface has been disturbed, such as roads, firing site pads, burial pits, boneyards, and open dumps. Disturbed soil can increase surface nun-off and make soil susceptible to erosional processes (Graf 1975, ER ID 12465; Nyhan and Lane 1986, ER ID 6539).

Uranium, a heavy metal used in dynamic weapons testing at OU 1086, was found to accumulate in particular geomorphologic deposits in Potrillo Canyon (Becker 1991, ER ID 15317). There is preferential accumulation of the smaller particulates in the stream bank deposits, point bars, and alluvial fans. Therefore, these geomorphologic deposits are expected to accumulate uranium and other contaminant metals, such as mercury, lead, and possibly beryllium.

Infiltration of Surface Water

Infiltration of surface water can occur in several different hydrologic settings. These include

- Native and disturbed soils,
- Exposed rock surfaces, and
- Active stream channels in the watersheds.

The rate of infiltration in any of these hydrologic settings at OU1086 is unknown due to the lack of site-specific measurements. The infiltration rate may be variable from hydrologic setting to hydrologic setting.

Slopes Analyses

Slopes are an important factor in the evaluation of contaminant transport because contaminant dispersion will occur more rapidly as the slope increases. Overland flow velocities (discharges) will increase proportionally to the square root of the slope over which flow occurs. A rapidly moving flow has less opportunity to infiltrate into the soil, and therefore has decreased potential to move contaminants vertically into the soil. Increased flow velocities have a greater capacity to erode sediments and transport contaminated sediment, particulates, and contaminants in the liquid phase away from their original disposal site. Gentle slopes tend to retard overland sediment movement. The shallow slope can permit increased infiltration of a contaminant vertically into the soil, which could then carry the contaminant to depth, ether in dissolved or particulate phases.

There is a wide variation in slope in OU 1086 (Appendix A to the RFI Work Plan for OU 1086 [LANL 1993, ER ID 20946]). Slopes on the mesa tops are typically about 2%. Steeply sided canyon walls that form the interface between the mesas and canyon bottoms range from 30% to 90%.

B-4.2.1 LANL-ER-AP-4.5 Assessment

At LANL, surface water runoff and sediment transport are among the potential migration pathways by which contaminants might be transported to off-site receptors. Surface water may also access subsurface contaminants exposed by soil erosion. Soil erosion is dependent on several factors, including soil properties; the amount of vegetative cover; the slope of the contaminated area; exposure; the intensity and frequency of precipitation; and seismic activity.

LANL's ER Project has developed AP-4.5 to assess sediment transport and erosion concerns at specific PRSs. AP-4.5 provides a basis for prioritizing and scheduling actions for controlling the erosion of potentially contaminated soils at specific PRSs. The procedure is a two-part evaluation. Part A is a compilation of existing PRS analytical data, site maps, and knowledge-of-process information. Part B is an assessment of the erosion/sediment transport potential at the PRS. Erosion potential is numerically rated from 1 to 100 using a matrix system. PRSs that score below 40 have a low erosion potential; those that score from 40 to 60 have a medium erosion potential; and those that score above 60 have a high erosion potential. Part A of this assessment is initiated and completed by LANL's Water Quality and

Hydrology Group (ESH-18). A Surface Water Assessment Team comprised of representatives from ER, ESH-18, the Facility Management Group (FSS-7), and the DOE Oversight Bureau evaluates each completed assessment. If necessary, as best management practice or other action is implemented based on the results of the assessment.

AP-4.5 assessment for the PRS addressed in the VCA completion report is attached following Appendix B.

B-4.3 Groundwater

Little drilling has been done to confirm or deny the presence of perched or alluvial aquifers in Three-Mile Canyon, Potrillo Canyon, Cañon de Valle, or Water Canyon. However, based upon the geology and hydrology of these canyons and observations made in other canyon locations where there is sufficient information on the existence of perched and alluvial aquifers, the following generalizations appear to be reasonable. The issue of alluvial aquifers is addressed in the 1991 IWP, Appendix M (LANL 1991, ER ID 07678).

Three-Mile Canyon has a small drainage area that heads on the Pajarito Plateau; ephemeral streamflow in the canyon occurs in response to snowmelt run-off and from storms during the spring, summer, and fall. The presence of permanent perched or alluvial water in this canyon is considered unlikely.

Potrillo Canyon heads on the Pajarito Plateau at TA-15. Streamflow in the channel is in response to snowmelt and run-off from storm events in the spring, summer, and fall. The stream channel in the upper reaches of the watershed (in OU 1086) is cut directly on the Bandelier Tuff. There is little to no alluvial fill in this reach of the watershed. Therefore, it is unlikely that a permanent alluvial aquifer exists in this canyon. Becker (1991, ER ID 15317) found no alluvial aquifers in the watershed further downstream where streamflow discharge is greater due to a larger contributing area.

Cañon de Valle heads on the flanks of the Sierra de los Valles. Cañon de Valle receives small amounts of recharge from springs in its uppermost reaches but, because of evapotranspiration and infiltration, streamflow from this source does not reach West Jemez Road. Cañon de Valle receives effluent from permitted wastewater discharge in the reaches below West Jemez Road but above OU 1086. Some streamflow is maintained in the direct vicinity of these effluent discharges, but are rapidly depleted by evaporation, transpiration, and infiltration. Cañon de Valle also receives recharge from springs west of TA-15 and there appears to a significant reach of perennial flow in this area of the canyon. Streamflow through OU 1086 is ephemeral and occurs in response to snowmelt run-off, and run-off from spring, summer, and fall precipitation.

Water Canyon is a large canyon that heads on the flanks of the Sierra de Los Valles. Several springs discharge from perched layers in the tuff in upper Water Canyon and the largest of these springs has been used to supply water to S-Site in the past. Water Canyon also receives wastewater discharge from TAs-II, 15, 16, and 37. A short distance downstream from the confluence of Water Canyon and Canyon de Valle is Beta Hole, a dry well extending 187 ft into the Bandelier Tuff. Two other shallow wells completed into the alluvium were drilled in Water Canyon, one of which is located on OU 1086. These wells are also dry. The lack of water in these wells confirms that Water Canyon in the vicinity of TA-15 contains no permanent perched or alluvial aquifers.

There is a possibility of perched zones on interfingers of basalts at intermediate depth. Perched groundwater horizons within the Bandelier Tuff may also be present beneath TA-15 as suggested by the presence of springs west, south, and east of the site.

B-4.3.1 Alluvial Waters

See section B-4.3 (above)

B-4.3.2 Perched Waters

See section B-4.3 (above)

B-4.3.3 Regional Aquifer

As summarized in Chapter 2 of the IWP (LANL 1993, ER ID No. 26077), the regional aquifer is the only aquifer capable of supplying municipal and industrial water needs. The upper surface of the Regional Aquifer rises to the west from the Rio Grande through the Santa Fe Group into the lower part of the Puye Conglomerate beneath the central and western parts of the Pajarito Plateau. The water in the aquifer moves in a general sense from the main recharge area in the Valles Caldera on the west side of the Sierra de Los Valles eastward towards the Rio Grande, where there is some discharge into the river through seeps and springs. As stated earlier, there are no wells at TA-15. Therefore, all inferences on the Regional Aquifer beneath this technical site have been drawn from information derived from supply wells PM-2, PM-4, and PM-5 as well as the three deep wells at TA49, DT-5A, DT-9, and DT-10 (Figure B-1.0-5).

The aquifer beneath TA-15 is located stratigraphically within the basaltic rocks of Chino Mesa and interflow breccia, in the Puye Conglomerate, and in the Santa Fe Group. These units are composed of basalts, interflow breccias; conglomerates; and sandstones, conglomerates, basalts interflow breccias, and siltstones; respectively. Not all of these rocks transmit water equally well. Thick basalts, siltstones, and fine-grained sandstones will not yield water as readily as coarse-grained conglomerates and sandstones, highly jointed bassets, and coarse sediments of interflow breccias. To maximize production, supply and test wells are screened through a thick section of the aquifer to draw from multiple, highly permeable layers.

The depth to the regional aquifer beneath TA-15 water is estimated to vary from about 875 to over 1100 ft (Purtymun and Stoker 1988, ER ID 6879), with depths increasing to the west and from valley bottoms to mesa tops. Aquifer hydrologic characteristics vary. The closest well to TA-15, designated as PM-2, is in Pajarito Canyon. All wells are open in the Puye Conglomerate and Santa Fe Group. The characteristics of the wells are listed in Table B-4.3-1.

TABLE B-4.3-1
CHARACTERISTICS OF WELLS NEAR TA-15

	Well (ft)	Saturated Thickness (gpm/ft)	Specific Capacity (gpd/ft)	Transmissivity Field Coefficient of Permeability (gpd/ft2)
PM-2	1426	23.1	40 000	28
PM-4	1828	36.8	44 000	24
DT-5A	643	5.7	11 000	17
DT-9	498	22	61 000	122
DT-10	324	16	36 100	111

* From Purtymun 1984, 0196.

The water levels in the Regional Aquifer have declined 25 ft at PM-2 since 1966 and 34 ft. at PM-4 since 1984. The water levels in DT-10 and DT5A have declined about 0.5 ft/yr. (Purtymun 1984, ER ID 6513). A detailed description of the latter wells is given in the RFI Work Plan for Operable Unit 1144 (TA-49).

As described by Purtymun (Purtymun 1984, ER ID 6513), the Regional Aquifer is sensitive to atmospheric pressure changes, earth shocks, and probable earth tide effects, as monitored by a continuous water stage recorder on test well DT-9. Possible earth tide effects result in minor water level fluctuations (0.01 to 0.03 ft) when the gravitational pull of the moon elongates and compresses the aquifer. Strong earth motions have been recorded. The 1964 Good Friday Alaskan earthquake caused a water level fluctuation of more than 1 ft at well DT-9. These earth motion fluctuations are caused by the expansion and compaction of the aquifer by an earthquake's surface waves. Boreholes and wells completed in the

Bandelier Tuff and Puye Conglomerate transfer air to and from the Tuff and Conglomerate in response to changes in atmospheric pressure. Wells will "exhale" during barometric lows and "inhale" during barometric highs. Water level fluctuation is usually less than 0.5 ft. Because the aquifer at DT-9 is composed of three different formations -conglomerates, basalts, and sandstones - each with a different transmissivity and pressure heads, the variation in the barometric fluctuation is influenced by all three layers.

B-4.3.4 Vadose Zone

Description

The Pajarito Plateau is characterized generally by elongated mesas separated by canyons from 30 to 150 m deep. The mesas have thin soil mantles (see Subsection B-3.2 of this OU work plan), whereas canyon bottoms have alluvial fill ranging from 0 to nearly 30 m thick. Underlying the soils and alluvial fill is a thick sequence of Bandelier Tuff. With the exception of possible small alluvial and perched aquifers, unsaturated flow conditions are believed to predominate throughout the Bandelier Tuff down to the top of the main aquifer.

Moisture Movement In the Vadose Zone

Moisture movement in the Bandelier Tuff at TA-15 has not been studied. Based on studies conducted elsewhere at LANL, fluid movement at higher moisture contents is expected to be dominated by gravity flow. As the moisture content decreases, matric potential is expected to become the dominant moisture redistribution force. As moisture content decreases further, vapor phase flow is expected to become the dominant moisture redistribution mechanism (Stoker et al. 1991, ER ID 7530).

Under unsaturated conditions, the hydraulic conductivity of the porous tuff matrix is extremely low and fluid movement is expected to be slow. Furthermore, open fractures within the tuff may act to impede fluid movement under these conditions. In contrast, contaminants can move long distances through pores and fractures of the tuff in the vapor phase when moisture conditions are very low and open fractures may provide preferential vapor phase pathways.

Data from other LANL sites suggests that the moisture content of the tuff may be near the holding capacity of the formation; therefore, infiltration of any additional fluid may promote more rapid gravity drainage within the tuff matrix. Hydrogeologic data also suggests that water movement through the porous tuff matrix could proceed fairly rapidly under saturated or near-saturated conditions. In addition, open fractures within the tuff may allow very rapid water movement under similar conditions.

Vadose Zone Soil and Rock Properties and Moisture Characteristics

No measurements have been made on soil and rock properties and moisture characteristics at OU 1086. The following subsections summarize data collected from coreholes in Mortandad Canyon that were completed below an alluvial aquifer and from areas in Sandia and Mortandad canyons where there is no alluvial or perched water present. Coreholes completed below an alluvial aquifer are designated MCM 5.1 and MCC 5.9A. Coreholes 6, 7, and SIMO-1 were completed where there was no alluvial aquifer present. Information on these holes is discussed in the following subsections and is summarized from Stoker et al. (1991, ER ID 7530).

Porosity

Values of porosity as a function of lithology as measured in the corehole SIMO1 were 55% to 56% in Unit 1A, 41% to 62% in the Tsankawi, and 44% in the Otowi. Porosity values from corehole MCM 5.1, completed through a shallow alluvial aquifer in Mortandad Canyon, varied from 41% to 49% in alluvium, from 29% to 60% in weathered Unit 1A, 50% to 63 % in unweathered Unit 1A, and from 35% to 48% in the Tsankawi.

Hydraulic Conductivity

Unsaturated hydraulic conductivity data measured on cores from boreholes in Mortandad Canyon varied from 10-6 to 10-11 cm/s in the Bandelier Tuff, and increased to 10-3 to 10-2 cm/s at the contact between the Tsankawi and the Otowi units, a region of moisture accumulation. Saturated hydraulic conductivity ranged between 5 x 10-5 to 2 x 10-3 cm/s in areas below the alluvial aquifer (Stoker et al. 1991, ER ID 7530).

Moisture Content

Gravimetric moisture measurements were made on samples collected in boreholes in Mortandad and Sandia canyons. Results indicated that the moisture content below the alluvial aquifer varied from 10% to 3 0 %. Gravimetric moisture increased to a peak in the Tsankawi just above and at the contact with the Otowi at about 60%, then declined in the Otowi to 12% to 18%. Maximum moisture content in wells that were not completed into the Otowi or beneath alluvial aquifers was 32%.

B-5.0 ECOLOGICAL RESOURCES

Summary

The environmental setting of OU 1086 is primarily associated with mesa tops, although there are several canyons that might receive contaminants as a result of chemical transport. The mesa-top environment within the OU consists of ponderosa pine, as the dominant overstory in the western portion, with a gradation to pinon, pine, and juniper in the eastern portions of the site. There are cleared, grassy areas scattered throughout the site.

TA-15 serves as an overwintering area for deer and elk. Other species that are known to occur on the site include a variety of small mammals (mice, coyotes, and others).

Although there is no perennial source of water on the mesa top, the proximity to canyons affords access to water during most of the year. Thus, area wildlife can inhabit the three different types of habitat without having to move great distances to a water source.

The dominant tree species within OU 1086 are one-seed juniper, pinon, and ponderosa pine. Douglas fir is common in the area and an occasional white fir is found. Common shrub species are Gambel oak, wavyleaf oak, mountain mahogany, cliffbush, and Colorado barberry. The dominant grasses of the area include mountain muhly, little bluestem, and blue grama. Some of the most common fortes found within OU 1086 are golden aster, bittersweet, and wormwood. The following habitat types are found in the operable unit.

Mesa top:
Ponderosa pine-Gambel oak/pinon phase
Pinon-Gambel oak
Pinon-wavyleaf oak

North-facing slopes and canyon bottoms:
Ponderosa pine-Gambel oak
Douglas fir-Gambel oak

Within the operable 91 species of plants, 51 species of nesting birds, 24 species of wintering birds, 34 species of mammals, and 10 species of reptiles and amphibians have been identified.

Biological and cultural resources were extensively surveyed in the summer of 1992. Several threatened and endangered species were identified for which TA-15 has a suitable ecology. The details of these investigations are presented below.

Introduction and Further Information

During 1992, field surveys were conducted by the Biological Resource Evaluations Team (BRET) of the Environmental Protection Group (EM-8) [now ESH-20] for Operable Unit (OU) 1086, Technical Area (TA)-15 Site Characterization. Further information concerning the biological field surveys for this OU is contained in the full report "Biological and Flood Plain/Wet Land Assessment for Environmental Restoration Program, OU 1086." (LANL 1995, ER ID 52026) the biological assessment contains specific information on survey methods, results, and mitigation measures. This assessment will also contain information that may aid us to define ecological pathways and vegetation restoration.

Laws

Field surveys were conducted for compliance with the Federal Endangered Species Act of 1973; New Mexico's Conservation Act: New Mexico Endangered Plant Species Act; Executive Order 11990, "Protection of Wetlands"; and Executive Order 11988, "Floodplain Management"; 10 CFR 1022; and DOE Order 5400.1.

Methods

The surveys had three purposes: (1) to determine the presence or absence of any critical habitat for any state or federal sensitive, threatened, or endangered plant or animal species within the operable unit boundaries, (2) to identify the presence or absence of any sensitive areas such as floodplains or wetlands that may be present within the areas to be sampled and, if such an area is present, its extent and general characteristics, and (3) to provide additional plant and wildlife data concerning the habitat types within Operable Unit 1086. These data provide further baseline information about the biological components of the site that will enable site characterization and determination of pre-sampling conditions. This information also is necessary to support the National Environmental Policy Act (NEPA) documentation and determination of a Categorical Exclusion of the sampling plan for site characterization.

After searching the data base maintained in (EM-8) [ESH-20] containing the habitat requirements for all state and federally listed threatened or endangered plant and animal species known to occur within the boundaries of LANL and surrounding areas, researchers at LANL conducted a Level II habitat evaluation survey. A Level II survey is performed when areas are present that are not highly disturbed and could potentially support threatened or endangered species. Techniques used in a Level II survey are designed to gather data on the percentage of cover and the density and frequency of both the understory and overstory components of the plant community.

The habitat information gathered through the field surveys was then compared with the requirements for species of concern as identified in the ESH-20 data base search. If habitat requirements were not met, then no further surveys were conducted and the site was considered cleared for impact on state and federally listed species. If habitat requirements were met, species surveys were done in accordance with pre-established survey protocols, which often required certain meteorological or seasonal conditions.

In each location, the National Wetland Inventory Maps and field checks were used to note all wetlands and floodplains within the survey area. Criteria outlined in the Corps of Engineers Wetlands Delineation Manual (Federal Interagency Committee for Wetland Delineation 1989, ER ID 45910)) was used to note characteristics of wetlands, floodplains, and riparian areas.

Species Identified

Data base searches indicated that the species of potential concern for this operable unit are those listed in Table B-5.0-1.

TABLE B-5.0-1
SPECIES OF POTENTIAL CONCERN

Common Name	Scientific Name	Federal		Federal		State
		Endangered	Threatened	Proposed	Candidate	Endangered
Bald eagle	*Haliaeetus lecocephaius*	X				X
Peregrine falcon	Falco *pereglinus*	X				X
Mexican spotted owl	*Strix occidentalis lucida*			X		
Northern goshawk	*Accipiter gentilis*				X	
Willow flycalcher	*Empidonax trailli extimus*				X	X
Spotted bat	*Euderma maculatufri*				X	X
Jemez Mountains salamander	*Plethodon neomexicanus*					X
Broad-billed hummingbird	*Cynanthus latirostris*					X
Common black hawk	*Buteogallus anthracinus*					X
Mississippi kite	*Ictinia mississippiensis*					X
Grama grass cactus	*Toumeya papyracanthus*				X	X
Wood lily	*Lilium phliadeiphicum*					X
Wright's fishhook cactus	*Mammillaria wnghtii*					X
Santa Fe cholla	*Opunita viridiftora*					X

Results and Mitigation

Threatened, Endangered, and Sensitive Species

Sensitive and endangered plant species may need to be surveyed further if specific sampling activities are proposed within any sensitive habitat. Each species has its own seasonal survey restrictions due to its flowering or emergence dates. BRET must be provided with specific sampling site locations. These data will help BRET to determine the necessity for surveying for a particular plant species. During the field season of 1992, each protected plant species was sought during the habitat evaluation surveys; none were found. However, the survey did not coincide with the blooming season of all the listed plants.

As a result of a habitat evaluation and previous data on the operable unit, several of the previously listed animal species may occur within or near the operable unit. These species are the Northern Goshawk, Jemez Mountains salamander (Plethodon neomexicanus), and the spotted bat (Euderma maculatum). These species are discussed in more detail below. The remaining animal species listed above are dismissed from further consideration because more specific suitable habitat components are lacking or because the species have not been located on habitat more suitable to them in other areas of LANL.

The Northern Goshawk is found in dense, mature, or old growth coniferous forest. The highest percentage of nests in Los Alamos County are found in ponderosa pine/Gambel oak (Pinus ponderosa/Quercus Gambelil), ponderosa pine/gray oak (Ouercus grisea), and mixed conifer/Gambel oak habitat types. The mixed conifers include white fir (Abies concolorj, Douglas-fir (Pseudotsuga Menziesii), and ponderosa pine. All of the above habitat types are represented in the operable unit. Travis (1992, ER ID 12015) reports observations of possible breeding pairs in TA-15. The following measures shall be taken to avoid adverse impact to potential nesting Northern Goshawks:

1. Any machine sampling occurring between May and October shall be cleared through BRET. BRET shall be contacted 60 days prior to sampling to evaluate possible nest sites in and around the specific sampling area.

2. If any area over 0.1 acre will be disturbed, BRET shall be contacted for a pre-sampling site-specific survey.

3. Any tree removal (live or snag) shall be approved by BRET.

The Jemez Mountains salamander has been reported from upper Water Canyon. The animal requires rocks (talus slopes) or downed, well-decayed conifer trunks in mixed confer forests. Moist slopes and moderate to heavy overstory cover also are necessary for this small amphibian's survival. Cañyon de Valle and Los Alamos, Pajarito, and Water canyons are recognized as a population center for this amphibian. This is one of three population centers that could serve as refuges to protect [Jemez Mountains] salamanders from significant loss of habitat due to logging, fire or insect damage and maintain genetically viable populations. Impacts to salamanders would include habitat destruction due to tree removal, soil disturbance and removal of downed trees and limbs. The following mitigation measures are required if sampling is conducted within Potrillo, Three-Mile, or Water canyons.

1. BRET shall be notified 60 days prior to sampling to permit the team to evaluate the sampling site for the Jemez Mountains salamander. If a survey is required, it can be conducted only in the summer months after several days of heavy rains.

2. If sampling occurs on north-facing slopes or near streamside, a biologist from EM-8 [ESH-20] shall be present during sampling. (This is not anticipated during phase I sampling). If any salamanders are discovered, all ground-disturbing activities will cease until the situation is evaluated.

3. Any trees that are cut will be left to enhance habitat.

4. All disturbed areas will be replanted with native plants.

The spotted bat is found in pinon/juniper, ponderosa pine, mixed conifer, and riparian habitats. The two critical requirements for the spotted bat are a source of water and an availability of roost sites (caves in cliffs or rock crevices). Water, Three-Mile, and Potrillo canyons should have a sufficient number of potential roost sites, but water sources are limited. Suitable water is defined as small ponds or pools of slow-moving water. To date, no spotted bats have been successfully mist-netted on LANL property. Due to the nature and extent of the proposed site characterization in the canyon bottoms, no potential impacts to spotted bats will occur if small caves are not disturbed and if water sources in the canyon bottoms are not altered.

Several sensitive raptors breed in OU 1086 (Travis 1992, ER ID 12015). Travis reports substantiated observations of breeding pairs of American Kestrel (Falco sparvenius), Great Horned Owl (Bubo virginianus), and Red-tailed Hawk (Buteo jamaicensis). Zone-tailed Hawk (Buteo albonotatus) and Turkey Vulture (Cathartes aura) may breed in TA-15. Potential raptor nest sites occur in ponderosa pine and mixed conifer forest: steep cliffs with small caves and rack crevices, found in the operable unit, also provide the seclusion and commanding views required for nesting. From May to September, nesting sites should be free of any major disturbances such as the use of heavy equipment. However, major

disturbances occur routinely at this OU's firing sites. The same notification procedures will be used as are used in the routine operations on the site. BRET shall be consulted to identify potential nesting sites prior to any machine sampling or use of other heavy equipment.

Wetlands/Floodplains

Portions of the stream channel in Upper Water (Cañon de Valle) and Three-Mile Canyon are classified by the National Wetlands Inventory as possible palustrine wetlands. Survey data suggest some of these areas have characteristics of jurisdictional wetlands. In addition, there are six NPDES permitted outfalls in which four of these have some hydrophytic vegetation associated with them and may also quality as jurisdictional wetlands. None of these wetlands exceed ten acres and most are less than one acre. Floodplain maps developed by McLin (1992, ER ID 12014) indicate that a floodplain does exist within Water, Three-Mile and Potrillo Canyons. RFI activities are not anticipated to adversely affect the floodplains and wetlands within OU 1086 as long as best management practices outlined in below are adhered to.

Best Management Practices

Impacts to nonsensitive plants should be avoided when possible. Off-road driving is especially harmful to plants and soil crust. Revegetation may be required at some sites. A list of native plants suitable for revegetation for OU 1086 is contained in the final report "Biological Assessment for the Environmental Restoration Program, OU 1086." Some additional best management practices include the following:

- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel) to surrounding vegetation during the actual sampling and when traveling into sampling sites.
- Avoid removal of vegetation along water sources, drainage systems, and stream channels.
- Avoid disturbance to vegetation along canyon slopes, especially in drainage areas.
- Avoid tree removal. If tree removal is required, BRET should be contacted for evaluation.

In addition to these measures, BRET also requests notification of any activity that would disturb the vegetation before that activity is actually conducted.

The "Biological Assessment for the Environmental Restoration Program, Operable Unit 1086" will be evaluated by the US Fish and Wildlife for compliance with the Endangered Species Act. This federal agency may require additional mitigation measures that are not represented in this summary.

B-5.1 T&E Review of PRS 15-012(b)

The following memo is related to T&E Review of PRS 15-012(b).

Los Alamos
NATIONAL LABORATORY

memorandum

Environmental, Safety, & Health Division
Ecology Group, ESH-20, MS M887

To/Ms: Tom Fogg, ICF Kaiser/MS M892
From/Ms: Mary Mullen, ESH-20/MS M887
Phone/FAX: *5-8963/7-0731*
Symbol: *ESH-20/Ecol-97-0642*
Date: June 29, 1998

SUBJECT: T&E and cultural review of PRSs 15-009(c), 15-009(j), 15-012

The following PRSs were reviewed to determine whether or not they are in or near T&E Habitat and/or cultural sites:

15-009(c)
15-009(j)
15-012

PRSs were located using the FIMAD GIS database. Cultural sites and T&E Habitat were located using GIS databases maintained by the Ecology Group, ESH-20. All PRSs are entirely within T&E Habitat Buffer. PRSs were within 150 ft of one or more cultural sites.

MM:rm

Cy: Tony Ladino, ESH-20, MS M887
Teralene Foxx, ESH-20, MS M887

B-6.0 CULTURAL RESOURCES

Cultural Resource Summary

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey was conducted during the summer of 1992 at OU 1086. The methods and techniques that were used for this survey conformed to those specified in the "Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation" (Federal Register, Vol. 48, No. 190).

Eighty-eight archaeological sites are located in the surveyed area at TA-15. Eighty of these are eligible for inclusion on the National Register of Historic Places under Criterion D because of their potential to yield research data. These are listed in Table B-6.0-1.

The attributes of these sites that make them eligible for inclusion on the National Register will not be affected by any environmental restoration (ER) sampling activities proposed at OU 1086. A report documenting the survey area, methods, results, and monitoring recommendations, if any, will be transmitted to the New Mexico State Historic Preservation Officer for his concurrence in a "Determination of No Effect' for this project. As specified in 36 CFR 800.5 (b) and following the intent of the American Indian Religious Freedom Act, a copy of this report will also be sent to the governor of San Ildefonso Pueblo and to any other interested tribal group for comment on any possible impacts to sacred and traditional places.

All monitoring and avoidance recommendations contained in the final report shall be followed by all personnel involved in ER sampling activities. EM-8 archaeologists shall be contacted 30 days before any ground-breaking activities are initiated so that monitoring and avoidance recommendations can be verified. The same procedures will be applied to ER personnel that apply to the operating group, M-4.

TABLE B-6.0-1
ARCHAEOLOGICAL SITES LOCATED AT OU 1086

Site #	Site Type	Cultural Affiliation	Time Period	Eligible for National Registered Historic Places
LA 4665	XP	Anasazi	Coalition-Classic	Yes
LA 4666	SP	Anasazi	Coalition	Yes
LA 4682	PP	Anasazi	Coalition	Yes
LA 14869	RR	Anasazi	Coalition	Yes
L-39	SP	Anasazi	Coalition	Yes
L-40	SP	Anasazi	Coalition	Yes
L-41	FH	Anasazi	Coalition-Classic	Yes
L-46	SP	Anasazi	Coalition	Yes
Q-61	SP	Anasazi	Coalition	Yes
Q-62	AS	Anasazi	Coalition	PE
Q-63	AS	Archaic/Anasazi	Archaic/Coalition	PE
Q-64	FH	Anasazi/Archaic	Classic	Yes
Q-65	AS	Anasazi	Unknown/Classic	PE
Q-66	FH	Anasazi	Coalition/Classic	PE
Q-67	FH	Anasazi	Coalition	Yes
Q-68	SP	Anasazi	Classic	Yes
Q-69	SP	Anasazi	Coalition	Yes
Q-70	FH	Anasazi	Coalition	Yes
Q-71	FH	Anasazi	Coalition	Yes
Q-72a	FH	Anasazi	Classic	Yes
Q-72b	IR	Anasazi	Classic	Yes
Q-73	SP	Anasazi	Coalition-Classic	Yes
Q-74	IR	Anasazi	Coalition	PE
Q-75	FH	Anasazi	Coalition	Yes
Q-76	FH	Anasazi	Coalition	Yes
Q-77	FH	Anasazi	Classic	Yes
Q-78	SP	Anasazi	Coalition	PE
Q-79	AP	Anasazi	Coalition	PE
Q-80	WC	Anasazi	Classic	PE
Q-81	SP	Anasazi	Coalition	Yes
Q-82	SP	Anasazi	Coalition	Yes
Q-83	AS	Anasazi	Coalition	PE
Q-84	FH	Anasazi/Archaic	Coalition	Yes
Q-85	AS	Anasazi	Unknown/Classic	PE
Q-86	AP	Anasazi	Coalition	Yes

TABLE B.6-1
ARCHAEOLOGICAL SITES LOCATED AT OU 1086
(Continued)

Site #	Site Type	Cultural Affiliation	Time Period	Eligible for National Registered Historic Places
Q-87	SH, RA	Anasazi	Coalition	Yes
Q-88	WC	Anasazi	Coalition/Classic	No
Q-89	SP	Anasazi	Coalition	Yes
Q-90	AS	Anasazi	Coalition	PE
Q-91	CP	Anasazi	Coalition-Classic	PE
Q-92	CP	Anasazi	Coalition-Classic	Yes
Q-93	LS	Archaic	Unknown	PE
Q-94	CP	Anasazi	Coalition-Classic	PE
Q-95	FH	Anasazi	Coalition	Yes
Q-96	CP	Anasazi	Coalition-Classic	Yes
Q-97	SP	Anasazi	Classic	Yes
Q-98	SP	Anasazi	Coalition-Classic	Yes
Q-99	FH	Anasazi	Classic	Yes
Q-100	AP	Anasazi	Coalition-Classic	PE
Q-101	FH	Anasazi	Classic or General Historic	Yes
Q-102	IR	Anasazi & or Unknown	Classic/General Historic	PE
Q-103	FH	Anasazi	Coalition-Classic	Yes
Q-104	WC	Anasazi/Euro-American	Coalition-Classic/Homesteading	PE
Q-105	FH	Anasazi	Classic	Yes
Q-106	IR	Anasazi/Unknown	Coalition-Classic/General Historic	PE
Q-107	IR	Anasazi/Unknown	Coalition-Classic/General Historic	PE
Q-108	SP	Anasazi	Coalition	Yes
Q-109	FH	Anasazi	Coalition	Yes
Q-110a	FH	Anasazi	Coalition	Yes
Q-110b	FH	Anasazi	Coalition	Yes
Q-110c	FH	Anasazi	Coalition	Yes
Q-111	CP	Anasazi	Classic	Yes
Q-112	RA	Anasazi	Unknown	Yes
Q-113	SH	Anasazi	Classic	Yes
Q-114	CP	Anasazi	Classic	Yes
Q-137	FH	Anasazi	Coalition	Yes
Q-138	WC	Anasazi	Coalition	No
Q-139	FH	Anasazi	Coalition	Yes

TABLE B.6-1
ARCHAEOLOGICAL SITES LOCATED AT OU 1086
(Continued)

Site #	Site Type	Cultural Affiliation	Time Period	Eligible for National Registered Historic Places
Q-140	FH	Anasazi	Coalition-Classic	Yes
Q-141	FH	Anasazi	Coalition-Classic	Yes
Q-142	FH	Anasazi	Coalition-Classic	Yes
Q-102	IR	or Unknown	General Historic	PE
Q-143	WC	Euro-American	Manhattan Project to Recent	No
Q-144	RA	Anasazi	Unknown	Yes
Q-145	SH	Anasazi/Unknown	Coalition-Classic	Yes
Q-146	SH	Unknown	General Historic	Yes
Q-147	IR	Anasazi/Unknown	Coalition-Historic	PE
Q-150	FH	Anasazi	Coalition-Classic	Yes
Q-151	FH	Anasazi	Coalition	Yes
Q-152	FH	Anasazi	Coalition-Classic	Yes
Q-153	IR	Anasazi	Coalition-Classic	Yes
Q-155	FH	Anasazi	Coalition	Yes
Q-157	SP	Anasazi	Coalition-Classic	Yes
Q-158	SP	Anasazi	Coalition	Yes
Q-159	FH	Anasazi	Coalition	Yes
W-15	SP	Anasazi	Coalition-Classic	Yes
W-16	IR	Anasazi	Coalition/Classic	Yes
W-19	SP	Anasazi	Coalition	Yes

Codes for Site Types: AP = Amorphous Pueblo, AS – Artifact Scatter, C P = Cavate(s) or Cavate Pueblo, FH – Fieldhouse, IR – Indeterminate Rubble, LS = Lithic Scatter, PP = Enclosed Plaza Pueblo, RA = Rock Art/Petroglyph, RR = Rock Ring, SH = Rock Shelter, SP = Single Roomblock Pueblo, WC = Water or Soil Control Deviced, and XP = Complex Shaped Pueblo.

Eligibility Code: PE = Potentially Eligible

Time Period Dates: Archaic Period = 4,000 V.C. to A. D. 600, Coalition Period = A.D. 1100 to A.D. 1325, Classic Period = A.D. 1325 to A.D. 1600, General Historic Period (which includes the Spanish Colonial and Territorial period and the Homesteading Period) = A.D. 1600 to A.D. 1943, Homesteading Period = A.D. 1890 to A.D. 1943, Manhattan Project to Recent Period = A.D. 1942 to present

B-6.1 Cultural Review of PRS 15-012(b)

The following memo is related to the cultural review of PRS 15-012(b).

Los Alamos
NATIONAL LABORATORY

memorandum

Environmental, Safety, & Health Division
Ecology Group, ESH-20, MS M887

To/Ms: Tom Fogg, ICF Kaiser/MS M892
From/Ms: Mary Mullen, ESH-20/MS M887
Phone/FAX: *5-8963/7-0731*
Symbol: *ESH-20/Ecol-97-0642*
Date: June 29, 1998

SUBJECT: T&E and cultural review of PRSs 15-009(c), 15-009(j), 15-012

The following PRSs were reviewed to determine whether or not they are in or near T&E Habitat and/or cultural sites:

15-009(c)
15-009(j)
15-012

PRSs were located using the FIMAD GIS database. Cultural sites and T&E Habitat were located using GIS databases maintained by the Ecology Group, ESH-20. All PRSs are entirely within T&E Habitat Buffer. PRSs were within 150 ft of one or more cultural sites.

MM:rm

Cy: Tony Ladino, ESH-20, MS M887
Teralene Foxx, ESH-20, MS M887

Los Alamos National Laboratory
Environmental Restoration Program
CONSTITUENT ASSESSMENT

SITE INFORMATION

1. PRS Number: 15-012(b)
2. Date/Time (M/D/Y H:M am/pm): 11/14/97 10:41:00 AM
3. ER Point of Contact: D. Pippin
4. FMU/Reeponsible Party Contact: 67/Franco Sisneros
5. (●) HSWA ( ) Area of Concern (AOC) (check both if AOC is on HSWA Permit)
6. Site Ranking System (SRS) #: 47
7. Description of the historical operations of this PRS:

Operational release. Used to contain wash water and debris from vessel washing.

8. Description of the current operations of this PRS (if any):

PRS STATUS

Action/Status to Date (check all that apply)

			Date Completed or Anticipated
( ) None			
(●) Field Investigation	(●) Phase I	( ) Phase II	9/1/94
( ) Interim Measures	( ) IM	( ) BMPs	
(●) Accelerated Cleanup	(●) VCA	( ) VCM	9/1/97
( ) Other	( ) Monitoring	( ) CMs	
(●) Report Status	(●) RFI Report	( ) SAP	11/1/94
( ) NFA/DOU. If checked, supply criteria number(s):	0		

SAMPLE INFORMATION

Y / N

[x] [ ] 10. Have surface/sediment (depth less than 12 inches) samples been collected that reflect current site conditions?

If yes: 1) Attach data.
2) Include analyte name, value, units, location ID, sample ID, SAL, depth, & media (soil, tuff, etc.)
3) Please attach existing map, showing where samples were taken, if available.

[ ] [x] 11. Have surface water samples been collected that reflect current site conditions?

If yes: 1) Attach data.
2) Include analyte name, value, units, location ID, filtered/non-filtered, & flow data, if available.
3) Please attach existing map, showing where samples were taken, if available.

[ ] [x] 12. Is data pending? If yes: 1) List date data are anticipated:
2) Provide list of COPCs identified in RFI Work Plan as an attachment.

D. Pippin

13. Signature of ER Representative

Los Alamos National Laboratory

Environment, Safety and Health Division
ESH-18 Water Quality and Hydrology Group

AP 4.5 Surface Water Assessment
Erosion Matrix for PRS 15-012(b)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			1.0
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	13.0
Slope	13	0-10%	10-30%	>30%	1.3
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			0.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	0.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	0.0
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	15.3

SITE INFORMATION

1a) PRS Number: 15-012(b) 1b) Structure Number: 1c) FMU Number: 67

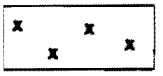
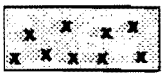
2. Date/Time (M/D/Y H:M am/pm): 8/28/97 9:50:00 AM

SITE SETTING (check all that apply)

3. (●) On mesa top (a). ( ) In the canyon floor, but not in an established channel (c).
( ) Within a bench of a canyon (b). ( ) Within established channel in the canyon floor (d).

Explanation: Flat area behind 15-285.

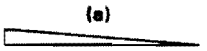
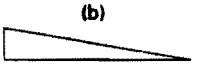
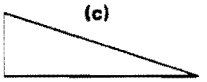
4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

(illustration) (a)  (b)  (c)

Estimated % of ground/canopy cover: (●) 0% to 25% ( ) 25% to 75 ( ) 75% to 100

Explanation: Contaminated soil recently excavated. No vegetation.

5. Steepest slope at the area impacted:

(a)  (b)  (c) 

(●) Less than 10% ( ) 10% to 30% ( ) 30% and greater

Explanation:

RUNOFF FACTORS

Y / N

[ ] [X] 6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:

[ ] [X] 6a) Is runoff channelized? If yes, describe ( ) Man-made channel. ( ) Natural channel.

Explanation: No photo/out film.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- ◯ **Drainage or wetland (name)** Potrillo
- ◯ **Within bench of canyon setting (name)**
- ◯ **Other (i.e., retention pond, meadow, mesa top)**

Explanation:

Y / N

☐ ☒ 6c) Has runoff caused visible erosion at the site? If yes, explain below ◯ Sheet ◯ Rill ◯ Gully

Explanation:

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: (Check EITHER #7 or #9)

☐ ☒ 7. Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation:

☐ ☒ 8. Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation:

☐ ☒ 9. Are natural drainage patterns directing stormwater onto site?

Explanation: Depressed area with bermed sides, run-off from surrounding terrain does not enter site.

ASSESSMENT FINDING:

☐ ☒ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

S. Veenis

11. Signature of Water Quality/Hydrology Representative

Initials of independent reviewer.

Check here when information is entered in database: ☒

This page is for ESH-18 notes, recommendations, and photos.

	Y	N	
12 a)	○	●	Is there visible trash/debris on the site?
b)	○	●	Is there visible trash/debris in a watercourse?

Description of existing BMPs:

○ ● Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

○ ● Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

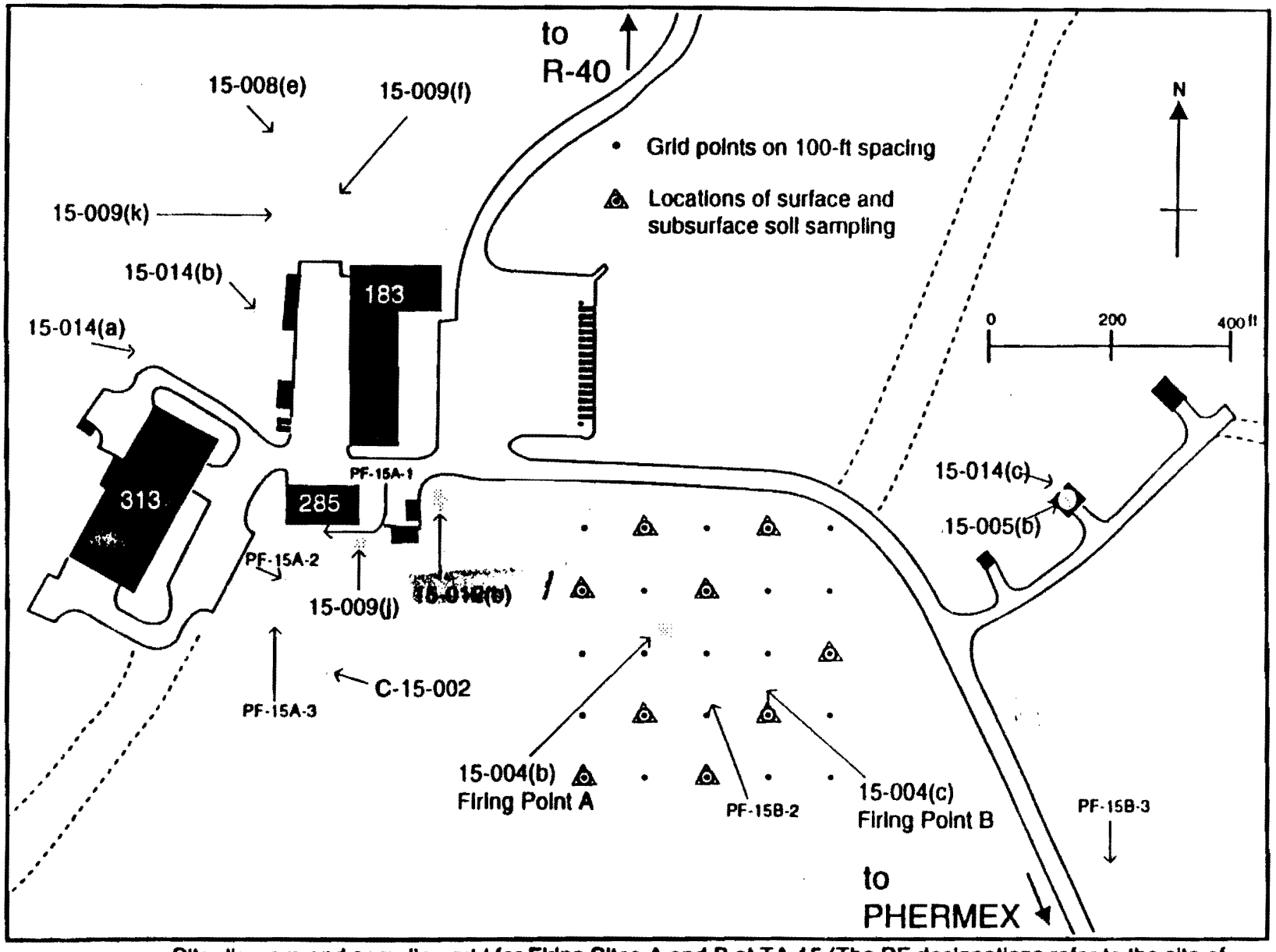


Figure 8.3-1 Site diagram and sampling grid for Firing Sites A and B at TA-15.(The PF designations refer to the site of samples taken prior to the installation of a new sewage line, June 1992. See Fresquez 1991,0003.)

AP4.5 PRS 15-012(b)

SAMPLE ID	PRS ID	LOCATION ID	BEGIN DEPTH	END DEPTH	DEPTH	ANALYTE CODE DESC	SAMPLE TYPE	ANALYTE TYPE	STD SAMPLE VALUE	STD REPORTING UNITS	LAB QUALIFIER	LANL QUALIFIER	LIMIT	LIMIT TYPE	MATRIX
0215-97-0105	15-012(b)	15-3441	0	6	N	Aluminum	SAMPLE	ANALYTE	6240	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Arsenic	SAMPLE	ANALYTE	1	MG/KG	S				SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Barium	SAMPLE	ANALYTE	188	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Beryllium	SAMPLE	ANALYTE	1.1	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Calcium	SAMPLE	ANALYTE	2260	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Cobalt	SAMPLE	ANALYTE	5.5	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Copper	SAMPLE	ANALYTE	6.1	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Mercury	SAMPLE	ANALYTE	0.019	MG/KG	B				SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Iron	SAMPLE	ANALYTE	7220	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Lead	SAMPLE	ANALYTE	15.5	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Nickel	SAMPLE	ANALYTE	6.6	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Sodium	SAMPLE	ANALYTE	255	MG/KG	B				SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Manganese	SAMPLE	ANALYTE	427	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Magnesium	SAMPLE	ANALYTE	1470	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Zinc	SAMPLE	ANALYTE	17.4	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Vanadium	SAMPLE	ANALYTE	14.8	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Uranium Tracer	SAMPLE	TRACER	106.8	%					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Uranium-238	SAMPLE	ANALYTE	1.18	PCI/G			0.0029	MDA	SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Uranium-234	SAMPLE	ANALYTE	0.927	PCI/G			0.0077	MDA	SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Potassium	SAMPLE	ANALYTE	1670	MG/KG					SURFACE SOIL
0215-97-0105	15-012(b)	15-3441	0	6	N	Chromium, Total	SAMPLE	ANALYTE	5	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Aluminum	SAMPLE	ANALYTE	6680	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Arsenic	SAMPLE	ANALYTE	1.3	MG/KG	S				SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Beryllium	SAMPLE	ANALYTE	1	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Barium	SAMPLE	ANALYTE	160	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Zinc	SAMPLE	ANALYTE	16.9	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Vanadium	SAMPLE	ANALYTE	15.3	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Lead	SAMPLE	ANALYTE	12.4	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Nickel	SAMPLE	ANALYTE	6.2	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Sodium	SAMPLE	ANALYTE	344	MG/KG	B				SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Manganese	SAMPLE	ANALYTE	405	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Magnesium	SAMPLE	ANALYTE	1400	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Potassium	SAMPLE	ANALYTE	1380	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Mercury	SAMPLE	ANALYTE	0.02	MG/KG	B				SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Iron	SAMPLE	ANALYTE	7470	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Uranium Tracer	SAMPLE	TRACER	96.5	%					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Uranium-238	SAMPLE	ANALYTE	1.27	PCI/G			0.0108	MDA	SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Uranium-234	SAMPLE	ANALYTE	0.826	PCI/G			0.0205	MDA	SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Copper	SAMPLE	ANALYTE	5.3	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Chromium, Total	SAMPLE	ANALYTE	5.2	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Cobalt	SAMPLE	ANALYTE	5.3	MG/KG					SURFACE SOIL
0215-97-0106	15-012(b)	15-3442	0	6	N	Calcium	SAMPLE	ANALYTE	2400	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Aluminum	SAMPLE	ANALYTE	7050	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Barium	SAMPLE	ANALYTE	167	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Zinc	SAMPLE	ANALYTE	17.7	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Vanadium	SAMPLE	ANALYTE	15.1	MG/KG					SURFACE SOIL

0215-97-0107	15-012(b)	15-3443	0	6	N	Nickel	SAMPLE	ANALYTE	5.5	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Sodium	SAMPLE	ANALYTE	368	MG/KG	B				SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Manganese	SAMPLE	ANALYTE	404	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Magnesium	SAMPLE	ANALYTE	1510	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Potassium	SAMPLE	ANALYTE	1650	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Iron	SAMPLE	ANALYTE	7660	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Copper	SAMPLE	ANALYTE	5.2	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Uranium Tracer	SAMPLE	TRACER	103.4	%					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Uranium-238	SAMPLE	ANALYTE	0.965	PCI/G			0.0039	MDA	SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Uranium-234	SAMPLE	ANALYTE	0.816	PCI/G			0.0205	MDA	SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Lead	SAMPLE	ANALYTE	12.2	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Chromium, Total	SAMPLE	ANALYTE	5.5	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Cobalt	SAMPLE	ANALYTE	4.9	MG/KG	B				SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Calcium	SAMPLE	ANALYTE	2150	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Beryllium	SAMPLE	ANALYTE	0.84	MG/KG					SURFACE SOIL
0215-97-0107	15-012(b)	15-3443	0	6	N	Arsenic	SAMPLE	ANALYTE	0.97	MG/KG	B				SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Aluminum	SAMPLE	ANALYTE	7170	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Uranium-234	SAMPLE	ANALYTE	1.04	PCI/G			0.0233	MDA	SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Lead	SAMPLE	ANALYTE	14.8	MG/KG	S				SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Sodium	SAMPLE	ANALYTE	421	MG/KG	B				SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Manganese	SAMPLE	ANALYTE	421	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Zinc	SAMPLE	ANALYTE	18.1	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Vanadium	SAMPLE	ANALYTE	16	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Uranium Tracer	SAMPLE	TRACER	110.5	%					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Uranium-238	SAMPLE	ANALYTE	2.64	PCI/G			0.012	MDA	SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Magnesium	SAMPLE	ANALYTE	1570	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Potassium	SAMPLE	ANALYTE	1540	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Mercury	SAMPLE	ANALYTE	0.072	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Iron	SAMPLE	ANALYTE	7960	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Copper	SAMPLE	ANALYTE	6.2	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Chromium, Total	SAMPLE	ANALYTE	5.8	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Cobalt	SAMPLE	ANALYTE	5.4	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Nickel	SAMPLE	ANALYTE	6	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Calcium	SAMPLE	ANALYTE	2180	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Beryllium	SAMPLE	ANALYTE	1.1	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Barium	SAMPLE	ANALYTE	168	MG/KG					SURFACE SOIL
0215-97-0108	15-012(b)	15-3444	0	6	N	Arsenic	SAMPLE	ANALYTE	1.1	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Barium	SAMPLE	ANALYTE	180	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Arsenic	SAMPLE	ANALYTE	1.3	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Aluminum	SAMPLE	ANALYTE	6680	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Nickel	SAMPLE	ANALYTE	6.3	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Sodium	SAMPLE	ANALYTE	368	MG/KG	B				SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Manganese	SAMPLE	ANALYTE	481	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Magnesium	SAMPLE	ANALYTE	1460	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Potassium	SAMPLE	ANALYTE	1580	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Mercury	SAMPLE	ANALYTE	0.03	MG/KG	B				SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Iron	SAMPLE	ANALYTE	7540	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Copper	SAMPLE	ANALYTE	8.5	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium-235	SAMPLE	ANALYTE	0.233	PCI/G			0.0159	MDA	SURFACE SOIL

0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium-235	DUP	ANALYTE	0.238	PCI/G			0.0242	MDA	SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium-234	SAMPLE	ANALYTE	2.54	PCI/G			0.0159	MDA	SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium-234	DUP	ANALYTE	2.6722	PCI/G			0.0242	MDA	SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Lead	SAMPLE	ANALYTE	21.8	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Zinc	SAMPLE	ANALYTE	17.8	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Vanadium	SAMPLE	ANALYTE	15.3	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium Tracer	SAMPLE	TRACER	87.1	%					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium Tracer	DUP	TRACER	87.7	%					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium-238	SAMPLE	ANALYTE	13.2	PCI/G			0.0113	MDA	SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Uranium-238	DUP	ANALYTE	13.8	PCI/G			0.012	MDA	SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Chromium, Total	SAMPLE	ANALYTE	5.5	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Cobalt	SAMPLE	ANALYTE	6.3	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Calcium	SAMPLE	ANALYTE	2280	MG/KG					SURFACE SOIL
0215-97-0109	15-012(b)	15-3445	0	6	N	Beryllium	SAMPLE	ANALYTE	1.8	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Arsenic	SAMPLE	ANALYTE	1.2	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Aluminum	SAMPLE	ANALYTE	7410	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Nickel	SAMPLE	ANALYTE	5.8	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Sodium	SAMPLE	ANALYTE	399	MG/KG	B				SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Manganese	SAMPLE	ANALYTE	412	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Magnesium	SAMPLE	ANALYTE	1570	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Potassium	SAMPLE	ANALYTE	1660	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Iron	SAMPLE	ANALYTE	7990	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Copper	SAMPLE	ANALYTE	7990	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Zinc	SAMPLE	ANALYTE	17.6	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Vanadium	SAMPLE	ANALYTE	16.2	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Uranium Tracer	SAMPLE	TRACER	104.8	%					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Uranium-238	SAMPLE	ANALYTE	1.63	PCI/G			0.0096	MDA	SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Uranium-234	SAMPLE	ANALYTE	0.864	PCI/G			0.0181	MDA	SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Lead	SAMPLE	ANALYTE	12.2	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Chromium, Total	SAMPLE	ANALYTE	5.7	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Cobalt	SAMPLE	ANALYTE	5.7	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Calcium	SAMPLE	ANALYTE	2180	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Beryllium	SAMPLE	ANALYTE	1	MG/KG					SURFACE SOIL
0215-97-0110	15-012(b)	15-3446	0	6	N	Barium	SAMPLE	ANALYTE	175	MG/KG					SURFACE SOIL

LOCATION ID	X_COORD	Y_COORD
15-3441	1622614.89	1761189.83
15-3442	1622629.85	1761200.94
15-3443	1622630.21	1761182.2
15-3444	1622648.06	1761197.89
15-3445	1622664.14	1761195.48
15-3446	1622600.07	1761194.87

LOCATION_I	X_COORD	Y_COORD
15-2525	1622649.36	1761201.18
15-2526	1622652.76	1761196.99
15-2527	1622646.72	1761194.05
15-2528	1622655.58	1761191.44
15-2529	1622628.15	1761194.84
15-2530	1622617.55	1761195.21

APPENDIX C

RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

Appendix C: Results of Quality Assurance/ Quality Control Activities

C-1.0 SUMMARY

Three surface and three subsurface soil samples were collected from the soil in the wash area for the RFI, and twenty-two surface and ten subsurface soil samples were collected from the soil in and around the wash area for the VCA at PRS 15-012(b). Six additional surface soil samples were subsequently collected from the same confirmatory sample locations in order to obtain lower and more representative detection limits for antimony. The samples were sent to off-site fixed analytical laboratories for analyses. The RFI samples were analyzed for TAL metals, uranium, and HE, while the VCA samples were analyzed for TAL metals, isotopic uranium, and HE. Table C-1.0-1 lists the analytical suites and method IDs used as well as a brief description of the analytical methods. The target analytes for each of these suites are listed in Appendix D-1.0 along with the detection or quantitation limits. The sample matrix for these samples was soil. Sample preservation techniques and holding time requirements are listed in LANL-ER SOP-1.02 and these guidelines were followed for these samples. The requirements of the VCA Plan for PRS 15-012(b) (Appendix I), the ER Project Quality Assurance Project Plan (QAPP) (LANL 1996, ER ID 53450), the analytical services statement of work (LANL 1995, ER ID 49738), and ER SOPs were followed during the analytical data collection and evaluation process. No deviations in these requirements were encountered.

TABLE C-1.0-1
ANALYTICAL METHODS AND DESCRIPTIONS

Analytical Suite	Analytical Method*	Method Description
Inorganic	SW846-6010A/CLP Metals (3050B)	Inductively Coupled Plasma Emission Spectroscopy (ICPES)
Arsenic, Selenium and Thallium	SW846-7060/7740/7841 (3050B)	Graphite Furnace Atomic Absorption Spectroscopy
Mercury	SW846-7471A (7471A)	Cold Vapor Atomic Absorption Spectroscopy (CVAA)
Uranium	KPA	Kinetic Phosphorescence Analysis
Isotopic Uranium	HASL300	Alpha Spectroscopy
HE	SW846-8330 (3540)	High Performance Liquid Chromatography (HPLC)

**Sample preparation methods are in parentheses.*

A field duplicate sample was also collected and analyzed in association with the VCA samples. An equipment blank was collected and analyzed for the sample analytical suites with the RFI samples. Equipment blanks, trip blanks, and rinsate blanks were not collected and analyzed along with the VCA samples. Laboratory QC samples associated with the samples included laboratory control samples, blanks, laboratory duplicates, matrix spikes/matrix spike duplicates, surrogates, and isotopic tracers. The type and frequency of QC analyses required for fixed-laboratory analyses are described in the ER Project Statement of Work for Analytical Services (LANL 1995, ER ID 49738) and definitions for the various types of QC samples are provided in the glossary in Appendix A-2.0.

All the data in this report has undergone routine validation as described in the Installation Work Plan (IWP) (LANL 1996, ER ID 55574). The ER data validation procedures are based on EPA's National Functional Guidelines for Data Review (EPA 1994, ER ID 48639; EPA 1994, ER ID 48640). If appropriate, qualifiers have been applied to the sample data; no data were rejected during the routine validation process. Based on the routine validation, the data are of sufficient quality and are useable for decision-making purposes. An overview of the results of the data validation and the impact of the qualification on the data are presented in Section 2.3.4.3, Data Review. Section C-5.0, Results of Data

Validation, presents and describes the QC issues encountered during the analyses and the qualifiers assigned to the data. Definitions of the qualifiers used during routine data validation are provided in Appendix A-2.0.

C-2.0 Inorganic Analyses

C-2.1 Field Analyses

The QA/QC for field analysis performed in 1994 consisted of checking the correlation between field and lab results. Field analysis methods capable of producing analytical Level II data were used during the sampling process to help determine which samples would be sent to the laboratory for analyses, also referred to as biased sampling. Samples from the field were processed in the mobile chemistry van using XRF techniques for mercury, lead and uranium, and LIBS techniques for beryllium. As described in the work plan, the intent was to bias the fixed lab analyses toward high concentrations. Samples with high field analysis values were sent for fixed lab analyses.

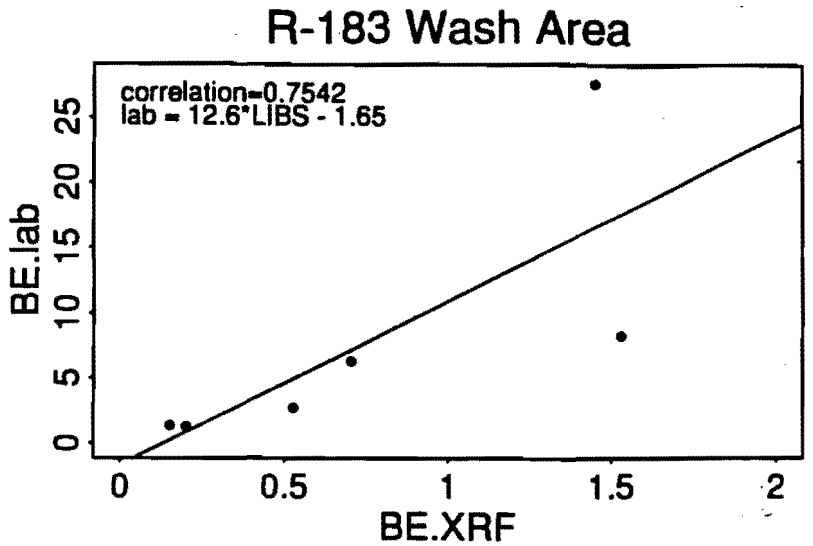
The analysis performed by LIBS and XRF are surface techniques, which measure the elements of interest in only the outermost few mm of the soil grains. The fixed laboratory analysis methods, by contrast, utilize a strong acid leaching procedure followed by either atomic absorption/emission for inductively coupled plasma emission. The fixed laboratory analysis measures more of a "total" concentration of an analyte than by the field methods. Thus, while the two analytical techniques are not identical, they are similar enough to be used in conjunction. The performance of field instruments is of interest because they are less costly and yield real-time results. In addition, when the field analysis measurements correlate well with the fixed analyses, the field information from samples not submitted to the analytical laboratory can be used to characterize the extent of contamination over the sites. The use of field analysis which produced Level II data is recognized by EPA as suitable to determine nature and extent of contamination.

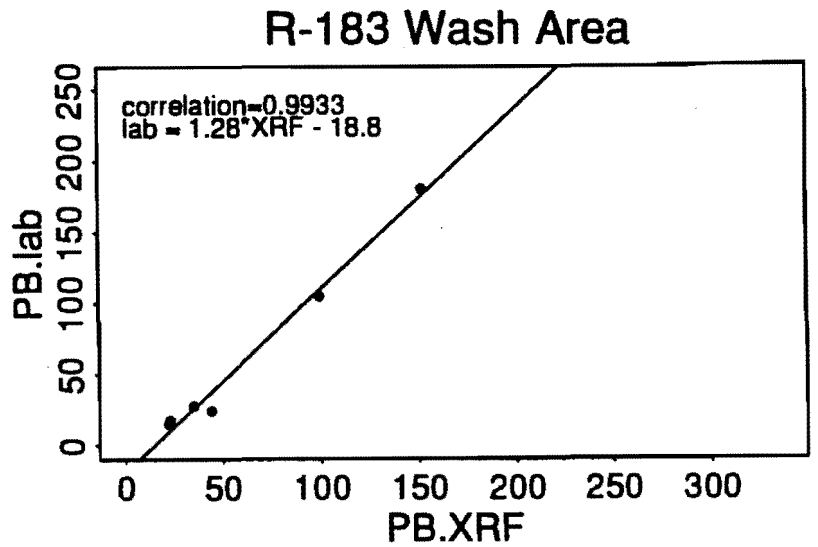
The scatter plots of the field measurements relative to the analytical lab result show the correlations between the two measurement methods. Included on the plots are the statistical correlation of the data and the equation of the lines representing the least square fit.

The results of Figure C-2.1-1 show a positive correlation between the measurements. Although there are varying amounts of scatter about the lines (due to the differences in the nature of the analytical techniques, matrix effects, inhomogeneities in the samples, etc), the results give confidence that the higher concentrations of metals in samples picked for fixed lab analysis were confirmed. This result, in turn, lends credence to the use of field analysis for biasing the samples sent for fixed lab analysis.

C-2.2 Fixed Laboratory Analyses

All of the surface and subsurface soil samples collected from the wash area during the RFI and VCA were analyzed for inorganics and uranium. The samples were analyzed by one of the following methods: ICPES, CVAA, graphite furnace atomic absorption or KPA (Table C-1.0-1). The inorganic and uranium analyses were performed by off-site analytical laboratories. Four inorganic analytes (antimony, cadmium, cobalt, and mercury) had estimated detection limits (EDLs) greater than the BVs for soil in one to six samples collected for the RFI. Two inorganics (antimony and cadmium) had EDLs greater than the BVs for soil in four to seven samples





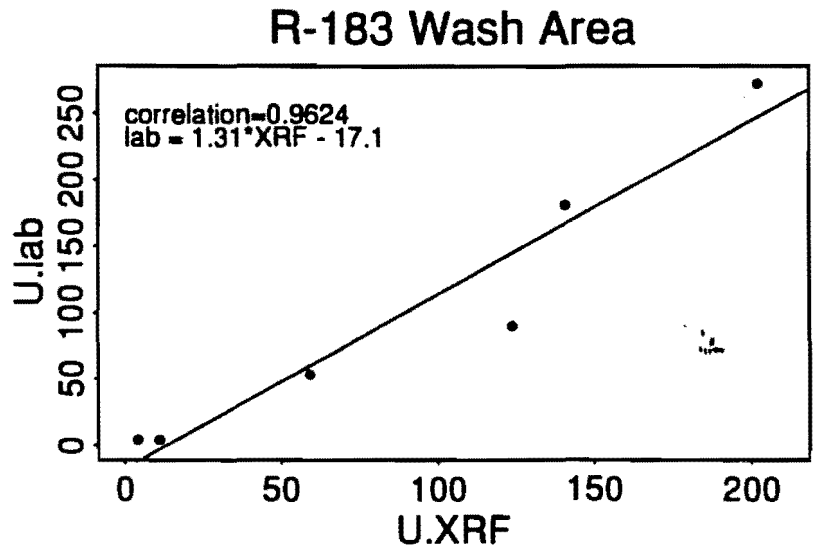


Figure C-2.1-1. Scatter plots showing correlation between field and laboratory analyses

collected during the VCA. The remediated area was subsequently re-sampled at the same confirmatory sample locations and analyzed for antimony in order to obtain lower and more representative detection limits. The EDLs for the inorganics did not exceed the contract required detection limits (Appendix D-1.0) and were the result of the analytical methods (ICPES and CVAA). The results are discussed in Section 2.3.4.3, RFI Data Review and Section 3.3.1, Confirmatory Sampling Data Review.

Inorganic QA/QC Samples

Laboratory Control Samples (LCS) – The LCS monitors the overall performance of each step during the analysis, including sample preparation. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640) if the recovery was outside of the acceptable limits. The acceptable limits for the LCS are 80-120%. The recoveries for the LCS analyses were within the acceptable limits for all samples, indicating that there was no apparent bias associated with the sample results.

Blanks – Assessment of the blank results is to determine the existence and magnitude of contamination resulting from laboratory and/or field activities. The analytical and blank results were compared according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640). The criteria for evaluation of blanks applies to any blank associated with the samples. The blanks analyzed by the analytical laboratories included an equipment blank for the RFI and method blanks for the RFI and VCA; no trip or field blanks were collected and analyzed for either activity. The blank results for the inorganic analyses were acceptable with the following exception.

- Selenium was detected in the preparation blank associated with 18 samples. The detected concentration in the samples were less than 5x the blank value, indicating that the detects are related to analytical laboratory contamination. As a result, the sample values for eight samples were qualified as U (undetected). The other 10 samples had selenium reported as undetected and were not affected by the blank contamination.

Matrix Spikes – Spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and measurement methodology. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640) if the recovery was outside of the acceptable limits. The acceptable limits for matrix spike recoveries are 75-125%. The recoveries for the matrix spike analyses were within the acceptable limits with the following exception.

- Barium matrix spike recovery in eighteen samples was below the limit of 75%. Barium results for these samples are qualified as J- based on the low spike recovery. The data are usable because the recovery of 67.4% was within the range of 30-74%, which results in potentially biased low data. The barium concentrations are estimated and were 40-175 mg/kg below the BV and less than 0.1 SAL. Therefore, the potential low bias for barium does not affect the data comparison.

- Antimony matrix spike recoveries for 24 samples were below the acceptable limit of 30%. The sample results were all nondetects and were qualified as RPM. Based on the routine validation, a representative number of samples from these two batches were resubmitted for antimony analysis and a focused validation was conducted on the data. The results of the re-analysis demonstrated that antimony was undetected in all samples (<0.14 mg/kg) with acceptable matrix spike recovery (77.7%). The focused validation concluded that the R qualifier was inappropriate and that the antimony data should be qualified as UJ. The focused validation for the antimony data is presented below. Based on this information, the antimony data were considered nondetects with detection limits less than the BV and are usable for this report.

The matrix spike recovery for antimony for request 4400R and 4475R were less than 30%. All antimony results were reported as non-detects. As per the LANL ER Baseline Validation procedure and in compliance with EPA Functional Guidelines, all associated antimony results were qualified as unusable (R). Antimony is not easily digested by standard nitric acid digestion methods. Because of this, low matrix

spike recoveries are expected and common. A representative number of samples were re-submitted for analysis using a more rigorous digestion method based on the Contract Laboratory Program Statement of Work (CLP SOW) method ILM03.0 with the additional use of hydrochloric acid to enhance the solubility of antimony. The following evidence suggests that though the original sample results were qualified as R this qualifier is inappropriate and all antimony results should be qualified as UJ and, therefore, all results are usable. No qualifiers were associated with the re-analyzed samples.

- The recovery for the matrix spikes for antimony in RN 4400R and RN 4475R were 24.5% and 26.4%, respectively. A re-analysis of random samples representative of both requests using a more rigorous preparation yielded a matrix spike recovery of 77.7%. All sample results from these above two requests were non-detects. Since, these results were non-detects and all the samples were collected under similar circumstances with the same sample matrix, it can be concluded that all the original samples were non-detects as well.

- A solid LCS was batched with RN 4400R and 4475R. The LCS recoveries for antimony in RN 4400R and RN4475R were 81.2% and 101.3%, respectively. For the re-analysis both an aqueous and a solid LCS were analyzed. The recoveries were 90.6% and 228.7%, respectively. The elevated solid LCS recovery is consistent with the superior digestion method. Since the re-analyzed samples were both representative of all samples in both requests and their results were non-detects, it can be concluded that all the antimony results associated with RN 4400R and 4475R are non-detects.

- All other QC results for both the original and re-analyzed samples meets both LANL ER Baseline Validation and EPA Functional Guidelines criteria.

Laboratory Duplicates – Duplicate sample analysis is used to demonstrate acceptable method precision by the analytical laboratory at the time of analysis or to determine long-term precision of the analytical method. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640) if the recovery was outside of the acceptable limits. The acceptable relative percent difference (RPD) between the sample and duplicate results is ±20% according to the routine validation procedure, but may be ±35% for soils according to EPA's functional guidelines (EPA 1994, ER ID 48640). The RPDs for the inorganic duplicate analyses were below one or both of these limits for all samples with the following exception.

- Manganese and mercury had RPDs of 21.7% and 34.8%, respectively, for 18 samples. The data were qualified with a P because the RPDs were above the routine validation limit of ±20%. Further review of the data found that the RPDs were below the EPA control limit of ±35% for soil (EPA 1994, ER ID 48460). Therefore, the data should not be qualified because they meet the EPA approved RPDs.

C-3.0 RADIOCHEMICAL ANALYSES

C-3.1 Field Analyses

C-3.2 Fixed Laboratory Analyses

The surface and subsurface soil samples collected from the wash area during the RFI were analyzed for uranium, while the surface and subsurface soil samples collected the VCA were analyzed for isotopic uranium. The uranium analysis was conducted by KPA, and the isotopic uranium analysis was by alpha spectroscopy (Table C-1.0-1). All of the analyses were performed by off-site analytical laboratories. The detection status for isotopic uranium was compared to the minimum detectable activity for all samples and analytes. The contract required detection limits (CRDLs) for uranium and isotopic uranium are presented in Appendix D-1.0. The results are discussed in Section 2.3.4.3, RFI Data Review and Section 3.3.1, Confirmatory Sampling Data Review.

The minimum detectable activities for isotopic uranium were equal to or less than the CRDLs with the following exceptions.

- Six samples had the minimum detectable activity for uranium-235 less than the estimated quantitation limit (EQL). The data are qualified as U (undetected).
- Seventeen samples had sample results greater than the minimum detectable activity but less than the EQL. The data was qualified as U (undetected)

Radionuclide QA/QC Samples

Laboratory Control Samples (LCS) – The LCS monitors the overall performance of each step during the analysis, including sample preparation. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640) if the recovery was outside of the acceptable limits. The LANL SOW specifies that the recoveries for the LCS be ±25% of the certified values. The recoveries for the LCS analyses were within the ±25% limits for all samples, indicating that there was no apparent bias associated with the sample results.

Blanks – Assessment of the blank results is to determine the existence and magnitude of contamination resulting from laboratory and/or field activities. The analytical and blank results were compared according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640). The criteria for evaluation of blanks applies to any blank associated with the samples. The blanks analyzed by the analytical laboratories included an equipment blank for the RFI and method blanks for the RFI and VCA; no trip or field blanks were collected and analyzed for either activity. The blank results for the uranium and isotopic uranium analyses were acceptable for all samples.

Laboratory Duplicates – Duplicate sample analysis are used to demonstrate acceptable method precision by the analytical laboratory at the time of analysis or to determine long-term precision of the analytical method. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Inorganic Data Review (EPA 1994, ER ID 48640) if the recovery was outside of the acceptable limits. There are no required acceptance criteria for duplicate analysis for radionuclides. The results were evaluated based on a 3-sigma (three standard deviations) agreement. All sample results were within 3-sigma of the original sample result.

Tracers – Radionuclide tracers are used to track the accuracy and bias of the analytical measurement. Tracers are designed to provide information about the effect of the sample matrix on the sample preparation procedures and measurement methodology. The LANL SOW specifies the required tracer recoveries for alpha emitters should be 30-110%. The tracer recoveries for isotopic uranium were within the acceptable limits for all samples.

C-4.0 ORGANIC ANALYSES

C-4.1 Field Analyses

Field analytical techniques were not used during the VCA to screen the PRS for organic compounds or bias sampling locations. Field screening was conducted for organic compounds for health and safety purposes.

C-4.2 Fixed Laboratory Analyses

All of the surface and subsurface soil samples collected from the wash area during the RFI and VCA were analyzed for HE using high performance liquid chromatography (HPLC) (Table C-1.0-1) by off-site fixed analytical laboratories. The extraction and analysis procedures were conducted as required in the LANL SOW for analytical services and the EQLs did not exceed the contract required detection limits (Appendix D-1.0).

Organic QA/QC Samples

Laboratory Control Samples – The data for the LCS are generated to provide information on the accuracy of the analytical method and on laboratory performance. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Organic Data Review (EPA 1994, ER ID 48639) if the recoveries were outside of the acceptable limits. The acceptable limits for the LCS are 80-120%. The recoveries for the organic LCS analyses were within the acceptable limits for all samples, indicating that there was no apparent bias associated with the sample results.

Matrix Spikes – The data for matrix spike/matrix spike duplicates (MS/MSD) are generated to determine long-term precision and accuracy of the analytical method on various matrices and to demonstrate compound recovery by the laboratory at the time of analysis. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Organic Data Review (EPA 1994, ER ID 48639) if the recoveries were outside of the acceptable limits. The acceptable limits are compound specific. The recoveries for the organic MS/MSD analyses were within the acceptable limits for all analytes and samples, indicating that there was no apparent bias associated with the sample results.

Surrogates – Laboratory performance on individual samples is established by measuring spiking activities. All samples are spiked with surrogate compounds prior to sample preparation and the recoveries evaluated. The analytical results for the samples were qualified according to the guidelines presented in EPA's National Functional Guidelines for Organic Data Review (EPA 1994, ER ID 48639) if the recoveries were outside of the acceptable limits. The acceptable surrogate recovery limit for HE is as follows:

1,4-Dinitrobenzene 20-120%

The recoveries for the surrogate were within the acceptable limits for all samples.

Blanks – Assessment of the blank results is to determine the existence and magnitude of contamination resulting from laboratory and/or field activities. The analytical and blank results were compared according to the guidelines presented in EPA's National Functional Guidelines for Organic Data Review (EPA 1994, ER ID 48639). The criteria for evaluation of blanks applies to any blank associated with the samples. The blanks analyzed by the analytical laboratories included an equipment blank for the RFI and method blanks for the RFI and VCA; no trip or field blanks were collected and analyzed for either activity. The blank results for the HE analyses were acceptable for all samples.

C-5.0 RESULTS OF DATA VALIDATION

TABLE C-5.0-1
DATA QUALITY EVALUATION OF VCA SAMPLES

Request Number	Sample ID	Suite	Comments
4400R	RE15-98-0001, -0002, -0003, -0004, -0005, -0006, -0007, -0008, -0009, -0010, -0011, -0012, -0013, -0014, -0015, -0016, -0017, -0018	Inorganics	Barium had a spike recovery outside of established limits (75%-125%). The data are qualified as J- and are usable because the recovery of 67.4% was within the range of 30-74%, which results in potentially biased low data. The barium results were 40-175 mg/kg below the BV and less than 0.1 SAL, so the potential low bias did not affect the data comparison.

TABLE C-5.0-1
DATA QUALITY EVALUATION OF VCA SAMPLES
(Concluded)

Request Number	Sample ID	Suite	Comments
4400R	RE15-98-0001, -0002, -0003, -0004, -0005, -0006, -0007, -0008, -0009, -0010, -0011, -0012, -0013, -0014, -0015, -0016, -0017, -0018	Inorganics	Manganese and mercury had RPDs above the routine validation control limit of ±20% and are qualified with P (professional judgement required). Further review of the data found that the RPDs of 21.7% and 34.8% were below the EPA's control limits for soil of ±35%. Therefore, the data should not be qualified.
			Selenium was detected in the preparation blank. The detected concentrations were less than 5x the blank value, indicating possible analytical laboratory contamination. Therefore, the detected sample values (8 samples) were qualified as u because of blank contamination. The remaining sample values were reported as nondetects by the analytical laboratory and were not affected by the blank contamination.
4400R and 4475R	RE15-98-0001, -0002, -0003, -0004, -0005, -0006, -0007, -0008, -0009, -0010, -0011, -0012, -0013, -0014, -0015, -0016, -0017, -0018 RE15-98-0019, -0020, -0021, -0022, -0023, -0024		Antimony had spike recoveries below the acceptable limit of 30% and were qualified as RPM. As a result of the low recoveries, a subset of the samples were re-submitted and re-analyzed for antimony and a focused validation was conducted. The focused validation concluded that the R qualifier was inappropriate and that the antimony data should be qualified as UJ. Based on this information the antimony data are considered nondetects, with detection limits below the BV and are usable for this report.

APPENDIX D ANALYTICAL SUITES AND RESULTS

D-1.0 TARGET ANALYTES AND DETECTION LIMITS

This section presents tables that list the target analytes and detection limits for all analyses conducted during this investigation.

D-1.1 Routine Analytical Suites

D-1.1.1 Inorganic Analyses

Estimated detection limits (EDLs) are presented in Table D.1.1.1-1.

TABLE D.1.1.1-1
DETERMINATION OF METALS

Analyte	*ICPAES*[1]	**GFAA or ICP-MS**
	Soils, mg/Kg[2]	Soils, mg/Kg[2]
Aluminum	40	
Antimony	12	
Arsenic	NR[3]	2
Barium	40	
Beryllium	1	
Cadmium[4]	1	
Calcium	1000	
Chromium[4]	2	
Cobalt	10	
Copper	5	
Cyanide[5]	NR[3]	NR[3]
Iron	20	
Lead[4]	0.6	0.2
Magnesium	1000	
Manganese	3	
Mercury[6]	NR[3]	NR[3]
Nickel	8	
Potassium	1000	
Selenium	NR[3]	1
Silver[4]	2	
Sodium	1000	
Thallium	NR[3]	2
Vanadium	10	
Zinc	4	

[1] Recommended method for inductively coupled plasma atomic emission spectroscopy (ICPAES) analysis is SW6010A. The preparation method is nitric acid digestion, method 3050A.
[2] Soil EDLs for ICPAES, graphite furnace atomic absorption spectroscopy (GFAA), and inductively coupled plasma mass spectroscopy (ICP-MS) analytes are based upon a 1 gram sample taken to a final volume of 200 mL.
[3] NR = not recommended; analyte should not be determined using this method
[4] Atomic absorption (AA) methods or ICP-MS may also be used for these analytes.
[5] Cyanide may be determined using methods SW9010, SW9010A, SW9012, or EPA 335.2. The EDLs for cyanide are 10 µg/L (water) and 0.05 mg/kg (soils). The soil EDL for CLP ILM03.0 method 335.2 is based upon a 5 gram sample taken to a final volume of 250 mL.
[6] Mercury should be determined by the cold vapor technique (method 7471A) with EDL for water = 0.2 µg/L and EDL for Soils = 0.1 mg/kg. The cold vapor technique soil EDL is based upon a 1 gram sample taken to a final volume of 100 mL.

In cases where the EDL for a metal cannot be met using ICPAES or false positives are known to be a problem historically within a laboratory, the subcontractor must use the GFAA technique (e.g., method SW7841 for thallium, method SW7421 for lead, method 7060 for arsenic, and method SW7740 for selenium) or the ICP-MS technique (e.g. method SW6020).

D-1.1.2 Organic Analytes

Organic analysis was not done on these samples.

D-1.1.3 High Explosives

Table D-4 presents the high explosives (HE) target analytes for method SW8330 and associated EQLs.

TABLE D.1.1.3-1
NITROAROMATIC AND NITRAMINE HE TARGET ANALYTES AND EQLs

Target Analyte	Abbreviation	EQL[1] Soils, mg/kg
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	(HMX)	2.2
Hexahydro-1,3,5-trinitro-1,3,5-triazine	(RDX)	1.0
1,3,5-Trinitrobenzene	(1,3,5-TNB)	0.25
1,3-Dinitrobenzene	(1,3-DNB)	0.25
Methyl-2,4,6-trinitrophenylnitramine	(Tetryl)	0.65
Nitrobenzene	(NB)	0.26
2,4,6-Trinitrotoluene	(2,4,6-TNT)	0.25
4-Amino-2,6-dinitrotoluene	(4-Am-DNT)	ND
2-Amino -4,6-dinitrotoluene	(2-Am-DNT)	0.26
2,4-Dinitrotoluene	(2,4-DNT)	0.25
2,6-Dinitrotoluene	(2,6-DNT)	0.26
2-Nitrotoluene	(2-NT)	0.25
3-Nitrotoluene	(3-NT)	0.25
4-Nitrotoluene	(4-NT)	0.25

[1] If "ND" appears in a cell, the EQL has not been determined. In those cases, assume an EQL of 1.0 µg/L for the low-level waters and an EQL of 10 µg/L for the high waters where values are missing.

D-1.1.4 Radiochemical Analytes

Table D-5 presents EQLs for commonly determined individual radiochemical analytes as well as analyte suites. The method for isotopic uranium analyses was a total dissolution using hydrofluoric acid in a manner similar to SW-846 method 3052. The remaining methods were applied only to liquid samples.

TABLE D.1.1.4-1
TARGET ANALYTE EQL BY MATRIX

Analyte	Soil	Technique[1]
Uranium-234, -235, -238	0.1	alpha spectroscopy

[1] The Los Alamos National Laboratory methods for these analytes are contained in LA-10300-M, "Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance".

D-2.0 RFI ANALYTICAL RESULTS

This section presents all analytical results associated with this investigation. Analytical results are provided in hard copy here and electronically in Excel 4.0 spreadsheet format on 3 disks. These disks are included with those copies of the report that state "Data disks included with this copy" on the front cover. Electronic copies of analytical results are also available from the ER Project's Facility for Information Management, Analysis, and Display (FIMAD).

TABLE D.2.1-1
FIELD ANALYTICAL SAMPLE RESULTS

PRS 15-012(b), R-183 Operational Release																	
Submitted to lab	AAB#	Grid Point # (15-1)	Depth (Inches)	Surface Measurements			Sample Measurements				Rad Van Results @			Chem Van			LIBS
				Beta/ Gamma (cpm)	Alpha (cpm)	Direct Reading (mR/hr)	Beta/ Gamma (cpm)	Alpha (cpm)	Direct Reading (mR/hr)	Miniram (mg/m3)	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g)	Hg (ppm)	Pb (ppm)	U (ppm)	Be (ppm)
	3404	2525	0-6	301	nda	0.16	211	nda	-	-	-7.38	-71.53	-0.75	<5	34	27	0.200
	3405	2525	18-24				246	nda	-	-	0	-193.24	-1.2	<5	20	8	0.209
*	3406	2526	0-6	484	nda	0.17	468	nda	-	-	-14.76	-1.07	2.19	<5	35	141	1.530
*	3415	2526	18-24				249	nda	-	-	0	-165.48	-0.99	<5	22	11	0.201
*	3417	2527	0-6	345	nda	0.12	450	nda	-	-	-14.76	-257.29	3.76	<5	152	202	1.449
*	3407	2527	18-24				323	nda	-	-	0	-80.07	-0.92	<5	44	59	0.526
	3412	2528	0-6	347	nda	0.07	240	nda	-	-	7.38	-109.96	-0.15	<5	36	54	0.468
	3410	2528	18-24				228	nda	-	-	0	-97.15	-1.05	<5	23	<8	0.282
*	3416	2529	0-6	221	0-50	0.12	419	nda	-	-	-14.76	-193.24	-1.09	<5	100	124	0.702
*	3408	2529	18-24				294	nda	-	-	-7.38	-39.5	-0.37	<5	23	<8	0.152
	3414	2530	0-6	200	nda	0.11	289	nda	-	-	-7.38	-86.48	-1.15	<5	34	63	0.256
	3409	2530	18-24				269	nda	-	-	-7.38	-161.21	-0.66	<5	19	<8	0.237
	3403	2595	0-6	(rep of 2529)							-14.76	-114.23	1.32	<5	95	124	0.684
	3411	2595	18-24	(rep of 2529)							22.14	-118.5	-0.44	<5	21	11	0.237

@ Ran van results have significant error

TABLE D.2.1-2
HE RADIOLOGICAL SCREENING RESULTS

PRS 15-012(b)			
Grid point	**AAB#**	**Ludlum 2221 with Ludlum 4410 2x2 NaI Probe**	
		3' reading (cpm)	**Surface reading (cpm)**
15-2525	3404, 3405	12152	12223
15-2526	3405, 3415	13273	15006
15-2527	3417, 3407	19523	18965
15-2528	3412, 3410	14190	14883
15-2529	3416, 2308	12323	11695
15-2530	3414, 3409	10450	11904

Background reading 7987 cpm
Probe calibrated for Natural Uranium

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Aluminum	6240	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Antimony	4.9	MG/KG	U
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Arsenic	1	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Barium	188	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Beryllium	1.1	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Cadmium	0.49	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Calcium	2260	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Cobalt	5.5	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Copper	6.1	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Iron	7220	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Lead	15.5	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Magnesium	1470	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Manganese	427	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Mercury	0.019	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Nickel	6.6	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Potassium	1670	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Selenium	0.21	MG/KG	U
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Silver	0.49	MG/KG	U
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Sodium	255	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Thallium	0.21	MG/KG	U
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Uranium-234	0.927	PCI/G	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.046	PCI/G	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Uranium-238	1.18	PCI/G	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Vanadium	14.8	MG/KG	None
15-012(b)	15-3441	0215-97-0105	28-Aug-97	0	6	IN	Not Available	Zinc	17.4	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Aluminum	6680	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Antimony	4.7	MG/KG	U
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Arsenic	1.3	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Barium	160	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Beryllium	1	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Cadmium	0.47	MG/KG	U
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Calcium	2400	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5.2	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Cobalt	5.3	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Copper	5.3	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Iron	7470	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Lead	12.4	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Magnesium	1400	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Manganese	405	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Mercury	0.02	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Nickel	6.2	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Potassium	1380	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Selenium	0.27	MG/KG	U
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Silver	0.47	MG/KG	U
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Sodium	344	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Thallium	0.27	MG/KG	U
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Uranium-234	0.826	PCI/G	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.036	PCI/G	U
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Uranium-238	1.27	PCI/G	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Vanadium	15.3	MG/KG	None
15-012(b)	15-3442	0215-97-0106	28-Aug-97	0	6	IN	Not Available	Zinc	16.9	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Aluminum	7050	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Antimony	5.1	MG/KG	U
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Arsenic	0.97	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Barium	167	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Beryllium	0.84	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Cadmium	0.51	MG/KG	UJ
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Calcium	2150	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5.5	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Cobalt	4.9	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Copper	5.2	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Iron	7660	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Lead	12.2	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Magnesium	1510	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Manganese	404	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Mercury	0.02	MG/KG	U
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Nickel	5.5	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Potassium	1650	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Selenium	0.25	MG/KG	U
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Silver	0.51	MG/KG	U
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Sodium	368	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Thallium	0.25	MG/KG	U
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Uranium-234	0.816	PCI/G	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.031	PCI/G	U
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Uranium-238	0.965	PCI/G	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Vanadium	15.1	MG/KG	None
15-012(b)	15-3443	0215-97-0107	28-Aug-97	0	6	IN	Not Available	Zinc	17.7	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Aluminum	7170	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Antimony	5.2	MG/KG	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Arsenic	1.1	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Barium	168	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Beryllium	1.1	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Cadmium	0.52	MG/KG	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Calcium	2180	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5.8	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Cobalt	5.4	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Copper	6.2	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Iron	7960	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Lead	14.8	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Magnesium	1570	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Manganese	421	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Mercury	0.072	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Nickel	6	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Potassium	1540	MG/KG	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Selenium	0.2	MG/KG	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Silver	0.52	MG/KG	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Sodium	421	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Thallium	0.2	MG/KG	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Uranium-234	1.04	PCI/G	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.07	PCI/G	U
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Uranium-238	2.64	PCI/G	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Vanadium	16	MG/KG	None
15-012(b)	15-3444	0215-97-0108	28-Aug-97	0	6	IN	Not Available	Zinc	18.1	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Aluminum	6680	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Antimony	5.3	MG/KG	U
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Arsenic	1.3	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Barium	180	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Beryllium	1.8	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Cadmium	0.53	MG/KG	U
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Calcium	2280	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5.5	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Cobalt	6.3	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Copper	8.5	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Iron	7540	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Lead	21.8	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Magnesium	1460	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Manganese	481	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Mercury	0.03	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Nickel	6.3	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Potassium	1580	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Selenium	0.26	MG/KG	U
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Silver	0.53	MG/KG	U
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Sodium	368	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Thallium	0.26	MG/KG	U
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Uranium-234	2.54	PCI/G	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.233	PCI/G	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Uranium-238	13.2	PCI/G	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Vanadium	15.3	MG/KG	None
15-012(b)	15-3445	0215-97-0109	28-Aug-97	0	6	IN	Not Available	Zinc	17.8	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Aluminum	7410	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Antimony	5	MG/KG	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Arsenic	1.2	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Barium	176	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Beryllium	1	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Cadmium	0.5	MG/KG	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Calcium	2180	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5.7	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Cobalt	5.7	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Copper	5.2	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Iron	7990	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Lead	12.2	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Magnesium	1570	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Manganese	412	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Mercury	0.02	MG/KG	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Nickel	5.8	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Potassium	1660	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Selenium	0.23	MG/KG	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Silver	0.5	MG/KG	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Sodium	399	MG/KG	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Thallium	0.23	MG/KG	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Uranium-234	0.864	PCI/G	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.034	PCI/G	U
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Uranium-238	1.63	PCI/G	None
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Vanadium	16.2	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3446	0215-97-0110	28-Aug-97	0	6	IN	Not Available	Zinc	17.6	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Aluminum	6980	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Antimony	4.9	MG/KG	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Arsenic	1.2	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Barium	187	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Beryllium	1.1	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Cadmium	0.49	MG/KG	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Calcium	2270	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Chromium, Total	5.1	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Cobalt	6.2	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Copper	4.9	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Iron	7420	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Lead	12.5	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Magnesium	1550	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Manganese	507	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Mercury	0.022	MG/KG	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Nickel	6.7	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Potassium	1560	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Selenium	0.26	MG/KG	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Silver	0.49	MG/KG	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Sodium	424	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Thallium	0.26	MG/KG	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Uranium-234	1.08	PCI/G	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Uranium-235	0.092	PCI/G	U
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Uranium-238	2.63	PCI/G	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Vanadium	15.5	MG/KG	None
15-012(b)	15-3446	0215-97-0111	28-Aug-97	0	6	IN	Not Available	Zinc	16.3	MG/KG	None
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.087	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.085	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Dinitrobenzene[1,3-]	0.082	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,4-]	0.062	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,6-]	0.082	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	HMX	0.166	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Nitrobenzene	0.093	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[2-]	0.166	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[3-]	0.163	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[4-]	0.165	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	RDX	0.166	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Tetryl	0.108	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Trinitrobenzene[1,3,5-]	0.083	MG/KG	U
15-012(b)	15-3441	0215-97-0126	1-Oct-97	0	6	IN	Not Available	Trinitrotoluene[2,4,6-]	0.087	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.087	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.084	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Dinitrobenzene[1,3-]	0.082	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,4-]	0.062	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,6-]	0.082	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	HMX	0.166	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Nitrobenzene	0.093	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[2-]	0.165	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[3-]	0.163	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[4-]	0.165	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	RDX	0.166	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Tetryl	0.107	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Trinitrobenzene[1,3,5-]	0.082	MG/KG	U
15-012(b)	15-3442	0215-97-0127	1-Oct-97	0	6	IN	Not Available	Trinitrotoluene[2,4,6-]	0.086	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.087	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.085	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Dinitrobenzene[1,3-]	0.082	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,4-]	0.062	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,6-]	0.082	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	HMX	0.166	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Nitrobenzene	0.093	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[2-]	0.166	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[3-]	0.163	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[4-]	0.165	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	RDX	0.166	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Tetryl	0.108	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Trinitrobenzene[1,3,5-]	0.083	MG/KG	U
15-012(b)	15-3443	0215-97-0128	1-Oct-97	0	6	IN	Not Available	Trinitrotoluene[2,4,6-]	0.087	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.086	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.084	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Dinitrobenzene[1,3-]	0.082	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Dinitrotoluene[2,4-]	0.062	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Dinitrotoluene[2,6-]	0.082	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	HMX	0.165	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Nitrobenzene	0.092	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Nitrotoluene[2-]	0.165	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Nitrotoluene[3-]	0.162	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Nitrotoluene[4-]	0.164	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	RDX	0.165	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Tetryl	0.107	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Trinitrobenzene[1,3,5-]	0.082	MG/KG	U
15-012(b)	15-3444	0215-97-0129	1-Oct-97	8	14	IN	Not Available	Trinitrotoluene[2,4,6-]	0.086	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.087	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.084	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Dinitrobenzene[1,3-]	0.082	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Dinitrotoluene[2,4-]	0.062	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Dinitrotoluene[2,6-]	0.082	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	HMX	0.166	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Nitrobenzene	0.093	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Nitrotoluene[2-]	0.165	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Nitrotoluene[3-]	0.163	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Nitrotoluene[4-]	0.165	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	RDX	0.166	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Tetryl	0.107	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Trinitrobenzene[1,3,5-]	0.082	MG/KG	U
15-012(b)	15-3445	0215-97-0130	1-Oct-97	4	10	IN	Not Available	Trinitrotoluene[2,4,6-]	0.086	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.087	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.085	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Dinitrobenzene[1,3-]	0.082	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,4-]	0.063	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,6-]	0.083	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	HMX	0.167	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Nitrobenzene	0.094	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[2-]	0.167	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[3-]	0.164	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[4-]	0.166	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	RDX	0.167	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Tetryl	0.108	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Trinitrobenzene[1,3,5-]	0.083	MG/KG	U
15-012(b)	15-3446	0215-97-0131	1-Oct-97	0	6	IN	Not Available	Trinitrotoluene[2,4,6-]	0.087	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Amino-2,6-dinitrotoluene[4-]	0.087	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Amino-4,6-dinitrotoluene[2-]	0.085	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Dinitrobenzene[1,3-]	0.083	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,4-]	0.063	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Dinitrotoluene[2,6-]	0.083	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	HMX	0.167	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Nitrobenzene	0.094	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[2-]	0.167	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[3-]	0.164	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Nitrotoluene[4-]	0.166	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	RDX	0.167	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Tetryl	0.108	MG/KG	U
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Trinitrobenzene[1,3,5-]	0.083	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3446	0215-97-0132	1-Oct-97	0	6	IN	Not Available	Trinitrotoluene[2,4,6-]	0.087	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Aluminum	20300	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Antimony	3.9	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Antimony	4	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Arsenic	3.5	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Arsenic	4	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Barium	200	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Barium	542	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Beryllium	8.2	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Cadmium	1.3	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Cadmium	3	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Calcium	3050	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Calcium	7900	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Chromium, Total	13.3	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Chromium, Total	16	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Cobalt	8.3	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Copper	27.4	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Copper	27	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Iron	14900	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Iron	20600	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Lead	27.3	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Lead	35	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Magnesium	2580	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Manganese	524	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Manganese	470	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Mercury	0.11	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Mercury	5	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Nickel	11.1	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Nickel	13	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Potassium	2890	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Potassium	20200	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Selenium	0.56	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Selenium	4	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Silver	0.65	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Sodium	169	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Thallium	0.67	MG/KG	U
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Thorium	14	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Titanium	3900	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Uranium	190.35	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Uranium	172.5	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Uranium	141	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Vanadium	27.2	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Zinc	37.5	MG/KG	None
15-012(b)	15-2526	AAB3406	26-Jul-94	0	6	IN	Not Available	Zinc	42	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Aluminum	18400	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Antimony	3.9	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Antimony	4	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Arsenic	3.6	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Arsenic	4	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Barium	198	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Barium	539	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Beryllium	2.7	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Cadmium	0.99	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Cadmium	3	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Calcium	2470	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Calcium	7300	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Chromium, Total	10.9	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Chromium, Total	26	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Cobalt	7.3	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Copper	12.7	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Copper	17	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Iron	14300	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Iron	23200	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Lead	23.8	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Lead	44	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Magnesium	2500	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Manganese	459	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Manganese	523	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Mercury	0.16	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Mercury	5	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Nickel	10.2	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Nickel	15	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Potassium	2590	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Potassium	19100	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Selenium	0.56	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Selenium	4	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Silver	0.65	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Sodium	154	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Thallium	0.67	MG/KG	U
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Thorium	23	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Titanium	3841	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Uranium	53.02	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Uranium	59	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Vanadium	26.1	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Zinc	31.9	MG/KG	None
15-012(b)	15-2527	AAB3407	26-Jul-94	18	24	IN	Not Available	Zinc	55	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Aluminum	25700	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Antimony	4.1	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Antimony	4	MG/KG	U.
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Arsenic	4.6	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Arsenic	4	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Barium	224	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Barium	597	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Beryllium	1.4	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Cadmium	1.2	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Cadmium	3	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Calcium	2720	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Calcium	7100	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Chromium, Total	13.6	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Chromium, Total	18	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Cobalt	8.9	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Copper	11.2	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Copper	14	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Iron	16900	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Iron	24400	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Lead	17	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Lead	23	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Magnesium	3050	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Manganese	507	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Manganese	454	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Mercury	0.12	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Mercury	5	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Nickel	11.6	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Nickel	13	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Potassium	2820	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Potassium	18600	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Selenium	0.59	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Selenium	4	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Silver	0.68	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Sodium	179	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Thallium	0.7	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Thorium	12	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Titanium	3959	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Uranium	3.88	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Uranium	8	MG/KG	U
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Vanadium	31	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Zinc	37	MG/KG	None
15-012(b)	15-2529	AAB3408	26-Jul-94	18	24	IN	Not Available	Zinc	44	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Aluminum	19000	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Antimony	3.9	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Antimony	4	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Arsenic	3.3	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Arsenic	4	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Barium	209	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Barium	590	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Beryllium	1.3	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Cadmium	0.92	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Cadmium	3	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Calcium	2570	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Calcium	7300	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Chromium, Total	11.5	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Chromium, Total	24	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Cobalt	8	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Copper	10.8	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Copper	11	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Iron	14600	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Iron	23000	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Lead	14.6	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Lead	22	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Magnesium	2570	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Manganese	536	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Manganese	531	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Mercury	0.11	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Mercury	5	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Nickel	10.2	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Nickel	13	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Potassium	2590	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Potassium	18900	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Selenium	0.57	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Selenium	4	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Silver	0.65	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Sodium	170	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Thallium	0.68	MG/KG	U
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Thorium	16	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Titanium	3961	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Uranium	4.1	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Uranium	11	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Vanadium	26.4	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Zinc	32.4	MG/KG	None
15-012(b)	15-2526	AAB3415	26-Jul-94	18	24	IN	Not Available	Zinc	45	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Aluminum	18600	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Antimony	4.1	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Antimony	4	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Arsenic	3.6	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Arsenic	4	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Barium	193	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Barium	487	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Beryllium	6.3	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Cadmium	0.68	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Cadmium	3	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Calcium	2500	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Calcium	7200	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Chromium, Total	10.3	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Chromium, Total	28	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Cobalt	7.2	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Copper	22	MG/KG	

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Copper	21	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Iron	13200	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Iron	21400	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Lead	104	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Lead	100	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Magnesium	2380	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Manganese	451	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Manganese	504	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Mercury	0.12	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Mercury	5	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Nickel	9.9	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Nickel	13	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Potassium	2720	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Potassium	20100	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Selenium	0.6	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Selenium	4	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Silver	0.69	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Sodium	145	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Thallium	0.71	MG/KG	U
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Thorium	23	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Titanium	3783	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Uranium	90.01	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Uranium	124	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Vanadium	23	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Zinc	32.3	MG/KG	None
15-012(b)	15-2529	AAB3416	26-Jul-94	0	6	IN	Not Available	Zinc	45	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Aluminum	19200	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Antimony	4.1	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Antimony	4	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Arsenic	4	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Arsenic	4	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Barium	201	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Barium	528	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Beryllium	27.6	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Cadmium	0.81	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Cadmium	3	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Calcium	2660	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Calcium	7500	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Chromium, Total	12.4	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Chromium, Total	20	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Cobalt	7.7	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Copper	61.1	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Copper	36	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Iron	14600	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Iron	20200	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Lead	180	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Lead	152	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Magnesium	2520	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Manganese	501	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Manganese	500	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Mercury	0.12	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Mercury	5	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Nickel	12.5	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Nickel	13	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Potassium	2820	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Potassium	19900	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Selenium	0.59	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Selenium	4	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Silver	1.7	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Sodium	171	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Thallium	0.7	MG/KG	U
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Thorium	17	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Titanium	3798	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Uranium	272.24	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Uranium	202	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Vanadium	25.5	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Zinc	38.5	MG/KG	None
15-012(b)	15-2527	AAB3417	26-Jul-94	0	6	IN	Not Available	Zinc	52	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Aluminum	10500	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Arsenic	2.7	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Barium	197	MG/KG	J-
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Beryllium	0.92	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Calcium	2750	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Chromium, Total	6.6	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Cobalt	5.6	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Copper	6.9	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Iron	10800	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Lead	13.6	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Magnesium	1730	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Manganese	338	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Nickel	6.6	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Potassium	1740	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Selenium	0.36	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Sodium	91.9	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Thallium	0.6	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Uranium-234	1.99	PCI/G	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.251	PCI/G	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Uranium-238	2.68	PCI/G	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Vanadium	16.3	MG/KG	None
15-012(b)	15-3450	RE15-98-0001	6-Jul-98	0	6	IN	ALLH	Zinc	25.5	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Aluminum	13800	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Arsenic	3.2	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Barium	196	MG/KG	J-
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Beryllium	1.2	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Calcium	2480	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Chromium, Total	7.6	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Cobalt	6.5	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Copper	6.6	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Iron	12700	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Lead	13.3	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Magnesium	2120	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Manganese	379	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Nickel	7.9	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Potassium	1850	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Selenium	0.84	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Sodium	94.8	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Thallium	0.59	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Uranium-234	1.045	PCI/G	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.07	PCI/G	U
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Uranium-238	0.995	PCI/G	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Vanadium	19.2	MG/KG	None
15-012(b)	15-3450	RE15-98-0002	6-Jul-98	18	24	IN	ALLH	Zinc	24	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Aluminum	11800	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Arsenic	2.8	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Barium	182	MG/KG	J-
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Beryllium	1	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Calcium	2360	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Chromium, Total	7.1	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Cobalt	6.4	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Copper	6.7	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Iron	11600	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Lead	14.5	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Magnesium	1890	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Manganese	391	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Nickel	7	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Potassium	2130	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Selenium	0.36	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Sodium	83	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Thallium	0.6	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Uranium-234	1	PCI/G	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.06	PCI/G	U
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Uranium-238	1.23	PCI/G	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Vanadium	17.9	MG/KG	None
15-012(b)	15-3451	RE15-98-0003	6-Jul-98	0	6	IN	ALLH	Zinc	24.1	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Aluminum	13100	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Antimony	0.28	MG/KG	UJ
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Arsenic	2.8	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Barium	190	MG/KG	J-
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Beryllium	1.1	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Calcium	2320	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Chromium, Total	7.6	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Cobalt	7	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Copper	6.4	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Iron	12700	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Lead	13.8	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Magnesium	2070	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Manganese	423	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Nickel	7.8	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Potassium	1920	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Selenium	0.34	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Sodium	132	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Thallium	0.57	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Uranium-234	0.869	PCI/G	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.089	PCI/G	U
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Uranium-238	1.14	PCI/G	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Vanadium	19.4	MG/KG	None
15-012(b)	15-3451	RE15-98-0004	6-Jul-98	18	24	IN	ALLH	Zinc	23.5	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Aluminum	10500	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Arsenic	2.8	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Barium	174	MG/KG	J-
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Beryllium	0.94	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Cadmium	0.02	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Calcium	2260	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Chromium, Total	6.5	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Cobalt	6.3	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Copper	7.1	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Iron	11500	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Lead	17.1	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Magnesium	1700	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Manganese	407	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Nickel	6.6	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Potassium	1940	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Selenium	0.48	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Sodium	73.7	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Thallium	0.3	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Uranium-234	1.29	PCI/G	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.094	PCI/G	U
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Uranium-238	1.51	PCI/G	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Vanadium	17.3	MG/KG	None
15-012(b)	15-3452	RE15-98-0005	6-Jul-98	0	6	IN	ALLH	Zinc	22.4	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Aluminum	14300	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Antimony	0.29	MG/KG	UJ
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Arsenic	2.7	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Barium	192	MG/KG	J-
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Beryllium	1.2	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Calcium	2390	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Chromium, Total	7.5	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Cobalt	6.5	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Copper	6.7	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Iron	12900	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Lead	14.3	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Magnesium	2080	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Manganese	371	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Nickel	7.7	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Potassium	1920	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Selenium	0.35	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Sodium	119	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Thallium	0.59	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Uranium-234	1.037	PCI/G	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.095	PCI/G	U
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Uranium-238	1.08	PCI/G	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Vanadium	19.3	MG/KG	None
15-012(b)	15-3452	RE15-98-0006	6-Jul-98	18	24	IN	ALLH	Zinc	23	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Aluminum	8760	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Antimony	0.29	MG/KG	UJ
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Arsenic	2.5	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Barium	138	MG/KG	J-
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Beryllium	0.83	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Cadmium	0.02	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Calcium	2000	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Chromium, Total	5.6	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Cobalt	4.6	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Copper	5.7	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Iron	10100	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Lead	13.2	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Magnesium	1480	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Manganese	311	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Nickel	5.9	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Potassium	1560	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Selenium	0.49	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Sodium	81.8	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Thallium	0.29	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Uranium-234	1.004	PCI/G	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.048	PCI/G	U
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Uranium-238	1.045	PCI/G	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Vanadium	13.9	MG/KG	None
15-012(b)	15-3453	RE15-98-0007	6-Jul-98	0	6	IN	ALLH	Zinc	22.5	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Aluminum	13100	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Antimony	0.29	MG/KG	UJ
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Arsenic	2.6	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Barium	194	MG/KG	J-
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Beryllium	1.1	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Calcium	2210	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Chromium, Total	7.5	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Cobalt	6.8	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Copper	6.4	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Iron	13100	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Lead	14	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Magnesium	1990	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Manganese	425	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Nickel	7.5	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Potassium	1920	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Selenium	0.34	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Sodium	102	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Thallium	0.57	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Uranium-234	0.998	PCI/G	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.049	PCI/G	U
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Uranium-238	0.973	PCI/G	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Vanadium	19.3	MG/KG	None
15-012(b)	15-3453	RE15-98-0008	6-Jul-98	18	24	IN	ALLH	Zinc	23.9	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Aluminum	10300	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Arsenic	3	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Barium	180	MG/KG	J-
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Beryllium	0.97	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Calcium	2320	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Chromium, Total	6.7	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Cobalt	6.7	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Copper	6.4	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Iron	11100	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Lead	18	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Magnesium	1740	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Manganese	446	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Nickel	7.1	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Potassium	2020	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Selenium	0.36	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Sodium	68.5	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Thallium	0.59	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Uranium-234	1.043	PCI/G	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.076	PCI/G	U
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Uranium-238	1.044	PCI/G	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Vanadium	17.5	MG/KG	None
15-012(b)	15-3454	RE15-98-0009	6-Jul-98	0	6	IN	ALLH	Zinc	22.2	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Aluminum	14700	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Arsenic	3.1	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Barium	191	MG/KG	J-

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Beryllium	1.4	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Calcium	2690	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Chromium, Total	8	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Cobalt	6.6	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Copper	7.5	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Iron	14300	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Lead	14	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Magnesium	2450	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Manganese	387	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Nickel	8.7	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Potassium	2000	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Selenium	0.36	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Sodium	119	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Thallium	0.6	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Uranium-234	0.886	PCI/G	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.074	PCI/G	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Uranium-238	1.125	PCI/G	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Vanadium	20.3	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	6-Jul-98	18	24	IN	ALLH	Zinc	28	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Aluminum	9230	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Arsenic	2.8	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Barium	166	MG/KG	J-
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Beryllium	0.96	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Cadmium	0.02	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Calcium	2290	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Chromium, Total	6.2	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Cobalt	6.5	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Copper	7.2	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Iron	10800	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Lead	15.8	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Magnesium	1680	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Manganese	438	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Nickel	6.5	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Potassium	1800	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Selenium	0.47	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Sodium	79.8	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Thallium	0.3	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Uranium-234	1.69	PCI/G	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.085	PCI/G	U
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Uranium-238	1.99	PCI/G	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Vanadium	16.3	MG/KG	None
15-012(b)	15-3455	RE15-98-0011	6-Jul-98	0	6	IN	ALLH	Zinc	23.4	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Aluminum	16100	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Antimony	0.31	MG/KG	UJ
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Arsenic	3	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Barium	195	MG/KG	J-
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Beryllium	1.3	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Cadmium	0.04	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Calcium	2610	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Chromium, Total	8.5	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Cobalt	6.8	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Copper	6.6	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	HMX	2.6	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Iron	10400	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Lead	16.2	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Magnesium	2320	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Manganese	355	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Nickel	8.3	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Potassium	1830	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Selenium	0.37	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Sodium	100	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Thallium	0.61	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Uranium-234	0.916	PCI/G	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.076	PCI/G	U
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Uranium-238	0.968	PCI/G	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Vanadium	20.5	MG/KG	None
15-012(b)	15-3455	RE15-98-0012	6-Jul-98	18	24	IN	ALLH	Zinc	27.6	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Aluminum	7270	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Antimony	0.29	MG/KG	UJ
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Arsenic	2.4	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Barium	120	MG/KG	J-
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Beryllium	0.8	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Cadmium	0.02	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Calcium	2610	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Chromium, Total	6.6	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Cobalt	4.1	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Copper	5	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Iron	8890	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Lead	17.2	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Magnesium	1430	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Manganese	278	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Nickel	5.6	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Potassium	1290	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Selenium	0.21	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Sodium	97.9	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Thallium	0.29	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Uranium-234	0.75	PCI/G	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.058	PCI/G	U
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Uranium-238	0.774	PCI/G	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Vanadium	13	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	6-Jul-98	0	6	IN	ALLH	Zinc	24.2	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Aluminum	18100	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Antimony	0.34	MG/KG	UJ
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Arsenic	3.4	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Barium	255	MG/KG	J-
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Beryllium	1.1	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Cadmium	0.04	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Calcium	2690	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Chromium, Total	9.2	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Cobalt	7.4	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Copper	9.4	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Iron	17400	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Lead	17.2	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Magnesium	2610	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Manganese	443	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Mercury	0.02	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Nickel	9.1	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Potassium	2430	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Selenium	0.4	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Silver	0.08	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Sodium	167	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Thallium	0.67	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Uranium-234	0.939	PCI/G	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.113	PCI/G	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Uranium-238	0.92	PCI/G	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Vanadium	23.6	MG/KG	None
15-012(b)	15-3456	RE15-98-0014	6-Jul-98	18	24	IN	ALLH	Zinc	30.7	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Aluminum	9480	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Antimony	0.29	MG/KG	UJ
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Arsenic	3	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Barium	227	MG/KG	J-
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Beryllium	0.71	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Calcium	2310	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Chromium, Total	6.5	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Cobalt	9	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Copper	7.2	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Iron	11600	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Lead	15.9	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Magnesium	1760	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Manganese	696	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Nickel	7.4	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Nitrobenzene	0.26	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Potassium	2030	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Selenium	0.37	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Silver	0.07	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Sodium	67.1	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Thallium	0.58	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Uranium-234	0.956	PCI/G	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Uranium-235	0.072	PCI/G	U
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Uranium-238	1.97	PCI/G	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Vanadium	19.1	MG/KG	None
15-012(b)	15-3457	RE15-98-0015	6-Jul-98	0	6	IN	ALLH	Zinc	24.1	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Aluminum	12900	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Antimony	0.29	MG/KG	UJ
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Arsenic	2.9	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Barium	227	MG/KG	J-
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Beryllium	0.74	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Calcium	2160	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Chromium, Total	7.3	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Cobalt	7.7	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Copper	7.2	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Iron	14000	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Lead	14.5	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Magnesium	2140	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Manganese	506	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Nickel	8.4	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Potassium	1930	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Selenium	0.34	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Sodium	110	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Thallium	0.58	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Uranium-234	0.954	PCI/G	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Uranium-235	0.098	PCI/G	U
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Uranium-238	0.973	PCI/G	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Vanadium	20.6	MG/KG	None
15-012(b)	15-3457	RE15-98-0016	6-Jul-98	18	24	IN	ALLH	Zinc	25.1	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Aluminum	14800	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Antimony	0.3	MG/KG	UJ
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Arsenic	3	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Barium	225	MG/KG	J-
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Beryllium	0.83	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Cadmium	0.03	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Calcium	2390	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Chromium, Total	7.7	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Cobalt	7	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Copper	8.4	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Iron	14400	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Lead	14.5	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Magnesium	2280	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Manganese	415	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Mercury	0.01	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Nickel	8.6	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Potassium	2110	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Selenium	0.36	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Sodium	141	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Thallium	0.6	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Uranium-234	0.932	PCI/G	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Uranium-235	0.077	PCI/G	U
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Uranium-238	1.11	PCI/G	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Vanadium	20.8	MG/KG	None
15-012(b)	15-3445	RE15-98-0017	6-Jul-98	30	36	IN	ALLH	Zinc	40.7	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Aluminum	13500	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Antimony	0.31	MG/KG	UJ
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Arsenic	2.8	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Barium	176	MG/KG	J-
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Beryllium	0.83	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Cadmium	0.04	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Calcium	5010	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Chromium, Total	8	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Cobalt	6	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Copper	7.4	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Dinitrobenzene[1,3-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Dinitrotoluene[2,4-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Dinitrotoluene[2,6-]	0.26	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	HMX	2.2	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Iron	12700	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Lead	13.9	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Magnesium	2520	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Manganese	365	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Mercury	0.02	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Nickel	9.3	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Nitrobenzene	0.26	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Nitrotoluene[2-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Nitrotoluene[3-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Nitrotoluene[4-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Potassium	2180	MG/KG	None

PRS 15-012(b) RFI AND VCA ANALYTICAL DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	RDX	1	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Selenium	0.42	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Silver	0.07	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Sodium	199	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Tetryl	0.65	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Thallium	0.61	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Trinitrobenzene[1,3,5-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Trinitrotoluene[2,4,6-]	0.25	MG/KG	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Uranium-234	0.491	PCI/G	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Uranium-235	0.038	PCI/G	U
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Uranium-238	0.815	PCI/G	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Vanadium	15.6	MG/KG	None
15-012(b)	15-3445	RE15-98-0018	6-Jul-98	54	60	IN	ALLH	Zinc	28.8	MG/KG	None
15-012(b)	15-3441	RE15-98-0019	30-Jul-98	0	6	IN	Not Available	Antimony	0.16	MG/KG	UJ
15-012(b)	15-3442	RE15-98-0020	30-Jul-98	0	6	IN	Not Available	Antimony	0.16	MG/KG	UJ
15-012(b)	15-3443.	RE15-98-0021	30-Jul-98	0	6	IN	Not Available	Antimony	0.15	MG/KG	UJ
15-012(b)	15-3444	RE15-98-0022	30-Jul-98	0	6	IN	Not Available	Antimony	0.16	MG/KG	UJ
15-012(b)	15-3445	RE15-98-0023	30-Jul-98	0	6	IN	Not Available	Antimony	0.15	MG/KG	UJ
15-012(b)	15-3446	RE15-98-0024	30-Jul-98	0	6	IN	Not Available	Antimony	0.16	MG/KG	UJ

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Available	73-2445	0173-97-0205 (R)	24-Jul-01	SOIL	3466R	Uranium-232 Tracer	63	%	DUP	TRACER	None
Not Available	73-2445	0173-97-0205 (R)	24-Jul-01	SOIL	3466R	Uranium-234	24.352	PCI/G	DUP	ANALYTE	None
Not Available	73-2445	0173-97-0205 (R)	24-Jul-01	SOIL	3466R	Uranium-235	0.8959	PCI/G	DUP	ANALYTE	None
Not Available	73-2445	0173-97-0205 (R)	24-Jul-01	SOIL	3466R	Uranium-238	21.308	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3441	0215-97-0105	29-Aug-01	S1	3643R	Uranium Tracer	106.8	%	SAMPLE	TRACER	None
15-012(b)	15-3442	0215-97-0106	29-Aug-01	S1	3643R	Uranium Tracer	96.5	%	SAMPLE	TRACER	None
15-012(b)	15-3443	0215-97-0107	29-Aug-01	S1	3643R	Uranium Tracer	103.4	%	SAMPLE	TRACER	None
15-012(b)	15-3444	0215-97-0108	29-Aug-01	S1	3643R	Uranium Tracer	110.5	%	SAMPLE	TRACER	None
15-012(b)	15-3445	0215-97-0109	29-Aug-01	S1	3643R	Uranium Tracer	87.1	%	SAMPLE	TRACER	None
15-012(b)	15-3445	0215-97-0109 (R)	29-Aug-01	S1	3643R	Uranium Tracer	87.7	%	DUP	TRACER	None
15-012(b)	15-3445	0215-97-0109 (R)	29-Aug-01	S1	3643R	Uranium-234	2.6722	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3445	0215-97-0109 (R)	29-Aug-01	S1	3643R	Uranium-235	0.238	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3445	0215-97-0109 (R)	29-Aug-01	S1	3643R	Uranium-238	13.8	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0110	29-Aug-01	S1	3643R	Uranium Tracer	104.8	%	SAMPLE	TRACER	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Antimony	97	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Arsenic	81.2	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Barium	98.1	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Beryllium	99.4	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Cadmium	95.4	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Chromium, Total	98	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Cobalt	94.8	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Copper	100.5	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Lead	159.8	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Manganese	-58.8	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Mercury	95.6	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Nickel	95.1	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Selenium	83.1	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Silver	95.6	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Thallium	94.8	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3643R	Uranium Tracer	102.9	%	SAMPLE	TRACER	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Vanadium	100	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111	29-Aug-01	S1	3642R	Zinc	101.3	%	MS	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Aluminum	7630	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Antimony	4.72	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Arsenic	0.986	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Barium	197	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Beryllium	1.13	MG/KG	DUP	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Cadmium	0.472	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Calcium	2260	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Chromium, Total	5.61	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Cobalt	7.1	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Copper	5.16	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Iron	8200	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Lead	12.4	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Magnesium	1660	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Manganese	554	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Mercury	0.021	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Nickel	6.05	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Potassium	1700	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Selenium	0.228	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Silver	0.472	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Sodium	406	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Thallium	0.228	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Vanadium	17	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3446	0215-97-0111 (R)	29-Aug-01	S1	3642R	Zinc	17.8	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3441	0215-97-0126	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	105	%	SAMPLE	SURR	None
15-012(b)	15-3442	0215-97-0127	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	101	%	SAMPLE	SURR	None
15-012(b)	15-3443	0215-97-0128	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	103	%	SAMPLE	SURR	None
15-012(b)	15-3444	0215-97-0129	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	104	%	SAMPLE	SURR	None
15-012(b)	15-3445	0215-97-0130	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	104	%	SAMPLE	SURR	None
15-012(b)	15-3446	0215-97-0131	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	102	%	SAMPLE	SURR	None
15-012(b)	15-3446	0215-97-0132	2-Oct-01	S1	3764R	Dinitrotoluene[3,4-]	102	%	SAMPLE	SURR	None
Not Applicable	Not Applicable	QC-97-18046	Not Applicable	WATER	3643R	Uranium Tracer	96.1	%	LCS	TRACER	None
Not Applicable	Not Applicable	QC-97-18046	Not Applicable	WATER	3643R	Uranium-234	99.9	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-18046	Not Applicable	WATER	3643R	Uranium-238	100.8	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-18047	Not Applicable	SOIL	3643R	Uranium Tracer	96.1	%	BS	TRACER	None
Not Applicable	Not Applicable	QC-97-18047	Not Applicable	SOIL	3643R	Uranium-234	99.8	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-18047	Not Applicable	SOIL	3643R	Uranium-238	100.8	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-18048	Not Applicable	SOIL	3643R	Uranium Tracer	93.6	%	BLANK	TRACER	None
Not Applicable	Not Applicable	QC-97-18048	Not Applicable	SOIL	3643R	Uranium-234	0.047	PCI/G	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-97-18048	Not Applicable	SOIL	3643R	Uranium-235	0.005	PCI/G	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-97-18048	Not Applicable	SOIL	3643R	Uranium-238	0.031	PCI/G	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Aluminum	5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Antimony	5	MG/KG	BLANK	ANALYTE	U

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Arsenic	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Barium	0.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Beryllium	0.4	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Cadmium	0.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Calcium	2.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Chromium, Total	1	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Cobalt	1	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Copper	0.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Iron	1	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Lead	0.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Magnesium	7.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Manganese	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Mercury	0.02	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Nickel	1.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Potassium	60	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Selenium	2.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Silver	0.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Sodium	10	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Thallium	2.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Vanadium	1	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-19387	Not Applicable	SOIL	3642R	Zinc	0.5	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Amino-2,6-dinitrotoluene[4-]	0.084	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Amino-4,6-dinitrotoluene[2-]	0.082	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Dinitrobenzene[1,3-]	0.079	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Dinitrotoluene[2,4-]	0.06	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Dinitrotoluene[2,6-]	0.08	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Dinitrotoluene[3,4-]	105	%	BLANK	SURR	None
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	HMX	0.161	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Nitrobenzene	0.09	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Nitrotoluene[2-]	0.16	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Nitrotoluene[3-]	0.158	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Nitrotoluene[4-]	0.16	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	RDX	0.161	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Tetryl	0.104	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Trinitrobenzene[1,3,5-]	0.08	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20920	Not Applicable	SOIL	3758R	Trinitrotoluene[2,4,6-]	0.084	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Amino-2,6-dinitrotoluene[4-]	94.4	%	BS	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Amino-4,6-dinitrotoluene[2-]	106.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Dinitrobenzene[1,3-]	100	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Dinitrotoluene[2,4-]	113.3	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Dinitrotoluene[2,6-]	111.7	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Dinitrotoluene[3,4-]	106	%	BS	SURR	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	HMX	96.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Nitrobenzene	110.9	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Nitrotoluene[2-]	102.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Nitrotoluene[3-]	104.8	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Nitrotoluene[4-]	104	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	RDX	103.6	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Tetryl	100.3	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Trinitrobenzene[1,3,5-]	119	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20921	Not Applicable	SOIL	3758R	Trinitrotoluene[2,4,6-]	102.1	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Amino-2,6-dinitrotoluene[4-]	0.084	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Amino-4,6-dinitrotoluene[2-]	0.082	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Dinitrobenzene[1,3-]	0.079	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Dinitrotoluene[2,4-]	0.06	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Dinitrotoluene[2,6-]	0.08	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Dinitrotoluene[3,4-]	105	%	BLANK	SURR	None
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	HMX	0.161	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Nitrobenzene	0.09	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Nitrotoluene[2-]	0.16	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Nitrotoluene[3-]	0.158	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Nitrotoluene[4-]	0.16	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	RDX	0.161	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Tetryl	0.104	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Trinitrobenzene[1,3,5-]	0.08	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20968	Not Applicable	SOIL	3764R	Trinitrotoluene[2,4,6-]	0.084	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Amino-2,6-dinitrotoluene[4-]	94.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Amino-4,6-dinitrotoluene[2-]	106.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Dinitrobenzene[1,3-]	100	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Dinitrotoluene[2,4-]	113.3	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Dinitrotoluene[2,6-]	111.7	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Dinitrotoluene[3,4-]	106	%	BS	SURR	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	HMX	96.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Nitrobenzene	110.9	%	BS	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Nitrotoluene[2-]	102.4	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Nitrotoluene[3-]	104.8	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Nitrotoluene[4-]	104	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	RDX	103.6	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Tetryl	100.3	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Trinitrobenzene[1,3,5-]	119	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-20969	Not Applicable	SOIL	3764R	Trinitrotoluene[2,4,6-]	102.1	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23684	Not Applicable	Not Available	3466R	Uranium Tracer	96.1	%	LCS	TRACER	None
Not Applicable	Not Applicable	QC-97-23684	Not Applicable	Not Available	3466R	Uranium-234	99.8	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23684	Not Applicable	Not Available	3466R	Uranium-238	100.8	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23685	Not Applicable	Not Available	3466R	Uranium-232 Tracer	96.1	%	SPIKE	TRACER	None
Not Applicable	Not Applicable	QC-97-23685	Not Applicable	Not Available	3466R	Uranium-234	99.8	%	SPIKE	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23685	Not Applicable	Not Available	3466R	Uranium-238	100.8	%	SPIKE	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23686	Not Applicable	Not Available	3466R	Uranium-232 Tracer	93.6	%	BLANK	TRACER	None
Not Applicable	Not Applicable	QC-97-23686	Not Applicable	Not Available	3466R	Uranium-234	0.047	PCI/G	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23686	Not Applicable	Not Available	3466R	Uranium-235	0.005	PCI/G	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-97-23686	Not Applicable	Not Available	3466R	Uranium-238	0.031	PCI/G	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Amino-2,6-dinitrotoluene[4-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Amino-4,6-dinitrotoluene[2-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Dinitrobenzene[1,3-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Dinitrobenzene[1,4-]	102	%	BLANK	SURR	None
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Dinitrotoluene[2,4-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Dinitrotoluene[2,6-]	0.26	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	HMX	2.2	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Nitrobenzene	0.26	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Nitrotoluene[2-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Nitrotoluene[3-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Nitrotoluene[4-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	RDX	1	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Tetryl	0.65	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Trinitrobenzene[1,3,5-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29617	Not Applicable	WATER	4399R	Trinitrotoluene[2,4,6-]	0.25	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Amino-4,6-dinitrotoluene[2-]	107	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Dinitrobenzene[1,3-]	110	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Dinitrobenzene[1,4-]	102	%	BS	SURR	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Dinitrotoluene[2,4-]	101	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	HMX	101	%	BS	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Nitrobenzene	110	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	RDX	101	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Trinitrobenzene[1,3,5-]	104	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29618	Not Applicable	WATER	4399R	Trinitrotoluene[2,4,6-]	111	%	BS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Amino-4,6-dinitrotoluene[2-]	104	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Dinitrobenzene[1,3-]	105	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Dinitrobenzene[1,4-]	101	%	BSD	SURR	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Dinitrotoluene[2,4-]	103	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	HMX	103	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Nitrobenzene	105	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	RDX	102	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Trinitrobenzene[1,3,5-]	106	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29619	Not Applicable	WATER	4399R	Trinitrotoluene[2,4,6-]	105	%	BSD	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29620	Not Applicable	WATER	4401R	Uranium-232 Tracer	81	%	BLANK	TRACER	None
Not Applicable	Not Applicable	QC-98-29620	Not Applicable	WATER	4401R	Uranium-234	0.018	PCI/G	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29620	Not Applicable	WATER	4401R	Uranium-235	0.0053	PCI/G	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29620	Not Applicable	WATER	4401R	Uranium-238	0.0012	PCI/G	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29621	Not Applicable	WATER	4401R	Uranium-232 Tracer	71	%	BLANK	TRACER	None
Not Applicable	Not Applicable	QC-98-29621	Not Applicable	WATER	4401R	Uranium-234	0.006	PCI/G	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29621	Not Applicable	WATER	4401R	Uranium-235	0.0095	PCI/G	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29621	Not Applicable	WATER	4401R	Uranium-238	0	PCI/G	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-29622	Not Applicable	WATER	4401R	Uranium-232 Tracer	75	%	LCS	TRACER	None
Not Applicable	Not Applicable	QC-98-29622	Not Applicable	WATER	4401R	Uranium-234	92	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29622	Not Applicable	WATER	4401R	Uranium-235	0.12	PCI/G	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29622	Not Applicable	WATER	4401R	Uranium-238	102	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29623	Not Applicable	WATER	4401R	Uranium-232 Tracer	71	%	LCS	TRACER	None
Not Applicable	Not Applicable	QC-98-29623	Not Applicable	WATER	4401R	Uranium-234	102	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29623	Not Applicable	WATER	4401R	Uranium-235	0.198	PCI/G	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-29623	Not Applicable	WATER	4401R	Uranium-238	105	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Aluminum	-1.027	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Antimony	0.26	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Arsenic	0.085	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Barium	0.016	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Beryllium	-0.008	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Cadmium	0.015	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Calcium	6.944	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Chromium, Total	0.071	MG/KG	BLANK	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Cobalt	0.035	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Copper	0.035	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Iron	1.106	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Lead	0.065	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Magnesium	-0.432	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Manganese	0.151	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Nickel	0.035	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Potassium	10.654	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Selenium	0.184	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Silver	0.06	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Sodium	2.082	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Thallium	0.304	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Vanadium	0.04	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30034	Not Applicable	WATER	4400R	Zinc	0.046	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Aluminum	85.4	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Antimony	81.2	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Arsenic	100.3	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Barium	85.1	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Beryllium	90.9	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Cadmium	89.9	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Calcium	82.2	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Chromium, Total	92.3	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Cobalt	91.5	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Copper	92.2	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Iron	100.8	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Lead	89.7	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Magnesium	86.2	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Manganese	86	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Nickel	92	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Potassium	72.2	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Selenium	96.6	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Silver	17.5	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Sodium	91.8	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Thallium	94.2	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Vanadium	83	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30035	Not Applicable	WATER	4400R	Zinc	87.8	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30036	Not Applicable	WATER	4400R	Silver	92.5	%	LCS	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-98-30037	Not Applicable	WATER	4400R	Mercury	-0.006	MG/KG	BLANK	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30038	Not Applicable	WATER	4400R	Mercury	92.3	%	LCS	ANALYTE	None
Not Applicable	Not Applicable	QC-98-30289	Not Applicable	WATER	4475R	Antimony	0.125	MG/KG	BLANK	ANALYTE	U
Not Applicable	Not Applicable	QC-98-30290	Not Applicable	WATER	4475R	Antimony	101.3	%	LCS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Antimony	24.5	%	MS	ANALYTE	UJ
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Arsenic	95.5	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Barium	67.4	%	MS	ANALYTE	J-
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Beryllium	97.6	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Cadmium	92.1	%	MS	ANALYTE	U
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Chromium, Total	118.2	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Cobalt	93.6	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Copper	98	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	105	%	SAMPLE	SURR	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Lead	126.6	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Manganese	95.3	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Mercury	111.2	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Nickel	92.6	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Selenium	93.5	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Silver	88.9	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Thallium	97.7	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4401R	Uranium-232 Tracer	67	%	SAMPLE	TRACER	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Vanadium	92	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001	7-Jul-02	SU	4400R	Zinc	93.1	%	MS	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Aluminum	10411.389	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Antimony	0.3006	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Arsenic	2.8699	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Barium	178.6306	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Beryllium	0.9277	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Cadmium	0.0347	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Calcium	2897.1329	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Chromium, Total	6.2636	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Cobalt	6.4445	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Copper	7.1023	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Iron	10593.2751	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Lead	14.2069	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Magnesium	1715.8491	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Manganese	420.3266	MG/KG	DUP	ANALYTE	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Mercury	0.0091	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Nickel	6.6127	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Potassium	1751.9347	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Selenium	0.3584	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Silver	0.0694	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Sodium	92.3173	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Thallium	0.6012	MG/KG	DUP	ANALYTE	U
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Vanadium	16.0873	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0001 (R)	7-Jul-02	SU	4400R	Zinc	23.9879	MG/KG	DUP	ANALYTE	None
15-012(b)	15-3450	RE15-98-0002	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	104	%	SAMPLE	SURR	None
15-012(b)	15-3450	RE15-98-0002	7-Jul-02	SS	4401R	Uranium-232 Tracer	73	%	SAMPLE	TRACER	None
15-012(b)	15-3451	RE15-98-0003	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	107	%	SAMPLE	SURR	None
15-012(b)	15-3451	RE15-98-0003	7-Jul-02	SU	4401R	Uranium-232 Tracer	68	%	SAMPLE	TRACER	None
15-012(b)	15-3451	RE15-98-0004	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	104	%	SAMPLE	SURR	None
15-012(b)	15-3451	RE15-98-0004	7-Jul-02	SS	4401R	Uranium-232 Tracer	69	%	SAMPLE	TRACER	None
15-012(b)	15-3452	RE15-98-0005	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	107	%	SAMPLE	SURR	None
15-012(b)	15-3452	RE15-98-0005	7-Jul-02	SU	4401R	Uranium-232 Tracer	69	%	SAMPLE	TRACER	None
15-012(b)	15-3452	RE15-98-0006	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	105	%	SAMPLE	SURR	None
15-012(b)	15-3452	RE15-98-0006	7-Jul-02	SS	4401R	Uranium-232 Tracer	74	%	SAMPLE	TRACER	None
15-012(b)	15-3453	RE15-98-0007	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	105	%	SAMPLE	SURR	None
15-012(b)	15-3453	RE15-98-0007	7-Jul-02	SU	4401R	Uranium-232 Tracer	69	%	SAMPLE	TRACER	None
15-012(b)	15-3453	RE15-98-0008	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	107	%	SAMPLE	SURR	None
15-012(b)	15-3453	RE15-98-0008	7-Jul-02	SS	4401R	Uranium-232 Tracer	78	%	SAMPLE	TRACER	None
15-012(b)	15-3454	RE15-98-0009	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	107	%	SAMPLE	SURR	None
15-012(b)	15-3454	RE15-98-0009	7-Jul-02	SU	4401R	Uranium-232 Tracer	63	%	SAMPLE	TRACER	None
15-012(b)	15-3454	RE15-98-0009 (R)	7-Jul-02	SU	4401R	Uranium-232 Tracer	73	%	DUP	TRACER	None
15-012(b)	15-3454	RE15-98-0009 (R)	7-Jul-02	SU	4401R	Uranium-234	0.944	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3454	RE15-98-0009 (R)	7-Jul-02	SU	4401R	Uranium-235	0.088	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3454	RE15-98-0009 (R)	7-Jul-02	SU	4401R	Uranium-238	1.039	PCI/G	DUP	ANALYTE	None
15-012(b)	15-3454	RE15-98-0010	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	102	%	SAMPLE	SURR	None
15-012(b)	15-3454	RE15-98-0010	7-Jul-02	SS	4401R	Uranium-232 Tracer	70	%	SAMPLE	TRACER	None
15-012(b)	15-3455	RE15-98-0011	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	103	%	SAMPLE	SURR	None
15-012(b)	15-3455	RE15-98-0011	7-Jul-02	SU	4401R	Uranium-232 Tracer	72	%	SAMPLE	TRACER	None
15-012(b)	15-3455	RE15-98-0012	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	104	%	SAMPLE	SURR	None
15-012(b)	15-3455	RE15-98-0012	7-Jul-02	SS	4401R	Uranium-232 Tracer	63	%	SAMPLE	TRACER	None
15-012(b)	15-3456	RE15-98-0013	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	105	%	SAMPLE	SURR	None
15-012(b)	15-3456	RE15-98-0013	7-Jul-02	SU	4401R	Uranium-232 Tracer	71	%	SAMPLE	TRACER	None

PRS 15-012(b) RFI AND VCA QC DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	COLLECTION DATE	SAMPLE MATRIX	REQUEST NUMBER	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	SAMPLE TYPE CODE	ANALYTE TYPE	RFI DATA VALIDATION QUALIFIER
15-012(b)	15-3456	RE15-98-0014	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	103	%	SAMPLE	SURR	None
15-012(b)	15-3456	RE15-98-0014	7-Jul-02	SS	4401R	Uranium-232 Tracer	69	%	SAMPLE	TRACER	None
15-012(b)	15-3457	RE15-98-0015	7-Jul-02	SU	4399R	Dinitrobenzene[1,4-]	104	%	SAMPLE	SURR	None
15-012(b)	15-3457	RE15-98-0015	7-Jul-02	SU	4401R	Uranium-232 Tracer	69	%	SAMPLE	TRACER	None
15-012(b)	15-3457	RE15-98-0016	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	105	%	SAMPLE	SURR	None
15-012(b)	15-3457	RE15-98-0016	7-Jul-02	SS	4401R	Uranium-232 Tracer	76	%	SAMPLE	TRACER	None
15-012(b)	15-3445	RE15-98-0017	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	100	%	SAMPLE	SURR	None
15-012(b)	15-3445	RE15-98-0017	7-Jul-02	SS	4401R	Uranium-232 Tracer	67	%	SAMPLE	TRACER	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Amino-4,6-dinitrotoluene[2-]	104	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Dinitrobenzene[1,3-]	102	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	100	%	MS	SURR	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Dinitrobenzene[1,4-]	107	%	SAMPLE	SURR	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Dinitrotoluene[2,4-]	101	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	HMX	104	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Nitrobenzene	102	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	RDX	92	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Trinitrobenzene[1,3,5-]	105	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4399R	Trinitrotoluene[2,4,6-]	104	%	MS	ANALYTE	None
15-012(b)	15-3445	RE15-98-0018	7-Jul-02	SS	4401R	Uranium-232 Tracer	75	%	SAMPLE	TRACER	None
15-012(b)	15-3441	RE15-98-0019	31-Jul-02	S1	4475R	Antimony	26.4	%	MS	ANALYTE	None
15-012(b)	15-3441	RE15-98-0019 (R)	31-Jul-02	S1	4475R	Antimony	0.1551	MG/KG	DUP	ANALYTE	U

PRS 15-012(b) ANTIMONY REANALYSIS DATA

PRS NUMBER	LOCATION ID	SAMPLE ID	BEGIN DEPTH	END DEPTH	DEPTH UNITS	SAMPLE MEDIUM	ANALYTE NAME	SAMPLE RESULTS	REPORTING UNITS	RFI DATA VALIDATION QUALIFIER
Not Applicable	Not Applicable	QC-98-30442	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Antimony	228.7	%	None
Not Applicable	Not Applicable	QC-98-30443	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Antimony	90.6	%	None
Not Applicable	Not Applicable	QC-98-30444	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Antimony	-0.208	MG/KG	None
Not Applicable	Not Applicable	QC-98-30445	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Antimony	-0.208	MG/KG	None
Not Applicable	Not Applicable	QC-98-30447	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Antimony	228.7	%	None
Not Applicable	Not Applicable	QC-98-30448	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Antimony	90.6	%	None
15-012(b)	15-3451	RE15-98-0003	0	6	IN	ALLH	Antimony	77.7	%	None
15-012(b)	15-3451	RE15-98-0003	0	6	IN	ALLH	Antimony	0.14	MG/KG	None
15-012(b)	15-3454	RE15-98-0010	18	24	IN	ALLH	Antimony	0.15	MG/KG	None
15-012(b)	15-3456	RE15-98-0013	0	6	IN	ALLH	Antimony	0.14	MG/KG	None
15-012(b)	15-3443.	RE15-98-0021	0	6	IN	Not Available	Antimony	0.15	MG/KG	None
15-012(b)	15-3445	RE15-98-0023	0	6	IN	Not Available	Antimony	0.15	MG/KG	None

APPENDIX E STATISTICAL ANALYSES

APPENDIX E STATISTICAL ANALYSES

Overview: Four statistical tests were used to assess whether the data for all analytes were members of the background data set or if the reported concentrations tended to exceed the background data set. The four tests used were:

- the Quantile Test,
- the Wilcoxon Rank Sum Test,
- the Slippage Test,
- and the Gehan Test.

It should be noted that the Wilcoxon Rank Sum Test and the Gehan Test are equivalent for those analytes that have no non-detects. The results of all these tests are summarized in Table E-1.

Prior to analysis, the duplicates (sample 215-97-0109 for the uranium isotopes only) were averaged with their associated sample using the following ad hoc approach:

- If both the sample and its duplicate were detected values or both were non-detected values, a simple average of the two samples was taken.
- If one was a detect and the other was a non-detect, the non-detected value was discarded and that sample location was given a concentration equal to the detected value

The uranium-234, -235, and –238 data was compared to the isotope specific uranium background data. The uranium-238 data was also analyzed without the sample 215-97-0109 and its duplicate. In addition, all three uranium isotopes were combined and compared to the uranium (no isotope specified) background data. This data was also analyzed without the uranium-238 data from sample 215-97-0109 and its duplicate

Quantile Test: The Quantile test was conducted as described in EPA (1994, 230-R-94-004) with a null hypothesis that the site and background are from the same population. The Quantile test is a nonparametric test suited for assessing shifts of a subset of the data. The Quantile test is performed at a specified quantile level, usually 80%. This threshold is established to determine if the relative proportion of the two populations being tested is different in the top 20% of the data than in the remainder of the data. If this difference is recognized then there is reason to believe that the distributions are partially shifted because of different tail effects. However, this implies that this test cannot be performed if more than 80% (or the threshold percentage) of the combined data are nondetected values. This is expressed as

H_0 : Reference-Based Cleanup Standard Achieved
H_a : Reference-Based Cleanup Standard Not Achieved
and H_0 is assumed true unless the test indicates H_0 should be rejected in favor of H_a.

Table E-2 gives the p-values obtained from the Quantile test. An initial level of 0.05 was taken for α, but none of the observed sample sizes (M and N) was given in the tables provided in EPA (1994, 230-R-94-004) The values for r and k were obtained from the table in EPA (1994, 230-R-94-004) for the values closest to the observed values of M and N and were adjusted until the computed value for α was as close to 0.05 as possible. The results from this test show that the sample concentrations are indistinguishable from the background concentrations.

Wilcoxon/Gehan Tests: The Wilcoxon rank sum test was performed to compare the background data to the site data using the method as described in Gilbert (1987, ER ID 55619). The Wilcoxon test (also called the Mann-Whitney U test) is a distribution-free rank sum test for a difference between the medians of two data sets. It is best suited for assessing complete shifts in distributions and is a nonparametric equivalent of the t-test. When there are nondetected chemicals at multiple detection limits, the Gehan test (Gehan 1965, ER ID 55611) is best suited for assessing complete shifts in distributions. This test

accounts for nondetected chemicals in a statistically robust manner. The test is not recommended if there are more than 40% nondetect chemicals in either of the two data sets. If there are no nondetected chemicals in the data, then the Gehan test is equivalent to the Wilcoxon test. The null hypothesis of the test was that the two populations, the site data and the background data, have the same median. The alternate hypothesis was that the measurements from the site data tend to exceed those from the background data. Since ties in the rank data did exist, the Z-statistic calculated in the Wilcoxon rank sum test was adjusted for the tied data.

The analysis for the cadmium data was done two ways, once using all the values and once comparing only the non-detected site and non-detected background data detection limits. Table E-1 shows the results of each statistical test, while Table E-2 shows the p-values from each test. Only for manganese was the null hypothesis rejected by these tests. Therefore, according to these tests, the manganese concentration in the samples tended to exceed the background levels.

Since the null hypothesis for manganese was rejected for the Wilcoxon and the equivalent Gehan Tests, a box and whiskers plot of the site data and the background data was prepared (Figure E-1). In this figure, the boxes represent the inner quartile range, the vertical line within the box represents the median, and the single line beyond the upper quartile whisker is the soil BV for manganese. This figure shows that the range in the site sample concentrations are totally within the range of values reported for the background concentration over all horizons.

Slippage Test: The Slippage test was also calculated on the data. This test consists of counting the number of site concentration values that exceed the maximum background concentration. Comparison of this count is made to the tabulated values in Rosenbaum (1954, ER ID 59167). If the number of site concentrations, which exceed the maximum background concentration, is too large, i.e. larger than the critical value, then the conclusion is that the population of site concentrations lies to the right of the population of background concentrations. In other words if too many of the site concentrations are above the maximum background concentration then the site concentrations population is considered to have a larger mean than the background population.

The result of Table E-1 show that none of the compounds exceeded the critical value for the number of site concentrations that are above the maximum background concentration.

TABLE E-1
SUMMARY OF STATISTICAL TESTS COMPARING SITE TO BACKGROUND

Compound	Quantile Test	Wilcoxon Rank Sum Test	Slippage Test	Gehan Test
Cadmium	N	N	N	N
Cadmium NDs only	N/A	N	N	N/A
Manganese	N	Y	N	Y
Uranium-234	N	N	N	N
Uranium-235	N	N	N	N
Uranium-238	N	N	N	N
Uranium-238 w/o 215-97-0109	N	N	N	N
Combined Uranium	N	N	N	N
Combined Uranium w/o Sample 215-97-0109 of Uranium-238	N	N	N	N

N- Accepted the Null Hypothesis that Site = Background
Y – Accept the Alternate Hypothesis Site > Background
N/A – Not Applicable

TABLE E-2
P-VALUES ASSOCIATED WITH EACH TEST

COMPOUND	Quantile	Wilcoxon	Slippage	Gehan
Cadmium	1.000	1.000	1.000	0.063
Cadmium – ND Only		1.000	1.000	
Manganese	0.653	0.000	1.000	0.000
Uranium-234	0.696	1.000	0.500	1.000
Uranium-235	0.696	0.969	0.245	0.845
Uranium-238	0.304	0.637	0.117	0.571
Uranium-238 w/o 215-97-0109	0.288	0.732	0.234	0.671
Combined Uranium	0.082	0.940	0.307	1.000
Combined Uranium w/o Sample 215-97-0109 of Uranium-238	0.154	0.959	1.000	1.000

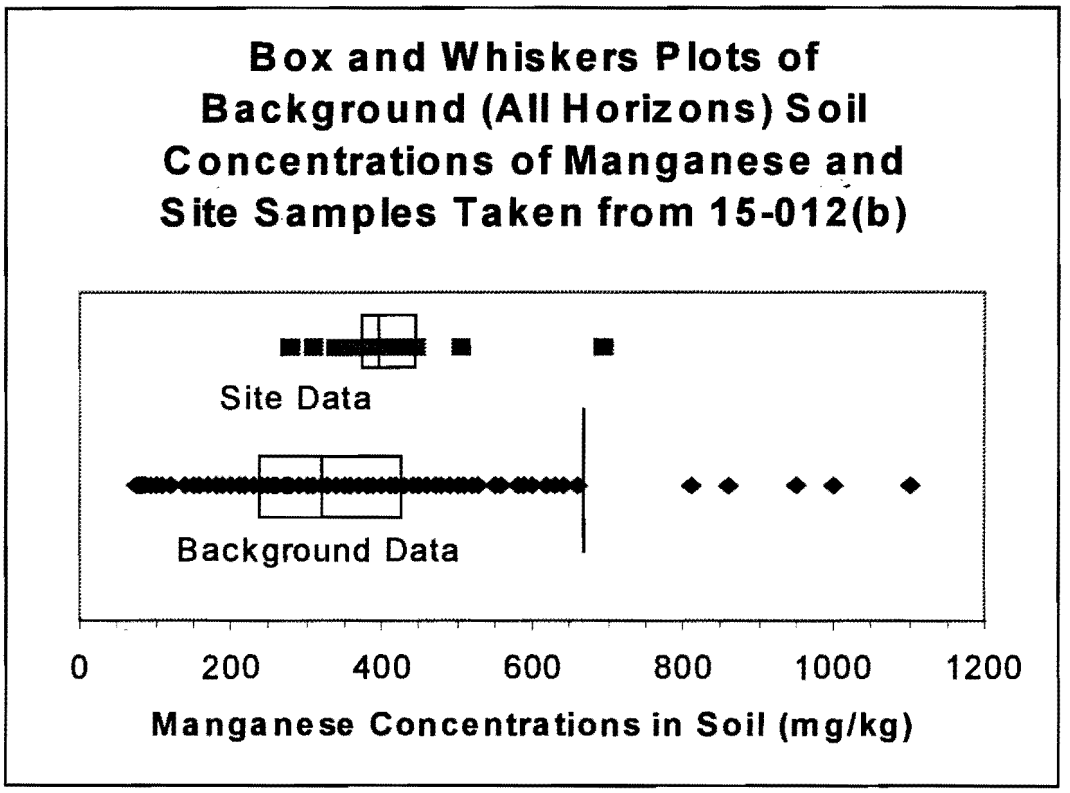


Figure E-1. Box and Whiskers Plot

APPENDIX F RISK ASSESSMENT CALCULATIONS

APPENDIX F RISK ASSESSMENT CALCULATIONS

F-1.0 HUMAN HEALTH

A quantitative human health risk assessment was not performed for the PRS presented in this VCA Completion Report.

The PRS is located on DOE-owned land and is removed from public access roads. It lies within the secured boundaries of TA-15, which results in limited and monitored access and egress. The land is currently and in the future to be used exclusively for Laboratory operations, i.e., industrial land use. The PRS is located near Building 15-285 and adjacent to an outdoor equipment storage area.

The facility intends to use the site where the wash area had been as a parking area and for storage. This proposed activity as well as current activities would make the likely exposed individual a Laboratory worker with potential exposure via the ingestion, inhalation, and dermal contact pathways. The SALs used for nonradiological compounds in the screening assessment reflect a residential exposure scenario and the industrial cleanup levels reflect a nonintrusive industrial worker exposure scenario. The risk-based cleanup values for an industrial exposure scenario (Table 3.1-1) were calculated using current toxicity values and standard default parameters. These values and the standard equation used to calculate risk-based industrial cleanup levels and obtained from the most recent guidance from EPA (1998, ER ID 58751) Region 9 are presented below.

Combined Exposures to Noncarcinogenic Contaminants in Industrial Soil for a Laboratory Worker

$$CleanupLevel(mg/kg) = \frac{THQ \, x \, BW_a \, x \, AT_n}{EF_o \, x \, ED_o \, [(1/RfD_o \, x \, IRS_o / 10^6 mg/kg) + (1/RfD_o \, x \, SA_a \, x \, AF \, x \, ABS / 10^6 mg/kg) + (1/RfD_1 \, x \, IRA_a / PEF)]}$$

THQ	Target Hazard Quotient	1.0
RfD_o	Reference dose oral (mg/kg-d)	0.0004 for antimony
		0.002 for beryllium
	Lead cleanup level of 1000 mg/kg is based on EPA Region 6 guidance	
		0.003 for uranium
RfD_I	Reference dose inhalation (mg/kg-d)	0.000057 for beryllium
RfDd	Reference dose dermal (mg/kg-d)	Same as the oral RfDs
BW_a	Body weight, adult (kg)	70
AT_n	Averaging time-noncarcinogens (days)	ED x 365
SA_a	Exposed surface area, adult (cm^2/day)	5000
AF_a	Adherence factor, adult (mg/cm^2)	0.2
ABS	Skin absorption (unitless):	
	— inorganics	0.01
IRA_a	Inhalation rate - adult (m^3/day)	20
IRS_o	Soil ingestion – occupational (mg/day)	50
EF_o	Exposure frequency – occupational (d/y)	250
ED_o	Exposure Duration – occupational (years)	25
PEF	Particulate emission factor (m^3/kg)	1.316×10^9

There are no inhalation toxicity values available for antimony, lead, and uranium. Route-to-route extrapolation from the oral to inhalation pathway is not performed for inorganics due to portal of entry effects and known differences in absorption efficiency for the two routes of exposure. Therefore, the inhalation pathway, which is the last part of the denominator in the above equation, was not included in the calculation of the Laboratory worker cleanup levels for these inorganics.

Much uncertainty surrounds the determination of hazards associated with skin contact with soils. One important data gap is the lack of verified toxicity values (RfDs) for the dermal pathway. It is assumed that

dermal toxicity values can be extrapolated from oral values. In doing so, it is recommended that a default value of complete (100%) oral absorption be assumed, thereby eliminating the need for oral toxicity value adjustment. Therefore, the oral RfDs of 0.0004 mg/kg-d for antimony, 0.002 mg/kg-d for beryllium, and 0.003 mg/kg-d for uranium were used as the dermal RfDs in the calculation of the industrial cleanup levels.

F-2.0 ECOLOGICAL

The ecological scoping checklist for PRS 15-012(b) is provided. The results of the scoping are summarized in Section 3.3.3.3(a).

A quantitative ecological risk assessment was not performed for PRS 15-012(b) and therefore no risk calculations are presented.

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ... 2
Site-Specific Parameter Summary 4
Summary of Pathway Selections 9
Contaminated Zone and Total Dose Summary 10
Total Dose Components
Time = 0.000E+00 11
Time = 1.000E+00 12
Time = 3.000E+00 13
Time = 1.000E+01 14
Time = 3.000E+01 15
Time = 1.000E+02 16
Time = 3.000E+02 17
Time = 1.000E+03 18
Dose/Source Ratios Summed Over All Pathways 19
Single Radionuclide Soil Guidelines 19
Dose Per Nuclide Summed Over All Pathways 20
Soil Concentration Per Nuclide 21

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
D-1	U-234	2.830E-04	2.830E-04	DCF3(6)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
[illegible]	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.200E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	6.000E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	8.500E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.400E-02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	9.010E-01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	4.400E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.800E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	5.200E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.700E+07	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	3.000E-01	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	not used	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	not used	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	not used	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	not used	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
	Distribution coefficients for U-235				
[illegible]	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.196E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.398E-06	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.425E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.000E-09	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.490E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	9.000E-05	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.840E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	4.600E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
	Ring 9	not used	0.000E+00	---	FRACA(9)
	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	0.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	0.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	0.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	not used	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	not used	1.000E+00	---	STOR_T(2)
STOR	Milk	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	not used	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	7.000E+00	---	STOR_T(6)
STOR	Well water	not used	1.000E+00	---	STOR_T(7)
STOR	Surface water	not used	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	not used	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	3.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	1.000E+00	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	0.000E+00	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	120.00 square meters	U-234	8.500E-02
Thickness:	0.60 meters	U-235	1.400E-02
Cover Depth:	0.00 meters	U-238	9.010E-01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 15 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	3.425E-02	3.425E-02	3.425E-02	3.425E-02	3.425E-02	3.427E-02	3.438E-02	0.000E+00
M(t):	2.283E-03	2.283E-03	2.283E-03	2.283E-03	2.283E-03	2.285E-03	2.292E-03	0.000E+00

Maximum TDOSE(t): 3.440E-02 mrem/yr at t = 259.8 ñ 0.3 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 259.8 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.194E-05	0.0006	1.418E-03	0.0412	6.365E-05	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.437E-05	0.0007
U-235	1.569E-03	0.0456	2.859E-04	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.584E-06	0.0
U-238	1.739E-02	0.5055	1.338E-02	0.3889	1.672E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.440E-04	0.0[illegible]
Total	1.898E-02	0.5517	1.508E-02	0.4385	6.382E-05	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.740E-04	0.0080

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 259.8 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.528E-03	0.0444
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.860E-03	0.0541
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.101E-02	0.9015
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.440E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.114E-06	0.0001	1.413E-03	0.0412	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.423E-05	0.0007
U-235	1.548E-03	0.0452	2.168E-04	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.766E-06	0.0001
U-238	1.741E-02	0.5083	1.339E-02	0.3909	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.442E-04	0.0071
Total	1.896E-02	0.5536	1.502E-02	0.4384	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.722E-04	0.0079

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.442E-03	0.0421
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.769E-03	0.0516
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.104E-02	0.9062
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.425E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.115E-06	0.0001	1.413E-03	0.0412	1.178E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.423E-05	0.0007
U-235	1.548E-03	0.0452	2.169E-04	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.769E-06	0.0001
U-238	1.741E-02	0.5083	1.339E-02	0.3909	8.868E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.442E-04	0.0071
Total	1.896E-02	0.5536	1.502E-02	0.4384	1.178E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.722E-04	0.0079

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.442E-03	0.0421
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.769E-03	0.0516
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.104E-02	0.9062
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.425E-02	1.0[illegible]

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.117E-06	0.0001	1.413E-03	0.0413	1.059E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.423E-05	0.0007
U-235	1.548E-03	0.0452	2.170E-04	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.776E-06	0.0001
U-238	1.741E-02	0.5082	1.339E-02	0.3909	3.176E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.442E-04	0.0071
Total	1.896E-02	0.5536	1.502E-02	0.4384	1.059E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.722E-04	0.0079

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.442E-03	0.0421
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.769E-03	0.0517
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.104E-02	0.9062
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.425E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.141E-06	0.0002	1.413E-03	0.0413	1.172E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.424E-05	0.0007
U-235	1.548E-03	0.0452	2.176E-04	0.0064	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.803E-06	0.0001
U-238	1.741E-02	0.5082	1.339E-02	0.3909	1.175E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.442E-04	0.0071
Total	1.896E-02	0.5536	1.502E-02	0.4385	1.172E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.722E-04	0.0079

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.442E-03	0.0421
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.770E-03	0.0517
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.103E-02	0.9062
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.425E-02	1.0[illegible]

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.351E-06	0.0002	1.413E-03	0.0413	1.042E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.424E-05	0.0007
U-235	1.549E-03	0.0452	2.209E-04	0.0064	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.907E-06	0.0001
U-238	1.740E-02	0.5081	1.339E-02	0.3908	3.136E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.441E-04	0.0071
Total	1.896E-02	0.5535	1.502E-02	0.4385	1.043E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.723E-04	0.0080

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.444E-03	0.0422
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.774E-03	0.0518
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.103E-02	0.9060
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.425E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.688E-06	0.0002	1.415E-03	0.0413	1.105E-05	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.427E-05	0.0007
U-235	1.554E-03	0.0453	2.390E-04	0.0070	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.388E-06	0.0001
U-238	1.739E-02	0.5074	1.338E-02	0.3905	1.111E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.441E-04	0.0071
Total	1.895E-02	0.5530	1.504E-02	0.4387	1.106E-05	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.728E-04	0.0080

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.458E-03	0.0425
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.798E-03	0.0524
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.102E-02	0.9050
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.427E-02	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.726E-05	0.0008	1.419E-03	0.0413	8.004E-05	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.441E-05	0.0007
U-235	1.572E-03	0.0457	2.978E-04	0.0087	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.886E-06	0.0002
U-238	1.733E-02	0.5041	1.338E-02	0.3892	2.431E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.440E-04	0.0071
Total	1.893E-02	0.5506	1.510E-02	0.4391	8.028E-05	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.743E-04	0.0080

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.551E-03	0.0451
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.875E-03	0.0545
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.095E-02	0.9004
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.438E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.00

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

't	Product	Branch	DSR(j,t) (mrem/yr)/(pCi/g)							
	(j)	Fraction	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	1.696E-02	1.696E-02	1.696E-02	1.696E-02	1.696E-02	1.695E-02	1.693E-02	0.000E+00
U-234	Th-230	1.000E+00	0.000E+00	3.761E-07	1.128E-06	3.760E-06	1.128E-05	3.757E-05	1.125E-04	0.000E+00
U-234	Ra-226	1.000E+00	0.000E+00	1.693E-08	1.522E-07	1.686E-06	1.501E-05	1.602E-04	1.202E-03	0.000E+00
U-234	Pb-210	1.000E+00	0.000E+00	2.234E-13	5.938E-12	2.084E-10	4.873E-09	1.189E-07	1.518E-06	0.000E+00
U-234	ädsr(j)		1.696E-02	1.696E-02	1.697E-02	1.697E-02	1.699E-02	1.715E-02	1.824E-02	0.000E+00
U-235	U-235	1.000E+00	1.263E-01	1.263E-01	1.263E-01	1.263E-01	1.263E-01	1.263E-01	1.262E-01	0.000E+00
U-235	Pa-231	1.000E+00	0.000E+00	4.222E-06	1.267E-05	4.221E-05	1.266E-04	4.215E-04	1.261E-03	0.000E+00
U-235	Ac-227	1.000E+00	0.000E+00	3.829E-07	3.374E-06	3.489E-05	2.594E-04	1.696E-03	6.509E-03	0.000E+00
U-235	ädsr(j)		1.263E-01	1.263E-01	1.264E-01	1.264E-01	1.267E-01	1.284E-01	1.339E-01	0.000E+00
U-238	U-238	1.000E+00	3.445E-02	3.445E-02	3.445E-02	3.444E-02	3.444E-02	3.442E-02	3.434E-02	0.000E+00
U-238	U-234	1.000E+00	0.000E+00	4.809E-08	1.443E-07	4.809E-07	1.443E-06	4.806E-06	1.440E-05	0.000E+00
U-238	Th-230	1.000E+00	0.000E+00	5.331E-13	4.797E-12	5.330E-11	4.796E-10	5.327E-09	4.787E-08	0.000E+00
U-238	Ra-226	1.000E+00	0.000E+00	1.202E-14	4.306E-13	1.594E-11	4.261E-10	1.519E-08	3.445E-07	0.000E+00
U-238	Pb-210	1.000E+00	0.000E+00	0.000E+00	5.065E-18	1.490E-15	1.081E-13	9.455E-12	3.975E-10	0.000E+00
U-238	ädsr(j)		3.445E-02	3.445E-02	3.445E-02	3.444E-02	3.444E-02	3.443E-02	3.435E-02	0.000E+00

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 15 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	8.842E+02	8.842E+02	8.842E+02	8.840E+02	8.830E+02	8.747E+02	8.223E+02	*6.245E+09
U-235	1.187E+02	1.187E+02	1.187E+02	1.187E+02	1.184E+02	1.168E+02	1.120E+02	*2.160E+06
U-238	4.355E+02	4.355E+02	4.355E+02	4.355E+02	4.355E+02	4.357E+02	4.366E+02	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 259.8 ñ 0.3 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	8.500E-02	449.9 ñ 0.4	1.903E-02	7.884E+02	1.798E-02	8.344E+02
U-235	1.400E-02	399.9 ñ 0.4	1.357E-01	1.106E+02	1.329E-01	1.129E+02
U-238	9.010E-01	190.5 ñ 0.2	3.445E-02	4.354E+02	3.442E-02	4.358E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	1.442E-03	1.442E-03	1.442E-03	1.442E-03	1.442E-03	1.441E-03	1.439E-03	0.000E+00
U-234	U-238	1.000E+00	0.000E+00	4.333E-08	1.300E-07	4.333E-07	1.300E-06	4.331E-06	1.298E-05	0.000E+00
U-234	ädose(j):		1.442E-03	1.442E-03	1.442E-03	1.442E-03	1.443E-03	1.445E-03	1.452E-03	0.000E+00
Th-230	U-234	1.000E+00	0.000E+00	3.196E-08	9.589E-08	3.196E-07	9.587E-07	3.194E-06	9.566E-06	0.000E+00
Th-230	U-238	1.000E+00	0.000E+00	4.803E-13	4.322E-12	4.802E-11	4.322E-10	4.799E-09	4.313E-08	0.000E+00
Th-230	ädose(j):		0.000E+00	3.197E-08	9.590E-08	3.197E-07	9.591E-07	3.199E-06	9.609E-06	0.000E+00
Ra-226	U-234	1.000E+00	0.000E+00	1.439E-09	1.294E-08	1.433E-07	1.276E-06	1.361E-05	1.022E-04	0.000E+00
Ra-226	U-238	1.000E+00	0.000E+00	1.083E-14	3.880E-13	1.436E-11	3.839E-10	1.369E-08	3.104E-07	0.000E+00
Ra-226	ädose(j):		0.000E+00	1.439E-09	1.294E-08	1.433E-07	1.277E-06	1.363E-05	1.025E-04	0.000E+00
Pb-210	U-234	1.000E+00	0.000E+00	1.899E-14	5.047E-13	1.772E-11	4.142E-10	1.011E-08	1.290E-07	0.000E+00
Pb-210	U-238	1.000E+00	0.000E+00	0.000E+00	4.564E-18	1.343E-15	9.742E-14	8.519E-12	3.582E-10	0.000E+00
Pb-210	ädose(j):		0.000E+00	1.899E-14	5.047E-13	1.772E-11	4.143E-10	1.012E-08	1.293E-07	0.000E+00
U-235	U-235	1.000E+00	1.769E-03	1.769E-03	1.769E-03	1.769E-03	1.768E-03	1.768E-03	1.766E-03	0.000E+00
Pa-231	U-235	1.000E+00	0.000E+00	5.911E-08	1.773E-07	5.910E-07	1.772E-06	5.902E-06	1.765E-05	0.000E+00
Ac-227	U-235	1.000E+00	0.000E+00	5.360E-09	4.724E-08	4.885E-07	3.631E-06	2.375E-05	9.112E-05	0.000E+00
U-238	U-238	1.000E+00	3.104E-02	3.104E-02	3.104E-02	3.103E-02	3.103E-02	3.101E-02	3.094E-02	0.000E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

de	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	8.500E-02	8.500E-02	8.500E-02	8.499E-02	8.498E-02	8.494E-02	8.481E-02	8.435E-02
U-234	U-238	1.000E+00	0.000E+00	2.554E-06	7.663E-06	2.554E-05	7.661E-05	2.553E-04	7.649E-04	2.538E-03
U-234	äS(j):		8.500E-02	8.500E-02	8.501E-02	8.502E-02	8.506E-02	8.519E-02	8.557E-02	8.689E-02
Th-230	U-234	1.000E+00	0.000E+00	7.652E-07	2.295E-06	7.651E-06	2.295E-05	7.645E-05	2.290E-04	7.588E-04
Th-230	U-238	1.000E+00	0.000E+00	1.150E-11	1.035E-10	1.150E-09	1.034E-08	1.149E-07	1.032E-06	1.141E-05
Th-230	äS(j):		0.000E+00	7.652E-07	2.296E-06	7.652E-06	2.296E-05	7.657E-05	2.300E-04	7.702E-04
Ra-226	U-234	1.000E+00	0.000E+00	1.657E-10	1.491E-09	1.655E-08	1.485E-07	1.633E-06	1.426E-05	1.432E-04
Ra-226	U-238	1.000E+00	0.000E+00	1.247E-15	4.470E-14	1.658E-12	4.467E-11	1.641E-09	4.332E-08	1.486E-06
Ra-226	äS(j):		0.000E+00	1.657E-10	1.491E-09	1.655E-08	1.485E-07	1.634E-06	1.431E-05	1.447E-04
Pb-210	U-234	1.000E+00	0.000E+00	1.704E-12	4.529E-11	1.590E-09	3.716E-08	9.072E-07	1.157E-05	1.349E-04
Pb-210	U-238	1.000E+00	0.000E+00	0.000E+00	4.095E-16	1.205E-13	8.742E-12	7.644E-10	3.214E-08	1.355E-06
Pb-210	äS(j):		0.000E+00	1.704E-12	4.529E-11	1.590E-09	3.717E-08	9.079E-07	1.161E-05	1.362E-04
U-235	U-235	1.000E+00	1.400E-02	1.400E-02	1.400E-02	1.400E-02	1.400E-02	1.399E-02	1.398E-02	1.393E-02
Pa-231	U-235	1.000E+00	0.000E+00	2.962E-07	8.886E-07	2.962E-06	8.882E-06	2.958E-05	8.846E-05	2.917E-04
Ac-227	U-235	1.000E+00	0.000E+00	4.665E-09	4.111E-08	4.252E-07	3.161E-06	2.067E-05	7.920E-05	2.826E-04
9	U-238	1.000E+00	9.010E-01	9.010E-01	9.010E-01	9.010E-01	9.009E-01	9.006E-01	8.997E-01	8.967E-01

BRF(i) is the branch fraction of the parent nuclide.

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ... 2
Site-Specific Parameter Summary 4
Summary of Pathway Selections 9
Contaminated Zone and Total Dose Summary 10
Total Dose Components
Time = 0.000E+00 11
Time = 1.000E+00 12
Time = 3.000E+00 13
Time = 1.000E+01 14
Time = 3.000E+01 15
Time = 1.000E+02 16
Time = 3.000E+02 17
Time = 1.000E+03 18
Dose/Source Ratios Summed Over All Pathways 19
Single Radionuclide Soil Guidelines 19
Dose Per Nuclide Summed Over All Pathways 20
Soil Concentration Per Nuclide 21

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
D-1	U-234	2.830E-04	2.830E-04	DCF3(6)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)

File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.200E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	6.000E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	8.500E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.400E-02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	9.010E-01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	4.400E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.800E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	5.200E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.700E+07	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	3.000E-01	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	2	1	---	NS
R015	Unsat. zone 1, thickness (m)	2.600E+02	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	5.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	4.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.000E+00	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.000E+02	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	5.000E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	4.000E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.700E+02	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU 1,1)
R016	Unsaturated zone 2 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.196E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.793E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.398E-06	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.425E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.000E-09	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	9.000E-05	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	8.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	8.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	0.000E+00	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	0.000E+00	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	0.000E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	0.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	0.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	0.000E+00	5.000E-01	---	FR9
R018	Contamination fraction of plant food	0.000E+00	-1	---	FPLANT
R018	Contamination fraction of meat	0.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	0.000E+00	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	0.000E+00	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	0.000E+00	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	0.000E+00	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	0.000E+00	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	0.000E+00	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	0.000E+00	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	0.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	0.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	0.000E+00	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	0.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	0.000E+00	2.000E+01	---	STOR_T(4)
STOR	Fish	0.000E+00	7.000E+00	---	STOR_T(5)
	Crustacea and mollusks	0.000E+00	7.000E+00	---	STOR_T(6)
	Well water	0.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	0.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	0.000E+00	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	not used	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	120.00 square meters	U-234	8.500E-02
ickness:	0.60 meters	U-235	1.400E-02
Depth:	0.00 meters	U-238	9.010E-01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 15 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	9.506E-02	9.506E-02	9.506E-02	9.506E-02	9.506E-02	9.507E-02	9.509E-02	0.000E+00
M(t):	6.337E-03	6.337E-03	6.337E-03	6.337E-03	6.337E-03	6.338E-03	6.339E-03	0.000E+00

Maximum TDOSE(t): 9.529E-02 mrem/yr at t = 226.2 ñ 0.2 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 226.2 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	6.581E-05	0.0007	2.322E-03	0.0244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.314E-05	0.0010
[illegible]	5.734E-03	0.0602	4.522E-04	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.040E-05	0.0002
[illegible]	6.374E-02	0.6689	2.193E-02	0.2301	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.338E-04	0.0098
Total	6.954E-02	0.7298	2.470E-02	0.2592	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.047E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 226.2 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.481E-03	0.0260
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.206E-03	0.0651
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.660E-02	0.9088
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.529E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.873E-05	0.0002	2.315E-03	0.0243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.272E-05	0.0010
U-235	5.668E-03	0.0596	3.553E-04	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.441E-05	0.0002
U-238	6.373E-02	0.6704	2.193E-02	0.2307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.342E-04	0.0098
Total	6.942E-02	0.7302	2.460E-02	0.2588	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.041E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.426E-03	0.0255
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.038E-03	0.0635
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.660E-02	0.9110
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.506E-02	1.0[illegible]

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.873E-05	0.0002	2.315E-03	0.0243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.272E-05	0.0010
U-235	5.668E-03	0.0596	3.553E-04	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.442E-05	0.0002
U-238	6.373E-02	0.6704	2.193E-02	0.2307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.342E-04	0.0098
Total	6.942E-02	0.7302	2.460E-02	0.2588	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.041E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.426E-03	0.0255
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.038E-03	0.0635
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.660E-02	0.9110
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.506E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.874E-05	0.0002	2.315E-03	0.0244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.272E-05	0.0010
U-235	5.668E-03	0.0596	3.555E-04	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.445E-05	0.0002
U-238	6.373E-02	0.6704	2.193E-02	0.2307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.342E-04	0.0098
Total	6.942E-02	0.7302	2.460E-02	0.2588	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.041E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.426E-03	0.0255
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.038E-03	0.0635
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.660E-02	0.9110
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.506E-02	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.882E-05	0.0002	2.315E-03	0.0244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.273E-05	0.0010
U-235	5.669E-03	0.0596	3.566E-04	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.455E-05	0.0002
U-238	6.373E-02	0.6704	2.193E-02	0.2307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.342E-04	0.0098
Total	6.941E-02	0.7302	2.460E-02	0.2588	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.041E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.427E-03	0.0255
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.040E-03	0.0635
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.659E-02	0.9109
[illegible]	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.506E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.959E-05	0.0002	2.316E-03	0.0244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.275E-05	0.0010
U-235	5.672E-03	0.0597	3.619E-04	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.495E-05	0.0002
U-238	6.372E-02	0.6703	2.193E-02	0.2307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.341E-04	0.0098
Total	6.941E-02	0.7301	2.461E-02	0.2589	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.042E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.428E-03	0.0255
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.049E-03	0.0636
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.658E-02	0.9108
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.506E-02	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.815E-05	0.0003	2.318E-03	0.0244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.284E-05	0.0010
U-235	5.690E-03	0.0599	3.916E-04	0.0041	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.679E-05	0.0002
U-238	6.367E-02	0.6697	2.193E-02	0.2307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.340E-04	0.0098
Total	6.939E-02	0.7299	2.464E-02	0.2592	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.044E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.439E-03	0.0257
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.099E-03	0.0641
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.654E-02	0.9102
. .1	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.507E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	9.982E-05	0.0010	2.325E-03	0.0244	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.339E-05	0.0010
U-235	5.754E-03	0.0605	4.879E-04	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.252E-05	0.0002
U-238	6.345E-02	0.6673	2.192E-02	0.2305	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.337E-04	0.0098
Total	6.930E-02	0.7288	2.474E-02	0.2601	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.050E-03	0.0110

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.518E-03	0.0265
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.265E-03	0.0659
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.631E-02	0.9076
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.509E-02	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-														
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
.1	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.854E-02	2.854E-02	2.854E-02	2.854E-02	2.854E-02	2.852E-02	2.848E-02	0.000E+00
U-234	Th-230	1.000E+00	0.000E+00	6.303E-07	1.891E-06	6.303E-06	1.890E-05	6.298E-05	1.886E-04	0.000E+00
U-234	Ra-226	1.000E+00	0.000E+00	1.123E-08	1.010E-07	1.121E-06	1.006E-05	1.105E-04	9.534E-04	0.000E+00
U-234	Pb-210	1.000E+00	0.000E+00	7.236E-13	1.924E-11	6.752E-10	1.578E-08	3.853E-07	4.916E-06	0.000E+00
U-234	äDSR(j)		2.854E-02	2.854E-02	2.854E-02	2.855E-02	2.857E-02	2.870E-02	2.962E-02	0.000E+00
U-235	U-235	1.000E+00	4.313E-01	4.313E-01	4.313E-01	4.313E-01	4.312E-01	4.311E-01	4.307E-01	0.000E+00
U-235	Pa-231	1.000E+00	0.000E+00	8.598E-06	2.579E-05	8.597E-05	2.578E-04	8.585E-04	2.568E-03	0.000E+00
U-235	Ac-227	1.000E+00	0.000E+00	8.323E-07	7.335E-06	7.585E-05	5.639E-04	3.688E-03	1.416E-02	0.000E+00
U-235	äDSR(j)		4.313E-01	4.313E-01	4.313E-01	4.314E-01	4.320E-01	4.356E-01	4.475E-01	0.000E+00
U-238	U-238	1.000E+00	9.611E-02	9.611E-02	9.611E-02	9.611E-02	9.609E-02	9.604E-02	9.577E-02	0.000E+00
U-238	U-234	1.000E+00	0.000E+00	8.092E-08	2.427E-07	8.091E-07	2.427E-06	8.087E-06	2.423E-05	0.000E+00
U-238	Th-230	1.000E+00	0.000E+00	8.935E-13	8.041E-12	8.934E-11	8.039E-10	8.928E-09	8.024E-08	0.000E+00
U-238	Ra-226	1.000E+00	0.000E+00	7.972E-15	2.857E-13	1.060E-11	2.855E-10	1.048E-08	2.732E-07	0.000E+00
U-238	Pb-210	1.000E+00	0.000E+00	0.000E+00	1.641E-17	4.827E-15	3.503E-13	3.063E-11	1.288E-09	0.000E+00
U-238	äDSR(j)		9.611E-02	9.611E-02	9.611E-02	9.611E-02	9.610E-02	9.605E-02	9.579E-02	0.000E+00

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 15 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	5.255E+02	5.255E+02	5.255E+02	5.254E+02	5.251E+02	5.227E+02	5.063E+02	*6.245E+09
U-235	3.478E+01	3.478E+01	3.478E+01	3.477E+01	3.472E+01	3.443E+01	3.352E+01	*2.160E+06
U-238	1.561E+02	1.561E+02	1.561E+02	1.561E+02	1.561E+02	1.562E+02	1.566E+02	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 226.2 ñ 0.2 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	8.500E-02	449.7 ñ 0.4	3.061E-02	4.901E+02	2.919E-02	5.138E+02
U-235	1.400E-02	376.2 ñ 0.4	4.499E-01	3.334E+01	4.433E-01	3.384E+01
U-238	9.010E-01	192.5 ñ 0.2	9.614E-02	1.560E+02	9.612E-02	1.561E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

ide	Parent	BRF(i)	DOSE(j,t), mrem/yr							
,)	(i)	t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄÄ
U-234	U-234	1.000E+00	2.426E-03	2.426E-03	2.426E-03	2.426E-03	2.426E-03	2.424E-03	2.421E-03	0.000E+00
U-234	U-238	1.000E+00	0.000E+00	7.291E-08	2.187E-07	7.290E-07	2.187E-06	7.286E-06	2.183E-05	0.000E+00
U-234	äDOSE(j):		2.426E-03	2.426E-03	2.426E-03	2.427E-03	2.428E-03	2.432E-03	2.442E-03	0.000E+00
Th-230	U-234	1.000E+00	0.000E+00	5.358E-08	1.607E-07	5.357E-07	1.607E-06	5.353E-06	1.603E-05	0.000E+00
Th-230	U-238	1.000E+00	0.000E+00	8.050E-13	7.245E-12	8.050E-11	7.244E-10	8.044E-09	7.230E-08	0.000E+00
Th-230	äDOSE(j):		0.000E+00	5.358E-08	1.607E-07	5.358E-07	1.608E-06	5.361E-06	1.611E-05	0.000E+00
Ra-226	U-234	1.000E+00	0.000E+00	9.544E-10	8.587E-09	9.531E-08	8.551E-07	9.394E-06	8.104E-05	0.000E+00
Ra-226	U-238	1.000E+00	0.000E+00	7.182E-15	2.575E-13	9.551E-12	2.572E-10	9.445E-09	2.462E-07	0.000E+00
Ra-226	äDOSE(j):		0.000E+00	9.544E-10	8.587E-09	9.532E-08	8.553E-07	9.404E-06	8.128E-05	0.000E+00
Pb-210	U-234	1.000E+00	0.000E+00	6.151E-14	1.635E-12	5.740E-11	1.342E-09	3.275E-08	4.179E-07	0.000E+00
Pb-210	U-238	1.000E+00	0.000E+00	0.000E+00	1.478E-17	4.349E-15	3.156E-13	2.760E-11	1.160E-09	0.000E+00
Pb-210	äDOSE(j):		0.000E+00	6.151E-14	1.635E-12	5.740E-11	1.342E-09	3.278E-08	4.190E-07	0.000E+00
U-235	U-235	1.000E+00	6.038E-03	6.038E-03	6.038E-03	6.038E-03	6.037E-03	6.035E-03	6.030E-03	0.000E+00
Pa-231	U-235	1.000E+00	0.000E+00	1.204E-07	3.611E-07	1.204E-06	3.610E-06	1.202E-05	3.595E-05	0.000E+00
Ac-227	U-235	1.000E+00	0.000E+00	1.165E-08	1.027E-07	1.062E-06	7.894E-06	5.163E-05	1.983E-04	0.000E+00
9	U-238	1.000E+00	8.660E-02	8.660E-02	8.660E-02	8.659E-02	8.658E-02	8.653E-02	8.629E-02	0.000E+00
ÍÍÍ	ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ
U-234	U-234	1.000E+00	8.500E-02	8.500E-02	8.500E-02	8.499E-02	8.498E-02	8.494E-02	8.481E-02	8.435E-02
U-234	U-238	1.000E+00	0.000E+00	2.554E-06	7.663E-06	2.554E-05	7.661E-05	2.553E-04	7.649E-04	2.538E-03
U-234	äS(j):		8.500E-02	8.500E-02	8.501E-02	8.502E-02	8.506E-02	8.519E-02	8.557E-02	8.689E-02
Th-230	U-234	1.000E+00	0.000E+00	7.652E-07	2.295E-06	7.651E-06	2.295E-05	7.645E-05	2.290E-04	7.588E-04
Th-230	U-238	1.000E+00	0.000E+00	1.150E-11	1.035E-10	1.150E-09	1.034E-08	1.149E-07	1.032E-06	1.141E-05
Th-230	äS(j):		0.000E+00	7.652E-07	2.296E-06	7.652E-06	2.296E-05	7.657E-05	2.300E-04	7.702E-04
Ra-226	U-234	1.000E+00	0.000E+00	1.657E-10	1.491E-09	1.655E-08	1.485E-07	1.633E-06	1.426E-05	1.432E-04
Ra-226	U-238	1.000E+00	0.000E+00	1.247E-15	4.470E-14	1.658E-12	4.467E-11	1.641E-09	4.332E-08	1.486E-06
Ra-226	äS(j):		0.000E+00	1.657E-10	1.491E-09	1.655E-08	1.485E-07	1.634E-06	1.431E-05	1.447E-04
Pb-210	U-234	1.000E+00	0.000E+00	1.704E-12	4.529E-11	1.590E-09	3.716E-08	9.072E-07	1.157E-05	1.349E-04
Pb-210	U-238	1.000E+00	0.000E+00	0.000E+00	4.095E-16	1.205E-13	8.742E-12	7.644E-10	3.214E-08	1.355E-06
Pb-210	äS(j):		0.000E+00	1.704E-12	4.529E-11	1.590E-09	3.717E-08	9.079E-07	1.161E-05	1.362E-04
U-235	U-235	1.000E+00	1.400E-02	1.400E-02	1.400E-02	1.400E-02	1.400E-02	1.399E-02	1.398E-02	1.393E-02
Pa-231	U-235	1.000E+00	0.000E+00	2.962E-07	8.886E-07	2.962E-06	8.882E-06	2.958E-05	8.846E-05	2.917E-04
Ac-227	U-235	1.000E+00	0.000E+00	4.665E-09	4.111E-08	4.252E-07	3.161E-06	2.067E-05	7.920E-05	2.826E-04
U-238	U-238	1.000E+00	9.010E-01	9.010E-01	9.010E-01	9.010E-01	9.009E-01	9.006E-01	8.997E-01	8.967E-01
íííííííí	íííííííí	íííííííííí	íííííííííí	íííííííííí	íííííííííí	íííííííííí	íííííííííí	íííííííííí	íííííííííí	íííííííííí

BRF(i) is the branch fraction of the parent nuclide.

Ecological Scoping Checklist
Objectives and Preparation Instructions

Objectives of checklist:

1. Confirm that ecological receptors can be affected by release

2. Determine if PRSs should be combined for screening

3. Evaluate data adequacy - primarily related to nature, rate and extent of contamination

4. Prepare for HQ/HI analysis (determine which screen is appropriate: terrestrial, aquatic screen, both?)

5. Provide information for prioritization / uncertainty analysis, e.g. what are the dominant/important transport pathways, exposure routes, and receptors

Scoping checklist instructions:

1. Obtain the following information to prepare for the scoping meeting
    - Most current biological information for the PRS, which is typically the Biological and Floodplain Assessment for applicable OU and/or TA
    - Surface runoff and erosion information from AP 4.5 Parts A,B
    - RFI Work Plan or Report, as applicable, that provide: contamination source, sample locations, analytical suites, results
    - FIMAD - ArcInfo maps that show the following features: neighboring PRSs, sample locations, vegetation types, watershed name, wetlands

1. Focus area manager for PRS or PRS aggregate will arrange a meeting prior to the site visit

2. Complete Section A of the checklist during the scoping meeting

3. Arrange site visit at an appropriate time of year (ideally spring or summer) to properly evaluate biological resources at the site (if the site visit is planned for another time of year make note of any uncertainties introduced in the initial biological assessment by such timing). The following resources are typically needed for the site visit:
    - Maps showing sample locations and results should be taken on site visit
    - Camera to record site conditions
    - If significant biological or contaminant transport features are noted, the following items will be useful:
        - ⇒ Distance measuring device, either a measuring tape or rangefinder
        - ⇒ GPS or markers to specify locations for surveying

1. Complete Section B of the checklist during the site visit

2. Complete Section C of the checklist after the site visit (should be completed within 1-2 days of site visit)

Ecological Scoping Checklist: Part A
Scoping Meeting Documentation

Site ID	**PRS 15-012(b), Wash Area**	
Nature of PRS releases (indicate all that apply)	Solid XX Liquid XX Gaseous Other, explain	**The PRS received wash water and debris from vessels used in explosives testing.**
List of Primary Impacted Media (indicate all that apply)	Surface soil XX Surface water/sediment Subsurface XX Groundwater Other, explain	**The RFI sampling results detected COPCs at 0-6 in and 18-24 in.**
Vegetation class (based on FIMAD or other available sources, indicate all classes that apply)	Water Bare Ground XXX Spruce/fir/aspen/mixed conifer Ponderosa pine Piñon juniper/juniper woodland Grassland/shrubland X Developed XX	**FIMAD vegetation class is bare ground. The site was covered with grasses prior to the VCA. It is adjacent to a developed area, which includes an equipment storage area next to Building 15-285. The area near the PRS is still grassland.**
Is T&E Habitat Present? List species if applicable. Are there proposed activities that might impact T&E species at the site?	**The Laboratory's Ecology Group (ESH-20) indicated that this area was within a Mexican Spotted Owl "Area of Interest, Buffer Zone". Areas of Environmental Interest consist of Core Zones and Buffer Zones. Core Zones are areas containing owls or suitable habitat. Buffer Zones are areas where activities could have Core Zone influence, but are not protected to the extent that Core Zones are. The PRS is approximately 190 ft from the core area, which has the potential for Mexican Spotted Owl nesting habitat. The PRS is potentially within the area that the Mexican Spotted Owl can be conservatively assumed to forage at a relatively medium frequency. Because of the proximity of the PRS to an active Laboratory complex it is unlikely that the VCA activities impacted any T&E species that may be present in the general area.**	
Provide list and description of Neighboring/ Contiguous/ Upgradient PRSs (consider need to aggregate PRS for screening)	**PRS 15-009(j) was a septic tank located approximately 50-100 ft west of the wash area. This septic tank received wastewater from Building R-183 and either was emptied or discharged to seepage pits. Although the wash area was slightly downgradient from the septic system at 15-009(j), the potential releases from 15-009(j) would be deep subsurface and the chemicals detected in the soil and tuff were VOCs compared inorganics and uranium at 15-012(b). In addition, the septic tank was removed as part of a separate VCA. Firing Site AB [PRSs 15-004(b,c)] was located approximately 400-500 ft east/southeast of the wash area. This site has been characterized and remediated and did not influence the wash area. Therefore, these PRSs were not aggregated. PRS C-15-002 is a pile of dirt resulting from the excavation of the area where Building 15-285 was built. This excavated dirt pile is located south of the building and southwest of the septic tank. It does not influence the wash area and was recommended for NFA in the RI Work Plan. The other PRSs are either behind buildings or distant and did not influence PRS 15-012(b).**	
AP 4.5 Part B Information Run-off score (out of 46) Terminal point of surface water transport	**Erosion Matrix Score 15.3** **Run-off score 0.0** **Potrillo Canyon**	
Other Scoping Meeting Notes		

Ecological Scoping Checklist: Part B
Site Visit Documentation

Site ID	**PRS 15-012(b), Wash Area**
Date of Site Visit	**6/12/98**
Site Visit Conducted by	**Tom Fogg and Richard Mirenda**

Receptor Information:

Estimate cover	% vegetated **10%** % wetland **0%** % structures/asphalt, etc. **90% bare ground**	**The area where the wash area used to be is currently covered with base course consisting of small cobble/pebbles and dirt.**
Field notes on the vegetation class	**Site visit confirms the vegetation class listed in Part A. Area is primarily bare ground and is adjacent to a developed area. The site is surrounded by grassland mixed with scattered pinon/juniper trees (100 yards or more from the site). The outer perimeter (approximately 400 yards from the PRS) of the area is ponderosa pine. The site has been cleared, graded, and covered by 8 inches to 3 feet of base course. The site has not been revegetated because the facility intends to use the area to park vehicles and for storage.**	
Field notes on T&E Habitat, if applicable	**Does not appear to be suitable habitat for T&E species because the site is disturbed and adjacent to an active, industrial area.**	
Are ecological receptors present at the PRS? (yes/no/uncertain) Provide explanation	**Possibly. Ecological receptors (small mammals and birds) may traverse the area. Following the VCA, the site was cleared, graded, and covered by 8 inches to 3 feet of base course and does not provide any habitat or forage for ecological receptors. The site has not been revegetated because the facility intends to use the area to park vehicles and for storage.**	

Contaminant Transport Information:

Surface water transport Field notes on the terminal point of surface water transport (if applicable)	**The site is on the mesa top approximately ¼ mile east of Canon de Valle. The slope in the area is <10% and in most places 1-2% with the drainage being to the southeast, away from Canon de Valle. There is no visible evidence of runoff and no channelization present.**
Are there any other off-site transport pathways? (yes/no/uncertain). Provide explanation	**No. When the wash area was in operation, it was surrounded by an earthen berm to prevent runoff of material in the surface water. The atmospheric pathway via particulate/dust dispersion would have been an unlikely for off-site transport because the area was vegetated prior to the VCA. Currently, the site is covered by 8 inches to 3 feet of clean base course, which would impede any off-site transport.**

Ecological Effects Information:

Physical Disturbance (provide list of major types of disturbances)	**The only physical disturbance would be the excavation conducted during the VCA. As part of the remedial activities, the area cleared, graded, and covered by 8 inches to 3 feet of clean base course. The site has not been revegetated because the facility intends to use the area to park vehicles and for storage.**
Are there obvious ecological effects? (yes/no/uncertain). Provide explanation	**Yes. The site has been remediated, the area cleared, graded, and covered by 8 inches to 3 feet of base course. The site has not been revegetated because the facility intends to use the area to park vehicles and for storage.**

No Receptor/ No Pathways:

If there are no receptors and no offsite transport pathways the remainder of the checklist should not be completed. Stop here and provide any additional explanation/justification for proposing an ecological No Further Action recommendation (if needed).

Data Adequacy:

Do existing data provide information on the nature, rate and extent of contamination? (yes/no/uncertain) Provide explanation. (consider if the maximum value was captured by existing sample data).	**Yes. The RFI data provide sufficient information about the nature and rate of contamination at the wash area. Because the site was surrounded by an earthen berm prior to the VCA, samples around the outside of the wash area were not collected. Off-site transport was unlikely at this site because the site is flat (<10% slope) with a 0.0 runoff factor under AP 4.5 and there is no evidence of erosion anywhere in the vicinity of the PRS. When in operation, off-site transport was minimal or non-existent because of the earthen berm surrounding the PRS. Following remediation, which involved the removal of the earthen berm, the area surrounding the wash area was sampled to determine lateral extent of contamination. Sampling data indicated that contamination was confined to the area formerly surrounded by the earthen berm. In addition, the cover of base course following remediation would impede any migration of residual material off-site.**
Do existing data, process knowledge or observation indicate that other areas of contamination may be influencing the PRS in question or it's area of influence? (yes/no/ uncertain) Explain.	**No. The wash area was surrounded by an earthen berm when in operation. The site is not influenced by neighboring PRSs. These PRSs are a septic tank [PRS 15-009(j)], Firing Site AB [PRS 15-004(b,c)], and a dirt pile (C-15-002). The septic tank is subsurface in nature. The firing sites and dirt pile did not contribute to the contamination of the wash area. In addition, the septic tank and firing sites PRSs have been remediated and the dirt pile was proposed for NFA in the RFI Work Plan.**

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors.

Ecological Scoping Checklist: Part C
Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to Q and use this information to complete the Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant $>10^{-5}$ atm-me/mol and molecular weight <200 g/mol).

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The COPCs identified at this PRS were inorganics and radionuclides.

Question B:

Could the soil contaminants identified above reach receptors through fugitive dust carried in air?

- Soil contamination would have to be on the actual surface of the soil to become available for dust.
- In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Currently, the site has been cleared, graded, and covered by 8 inches to 3 feet of base course. The site has not been revegetated because the facility intends to use the area to park vehicles and for storage.

Question C:

Can contaminated soil be transported to aquatic ecological communities via surface erosion?

- Use AP 4.5 run-off score and terminal point of surface water runoff to help answer this question.
- If the AP 4.5 run-off score* equal to zero, this suggests that erosion at PRS is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points)
- If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected.

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: AP 4.5 was 15.3 with 0.0 for runoff score. The site is relatively flat (<10% slope) and no evidence of channelization or erosion is apparent. In addition, the PRS was surrounded by an earthen berm designed to prevent runoff from the area. The area is within ¼ mile from Canon de Valle but on the mesa top and not prone to mass wasting events and the drainage is to the southeast away from Canon de Valle.

Question D:

Is groundwater contaminated and potentially available to biological receptors through seeps or springs?

- Known or suspected contaminant *presence in* groundwater.
- The potential for contaminants to be carried via groundwater and discharge into habitats and/or surface waters.
- Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with contaminated groundwater present within the root zone (~1 m depth).
- Terrestrial wildlife receptors will generally only contact groundwater if it is discharged to the surface.

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Groundwater is not present near the surface and no seeps or springs are present in the area.

Question E:

May groundwater become contaminated from infiltration/percolation from contaminated subsurface material?

- Suspected ability of contaminants to *migrate to* groundwater.
- The potential for contaminants to reach groundwater then discharge into habitats and/or surface waters.
- Might contaminants be taken up by terrestrial and rooted aquatic plants whose roots are in contact with potentially contaminated groundwater present within the root zone (~1 m depth)?
- Terrestrial wildlife receptors will generally only contact groundwater if it is discharged to the surface.

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Groundwater is several hundred to a thousand feet below the surface and no evidence of perched aquifers is available for this area of TA-15. COPCs have limited capability of migrating to groundwater.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- Consider, particularly, the erodability of fill material and the geologic processes of canyon/mesa edges.

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The area is within ¼ mile from Canon de Valle but on the mesa top and not prone to mass wasting events. The site is relatively flat (<10% slope) with the drainage being to the southeast away from Canon de Valle and no evidence of channelization or erosion is apparent. In addition, the PRS was surrounded by an earthen berm designed to prevent runoff from the area.

Airborne contamination
(terrestrial receptors)

Question G:

Could airborne contaminants interact with plants or animals through respiration of vapors?
- Contaminants must be present as volatiles in the air.
- Consider the importance of inhalation of vapors for burrowing animals.
- Foliar uptake of organic vapors is typically not a significant pathway.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial/Emergent Plants:** 0
⇒ **Terrestrial Animals:** 0

Provide explanation: Volatiles were not used at this PRS.

Question H:

Could airborne contaminants interact with plants or animals through deposition of particulates or with animals through inhalation of fugitive dust?
- Contaminants must be present as particulates in the air or as dust for this pathway to be viable.
- Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial/Emergent Plants:** 1
⇒ **Terrestrial Animals:** 1

Provide explanation: Some residual uranium contamination was detected in the soil following remediation. Following remediation, the site was covered by several inches to several feet of clean base course, which would prevent any residual contamination from being dispersed by wind. The potential for burrowing animals to come in contact with the uranium underneath the layer of base course is unlikely.

Soil-borne contamination
(terrestrial receptors)

Question I:

Could soil-borne contaminants reach plants via root uptake or rain splash to leaf and stem surfaces from surface soils?
- Contaminants in bulk soil may partition into soil solution, making them available to roots.
- Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 1

Provide explanation: The site has not been revegetated because the facility intends to use the area to park vehicles and for storage. The residual uranium contamination is located beneath approximately 12 inches of base course.

Question J:

Could soil-borne contaminants reach receptors through food web transport from surface soils?

- Consider bioaccumulation and biomagnification. See list of potentially persistent bioaccumulators and biomagnifiers, presented in Table 1.
- Animals: may ingest contaminated prey.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 0

Provide explanation: Isotopic uranium was detected in the soil following remediation. However, the residual uranium contamination is located beneath approximately 12 inches of base course and is not readily available to receptors.

Question K:

Could soil-borne contaminants interact with receptors via incidental ingestion of surface soils?

- Incidental ingestion of contaminated soil may occur while animals grub for food resident in the soil, or feed on plants/animals covered with contaminated soil, or while grooming themselves clean of soil.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 0

Provide explanation: The site is covered by approximately 12 inches of base course.

Question L:

Could soil-borne contaminants interact with receptors through dermal contact with surface soils?

- Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 0

Provide explanation: The COPC is a radionuclide and is covered by approximately 12 inches of base course.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- External irradiation effects are most relevant for gamma emitting radionuclides.
- Burial of contamination severely attenuates radiological exposure.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 1
⇒ **Terrestrial Animals:** 1

Provide explanation: Isotopic uranium is an alpha emitter and is not readily absorbed across the skin.

Water borne contamination
(terrestrial and aquatic receptors)

Question N:

Could water and sediment-borne contaminants reach plants via direct uptake from water and sediment or rain splash to leaf and stem surfaces from surface sediment?

- Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.
- Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash on sediments *not* soils). in an area that is only periodically inundated with water.
- Contaminants in sediment may partition into soil solution, making them available to roots.
- Aquatic plants are in direct contact with water.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 0
⇒ **Aquatic Plants:** 0

Provide explanation: No water or sediments are present at the site and transport off-site is minimal or unlikely.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- The chemicals may bioaccumulate in animals (see list of potentially persistent bioaccumulators and biomagnifiers, presented in Table 1.)
- Animals: may ingest contaminated prey.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 0
⇒ **Aquatic Animals:** 0

Provide explanation: No aquatic systems are present at or near the site and transport off-site is minimal, if at all.

Question P:

Could contaminants interact with receptors via incidental ingestion of water and sediment?

- If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.
- Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.
- Aquatic receptors may regularly or incidentally ingest sediment while foraging.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 0
⇒ **Aquatic Animals:** 0

Provide explanation: No standing water has been found at the site and no aquatic systems are present at or near the site.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.
- Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.
- Aquatic receptors may be directly exposed to sediments or may be exposed through osmotic exchange, respiration, or ventilation of sediment pore waters.
- Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 0
⇒ **Aquatic Animals:** 0

Provide explanation: No standing water has been found at the site and no aquatic systems are present at or near the site.

Question R:

Could contaminants interact with plants or animals through external irradiation via water and sediment exposure?

- External irradiation effects are most relevant for gamma emitting radionuclides.
- Burial of contamination severely attenuates radiological exposure.
- The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 0
⇒ **Aquatic Plants:** 0
⇒ **Terrestrial Animals:** 0
⇒ **Aquatic Animals:** 0

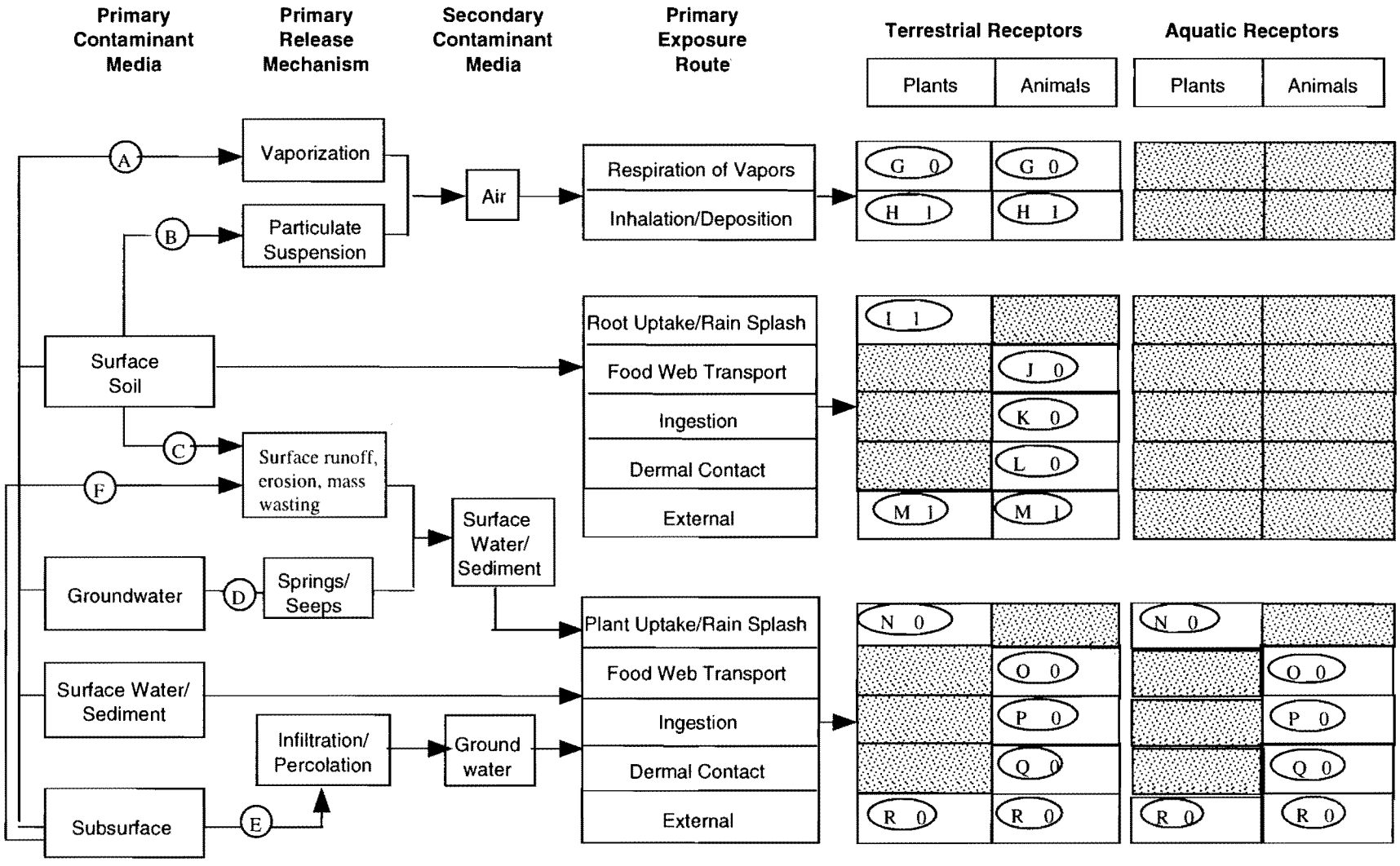
Provide explanation: No standing water has been found at the site and no aquatic systems are present at or near the site. Uranium is an alpha emitter and does not penetrate skin.

Table 1
List of Bioaccumulating Chemicals

Volatile Organics	**PCBs/Pesticides**
Dichlorobenzene[1,4-]	All Aroclors
Trichlorobenzene[1,2,4-]	beta-BHC
Xylene (mixed isomers)	BHC-mixed isomers
	Chlordane
Semivolatile Organics	Chlorecone (Kepone)
Acenaphthene	DDT and metabolites
Anthracene	Dieldrin
Benzo(a)anthracene	Endosulfan
Benzo(a)pyrene	Endrin
Benzo(b)fluoranthene	Heptaclor
Benzo(g,h,i)perylene	Lindane
Benzo(k)fluoranthene	Methoxyclor
Bis(2-ethylhexyl)phthalate	Toxaphene
Butyl benzyl phthalate	
Chrysene	**Inorganics**
Dibenzo(a,h)anthracene	Aluminum
Di-n-butyl phthalate	Cadmium
Di-n-octyl phthalate	Copper
Fluoranthene	Lead
Fluorene	Mercury
Indeno(1,2,3-cd)pyrene	Nickel
Phenanthrene	Selenium
Pyrene	
Pentachloronitrobenzene	**Radionuclides**
Pentachlorophenol	Americium-241
	Cesium-137
Dioxins/Furans	Plutonium-238,239,240
Dibenzofuran	Radium-226,-228
2,3,7,8-tetrachloro-dibenzo(p)dioxin	Strontium-90
2,3,7,8-tetrachloro-dibenzo(p)furan	Thorium-228,-230,-232
	Uranium-234,-235,-238

Ecological Scoping Checklist: Ecological Pathways Conceptual Exposure Model

KEY
0 - No Pathway
1 - Unlikely Pathway
2 - Minor Pathway
3 - Major Pathway



Signatures and certifications:

Checklist completed by (provide name, organization and phone number)

Name (printed):	Richard J. Minnella, Ph.D.
Name (signature):	Richard J. Minnella
Organization:	Program Management Co.
Phone number:	(505) 662-1329
Date completed:	9/4/98

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number)

Name (printed):	Mark M. Hooten, Ph.D.
Name (signature):	Mark M. Hooten
Organization:	Neptune & Co., Inc.
Phone number:	(505) 662-0707 x 30

Los Alamos National Laboratory

ESH-20, Ecology Group
P.O. Box 1663, Mail Stop M887
Los Alamos, New Mexico 87545
(505) 665-8961 / FAX: (505) 667-0731

Date: September 3, 1998
Refer to: ESH-20/Ecol-98-0738

Rich Mirenda
Program Management Company
Bldg 2, 1st Floor
2237 Trinity Drive
Los Alamos, NM 87544

Dear Dr. Mirenda:

SUBJECT: Review of Potential Release Sites for Threatened and Endangered Species Habitat for The Purpose of Ecological Screening/Risk Assessment.

Resulting from your request, the purpose of this memo is to communicate whether Threatened and Endangered (T&E) species may be present in Environmental Restoration Potential Release Sites (PRS's) under consideration for ecological screening and/or risk assessment purposes. This information will help: (1) to establish whether contaminant pathways might exist to T&E species nesting within or in the vicinity of a PRS, (2) to determine whether there are proposed activities relating to the ecoscreen/risk assessment that might impact T&E species at the PRS, (3) to notify, when necessary, risk assessors to pay particular attention to relevant contaminant Ecological Screening Levels primarily for birds, (4) to notify, when necessary, risk assessors to pay particular attention to PRS aggregation issues relative to foraging patterns of T&E species.

The following PRSs – 15-009(j) and 15-012(b) - were reviewed to determine whether or not they are in or near federally-listed T&E Nesting Habitat, whether they are in a Foraging Area and, if so, to indicate the relative amount of foraging that can be expected at or in the vicinity of the specific PRSs of interest:

PRS location information maintained by FIMAD was intersected with T&E species Habitat using GIS databases maintained by the Ecology Group, ESH-20. Both PRSs are in the vicinity of the Mexican Spotted Owl Nesting Habitat. PRSs 15-009(j) and 15-012(b) are 120 feet and 190 feet from the core area, respectively. Both PRSs are entirely within an area in which the Mexican Spotted Owl can be conservatively assumed to forage at a relatively medium frequency.

Your request did not propose any ground-disturbing activities.

If you need more detailed or more extensive information please do not hesitate to contact me.

Sincerely,

Gil

Gilbert J. Gonzales, Ph.D.
Biology Team Leader
Ecology Group

GG/JP:rm

Cy: Elizabeth Kelly, TSA-11, MS K557
J. Podolsky, ESH-20, MS M887
S. Koch, ESH-20, MS M887

APPENDIX G RELEVANT DOCUMENTS

G-1.0 DOCUMENTATION OF REGULATORY HISTORY

G-1.1 Corrective Action History

TABLE G1.1-1. OU – 1086, TA 15 RFI CORRECTIVE ACTION HISTORY SUMMARY FOR PRSs 15-004(a-d,f), 15-007(b), 15-008(a,b), 15-009(e,j), 15-012(b), AND C-15-004

DATE	DESCRIPTION
1992	OU 1086 RFI Work Plan submitted to EPA
7/26/94	DOE received letter from EPA with NODs on the Work Plan
8/5/94	LANL received memo from DOE with NODs on the Work Plan
8/24/94	LANL sent letter to DOE with LANL's response to EPA's NODs on the Work Plan
8/26/94	DOE sent letter to EPA with LANL's response to EPA's NODs on the Work Plan
10/94	LANL received letter form EPA with requested modifications to LANL's response
11/1/94	Phone conversation between Barbara Driscoll, EPA and Scott Kinkead, LANL, regarding requested modifications
11/29/94	LANL sent letter to DOE with LANL's response to EPA's modifications
1/9/95	LANL received letter from EPA approving the Work Plan with a few modifications listed
7/30/95	RFI report for PRSs 15-004(a-d,f), 15-007(b), 15-008(a,b), 15-009(e,j), 15-012(b), and C-15-004 due to EPA
8/1/95	LANL sent letter to EPA requesting extension for RFI Report due date
11/1/95	RFI Report submitted to EPA
7/17/97	LANL/DOE received letter from NMED with NODs on the RFI Report
8/15/97	LANL/DOE sent letter to NMED with LANL's response to NMED's NODs on the RFI Report
11/20/97	LANL/DOE received letter from NMED with conditional approval upon modification of the RFI Report
12/17/97	LANL/DOE sent letter to NMED requesting extension on the conditional approval response due date until 4/1/98
3/25/98	LANL/DOE sent letter to NMED requesting extension on the conditional approval response due date until 6/1/98
6/1/98	LANL/DOE submit conditional approval response and modified RFI Report to NMED

TABLE 61.2-1
PRS 15-102(b) VAC HISTORY AND SUMMARY

01/97	Outline presentation of VCA Plan to NMED
07/29/97	VCA Plan sent out for internal review
09/22/97	VCA Report sent out for internal review
09/30/97	VCA Report re-sent out for internal review
10/30/97	VCA Report re-sent out for internal review
03/05/98	VCA Report re-sent out for internal review
04/03/98	VCA Plan and Report put on hold pending additional sampling
08/29/98	VAC Report with Plan as an attachment sent to peer review
09/30/98	VAC Report sent to DOE with the Plan as an attachment

APPENDIX H COMPARISON OF ANTICIPATED AND ACTUAL COSTS

APPENDIX H COMPARISON OF ANTICIPATED AND ACTUAL COSTS

The estimated costs of this VCA are compared with the actual costs in Table H-1. Differences between estimated and actual costs are shown below.

Table H-1

Estimated versus Actual Cost for VCA at PRS 15-012(b)

Activity	Estimated Cost	Actual Cost
Pre-Fieldwork	$ 11,500	$ 11,500
Fieldwork	$ 50,000	$ 40,000
Laboratory Analysis	$ 50,000	$ 50,000
Waste Management/Disposal	$100,000	$ 10,000
Post-Fieldwork	$ 4,500	$ 5,500
TOTAL	**$216,000**	**$117,000**

Discrepancies

The actual costs associated with this VCA were lower due to disposal of waste at LANL's TSD.

APPENDIX I. VCA PLAN FOR PRS 15-012(b)

Voluntary Corrective Action Plan for

Potential Release Site
15-012(b)
Surface Disposal Site/
Wash Area

(formerly
Field Unit 2)

Environmental
Restoration
Project

March 1998

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-98-XXXX

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Site Type and Description 1

1.1.1 Operational History 1
1.1.2 COPCs and Rationale for Proposed Remedial Action 1

2.0 SITE CHARACTERIZATION 2

2.1 RFI Information/Other Decision Data 2

2.1.1 Data Quality Evaluation 2
2.1.2 Sampling Results 2

2.2 Nature and Extent of Contamination 3

3.0 PROPOSED REMEDY 4

3.1 Description of the Proposed Remedial Action 4

3.2 Basis for Cleanup Levels 5

3.3 Site Restoration 5

4.0 WASTE MANAGEMENT 5

4.1 Estimated Types and Volumes of Waste 5

4.2 Method of Management and Disposal 6

5.0 DESCRIPTION OF CONFIRMATORY/VERIFICATION SAMPLING 7

6.0 ESTIMATED TIME TO COMPLETE THE ACTION AND UNCERTAINTIES 7

7.0 ANNEXES

Annex 7.1 Risk-Based Cleanup Level Assumptions and Calculations 8
Annex 7.2 RFI Analytical Results 9
Annex 7.3 Site Map 11
Annex 7.4 Implementation SOPs 13
Annex 7.5 Quality Assurance Plan 14
Annex 7.6 Site-Specific Health and Safety Plan 15
Annex 7.7 Waste Management Checklist 17
Annex 7.8 VCA Checklist and Field Work Authorization Form 29
Annex 7.9 Cost Estimate 31

8.0 REFERENCES 32

VOLUNTARY CORRECTIVE ACTION PLAN FOR POTENTIAL RELEASE SITE 15-012(b) SURFACE DISPOSAL SITE/WASH AREA

1.0 INTRODUCTION

This voluntary corrective action (VCA) plan addresses potential release site (PRS) 15-012(b), which is located in Technical Area (TA)-15. This PRS was a wash area where metal spheres, used to contain debris from explosive device testing, were washed with water and drained onto the ground within an earthen berm area to clean them for re-use. Based on the Phase I sampling results, uranium, lead and beryllium were identified as chemicals of potential concern (COPCs). Visible DU exists in the surface soil of this site. This PRS is on the list of Laboratory sites in or near a watercourse, and is listed in Table A of the Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's RCRA permit.

1.1 Site Type and Description

PRS 15-012(b) is a sunken, soil-bermed area approximately 63 by 20 ft located southeast of Building TA-15-285. In this area, the explosives groups (DX Division) used water to wash out vessels used for explosive device testing. This site was in use from the late 1970's until mid 1980. These vessels were heavy-walled steel spheres (diameter 6 ft) that contained debris from explosions. Any debris remaining from the explosives testing was contained within the spheres and dumped into the bermed area at PRS 15-012(b) along with the wash water. The chemical nature of the disposed material is expected to be similar to that found at firing sites for uncontained explosions (e.g., uranium, beryllium, and lead). During the washing process, the spheres were suspended from a boom truck, which remained on a macadam parking area east of Building TA-15-285; the suspended spheres were southeast of Building TA-15-285. Personnel usually entered the spheres to thoroughly clean them. The washed spheres were stored at PRS 15-001, the boneyard.

1.1.1 Operational History

TA-15, commonly referred to as R-Site, consists of a number of firing sites that have been used extensively since 1944 for research and explosive testing of weapons design components. These components were tested without fissionable materials to determine whether performance would match design calculations. Both the SWMU report (LANL 1990, 0145) and the Comprehensive Environmental Assessment and Response Program (CEARP) report (DOE 1987, 0264) stated that contaminated vessels were washed out with water in a bermed area near Building TA-15-285.

1.1.2 COPCs and Rationale for Proposed Remedial Action

Samples were collected from the surface and subsurface soil at six locations within the bermed area in accordance with the approved RFI work plan (LANL 1994, 1156). Analytical results from the Phase I sampling detected uranium at concentrations greater than SAL, lead with a normalized value of 0.45 in the multiple chemical evaluation (MCE), and beryllium at concentrations greater than the background upper tolerance level (UTL) in four samples (three surface and one subsurface). Because the screening action level (SAL) for beryllium is less than the Laboratory-wide background UTL, the decision criterion is the background value. Visible DU is present at the site.

Based on the presence of COPCs (i.e., uranium, beryllium, and lead) in the surface and subsurface soil, a cleanup of the wash area is recommended. The proposed corrective action for PRS 15-012(b) is to remove the contaminated soil, return the area to the original grade, and revegetate, i.e., reseed. Additional clean fill material will be used if necessary to return the area to its original condition.

2.0 SITE CHARACTERIZATION

The site consists of a sunken, soil-bermed area approximately 63 by 20 ft located southeast of Building TA-15-285. Only the soil within the bermed area was sampled as part of the Phase I investigation.

2.1 RFI Information/Other Decision Data

PRS 15-012(b) was previously surveyed with hand-held radiation meters and was found to be contaminated with radioactivity (Veverka 1988, ER ID No. 5434; Schlapper 1991, ER ID No. 15005), but contamination levels were not quantified.

Phase I sampling was conducted in the summer of 1994 in accordance with the approved RFI work plan (LANL 1993, 1087). The objectives of sampling were to determine whether or not contamination exists and, if present, the nature of the contamination. Field screening of the area was performed to determine potential hazards, to establish health and safety conditions for onsite workers, and to screen samples for metals prior to selecting samples for submission for offsite fixed laboratory analyses. Six sampling locations were field screened for HE using the HE spot test; for gross alpha, beta, and gamma using portable field instruments; and for metals using x-ray fluorescence (XRF). All samples were submitted to the mobile radioanalysis van for gross alpha, beta, and gamma screening, and to the mobile chemistry van for XRF screening analysis for metals. A portable laser-induced breakdown spectroscopy (LIBS) instrument was used to screen the soil samples for beryllium.

During field screening for radioactivity, the field team found higher readings in the bermed area and around an ant hill immediately outside the fence that runs along the top of the berm.

Twelve samples were collected (six surface samples and six subsurface samples) and were submitted to the analytical laboratory. The surface soil samples (0 to 6 in.) were collected using the approved spade and scoop technique (LANL-ER-SOP 6.09), and the subsurface soil samples (18 to 24 in.) were collected using the approved hand-auger technique (LANL-ER-SOP 6.10). The site map (Figure 7.3-1) presents the sample locations at this PRS.

In accordance with the RFI work plan (LANL 1993, 1087), selected samples were submitted to an offsite laboratory for analysis. As required, three surface samples (0 to 6 in) with the highest concentrations of lead and uranium were sent to the offsite fixed laboratory. Also as required, three subsurface soil samples (18 to 24 in.) with the highest concentrations of metals were submitted to the offsite fixed laboratory. The locations of the subsurface samples with the highest concentrations of metals corresponded to the surface sample locations with the highest concentrations of metals. Analyses for uranium were requested by kinetic phosphorescence analysis (KPA), and analyses for metals were requested for target analyte list (TAL) metals using SW-846 methods. According to the chain-of-custody records, the samples were submitted and analyzed within the prescribed holding times.

2.1.1 Data Quality Evaluation

The QA/QC data associated with the analyses at PRS 15-012(b) (inorganics and uranium) indicated that 100% of the data were acceptable and defensible. None of the analytical results were qualified. The QA/QC mechanisms were effective in ensuring the reliability of measured data within expected limits of sampling and analytical error.

2.1.2 Sampling Results

All of the Phase I analytical data collected at PRS 15-012(b) are available in the Facility for Information Management Analysis and Display (FIMAD). A printout of the RFI data is provided in Annex 7.2. The reported values for detected chemicals are compared with the respective background UTLs and SALs. Data comparison tables of detected concentrations greater than background UTLs and SALs are provided in Annex 7.2 (Table 7.2-1). Based on a review of the sampling data, the results are as follows:

- Five inorganics - beryllium, copper, lead, mercury, and uranium - were detected in the surface and subsurface soil at concentrations above their background UTLs (Table 7.2-1). All other inorganics were detected at concentrations below their respective background UTLs and are eliminated from further evaluation.

- Copper, lead, and mercury were detected above background, but below their SALs of 2,800 mg/kg, 400 mg/kg, and 23 mg/kg, respectively, and were submitted to a MCE. The natural background concentrations of beryllium in the Los Alamos area exceed the risk-based threshold (i.e., SAL) that would otherwise be used as a screening value, so the background UTL is used to determine the presence of beryllium as a COPC. The data for this site indicate beryllium concentrations greater than background; therefore, beryllium is considered a COPC.

- Uranium was detected at concentrations greater than its inorganic SAL of 230 mg/kg (based on systemic effects), and it is retained as a COPC (Table 7.2-1).

- The MCE for noncarcinogenic effects had a sum of maximum normalized concentrations for three analytes (copper, lead, and mercury) of 0.5, which is below the target value of 1.0 (Table 7.2-2). Copper and mercury are eliminated from further evaluation because the normalized values were less than 0.1. Because the normalized value for lead (0.45) was greater than 0.1, lead was retained as a COPC.

- Isotopic uranium was not analyzed in any of the samples, so isotopic ratios could not be determined. Historical information indicates that natural and depleted uranium (DU) may have been used in the explosives testing. The uranium data are compared to the SALs for DU (130 mg/kg) and natural uranium (29 mg/kg). The data comparison found that uranium was detected above its radionuclide SALs (Table 7.2-1), and it is retained as a COPC.

- Analyses for organics [semi-volatile organic compounds (SVOCs), volatile organic compounds (VOCs), and high explosives (HE)] were not conducted on the samples collected from the wash area because the explosive testing was believed to have consumed HE.

The results of the RFI screening assessment indicate that beryllium, lead, and uranium are retained as COPCs.

2.2 Nature and Extent of Contamination

The extent of the contamination at PRS 15-012(b) is the wash area within the berm, and possibly the berm itself. The Phase I sampling to determine the presence of metals and radioactivity indicated that the wash area contains uranium, beryllium, and lead as COPCs, defining the nature of contamination, while the radiation screening indicated that the berm itself may have radioactive contamination. The approved RFI Workplan called for screening of all collected samples, followed by submission of a subset of samples with the greatest concentrations for fixed laboratory analysis.

As required, three surface samples (0 to 6 in) with the highest concentrations of lead and uranium were sent to the offsite fixed laboratory. Also as required, three subsurface soil samples (18 to 24 in.) with the highest concentrations of metals were submitted to the offsite fixed laboratory. Only one deep sample had concentrations of either metals or uranium greater than background, while all three surface samples had concentrations of metals or uranium greater than background.

The laboratory results showed that beryllium was observed at concentrations greater than background in all three surface samples and in one deep (18-24") sample. Copper was reported at a concentration twice background in one surface sample. Lead was reported at concentrations greater than background but below SAL in 3 surface samples and in one deep sample. Mercury was reported at a concentration twice background but roughly 100 times less than SAL in the one deep sample . Uranium was reported at concentrations greater than background but below SAL in the one deep sample and one surface sample. Uranium was reported at concentrations above SAL in two surface samples.

Based upon the fixed-laboratory analyses of samples selected for analysis based upon the greatest concentrations of lead and uranium (as determined by field XRF measurements), the vertical extent of contamination in the wash area appears to be limited to less than two feet. This result is consistent with the release of metals and uranium to the surface soil after washing the spheres with water and draining them onto the soil within the berm. Metals are much less mobile than water, and these results confirm the soil attenuation. Coupled with the evaporation and low quantities of water discharged, these facts are consistent with the very shallow migrating metals and U at this PRS. In accordance with the approved Work Plan, six Phase I sample locations were screened and/or analyzed by the fixed laboratory; thus, the horizontal extent of contamination is inferred to be the boundaries of the berm, and the berm itself (due to the radiation readings greater than background obtained there).

3.0 PROPOSED REMEDY

3.1 Description of the Proposed Remedial Action

The remedial action at PRS 15-012(b) consists of removing the top 2 ft of soil (a worst-case estimate) from the flat area inside the berm and the berm itself, if it is determined that the soil contains unacceptable levels of uranium and beryllium. An unpaved access field leading up to the wash area makes the PRS easily accessible. There are no fences, trenches, etc., that would impede site access. Lead toxicity characteristic leaching procedure (TCLP) values, as measured in the excavated soil, will determine if the removed soil is a RCRA waste.

To implement the remedy, this plan will be followed. After appropriate health and safety screening (see Annex 7.6), the area of concern, including the berm, will be gridded on an 8 ft contour (approximately the size of a front-end loader bucket). Samples of surface and subsurface soil from the center of each grid will be collected using approved techniques. Soil will be analyzed in the field using both a Ludlum 2121 with a sodium iodide detector to determine the activity of the sample in pCi/g, and an XRF to determine the concentrations of lead and uranium. The soil outside of the bermed area within 20 ft of the berm will also undergo field screening to further define the extent of the contamination, and samples will be submitted to the offsite fixed analytical laboratory for confirmatory analyses. The field screening will assist the remediation team in more precisely defining the area of contamination and will ensure that all contaminated soil is remediated while minimizing the amount of waste generated. Those areas of the site, including the berm or outside the berm that are identified as being contaminated will be removed with the backhoe. The soil will be placed in roll-off containers, as appropriate, given the estimates of contaminated soil volumes determined from field screening.

During the excavation of the soil, dust suppression will be performed using hand-held water sprayers. The application of water will be limited and will not result in runoff or in the generation of a dual-phase (water and soil) waste.

Prior to beginning remedial action, a radiation level for cleanup will be established. This level will be used to determine whether or not fixed radiation exists or if all the radioactivity is removed with the soil. When the soil is completely removed, the area will be screened, relative to the LANL background, to ensure the removal of radiological contamination. At this time, confirmatory cleanup samples of the underlying soil will be collected. The results of the field screening measurements, along with the fixed analytical results, will be provided in the VCA completion report.

After completion of the soil removal and confirmatory sampling, tools and equipment will be decontaminated, and the decon fluid will be stored in 55-gallon drums, sampled for waste characterization, and disposed of accordingly. Personal protective equipment (PPE) will be cleaned. Uncleanable portions will be segregated and disposed of as waste. Until waste characterization results are received, all drums will be stored onsite, on pallets, under plastic, and initially managed as non-RCRA waste. After the results are received, final disposition for the drums will be determined.

The Spill Prevention, Control, and Countermeasures (SPCC) Plan and the Stormwater Plan will be followed, as well as the air pollution control procedures, if applicable.

3.2 Basis for Cleanup Levels

PRS 15-012(b) lies within DOE-owned land and is removed from public access roads. The area is heavily used by the Laboratory, and the future land use is expected to be continued Laboratory operations (i.e., industrial land use).

The PRGs for beryllium, lead, and uranium were calculated based on an industrial land use as well as a residential scenario for comparison purposes. The industrial PRG for beryllium for the EPA Region 9 PRG Tables (EPA 1996, 1351) is 1.1 mg/kg, which corresponds to a cancer risk of 10^{-6}. Because this value is less than the background UTL for beryllium of 1.95 mg/kg, the recommended industrial PRG is 11 mg/kg, which corresponds to a cancer risk of 10^{-5} (Table 3.2-1). The residential PRG from the EPA Region 9 PRG Tables (EPA 1996, 1351) is 0.14 mg/kg and corresponds to a cancer risk of 10^{-6}. The residential PRG that corresponds to the same cancer risk level as the industrial PRG is 1.4 mg/kg. These concentrations represent cancer risks that are in the middle of the US EPA's target risk range of 10^{-4} to 10^{-6} (EPA 1990, 0559). The PRGs for uranium (both for depleted and natural uranium) were calculated to be 1090 mg/kg and 750 mg/kg, respectively, for an industrial scenario (Table 3.2-1). The PRGs for a residential scenario were 394 mg/kg and 305 mg/kg respectively (Table 3.2-1). These values were calculated using RESRAD 5.70 and were based on an exposure limit of 15 mrem/yr. Exposure parameters for LANL were used in the model to derive the PRGs (LANL 1996, ER ID No. 54849). The PRGs for lead were obtained from the EPA Region 9 PRG Tables (EPA 1996, 1351) and are based on a hazard quotient of 1.0.

TABLE 3.2-1
PRGs FOR PRS 15-012(b)

COPC	Maximum Concentrations mg/kg	Industrial PRGs		Residential PRGs		Rationale
		DU[1] mg/kg	NU[2] mg/kg	DU mg/kg	NU mg/kg	
Uranium	272	1090	750	394	305	Radionuclide (based on a dose limit of 15 mrem/yr)
Lead	180	1000		400		Noncarcinogen (based on a hazard quotient of 1)
Beryllium	27.6	11		1.4		Carcinogen (based on a cancer risk of 10^{-5})

3.3 Site Restoration

Following confirmation that the PRS has been remediated in accordance with this plan, the excavated areas will be returned to the original grade and revegetated, i.e., reseeded. Backfill material (if needed) will consist of clean fill obtained from the Laboratory maintenance contractor.

4.0 WASTE MANAGEMENT

4.1 Estimated Types and Volumes of Waste

Wastes expected to be generated during the VCA are included in Table 4.1-1.

TABLE 4.1-1
ESTIMATED WASTE TYPES AND VOLUMES

Item	Waste Type	Anticipated Volume
Sampling waste/PPE	Solid - potential hazardous	< 7 55-gallon drums
Contaminated soils	Solid - low-level radioactive	< 8 roll-offs (20 cubic yards each)
Decontamination wastes	Liquid - potential hazardous	< 10 55-gallon drums

The known contaminants from this site may include beryllium, uranium, and lead. The estimated volume of soil to be removed is less than eight roll-off containers. The soil will be stored onsite in the containers until the results of the chemical analyses are known.

One representative composite sample of soil will be collected from each roll-off container. The following analyses will be conducted based on the Phase I RFI results: TCLP metals, isotopic uranium, SVOCs, VOCs, gamma spectroscopy, tritium, and HE. As the soil is removed from the PRS and placed in the roll-off containers, it will be screened for gross radioactivity (alpha, beta, and gamma) by hand-held instruments.

Visibly contaminated PPE and waste handling equipment may be considered radioactive waste, depending on the results of the field radiological screening. Depending on the results of the field screening, visibly uncontaminated items will be considered either industrial or radioactive wastes. The volume of PPE/waste handling equipment generated during the VCA is estimated to be less than seven 55-gallon drums and will not be directly sampled.

Decontamination liquids-Liquinox® detergent, tap water, and distilled water-may be radioactive waste. One grab sample of the decontamination liquids will be collected from every other drum and analyzed for TAL metals, isotopic uranium, SVOCs, gamma spectroscopy, and HE. The total volume of decontamination liquids generated is estimated to be less than seven 55-gallon drums.

4.2 Method of Management and Disposal

Waste soil will be stored/handled as non-RCRA wastes according to DOE Order 5820.2A (Radioactive Waste Management) requirements. Pending the analytical results, wastes will be stored at the PRS and will be initially managed as low-level radioactive waste. The storage area will be roped off and labeled as a radioactive materials storage area. Once the analytical results are received, the hazard category of each roll-off container or 55-gallon drum will be determined. The waste will be appropriately disposed of depending on whether it is RCRA, mixed, radioactive, or nonradioactive waste.

Visibly contaminated PPE and waste handling equipment will be segregated and managed as low-level radioactive waste. The total volume is estimated to be less than seven 55-gallon drums. The PPE/waste handling equipment will be placed in sealed bags inside 55-gallon drums. The visibly contaminated waste will be disposed of in the same manner as the roll-off containing the soil to which this waste was exposed. Visibly uncontaminated PPE/waste handling equipment (i.e., with no elevated radiation levels, as determined by field screening) will be segregated, placed in labeled and sealed plastic bags inside 55-gallon drums, and disposed of as nonhazardous industrial waste.

Decontamination liquids will be managed as low-level radioactive wastes and stored in 55-gallon drums in the same area as the roll-off containers. The total volume of decontamination liquids generated is estimated to be less than 10 55-gallon drums. A grab sample of the liquid waste will be collected from every other drum and the analytical results used to determine the final disposal location. If the waste meets acceptance requirements, nonhazardous decontamination liquids will be disposed of at the TA-46 Sanitary Wastewater System Consolidation (SWSC) Plant. Liquid waste not meeting the SWSC acceptance requirements will be disposed of as low-level radioactive liquid waste at the TA-50 treatment,

disposal, and storage (TSD) facility, or as hazardous or low-level radioactive waste at another approved TSD facility.

EM-SWO personnel will assist in the determination of the final disposal location for the wastes and verify the availability of TSD space, if necessary. Offsite disposal of mixed waste will require further analyses to meet the waste acceptance criteria of Envirocare, a mixed waste disposal facility located in Utah. Additional analyses will be performed only after the mixed waste status of the soil in the roll-off containers has been verified.

5.0 DESCRIPTION OF CONFIRMATORY/VERIFICATION SAMPLING

Field screening using both Ludlum and XRF instruments will direct onsite determination of the boundaries of soil to be remediated. Following remediation, soil samples will be sent to fixed laboratories to determine the remaining concentrations of the COPCs in soil at this site. If the average site concentrations are below the cleanup levels for each of the COPCs as presented in Section 3.2, the remediation goals will have been attained.

Based on the guidance set forth in EPA's "Methods for Evaluating the Attainment of Cleanup Standards Volume 1: Soils and Solid Media," six randomly collected samples are needed to verify that the remediation goal has been attained. The six samples will be collected, following remediation, randomly from the excavated area of PRS 15-012(b). These samples will be sent to a fixed laboratory for TAL metals, HE, and total uranium analyses, based upon the identified Phase I COPCs. Comparison of the reported concentration values with the cleanup levels will occur following analyses to determine if cleanup standards have been achieved.

6.0 ESTIMATED TIME TO COMPLETE THE ACTION AND UNCERTAINTIES

The estimated completion time for the VCA at PRS 15-012(b) is 2 weeks (10 working days). This estimate is based on one day to mobilize, eight days to complete the removal of contaminated soil and ship the confirmatory samples, and one day to demobilize. The analytical results from the confirmation sampling are expected to be received within 14 days, the waste characterization sampling results are expected to be received within 30 days, and waste removal from onsite storage is expected within another 60 days. Therefore, the total time from mobilization to removal of waste is estimated to be 90 days.

There is one major uncertainty with this cleanup. While the area containing the waste is easily identifiable and heavy equipment is available from EES-15, the actual waste determination (i.e., mixed, metals only, or rad only) is currently unknown. If all waste is mixed, inadequate TSD capacity exists. Thus, the field screening is necessary and will be completed prior to soil removal, to ensure that adequate capacity or ability to store the waste exists. If, during the course of the removal, the waste volume exceeds the TSD capacity estimate, the effort will be stopped and re-evaluated.

7.0 ANNEXES

ANNEX 7.1

RISK-BASED CLEANUP LEVEL ASSUMPTIONS AND CALCULATIONS

ANNEX 7.2

RFI ANALYTICAL RESULTS

All analytical data are available on FIMAD. If FIMAD is not accessible, data will be provided on request. A hard copy of the data is presented in the RFI report for TA-15 dated November 1995 (Environmental Restoration Project 1995, 1325) and is available from the Records Processing Facility (RPF).

TABLE 7.2-1

INORGANIC/RADIONUCLIDE CHEMICALS WITH CONCENTRATIONS AT OR ABOVE BACKGROUND SCREENING VALUES FOR PRS 15-012(b)

Sample ID	Location ID	Depth (in.)	Beryllium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Uranium (mg/kg)
SAL	N/A[b]	N/A[b]	0.14	2800	400	23	230/130[c]
Soil UTL[a]	N/A[b]	N/A[b]	1.95	15.5	23.3	0.1	5.45
AAB3406	15-2526	0-6	8.2	27.4	27.3	<0.1(U)	190
AAB3407	15-2527	18-24	2.7	12.7	23.8	0.16	53
AAB3417	15-2527	0-6	27.6	61.1	180	<0.1(U)	272
AAB3416	15-2529	0-6	6.3	22	104	<0.1(U)	90

[a]Upper tolerance limit of LANL-wide soil background data from A,B, and C horizons.
[b]N/A = Not applicable.
[c]Inorganic uranium SAL of 230 mg/kg is based on systemic effects (kidney); the DU SAL of 130 mg/kg is based on radiation dose.

TABLE 7.2-2

MULTIPLE CHEMICAL EVALUATION FOR SOILS FROM THE WASH AREA AT PRS 15-012(b)

Chemical	Location ID	Sample ID	Maximum Sample Values	Soil SAL	Normalized Values
Noncarcinogenic Effects (mg/kg)					
Copper	15-2527	AAB3417	61.1	2,800	0.02
Lead	15-2527	AAB3417	180	400	0.45
Mercury	15-2527	AAB3407	0.16	23	0.007
				Total	0.5

ANNEX 7.3

SITE MAP

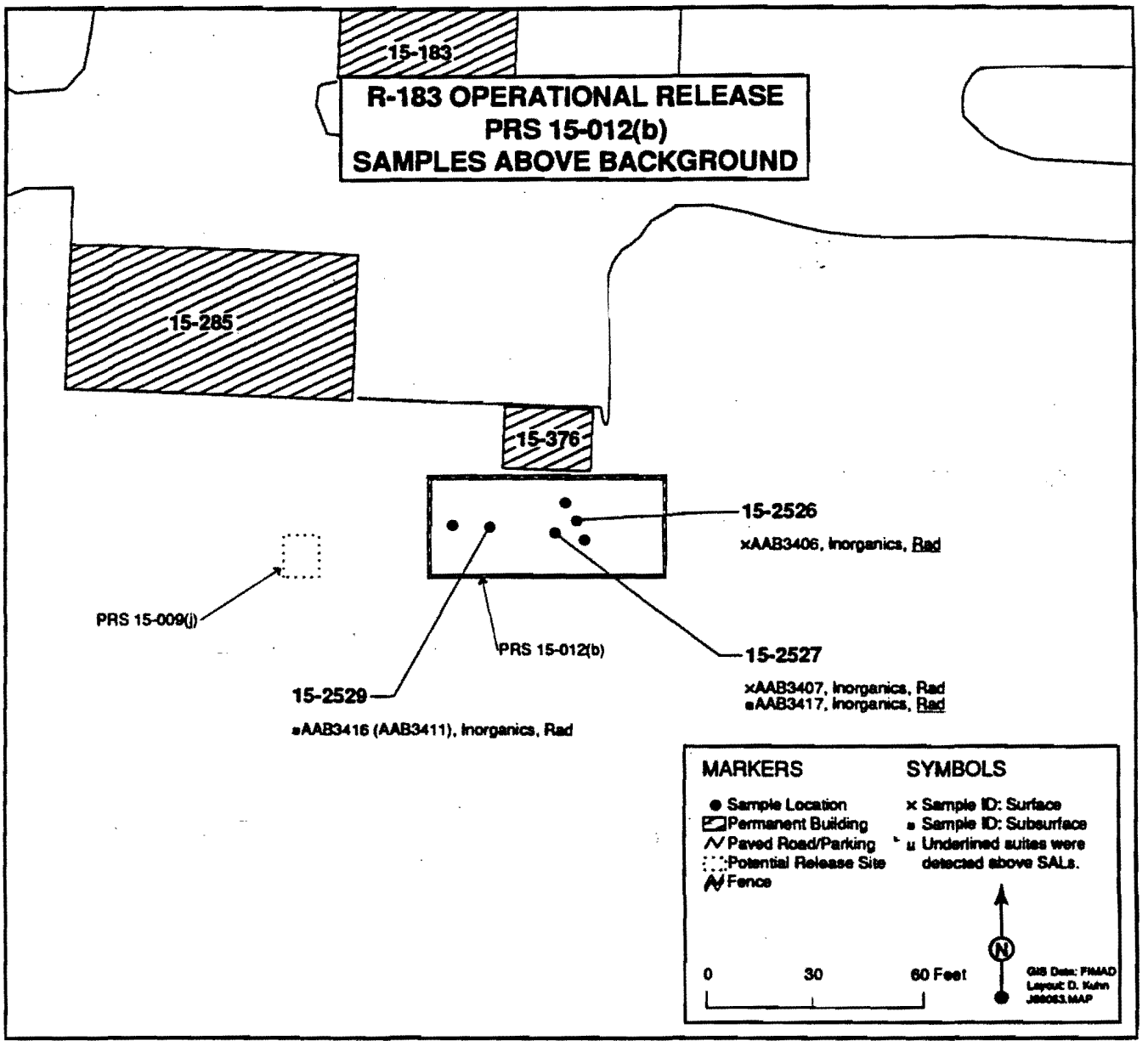


Figure 7.3-1. PRS 15-012(b) site map.

ANNEX 7.4

IMPLEMENTATION SOPS

See Environmental Restoration Standard Operating Procedures, Volumes I and II, November 17, 1993, Los Alamos National Laboratory.

ANNEX 7.5

QUALITY ASSURANCE PLAN

See Quality Program Plan and Quality Assurance Project Plan for Environmental Restoration, February 1995 revision, Los Alamos National Laboratory.

ANNEX 7.6

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Prior to initiation of any work, a completed Site Specific Health and Safety Plan (SSHASP) will be approved by LANL representatives, including the Explosives Review Committee. This Site-Specific Health and Safety Plan (SSHASP) will be developed for the Environmental Restoration (ER) Project at the Los Alamos National Laboratory (LANL) to comply with applicable federal and state occupational health and safety (HS) requirements, including those of the U.S. Department of Energy (DOE). The DOE requires LANL to comply with the federal Occupational Safety and Health Administration (OSHA) requirements, although operations at LANL are not subject to the jurisdiction of OSHA. The environmental restoration (ER) Project has developed a generic Health and Safety Plan, the ER Project HASP, which establishes HS information and requirements applicable to ER field operations projectwide. In addition to the HASP, this SSHASP establishes site-specific HS information and requirements applicable to the scope of work described in Section 2.

ER participants are responsible for conducting work in accordance with applicable regulations. The term "ER participants" refers to anyone performing ER work, including LANL, subcontractors to LANL and their lower-tier contractors, consultants, and agents. In some cases in this document, LANL has chosen to invoke OSHA and LANL requirements that may not ordinarily apply to ER field operations (e.g., OSHA's general industry standards in Part 1910 of Title 29 of the Code of Federal Regulations [29 CFR 1910]). These choices were made on a case-by-case basis to maintain consistency with LANL's ALARA policy and to clarify LANL's expectations with regard to interpretable requirements of the multiple agencies governing ER work. Where there is concern that implementation of work orders or HS requirements would conflict with contract terms, or that it could unreasonably compromise the safety or health of an individual or the environment, such concerns should immediately be brought to the attention of the Contract Administrator and the Field Unit HS Representative. Failure to comply with terms of HS plans may constitute cause to stop activity or the issuance of a stop work order, as specified in Section 3.4.2 of the HASP, without cost or penalty to LANL.

This SSHASP shall be reviewed and approved in accordance with Section 1.2 of the HASP. Once this SSHASP has been approved, revisions will be tracked using a SSHASP modification form (Appendix B of the HASP) per Section 1.3 of the HASP. Modifications to this SSHASP may result in a change to the terms or scope of a subcontract. Completion of an SSHASP modification form is <u>not</u> the means for modifying the scope or terms of the project contract. To modify a contract, the Subcontractor shall notify the Contract Administrator and Field Unit HS Representative under the changes clause and shall not proceed with the change until a change order has been mutually agreed upon between the parties, or unless unilateral direction is given by the Contract Administrator.

The SSHASP will be presented in a format similar to this example:

1.0 Introduction

2.0 Background Information

Table 2-1 Site Description(s)
Table 2-2 Scope of Work

3.0 Organization, Responsibilities and Authority

4.0 Hazard Analysis
4.1 Personnel by Task
4.2 Hazard Substances of Occupational Health Concern
4.3 Hazard Assessment and Administrative/Engineering Controls

5.0 Site Controls

6.0 Exposure Monitoring and Corresponding Actions

6.1 Direct-Reading Monitoring
6.2 Personal Dosimetry
6.3 Area Sampling

7.0 Personal Protective Equipment

8.0 Decontamination

9.0 Emergency/Incident Action Plan

10.0 Training

11.0 Medical Surveillance

12.0 Quality Control and Quality Assurance (QC/QA)

13.0 Recordkeeping

Appendixes

A Map(s) of Site Locations and Site Control Zones/Facilities
B Hazardous Substance - Hazard Assessment
C Chemical, Physical, and Toxicological Properties of Hazardous Chemical Substances
D Emergency Contacts and Route(s) to Medical Services

ANNEX 7.7

WASTE CHARACTERIZATION STRATEGY FORM

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
All Waste Types or Wastestreams: Soil, PEE and waste handling equipment, and decontamination liquids		

Completed By: J. W. Heyser	Date: July 16, 1997
FPL: T. E. Gene Gould	WMC: Jeff Bingham, EES-15
Type of Activity (site investigation, EC, etc.): VCA	

Description of the Activity (e.g., drilling, surface sampling, excavation and recontouring, soil washing, etc.)

Up to 125 cubic yards of soil will be removed using heavy equipment from this area once used to decontaminate spherical vessels used in explosive testing. The interior of the berm described below will be removed up to a depth of 2 feet. This area which contains both lead and uranium contamination based on Phase I analyses will first be gridded off (5 ft by 5 ft squares). Each grid will be surveyed for metals using XRF, HE by a field spot test, and for radiation using field screening instruments. The purpose for field screening is to remove only contaminated soil and where possible to segregate soil containing RCRA constituents from that containing radioactive isotopes. Each excavated location will be field screened and soil removal will cease when the above mentioned analyses indicate below detection levels for each constituent. After all the soil is excavated at identified locations within the berm and from the berm itself, the remaining uncontaminated soil from the berm will be used to fill in the holes created by the removal of contaminated soil. Laboratory analyses performed on the excavated soil will include TCLP metals, SVOCs, VOCs, HEs, isotopic uranium, isotopic plutonium, tritium, and by a gamma scan.

Acceptable Knowledge

Site Description, Site History, and Historical Waste Generating Processes or Activities: (Include dates for site history):

PRS 15-012(b) is a sunken, soil-bermed area approximately 63 ft. by 20 ft. located southeast of TA-15-285. In this area spherical containment vessels (6. ft. in diameter) were washed out after being used for explosive testing. Contamination from inside these vessels was similar to that found at sites where non-contained explosive testing was performed. Contaminants include uranium, beryllium, and lead. During the vessel cleaning the spheres were suspended from a boom truck parked on the macadam parking area east of TA-15-285. The rinse water from the vessels was then dumped inside the berm at PRS 15-012(b). Personnel showered in Building 15-285 and the spheres were stored at the boneyard, PRS 15-001 (1086 RFI Report, October 30, 1995). Vessels were washed at this PRS from the late 1970s to mid-1980.

Previous Investigation Analytical Results: (Report the analytical methods and results above background levels) In Phase I six locations were sampled at two depths (0-6 in. and 18-24 in.). All samples were screened at the mobile radioanalysis lab (alpha, beta, and gamma radiation), by XRF for mercury, lead and uranium, by LIBS for beryllium, and by a field spot test for HE. No positive HE samples were detected. These field analyses were used to select samples sent to the analytical laboratory for further analyses. These samples were then analyzed for total uranium and TAL metals. The highest levels for TAL metals were arsenic at 4.6 mg/kg, beryllium at 27.6 mg/kg, cadmium at 2.2 mg/kg, chromium at 13.6 mg/kg, lead at 180 mg/kg, mercury at 0.16 mg/kg, and silver at 1.7 mg/k. Maximum uranium was 272 mg/kg.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: Soil		

Waste Description

Description of Waste Type, Potential Contaminants, Volume Estimate, and Waste Packaging:

Waste Type Description: Soil
Potential Regulatory Status: RCRA, mixed waste, and/or low-level radioactive waste. Using field screening and mobile laboratory methods (XRF), the soil will be segregated based on its RCRA metal content and its uranium content. Segregated waste streams will be put in separate containers.
Volume Estimate: Up to eight roll-off containers (each holding a maximum of 15 cu. yds.). Using segregation techniques, the actual volume of soil removed may well be less than half of this estimated volume..
Waste Packaging: Roll-off containers (maximum volume 20 cu. yds. each)

Characterization Strategy

Description of Strategy:

One representative sample will be taken from each roll-off container. The soil will be analyzed for TCLP metals, isotopic uranium, isotopic plutonium, tritium, by a gamma scan, and for SVOCs, VOCs, and HE. If found, visible pieces of lead and uranium will be segregated and disposed of as hazardous, radioactive, or mixed waste, respectively. Field screening with hand-held instruments will be used to monitor for alpha, beta and gamma radiation, XRF analyses will be used to monitor RCRA metals and HE will be detected by a field spot test. before the soil is removed and placed into the appropriate container holding RCRA, mixed or low-level radioactive waste.
Waste Sampling*: (If sampling will be used, indicate how many grab or composite samples will be collected per container or volume of waste and whether the waste is considered homogeneous or heterogeneous.)

One composite sample will be collected from each roll-off container. One composite sample is considered to be representative because the waste is fairly homogenous based on field observation. The composite sample will consist of at least five subsamples. Each composite sample will be analyzed for the constituents listed above. VOCs will be analyzed in a separate grab sample.

* Grab sampling is appropriate for wastes that are fairly homogeneous, and will reduce VOA volatilization.
* Composite sampling is appropriate for wastes that are heterogeneous, such as soil, sediment, and debris.

Analytical Strategy

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Volatile Organic Constituents	SW 846 8260	Unk	X		
Semivolatile Constituents	SW 846 8270	Unk	X		
Organic Pesticides		No		X	
Organic Herbicides		No		X	

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: Soil		

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Pesticides and PCBs		No		X	
PCBs		No		X	
Total Metals		Yes			X
Total Cyanide		No		X	
Other Inorganic Constit (specify)		No		X	
High Explosive Constit	SW 846 8330	Unk	X		
Asbestos		No		X	
TPH		No		X	
TCLP Metals	SW 846 1311, 6010	Yes	X		
TCLP Organics		No		X	
TCLP Pest. & Herb.		No		X	
Gross Alpha	Field	Yes	X		
Gross Beta	screen	Yes	X		
Gross Gamma	"	Yes	X		
Tritium[1]	HASL 300	Unk	X		
Gamma Spectroscopy	HASL 300	Yes	X		
Isotopic Plutonium	HASL 300	Unk	X		
Total Plutonium		Unk			X
Isotopic Uranium	HASL 300	Yes	X		
Total Uranium		Yes			X
Strontium-90		No		X	
Americium-241		No		X	

[1] If tritium is not expected, attach a statement signed by the FPL stating that, based on a review of the available information and professional judgment, it is not necessary to sample for tritium at this site.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: Soil		

Preliminary RCRA Determination

Based on available information, indicate the waste and whether it could potentially be any of the wastes as defined in 40 CFR 261. List the F-, D-, K-, P-, or U- category and number.

In Phase I sampling, the metal above its TC screening levels was lead. Uranium was above its LANL background level. The potential for mixed waste exists; however, the highest lead concentration (180 mg/kg) may still pass the TCLP test, in which case the soil will be only be low-level radioactive waste. The segregation of soils containing high metals from those containing uranium will be done using field screening and mobile laboratory analyses. Uncontaminated soil as measured by these tests will be left in place. A final RCRA determination will be made after the soil sample results are evaluated for each segregated waste stream

Preliminary RCRA Status

__X__ Non-RCRA: (No 90-Day Storage Requirement)
Describe how waste will be stored/handled:
Wastes will be stored onsite in roll-off containers until all analyses are completed.

__X__ RCRA: (90-Day Storage Requirement)
Waste will be stored/handled in accordance with 20 NMAC Generator Requirements
Low-level radioactive wastes will be stored in different containers in an area labeled for the storage of radioactive wastes.

Preliminary Determination for Radioactivity

Based on available information, indicate the amount and type of radiation contamination expected in the waste.

The level of uranium (up to 272 mg/kg) indicates that the soil is low-level radioactive.

Preliminary Radioactivity Status

__X__ Material is not radioactive
Describe how waste will be stored/handled
Wastes will be stored onsite in roll-off containers until all analyses are completed.

__X__ Material is radioactive
Describe the controlled area, labeling, and protection against inadvertent contamination
Wastes will be stored as described above in different containers after segregation based on field tests.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: PPE and waste handling Equipment		

Waste Description Description of Waste Type, Potential Contaminants, Volume Estimate, and Waste Packaging: Waste Type Description: PPE & waste handling equipment
Potential Regulatory Status: Visibly contaminated items will be considered low-level radioactive waste (based on the radiological field screening results of the soil removed). Visibly uncontaminated items will be considered non-hazardous or low-level radioactive waste based on the field screening results.
Volume Estimate: The volume generated will be less than the equivalent of seven 55-gal. drums.
Waste Packaging: The PPE and waste handling will be placed in sealed plastic bags labeled with the PRS number, and then placed inside the 55-gal drums.

Characterization Strategy

Description of Strategy:

If possible, the PPE/sampling equipment will be decontaminated prior to disposal. After decontamination the PPE/sampling equipment will be field screened for gross alpha, gross beta and gross gamma radiation in accordance with LANL-ER-SOP-10.07, "Field Monitoring for Surface and Volume Radioactivity Levels." Gross alpha radiation will be screened using an alpha probe, gross beta radiation will be screened using a beta/gamma probe, and gross gamma radiation will be screened using a Ludlum Model 2221 Scaler/Ratemeter with a Ludlum Model 44-10 2" x 2" Gamma Scintillator (SPA-3), which is equivalent to micro-R. The waste will be inspected to determine if there is any visible contamination. If it is not visibly contaminated and does not have readings above background radioactivity, it will be placed in plastic bags, segregated by PRS, and disposed of as non-hazardous waste.
If the PPE/sampling equipment is not decontaminated or if decontamination is not effective, the contaminated piece(s) will be placed in separate plastic bags, segregated by PRS. Each plastic bag will be labeled with the PRS number. The RCRA and radioactivity status of the contaminated items will be based on the analytical results of soil samples associated with the area of the PRS where this PPE/waste handling equipment was used (See Analyte Suite section of this form).
Waste Sampling*: (If sampling will be used, indicate how many grab or composite samples will be collected per container or volume of waste and whether the waste is considered homogeneous or heterogeneous.)
The PPE/waste handling equipment will not be directly sampled, but will be characterized as described above. * Grab sampling is appropriate for wastes that are fairly homogeneous, such as liquid wastes.
* Composite sampling is appropriate for wastes that are heterogeneous, such as soil, sediment, and debris.

Analytical Strategy

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Volatile Organic Constituents		No			X
Semivolatile Constituents		Unk			X
Organic Pesticides		No		X	
Organic Herbicides		No		X	
Pesticides and PCBs		No		X	
PCBs		No		X	

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-02(b)	Vessel Washing Area
Specific Waste Type: PPE and Waste Handling Equipment		

Analytical Strategy (Continued)

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Total Metals		Unk			X
Total Cyanide		No		X	
Other Inorganic Constit. (specify)		No		X	
High Explosive Con.		Unk			X
Asbestos		No		X	
TPH		No		X	
TCLP Metals		Unk			X
TCLP Organics		No		X	
TCLP Pest. & Herb.		No		X	
Gross Alpha	Field	Unk	X		
Gross Beta	Screen	Unk	X		
Gross Gamma	"	Unk	X		
Tritium[2]		No		X	
Gamma Spectro.		Unk			X
Isotopic Plutonium		Unk			X
Total Plutonium		Unk		X	
Isotopic Uranium		Unk			X
Total Uranium		Unk		X	
Strontium-90		No		X	
Americium-241		No		X	

[2] If tritium is not expected, attach a statement signed by the FPL stating that, based on a review of the available information and professional judgment, it is not necessary to sample for tritium at this site.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: PPE and Waste Handling Equipment		

Preliminary RCRA Determination

Based on available information, indicate the waste and whether it could potentially be any of the wastes as defined in 40 CFR 261. List the F-, D-, K-, P-, or U- category and number.

During Phase I sampling, lead and uranium were detected at levels that would make the soil mixed waste. However, the amount of these constituents likely to be present on visibly contaminated PPE and waste handling equipment is not expected to make these items mixed waste. Visibly uncontaminated PPE and waste handling equipment that does not have above background radiation levels is considered non-hazardous and non-radioactive. A final RCRA determination for the visibly contaminated PPE/waste handling equipment will be based on an evaluation of the soil sample results.

Preliminary RCRA Status

__X__ Non-RCRA: (No 90-Day Storage Requirement)

Describe how waste will be stored/handled:

Wastes will be stored onsite in sealed and labeled plastic bags placed in 55-gal. drums.

__X__ RCRA: (90-Day Storage Requirement)

Waste will be stored/handled in accordance with 20 NMAC Generator Requirements

Wastes will be stored in sealed and labeled plastic bags and placed inside 55-gal. drums containing hazardous wastes.

Preliminary Determination for Radioactivity

Based on available information, indicate the amount and type of radiation contamination expected in the waste.

PPE and waste handling equipment with above background radiation is considered low level radioactive waste.

Preliminary Radioactivity Status

__X__ Material is not radioactive

Describe how waste will be stored/handled

Wastes not giving elevated readings will be stored onsite until and evaluation is made for RCRA.

__X__ Material is radioactive

Describe the controlled area, labeling, and protection against inadvertent contamination

Wastes with above background readings will be stored in sealed plastic bags labeled as radioactive and placed in 55-gal. drums with other radioactive wastes.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area

Specific Waste Type: Decontamination liquids

Waste Description

Description of Waste Type, Potential Contaminants, Volume Estimate, and Waste Packaging:

Waste Type Description: Decontamination liquids consist of Liquinox® detergent, tap water and distilled water.
Potential Regulatory Status: RCRA, mixed waste and or low-level radioactive liquid waste.
Volume Estimate: A total volume of less than ten 55-gal drums.
Waste Packaging: The liquid will be placed inside sealed 55-gallon drums.

Characterization Strategy

Description of Strategy:

The decontamination liquids will be characterized for RCRA based on the results of an analysis of a grab liquid sample. The decontamination liquids from this PRS will be segregated according to the location where they are generated, placed in separate drums and labeled with the PRS number. Further analyses may be required to meet the waste acceptance criteria of a TSD after the hazard and radioactive determination is made for the decon. liquids. Disposal sites could be the TA-46 SWSC sewer plant, if the liquids are non-hazardous and non-radioactive. If they are either hazardous or radioactive disposal may be at the TA-50 TSD or at another approved TSD.

Waste Sampling*: (If sampling will be used, indicate how many grab or composite samples will be collected per container or volume of waste and whether the waste is considered homogeneous or heterogeneous.)

One grab sample of the decontamination liquids for every other drum will be analyzed for TAL metals, HE, SVOCs, by a gamma scan and for isotopic uranium. A grab sample was selected because the waste is expected to be homogeneous.

* Grab sampling is appropriate for wastes that are fairly homogeneous, such as liquid wastes.
* Composite sampling is appropriate for wastes that are heterogeneous, such as soil, sediment, and debris.

Analytical Strategy

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Volatile Organic Constituents		No		X	
Semivolatile Constituents	SW 846 8270	Unk		X	
Organic Pesticides		No		X	
Organic Herbicides		No		X	
Pesticides and PCBs		No		X	
PCBs		No		X	

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: Decontamination liquids		

Analytical Strategy (Continued)

Analyte Category	Analytical Method	May be Present (yes, no, unknown)	Direct Sampling of Containerized Waste	Acceptable Knowledge Existing Information	Acceptable Knowledge Data from Proposed Site Characterization
Total Metals	SW 846 6010	Unk	X		
Total Cyanide		No		X	
Other Inorganic Constit (specify)		No		X	
High Explosive Con.	SW 846 8330	Unk	X		
Asbestos		No		X	
TPH		No		X	
TCLP Metals		Unk			X
TCLP Organics		No		X	
TCLP Pest. & Herb.		No		X	
Gross Alpha	Field	Unk			X
Gross Beta	Screen	Unk			X
Gross Gamma	"	Unk			X
Tritium[3]		No		X	
Gamma Spectro.	HASL300	Unk	X		
Isotopic Plutonium		Unk			X
Total Plutonium		Unk		X	
Isotopic Uranium	HASL300	Unk	X		
Total Uranium		Unk		X	
Strontium-90		No		X	
Americium-241		No		X	

[3] If tritium is not expected, attach a statement signed by the FPL stating that, based on a review of the available information and professional judgment, it is not necessary to sample for tritium at this site.

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Specific Waste Type: Decontamination liquids		

Preliminary RCRA Determination

Based on available information, indicate the waste and whether it could potentially be any of the wastes as defined in 40 CFR 261. List the F-, D-, K-, P-, or U- category and number.

During Phase I sampling, only lead (maximum 180 mg/kg) and uranium (maximum 272 mg/kg) were detected at higher levels. The decon. liquids should contain considerably diluted concentrations of these hazardous or radioactive constituents. The decon. liquids are expected to be non-hazardous and non-radioactive, however, they will be disposed at an approved TSD (TA-50 or SWSC sewer plant). A final RCRA determination will be made after the liquid sample results are evaluated.

Preliminary RCRA Status

__X__ Non-RCRA: (No 90-Day Storage Requirement)
Describe how waste will be stored/handled:
The wastes will be stored onsite in sealed drums until all liquid analyses are evaluated.

_____ RCRA: (90-Day Storage Requirement)
Waste will be stored/handled in accordance with 20 NMAC Generator Requirements

Preliminary Determination for Radioactivity

Based on available information, indicate the amount and type of radiation contamination expected in the waste.

The soils at this PRS contain uranium, however, the level found in the decon. liquids is not expected to make these liquids radioactive.

Preliminary Radioactivity Status

__X__ Material is not radioactive
Describe how waste will be stored/handled
Liquids will be stored onsite in sealed drums until all analyses are evaluated.

_____ Material is radioactive
Describe the controlled area, labeling, and protection against inadvertent contamination

WASTE CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1086/FU2	15-012(b)	Vessel Washing Area
Waste Types or Wastestreams: Soil, PPE and waste handling equipment, and decontamination liquids		

Signatures:

Field Team Leader _____ 7/15/97

Field Team Waste Management Coordinator _____ 8-5-97

Waste Management Representative _____ 7/30/97

ANNEX 7.8

VCA CHECKLIST AND FIELD WORK AUTHORIZATION FORM

Voluntary Corrective Action (VCA)
Checklist and Fieldwork Authorization Form

PRS 15-012(b) HSWA or AOC

X_____ COPC(s) defined.

X_____ Nature and extent defined or field screening method available to guide where not defined.

X_____ Remedy is obvious.

X_____ Time for removal is less than 6 months.

X_____ Remedy is final.

X_____ Land use assumptions straightforward.

X_____ Treatment, Storage, Disposal Facilities are available for waste type and volume.

X_____ Cleanup cost is reasonable for the planned action, and meets accelerated decision logic criterion for decision to proceed with VCA.

Explain criteria not checked above._____

_____

_____

Through reviewing the above criteria associated with this site, I believe that a VCA is the appropriate Accelerated Cleanup approach.

FPL _____ Date _____

FPC _____ Date 3/30/98

The undersigned have reviewed the final plan and believe that it fully satisfies the appropriate Accelerated Cleanup approach.

FPL _____ Date _____

FPC _____ Date 3/30/98

Through reviewing the VCA Plan, for site **15-012(b)**, and believing that the above criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager_____ Date_____

ANNEX 7.9

COST ESTIMATE

Table 7.9-1 is a cost estimate for PRS 15-012(b).

TABLE 7.9-1

COST ESTIMATE FOR PRS 15-012(b)

Plan Development	$ 1,500
Mobilization[a]	$ 10,000
Cleanup	$ 40,000
Verification Sampling[b]	$ 50,000
Waste Disposal[c]	$100,000
Field Screening	$ 10,000
Demobilization	$ 3,000
Reporting	$ 1,500
Total Cost	**$216,000**

a Includes purchase of waste containers.
b Includes waste characterization sampling.
c Worst-case estimate 125 cubic yards of mixed waste.

8.0 REFERENCES

DOE (US Department of Energy), October 1987. "Phase I: Installation Assessment, Los Alamos National Laboratory", Volumes 1 and 2, (draft), Comprehensive Environmental Assessment and Response Program, Albuquerque Operations Office, Albuquerque, New Mexico. (DOE 1987, 0264)

Environmental Restoration Project, October 30, 1995. "RFI Report for Field Unit 2 (OU 1086), Potential Release Sites 15-004(b,c), 15-004(a,d), 15-004(f), 15-007(b), 15-008(b), 15-012(b), 15-009(j)", Los Alamos National Laboratory Report LA-UR-95-3738, ER ID No. 50294, Los Alamos, New Mexico. (Environmental Restoration Project 1995, 1325)

EPA (US Environmental Protection Agency), March 8, 1990. "National Oil and Hazardous Substances Pollution Contingency Plan", Final Rule, 40 CFR Part 300, Federal Register, Vol. 55, No. 46, p. 8666. (EPA 1990, 0559)

LANL (Los Alamos National Laboratory), May 1994. "RFI Work Plan for Operable Unit 1085", Los Alamos National Laboratory Report LA-UR-94-1033, Los Alamos, New Mexico. (LANL 1994, 1156) Verified.

LANL (Los Alamos National Laboratory), July 1993. "RFI Work Plan for Operable Unit 1086", Los Alamos National Laboratory Report LA-UR-92-3968, Los Alamos, New Mexico. (LANL 1993, 1087)

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report", Volumes I through IV, Los Alamos National Laboratory Report LA-UR-90-3400, prepared by International Technology Corporation under Contract 9-XS8-0062R-1, Los Alamos, New Mexico. (LANL 1990, 0145)

Perona, R., April 12, 1996. "Derivation and Use of Radionuclide Soil Cleanup Guidelines", Los Alamos National Laboratory Report LA-UR-96-1985, Los Alamos, New Mexico. (Perona 1996, 1330)

Schlapper, G. August 14, 1991. "Survey of Firing Points Operated by M Division", Los Alamos National Laboratory Memorandum HS-1-91:OHP-22, ER ID No. 15005, Los Alamos, New Mexico. (Schlapper 1991, ER ID No. 15005)

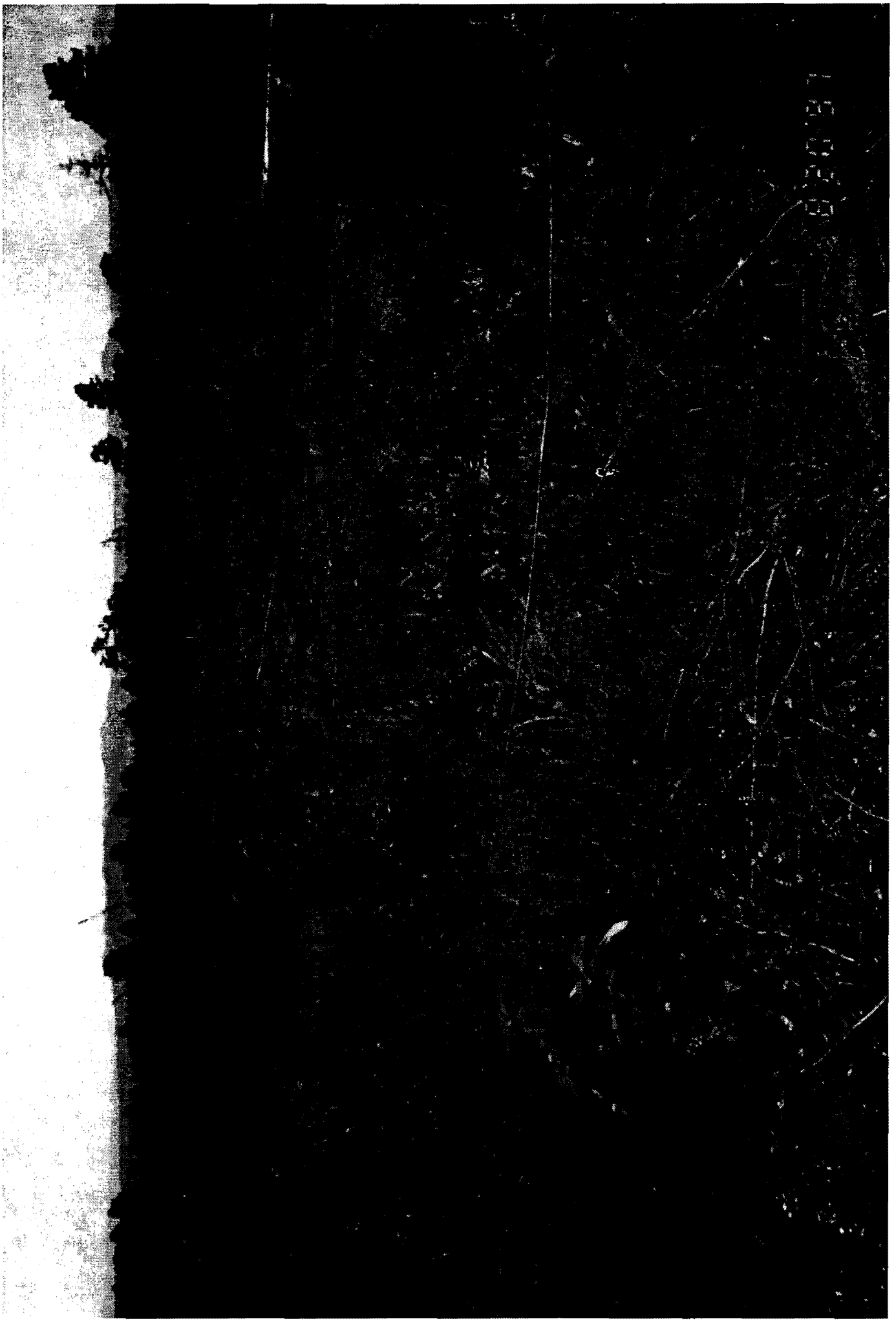
Veverka, P., July 14, 1988. "Contamination Survey of the Dual Axis Radiographic Hydrotest Facility Construction Site at TA-15", Los Alamos National Laboratory Memorandum HSE-1-OHP-235, ER ID No. 5434, Los Alamos, New Mexico. (Veverka 1988, ER ID No. 5434)

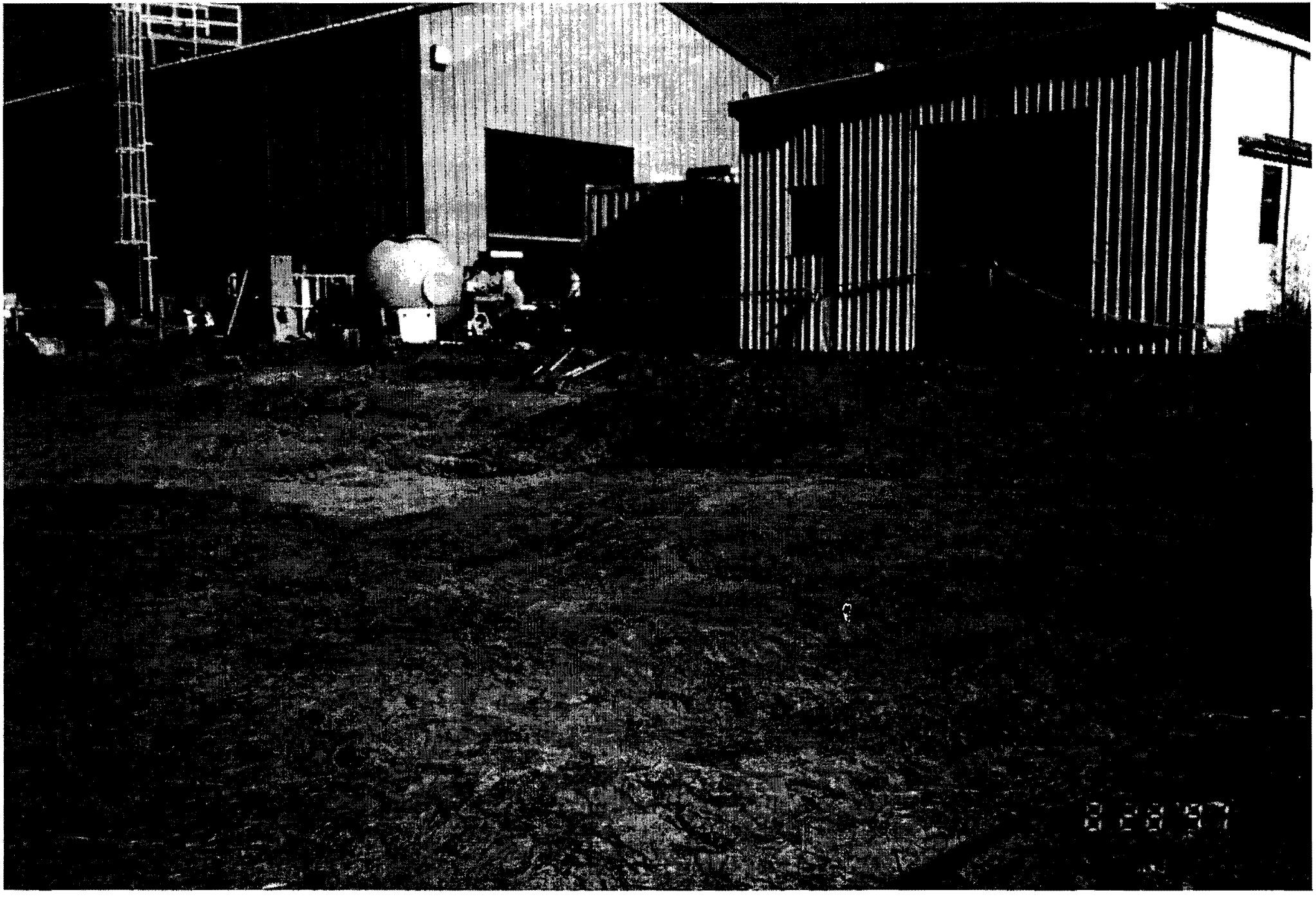
APPENDIX J. PHOTOGRAPHS

APPENDIX J PHOTOGRAPHS

PHOTO LOG

Photograph 1	PRS 15-012(b) prior to VCA activities
Photograph 2	PRS 15-012(b) after site cleaning
Photograph 3	Surface DU from grid number 26
Photograph 4	Excavation of contaminated soils
Photograph 5	RCT field screening for radionuclides
Photograph 6	PRS 15-012(b) after cleanup activities, prior to receiving base course




8 28 97

APPENDIX K. MEMO FROM ROGER LONDON