Addendum RFI Report for Potential Release Sites

C-15-001, Soil Pile
C-15-007, Stained Soil

Field Unit 2

Environmental Restoration Project

September 1997

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

LA-UR-97-3881

Reports
RFI RPT TA 0: PRS 0-003, 0-012
NFA RPT TAs 0, 73: PRS 0-034(a,b), 73-001(b), 73-004(c,d)
RFI RPT TA 1: PRS 1-001(s,u), 1-007(l)
RFI RPT TA 3: PRS 3-004(c,d),3-007, 3-014(o), 3-049(b), 3-052(b), 3-056(k), C-03-014, 3-014(k,l,m)
RFI RPT TA 3, PRS 3-054(e), C-3-006, CMR
RFI RPT TA 10: 10-008
Addendum RFI RPT TA 15: PRS C-15-001, C-15-007
RFI RPT TA 19: 19-001, 19-003, C-19-001
Addendum RFI RPT TA 36: PRS 36-005
RFI RPT TA 16: 16-024(c,d,f,g,k,m,o,p-s) 16-025(b2,d,g,h,j,k,m,n,o,y), 16-034(c,d,e,f,l,m), C-16-005, C-16-017
RFI RPT TAs 11, 13, 16: PRSs 11-012(a,b), 13-003(a), 16-006(c,d), 16-010(a), 16-021(a), 16-026(c,d,v), 16-028(a), 16-030(g)
RFI RPT TA 33: PRSs 33-002(b,c), 33-003(b), 33-004(k), 33-006(a), 33-008(a,b), 33-011(d), 33-013, 33-017

CERTIFICATION

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Document Title: Addendum RFI Report for PRSs C-15-001, C-15-007 in TA-15

Name: ______________________ Date: 9-30-97

Jorg Jansen, Program Manager
Environmental Restoration Project
Los Alamos National Laboratory

or

Tom Baca, Program Director
Environmental Management
Los Alamos National Laboratory

Name: ______________________ Date: 9/30/97

Joseph Vozella,
Acting Assistant Area Manager of
Environmental Projects
DOE-Los Alamos Area Office

or

Theodore J. Taylor, Program Manager
Environmental Restoration Program
DOE-Los Alamos Area Office

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Document Title: Addendum RFI Report for PRS 36-005 in TA-36

Name: ______________________ Date: 9-30-97

Jorg Jansen, Program Manager
Environmental Restoration Project
Los Alamos National Laboratory

or

Tom Baca, Program Director
Environmental Management
Los Alamos National Laboratory

Name: ______________________ Date: 9/30/97

Joseph Vozella,
Acting Assistant Area Manager of
Environmental Projects
DOE-Los Alamos Area Office

or

Theodore J. Taylor, Program Manager
Environmental Restoration Program
DOE-Los Alamos Area Office

Executive Summary

The former Operable Unit (OU) 1086, located in the northwestern quadrant of the Los Alamos National Laboratory in Los Alamos, New Mexico, consists of one active technical area, TA-15. TA-15, also known as R-Site, occupies a roughly rectangular area about 1.3 mi wide by 1.5 mi long. Established in 1944, the site has been used for explosive development and testing, and is currently used for ongoing explosion research.

The overall objectives of the Phase I investigation were to determine:

- whether any releases of COPCs to the environment occurred at these PRSs, and, if so, the nature of the contamination;
- the potential risks posed by any contamination to workers and the public; and
- the need for corrective action, if any.

Field activities for PRS C-15-001 were conducted on July 13, 1995 and August 18, 1997. Samples were collected from the surface soil to determine whether contamination was present. The initial results indicated that uranium was the only chemical of potential concern (COPC) detected at this site. The additional sampling in 1997 identified the uranium as natural, based on the isotopic ratio. The concentrations of natural uranium were below the industrial preliminary remediation goal (PRG) derived using RESRAD. As a result, this site is recommended for no further action (NFA) based on human health (Table ES-1).

Field activities for PRS C-15-007 were conducted in August and September, 1997. Samples were collected from the surface and subsurface soils to determine if a release had occurred. The analytical results and risk-based screening assessment did not identify any COPCs as a result of site activities. Therefore, the PRS is recommended for NFA based on human health (Table ES-1).

TABLE ES-1
SUMMARY OF PROPOSED ACTIONS

PRS	HSWA	NFA Criteria*	Further Action	Rationale	Section
C-15-001	-	5	NFA for human health	Site has been characterized and no COPCs are present	5.1
C-15-007	-	5	NFA for human health	Site has been characterized and no COPCs are present	5.2

* See NMED et al. 1995, 1328

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1.0 INTRODUCTION

1.1 GENERAL SITE HISTORY

Technical Area (TA)-15, part of Field Unit (FU) 2, was formerly designated as Operable Unit (OU) 1086 at Los Alamos National Laboratory (the Laboratory) in Los Alamos, New Mexico. TA-15 is located in the northwestern quadrant of the Laboratory and south of the Los Alamos townsite. It occupies a roughly rectangular area, about 1.3 mi wide by 1.5 mi long (Figure 1.1-1).

The northern boundary with TAs-46, 66, and 67 is formed by the stream channels in Pajarito and Three-Mile Canyons. The area is bounded on the west by TA-14 and along TA-16 and TA-37 by the stream channel of Cañon de Valle. TA-49, located on the southern margin of Water Canyon, forms the southern boundary, and TA-36 forms the eastern boundary.

The relatively flat surface of Three-Mile Mesa on Pajarito Mesa encompasses most of TA-15, but steep-walled Water Canyon traverses the southern site boundary. 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.

TA-15, also known as R-Site, has been used for explosives development and testing since 1944, including tests involving radioactive materials. Currently, TA-15 is an active technical area of the Laboratory used for ongoing explosion research.

Potential release sites (PRSs) C-15-001 and C-15-007 are located in the southern and western sections of TA-15. PRS C-15-001 is associated with PRS 15-004(g), Firing Site G, and PRS C-15-007 is located in an area known as the Hollow.

Potential nonradiological chemical of concern at TA-15 included spent high explosives (HE) and their known residual products, inorganics (beryllium, lead, mercury), and other organics (e.g., solvents). Radionuclides possibly present because of the site activities include uranium (natural and depleted). The RCRA Facility Investigation (RFI) Work Plan (LANL 1993, 1087) identified uranium and metals as the potential chemicals of concern at PRS C-15-001 as a result of activities at Firing Site G. The Hollow consists of a series of buildings used for assembly, as laboratories, and as shops, which are currently used by DX-6, the Laboratory's Dynamic Explosives Group. Organics, inorganics, and uranium were considered likely contaminants as a result of site activities in the Hollow.

1.2 RFI OVERVIEW

The overall objectives of the Phase I field investigations at TA-15, as outlined in the RFI Work Plan (LANL 1993, 1087), were to determine:

- whether any releases occurred at the PRSs, and, if so, the nature of any contamination;
- the potential risks posed by any contamination to workers and the public; and
- the need for corrective action or further action.

These investigations also satisfied the site-specific regulatory requirements contained in the Laboratory's RCRA operating permit, specifically in Module VIII, which contains the Hazardous and Solid Waste Amendments (HSWA) corrective action requirements (LANL 1995, 1275). The Laboratory sites that are presented in this addendum to the RFI report include two PRSs. The PRSs are sites that contain potentially hazardous substances, such as radionuclides, not regulated under RCRA.

The RFI Work Plan, which governed the investigations, was submitted to the U. S. Environmental Protection Agency (EPA) in July 1993 (LANL 1993, 1087), was amended to correct deficiencies noted by

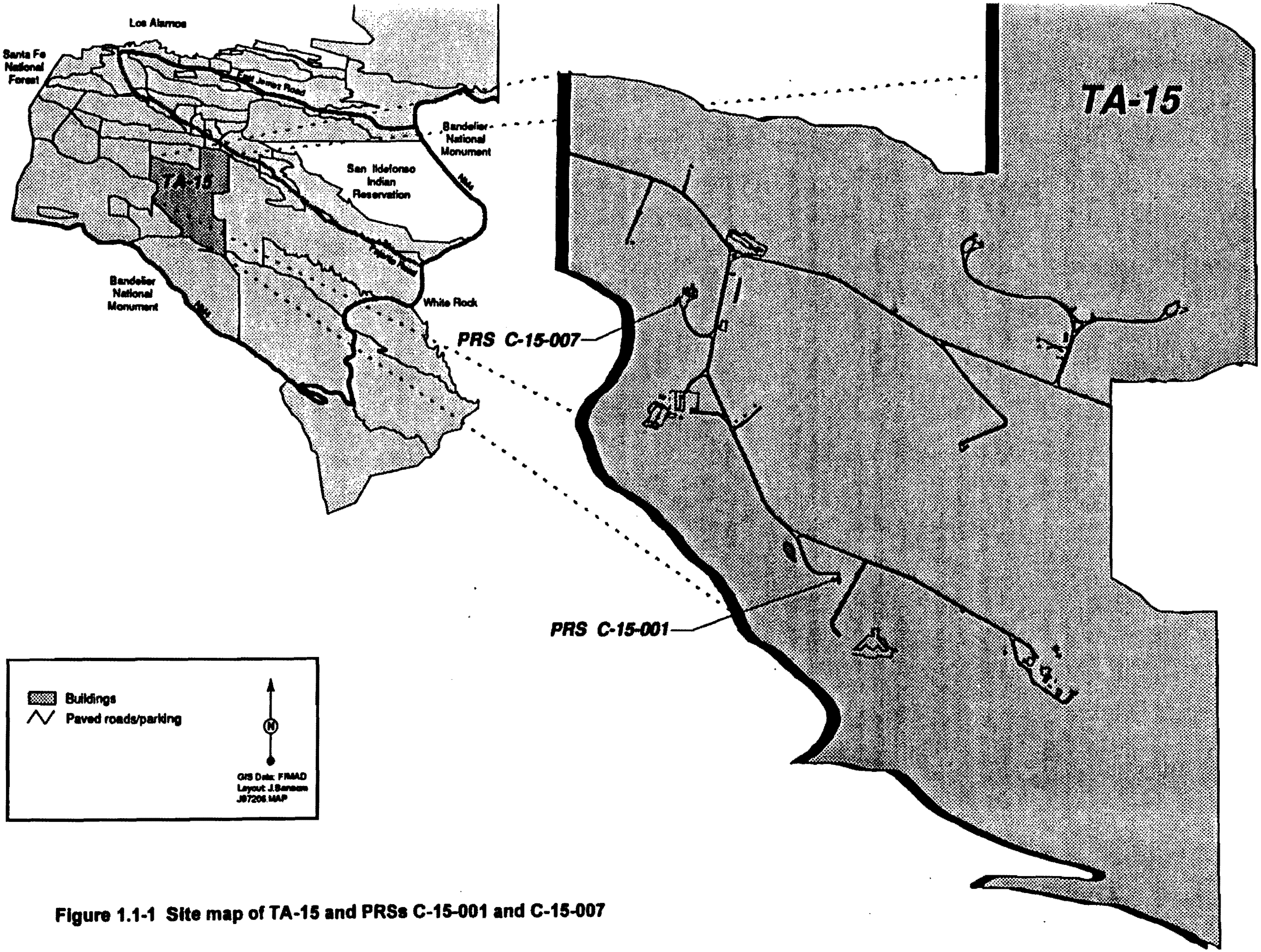

Figure 1.1-1 Site map of TA-15 and PRSs C-15-001 and C-15-007

the EPA; and was then re-submitted to the EPA on August 24, 1994 and November 29, 1994. Final approval was given on January 9, 1995.

The conceptual model developed for the RFI Work Plan identified sources of contaminants, release mechanisms, and exposure routes. The elements for this model are presented in Table 4-1 of the RFI Work Plan (LANL 1993, 1087). This information was used to develop a conceptual model for each PRS and to make decisions regarding the sampling and analyses required to adequately characterize a site. The majority of sites discussed in the work plan had dispersion, runoff, and either infiltration or radiological decay as potential release mechanisms; direct contact, inhalation, and ingestion were noted as potential exposure routes.

PRS C-15-001 was recommended for a continuation of Phase I sampling in the RFI report of May 22, 1996 (ER Project 1996, ER ID No. 54977). The purpose of the sampling was to determine the isotopic composition of the detected uranium. PRS C-15-007 was not sampled and could not be included in the 1996 RFI report because a temporary building was located on top of the PRS. The building was moved and Phase I sampling was conducted at this PRS.

This addendum to the RFI Report for Potential Release Sites at TA-15 (Environmental Restoration Project 1996, ER ID No. 54977) contains all of the sampling data from the Phase I activities at PRSs C-15-001 and C-15-007. Both sites are proposed for NFA based on Criterion 5 of the "Environmental Restoration Document of Understanding" (NMED et al. 1995, 1328). Criterion 5 states that the PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants of concern are either not present or are present in concentrations that would pose an acceptable level of risk under future land use.

1.3 FIELD ACTIVITIES

Field activities for this Phase I field investigation, as outlined in the RFI Work Plan, consisted of field surveys, screening, and sampling. The sampling activities associated with PRS C-15-001, reported here, are a continuation of activities that began on 7/13/95. The remainder of the field activities for the two PRSs occurred in August and September 1997. The sampling activities associated with PRS C-15-007 are the initial Phase I sampling activities.

Land surveys were performed at all the sites to set grid points and sample locations using established survey monuments and coordinates published in the LANL Survey Monument Network Manual (LANL 1994, 1395). A Sokkia Set IIIB Total Station with SDR Data Collector was used to conduct the surveys.

Field screening was performed at each sample location and on the collected sample material to determine potential hazards and to protect the health and safety of on-site workers. Portable radiation detection instruments included a Ludlum Model 2221 scaler/ratemeter with a 44-10 2x2 scintillator and an Eberline ESP-1 survey meter with an HP260 detector. A photoionization detector (PID) was used to measure for organic vapors at PRS C-15-007.

A high explosives (HE) spot test kit was used to screen every sample location prior to the start of any intrusive activities. The kit, designed by the Laboratory High Explosives—Science and Technology Group, tests for common HE such as Composition B, cyclonite (RDX), octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), nitroglycerine, nitrocellulose, trinitrotoluene (TNT), and tetryl (methyl-2,4,6-trinitrophyenylnitramine) (TETRYL). These HE analytes can be detected to a concentration of 100 ppm. The test was not used to attempt to quantify the content of HE in any particular sample; its purpose was to indicate the presence of HE that could create special packaging and shipping requirements.

Sample matrices collected were soil, both surface and subsurface. All applicable Los Alamos National Laboratory Environmental Restoration (ER) Standard Operating Procedures (LANL-ER-SOP) were followed.

2.0 ENVIRONMENTAL SETTING

The environmental, geologic, and hydrologic setting of the Laboratory are described in Sections 2.4 and 2.5 of the Installation Work Plan (IWP) for Environmental Restoration (LANL 1995, 1164). A detailed discussion of the environmental setting for TA-15, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area, is presented in the RFI Work Plan for OU 1086 (LANL 1993, 1087). A summary is presented in the following sections.

2.1 CLIMATE

Los Alamos County, including the Laboratory, has a semiarid, temperate mountain climate. Summers are generally sunny, with moderate, warm days and cool nights. The high altitude, light winds, clear skies, and dry atmosphere allow summer temperatures to range from 45° F to 95°F. During the winter, temperatures typically range from 15° to 50°F. Average annual precipitation is 16 in., but there is a large east-to-west gradient in precipitation across the area. July and August storms account for 40% of the precipitation. Streamflow in the canyons results from summer storms and spring snowmelt (Environmental Protection Group, 1994, 1179).

2.2 GEOLOGY

2.2.1 Geologic Setting

TA-15 occupies a roughly rectangular area about 1.3 mi wide by 1.5 mi long. 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. The maximum elevation of TA-15 is 7329 ft on the mesa west of building TA-15-40, and the minimum elevation is 6719 ft 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.

Both the mesa tops and the canyon bottoms of TA-15 are 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 area. The generalized stratigraphy of OU 1086 is shown in Figure 2.2.1-1.

A detailed discussion of the geology of the entire Los Alamos area can be found in Section 2.5.1 of the IWP (LANL 1995, 1164).

2.2.2 Soils

TA-15 contains at least 8 different kinds of soils, mainly surface deposits of colluvium and alluvium, each of which is described and mapped by Nyhan (Nyhan et al. 1978, 0161). Coverage is highly variable over TA-15; the progression from north to south is as follows:

The extreme northern portion of TA-15 starts at the bottom of Pajarito Canyon and consists primarily of rock outcrops. 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, which is generally central to the Mesa throughout its length.

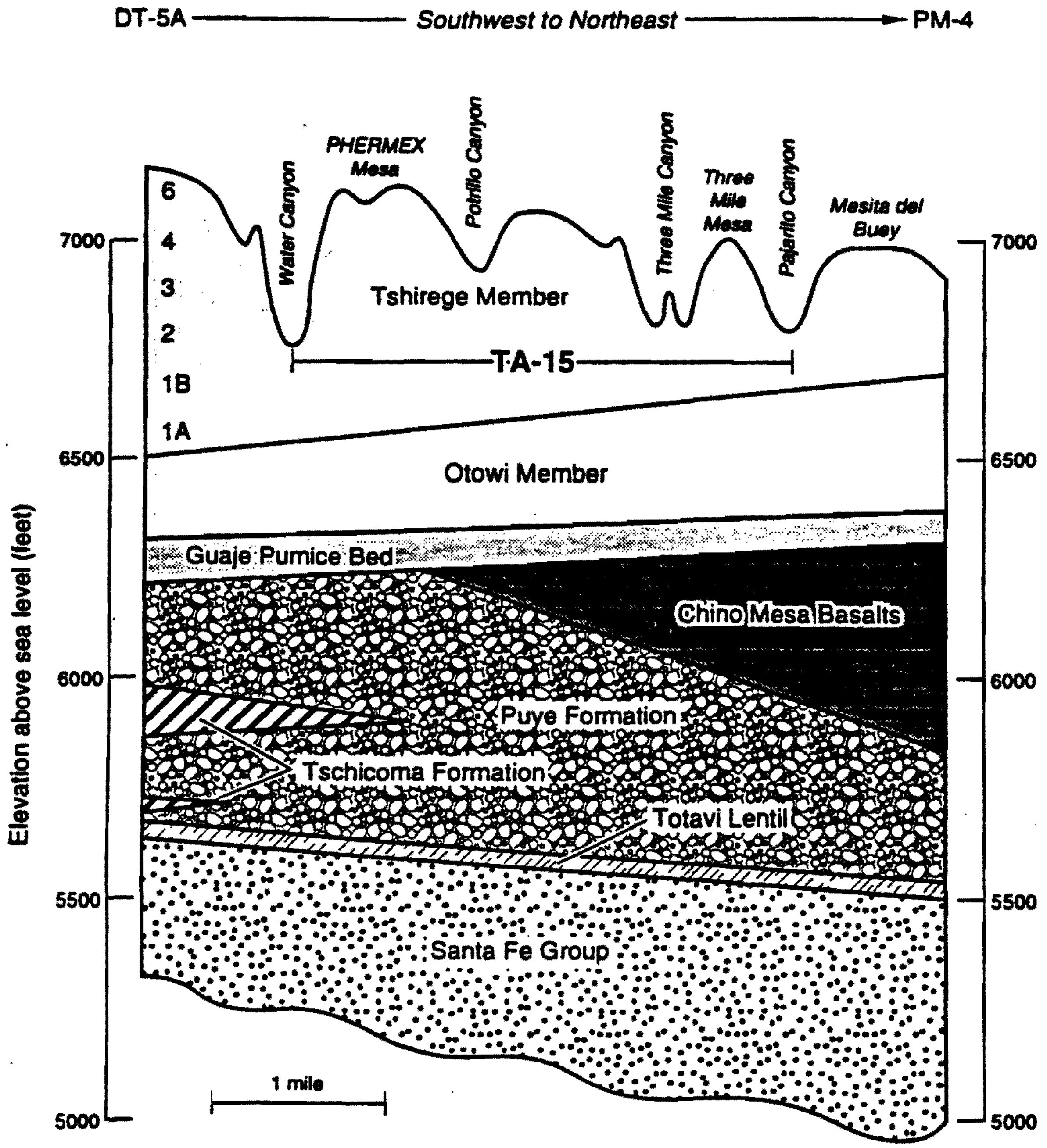

Figure 2.2.1-1 Generalized stratigraphy of OU 1086

The eastern portion of Mesita del Potrillo, which joins Three-Mile Mesa, is covered with Hackroy rock outcrop complex at the extreme eastern edge, grading into Carjo loam. This 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 PHERMEX Mesa has the following progression 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 is Tocal loam and, in the bottom of the canyon, Totavi sandy loam.

The center of PHERMEX Mesa is covered with Nyjack loam. This grades to the north to Seaby loam and Hackroy loam on the northeast rim of Potrillo Canyon. Seaby loam grades to the west and east of PHERMEX site, with a small pod of Nyjack loam 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.

2.2.3 Sedimentation and Erosion

Sediment deposition and erosion by surface water occurs at TA-15 in response to snowmelt and storm-water runoff events. Periods of runoff can produce erosion, sediment transport, and deposition. At the firing sites, where the natural soil surface has been disturbed through use, erosion is generally accelerated (Graf 1975, 0847; Nyhan & Lane 1986, 0159). Active erosional processes on the Pajarito Plateau are addressed in Section 2.5.1.6 of the IWP (LANL 1995, 1164). No evidence of erosion is visible at either PRS described in this addendum.

2.3 HYDROLOGY

2.3.1 Surface Water

Four separate watersheds, each with an established stream-channel drainage network, are present within TA-15 (Figure 2.3.1-1). These watersheds are Three-Mile Canyon, Potrillo Canyon, Water Canyon, and Cañon de Valle. For locations and boundaries of these watersheds, see Appendix A of the RFI Work Plan for OU 1086 (LANL 1993, 1087). All surface water transport of contaminants at TA-15 ultimately will flow into one of these four canyons. A fifth watershed, Pajarito Canyon, receives runoff from a small, undeveloped area within TA-15. Because this watershed is not expected to receive any contaminants from TA-15, it is excluded from further discussion.

Stream flow in Three-Mile and Potrillo canyons is ephemeral, occurring in response to rainfall and snowmelt events. Flow in Cañon de Valle in the vicinity of TA-15 may occur at times from permitted wastewater discharge and from snowmelt and storm-water runoff. Water Canyon receives flow from springs upstream from West Jemez Road, from permitted wastewater discharge at TAs-11, 15, and 16, and from snowmelt and storm-water runoff. In years of heavy snow pack, all these channels may transport continuous flow during the spring; intermittent flow in response to heavy rainfall occurs during the spring, summer, and fall.

Both PRS C-15-001 and PRS C-15-007 are listed as PRSs in or near watercourses. PRS C-15-001 is located on a small mounded area of soil approximately 2 ft high. The area is surrounded by asphalt pavement, with a gradual slope to Cañon de Valle. PRS C-15-007 is sloped toward Cañon de Valle. This PRS is located at the edge of the parking lot that is used by personnel working in the Hollow.

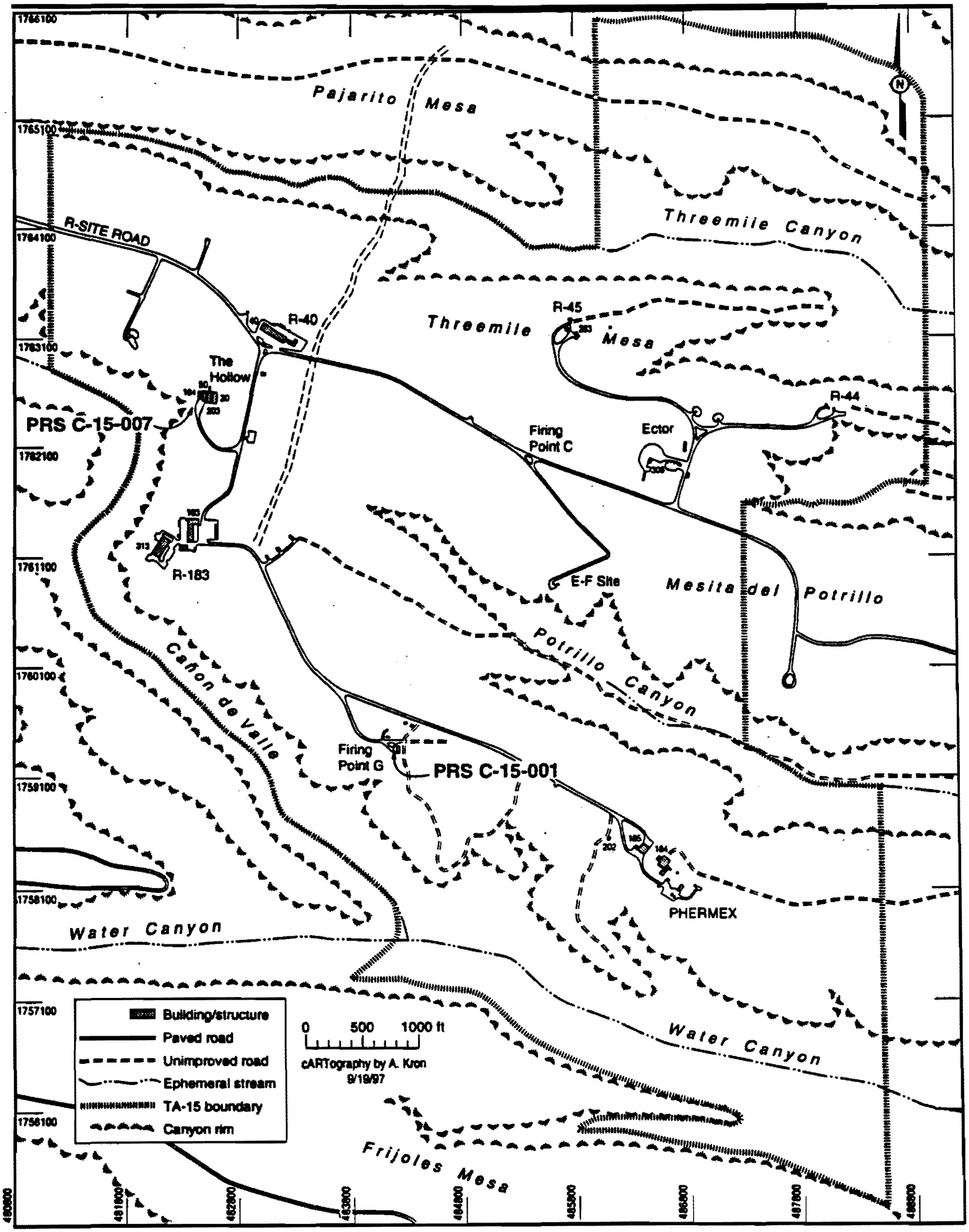

Figure 2.3.1-1 Topography of OU 1086

2.3.2 Groundwater

The depth to the main aquifer varies from 875 to 1100 ft below ground surface in the vicinity of TA-15 (Purtymun and Stoker 1988, 0205). The water in the main aquifer generally moves eastward across the plateau toward the Rio Grande, with some discharge into the Rio Grande through seeps and springs (Purtymun 1984, 0196). No evidence of perched groundwater exists in the vicinity of PRS C-15-001 or PRS C-15-007.

2.4 BIOLOGICAL SURVEY

Biological resource field surveys have been conducted at TA-15 in compliance with the Federal Endangered Species Act of 1973; the New Mexico Wildlife Conservation Act (NM Game and Fish Dept. 1978); the New Mexico Endangered Plant Species Act; Executive Order 11990, "Protection of Wetlands;" Executive Order 11988, "Floodplain Management;" 10 CFR 1022; Compliance with Floodplain/Wetlands Environmental Review Requirements (DOE 1979, 0633); and DOE Order 5400.1, General Environmental Protection Program (DOE 1988, 0075).

Biological resources were extensively surveyed in the summer of 1992. Several threatened and endangered species were identified for which TA-15 has a suitable ecology; however, none were determined to have significant potential of occurrence in the area. Within TA-15, 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. 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.

2.5 CULTURAL SURVEY

A cultural resources survey was conducted at various areas within TA-15, as required by the National Historic Preservation Act (amended). Over 80 sites of cultural interest were located. For a summary of the results, see Appendix E of the RFI Work Plan for OU 1086 (LANL 1993, 1087). None of these sites were disturbed by the RFI activities.

3.0 APPROACH TO SAMPLE ANALYSIS AND DATA ASSESSMENT

The approach to data assessment used by the ER Project is described in the policy document "Risk-Based Corrective Action Process" (Dorries 1996, 1297). The approach includes:

- sampling and analysis design;
- field investigation and collection of field and QA samples;
- chemical and radiochemical analyses of samples and reporting of analytical data;
- baseline verification and validation of analytical data;
- organization of field and analytical data into PRS-specific data set(s);
- exploratory data analysis;
- focused validation when necessary to further assess questionable data;
- comparison of validated analytical results with LANL background data;
- comparison of validated analytical results with SALs;
- evaluation of sufficiency of data set(s) to support the site decisions; and
- assessment of human health risk.

The following subsections provide overviews of the methods used to complete the steps listed above for the PRSs discussed in this addendum to the RFI report.

3.1 SAMPLE ANALYSES

Samples were collected in accordance with the sampling and analysis plan presented in the RFI Work Plan (LANL 1993, 1087) and the additional sampling mentioned in the RFI report (LANL 1996, ER ID No. 54977) for PRS C-15-001, with the addition of depth (18-24 in) samples. The samples from PRS C-15-007 were collected in accordance with the Sampling and Analysis Plan for PRS C-15-007 submitted to DOE in July 1997. All 1997 samples requiring chemical and radiochemical analyses and chain-of-custody documentation were submitted to the Sample Management Office (SMO) for shipment to an offsite laboratory. The 1995 samples from C-15-001 were shipped to the fixed analytical laboratory directly from the field by the direct ship pilot program.

3.1.1 Analytical Methods

The following analytical methods were used for the sample analyses in this RFI report: inorganic chemicals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total uranium, and isotopic uranium.

All samples were analyzed by contract analytical laboratories using methods specified in ER SMO analytical subcontracts (LANL 1995, 1278). The allowed methods are current EPA SW-846 and Contract Laboratory Program (CLP) methods or equivalent for inorganic chemicals, VOCs, SVOCs, total uranium, and isotopic uranium. Prior to analysis for inorganic chemicals, solid samples were digested according to the technologies identified in the subcontract. Analytical method selection is described in Appendix IV of the ER Project Quality Assurance Project Plan Requirements for Sampling and Analysis (QAPP) (LANL 1996, 1292). For each analyte, quantitation or detection limits are specified as contract-required estimated quantitation limits (EQLs) for organic chemicals and radionuclides and estimated detection limits (EDLs) for inorganic chemicals. These limits are included in Appendix III of the ER Project QAPP (LANL 1996, 1292) along with the target analytes for each analytical suite.

3.1.2 Data Validation

Data verification and baseline validation procedures were used to determine whether data packages received from the analytical laboratory were generated according to specifications and contain the information necessary to determine data sufficiency for decision making. For analytical data used for decisions discussed in this RFI report, baseline data validation under the ER protocol was performed as described in the QAPP (LANL 1996, 1292).

This process produced validation reports, with data qualifiers designating potential deficiencies for affected results. Each data qualifier is accompanied by a reason code that provides information about the deficiency that led to qualification of the data. The validation reports were used in the decision-making process and to direct the focused validations required to evaluate the usability of the data for this report.

Data were qualified (i.e., a marker was attached to the data results) for a variety of reasons during the baseline validation process. The baseline validation procedure used for routine analytical services provides information about the reason the qualifier was applied and its potential impact on the affected data. The purpose is not to reject data but rather to ensure that the relative quality of the data is understood so that the data may be used appropriately.

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

A	The data required for data review and evaluation are not available.
U	The analyte was not positively identified in the sample, and the associated value is the sample-specific EQL/EDL.
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 EQL/EDL.
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. NOTE: Any results qualified as RPM must be evaluated for relevance to data use.
P	Professional judgment should be applied to using the data in decision-making.
PM	Professional judgment should be applied to using the data in decision-making. A manual review of raw data is recommended to determine if the defect impacts data use for decision-making.

A focused data validation may be required as a follow-up to the baseline validation. The purpose of a focused validation is to determine the technical adequacy of measurement data when

- the data are qualified as deficient or as requiring professional judgment during the verification/baseline validation process. For example, when holding times are exceeded or interferences are present, a focused validation may be required to assist in determining data adequacy for the intended use.
- the data quality assessment process requires additional information about the
  - variability or uncertainty of the reported data or

- data quality prior to making a data use decision because of anomalies detected in a data set.

Details of quality assurance/quality control activities are presented in Chapter 4 of this RFI report. Qualifiers resulting from baseline and focused validation are shown in the analytical results tables included in Chapter 5 of this report. Summaries of data quality evaluations and focused validation of analytical data relevant to this report are given in Appendix B. The RPM, P, and PM qualifiers do not appear in Chapter 5 data tables because they are replaced during focused validation according to the data use.

3.2 PROCESS FOR THE IDENTIFICATION OF COPCS

3.2.1 Inorganic Chemicals

Detected inorganic chemicals are compared with natural background distributions to determine if they should be retained as chemicals of potential concern (COPCs) or eliminated from further consideration. The inorganic background data used in this RFI report are from analysis of soil samples collected throughout Los Alamos County for which chemical analyses were performed for certain inorganic (metal) chemicals (Longmire et al. 1995, 1142; Longmire et al. 1995, 1266). The site-wide background value or upper tolerance limit (UTL) is calculated as the 95% upper confidence level of the 95th percentile. The all-soil-horizon data set was used because the soil master horizon was not identified during the sampling.

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a chemical-specific background screening value that is the UTL, the maximum reported concentration, or the detection limit of a nondetected chemical. The background screening values are derived from LANL-wide soil background data, and details on the calculation of these values are presented in a Laboratory report (Longmire et al. 1995, 1266). Certain inorganic chemicals in certain media have no LANL-wide background data. For these exceptions, PRS sample-specific detection limits are used as nominal background screening values. In this report, inorganic chemicals that lack background data include silver.

Further statistical comparisons are performed for the analytes that exceed their UTLs to determine whether statistically significant differences exist between the observed site and background data sets. The Gehan/Wilcoxon Rank Sum test, the Quantile test, and the Slippage test are used for these evaluations (Gilbert 1987, 0312). The Gehan modification of the Wilcoxon Rank Sum test is best suited for assessing complete shifts in distribution, whereas the Quantile test is better suited for assessing partial shifts. The Slippage test determines the probability of the observed number of site concentrations being greater than the maximum background concentration, given that the site data originates from the same distribution as the background data. Among the three tests, most types of differences between distributions can be determined. Observed significance levels (p-values) are reported for the tests. The p-value is the probability of observing data at least as different from the typical background data as the observed site data if the site concentration distribution is the same as background. If a p-value is less than 0.05, then there is reason to suspect that there is a difference between the background and site distributions; otherwise, no difference is indicated and the site concentrations are not statistically different from background. These tests are performed only for PRSs that have at least four samples and only for the analytes that have adequate background data sets. For example, mercury data are not subjected to these tests because the background data set is almost entirely composed of non-detect data. The p-values for any analytes that are shown not to be statistically different from background are included in Chapter 5 where comparisons to background are discussed. Histograms, smoothed density images, and box plots for all analytes subjected to these analyses are presented in Appendix D.

3.2.2 Radionuclides

Comparing reported radionuclide results with minimum detectable activities and background data is necessary to determine the presence of radionuclides and to distinguish concentrations of radionuclides associated with Laboratory operations from those attributable to global fallout and/or to naturally occurring radionuclides.

The ER Project requires that radiochemical data be reported by a laboratory on the basis of a detection test. Therefore, as part of the data validation/data assessment, reported results must be evaluated to ensure that only those results that represent detections be used to classify a radionuclide as a COPC. This is typically done by comparing the reported value with the associated minimum detectable activity if one is reported. When minimum detectable activity is not available or does not meet the data quality needs of the ER Project, the reported value will be tested against an estimated minimum detectable activity. The estimated value is based on instrument counting error. The counting error is typically reported as the analytical uncertainty at a value of 1-sigma (i.e., one standard deviation), and the estimated minimum detectable activity is computed as 3-sigma.

Detected radionuclides are retained as COPCs or eliminated from further consideration based on a comparison with natural or anthropogenic background distributions. The radionuclide background data used in this report are from the following sources:

- Soil samples collected throughout Los Alamos County for which chemical analyses were performed for certain naturally occurring radioactive chemicals (Longmire et al. 1995, 1142; Longmire et al. 1995, 1266). The soil background data set was used throughout the background comparison because the soil master horizon was not identified during sampling activities.

- Background concentrations of radioactive chemicals associated with global fallout from atmospheric testing (e.g., plutonium, cesium, strontium, and tritium) reported in LANL Environmental Surveillance Reports (Purtymun et al. 1987, 0211; ESG 1988, 0408; ESG 1989, 0308; Environmental Protection Group 1990, 0497; Environmental Protection Group 1992, 0740).

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a radionuclide-specific background screening value that is either the UTL or the maximum reported activity. These background screening values are derived from LANL-wide soil background data. Details on the calculation of these values are presented in a Laboratory report (Longmire et al. 1995, 1266). Certain radionuclides in certain media have no LANL-wide background data. For these exceptions, PRS sample-specific minimum detectable activities are used as nominal background screening values.

3.2.3 Organic Chemicals

Background data are not available for organic chemicals. Except as noted in Section 5.2.7, Evaluation of Organic Chemicals for PRS C-15-007, organic chemicals positively identified in one or more samples have been carried forward in the screening assessment process for the PRS(s) in this RFI report. Chemicals not detected in any sample have been removed from further consideration.

Based on previous investigations conducted by the ER Project, polycyclic aromatic hydrocarbons (PAHs) have been detected at multiple PRSs across the Laboratory and its surrounding area. In most cases, the presence of PAHs is not related to historical PRS operations, but rather attributable to non-PRS activities such as combustion of fossil fuels; run-off from asphalt roads, parking lots, or roofs; or forest fires

(ATSDR 1995; Bradley et al. 1994; Menzie et al. 1992; Butler et al. 1984; Edwards 1983). Potential site contaminants were evaluated prior to conducting the risk-based screening assessment for PRS C-15-007. The identification of potential contaminants took into consideration the number of chemicals detected; the frequency, magnitude, and location at which the chemicals were detected; the accuracy of archival information regarding historical PRS operations; and the presence of obvious, non-PRS related sources. Only those chemicals believed or suspected to be attributable to a PRS-associated release are carried forward in the screening assessment.

3.2.4 Risk-Based Screening Assessment

Inorganic chemicals and radionuclides that exceed background and organic chemicals positively identified in one or more samples require further evaluation if they also exceed screening action levels (SALs). The SALs for nonradioactive chemicals are based on EPA Region 9 preliminary remediation goals (PRGs) for residential soil. Chemicals that do not have SALs available used surrogate SALs for compounds with similar chemical structure and/or toxicology.

If more than one COPC is present at the site, a multiple chemical evaluation (MCE) is performed to determine if the potentially additive effect of chemicals detected below SALs warrants additional investigation. The method for performing an MCE is summarized in the policy document "Risk-Based Corrective Action Process" (Dorries 1996, 1297). These comparisons are the last quantitative steps in the screening assessment process for human health concerns. If COPCs remain after this step, then further evaluation is required. If no COPCs remain after this step and the data set is sufficient to support the decision, a no further action (NFA) recommendation may be proposed based on human health concerns.

If COPCs remain after the screening assessment, several options exist for the PRSs. A further site-specific evaluation may lead to eliminating a COPC without going into a formal risk assessment. The site may be proposed for further sampling to more completely characterize the site, or for remediation if it is cost-effective to proceed without a risk assessment. A risk assessment may be conducted to determine if the remaining COPCs present an unacceptable human health risk.

3.3 HUMAN HEALTH ASSESSMENT

3.3.1 Risk Due to Naturally Occurring Inorganic Chemicals in Soils (Background)

Risk is associated with exposure to inorganic chemicals naturally occurring in soil. Calculation of background risks using the same methodology as site risk estimates provides a frame of reference for risk levels calculated at a site. This information provides a basis for determining risk-based remediation goals, which in some circumstances may be set at target risks comparable to background rather than default values, i.e., a cancer risk of 10^{-6} or a hazard index of 1. Background risks can also affect decisions at sites that have chemicals for which there is a toxicity threshold. For some inorganic chemicals, background intakes may be near a toxicity threshold such that incremental intakes associated with contamination may be unacceptable.

Background risk estimates provided in Table 3.3.1-1 were calculated using the same exposure assumptions by which SALs are calculated. SALs are based on health-protective assumptions for a residential scenario (EPA 1996, 1351). For soil exposure, the pathways include incidental soil ingestion, inhalation of resuspended dust, and dermal contact with soil. The background soil data used for these calculations were collected from several soil horizons at geographically diverse locations. Background risks are estimated for two statistics. One statistic is the median, which represents the midpoint in the concentration range (technically, the median is the concentration value that divides the results into two equal groups or where half of the data are above and half are below this value). The second statistic represents the upper range of background concentration values, and is either a calculated UTL or a

TABLE 3.3.1-1

RISK DUE TO BACKGROUND CONCENTRATIONS OF INORGANIC CHEMICALS IN SOIL ASSUMING A RESIDENTIAL SCENARIO[a]

Inorganic Chemical	Background Soil Concentration[b] mg/kg		Hazard Quotient		Lifetime Cancer Risk	
	Median	UTL	Median	UTL	Median	UTL
Aluminum	10,000	38,700	0.1	0.5	NC[c]	NC
Antimony	0.6	1[d]	0.02	0.03	NC	NC
Arsenic	4	7.82	0.2	0.4	1×10^{-5}	2×10^{-5}
Barium	130	315	0.03	0.06	NC	NC
Beryllium	0.895	1.95	0.003	0.006	6×10^{-6}	1×10^{-5}
Cadmium[e]	0.2	2.6[d]	0.005	0.07	2×10^{-10}	2×10^{-9}
Chromium[f]	8.6	19.3	0.00009	0.0002	NC	NC
Cobalt	6	19.2	0.001	0.004	NC	NC
Copper	5.75	15.5	0.002	0.01	NC	NC
Lead[g]	12	23.3	0.03	0.06	NC	NC
Manganese	320	714	0.8	1.9	NC	NC
Mercury	0.05	0.1[d]	0.002	0.004	NC	NC
Nickel	7	15.2	0.005	0.01	NC	NC
Selenium	0.3	1.7[d]	0.0008	0.005	NC	NC
Thallium	0.2	1[d]	0.03	0.2	NC	NC
Uranium	0.9	1.87	0.004	0.008	NC	NC
Vanadium	21	41.9	0.04	0.08	NC	NC
Zinc	30.7	50.8	0.001	0.002	NC	NC

a Risk estimates are based on reference doses, slope factors, and EPA Region 9 default exposure assumptions effective April 1996.
b Background concentrations taken from the Longmire et al. all soil horizons set (Longmire et al. 1995, 1142).
c NC = noncarcinogen.
d Maximum detected background value.
e Cancer risks from cadmium are based solely on inhalation of resuspended dust.
f Naturally occurring chromium is assumed to exist in a trivalent.
g Hazard quotient based on biokinetic uptake model.

maximum concentration value. [Note: UTLs and maximum concentration values are identical to those described in Section 3.2.1 (Inorganic Chemicals)].

The background risks based on the LANL SAL residential exposure model are provided in Table 3.3.1-1. Risks due to background concentration are presented for both noncarcinogenic and carcinogenic outcomes. The potential for adverse noncarcinogenic health effects is estimated by a hazard quotient. A chemical intake leading to a hazard quotient of up to 1 is not associated with adverse health effects. None of the median background concentrations result in hazard quotients greater than 1. The hazard quotient of the UTL concentration for manganese exceeds 1 (1.9). However, exposure to naturally occurring manganese is not expected to have significant health consequences because of the unlikely occurrence of the UTL concentration over an entire exposure area, the conservative assumptions used in the exposure assessment, and the margin of safety incorporated into the reference dose.

Three of the background inorganic chemicals provided in Table 3.3.1-1 are also carcinogens. Applying the default exposure assumptions used for SALs, the lifetime cancer risks due to residential soil exposure to background concentrations (UTL column) are estimated at approximately 1 excess case of cancer in 100,000 people for beryllium; 2 in 100,000 for arsenic; and 2 in 1,000,000,000 for cadmium (carcinogenic only by inhalation). EPA uses a range of 1 excess case of cancer in 10,000 people to 1 in 1,000,000 as a guidance for an acceptable range of cancer risk (EPA 1990, 0559).

These background risk estimates provide a frame of reference for risk-based screening assessment and site decisions. If a site-specific risk assessment is necessary to further evaluate risks, background risks can also be calculated using site/scenario-specific assumptions to assist in any remedial action decisions for the site.

3.3.2 Risk Assessment

No baseline human health risk assessments were conducted for the PRSs presented in this addendum. A preliminary risk evaluation was conducted for uranium at C-15-001. This evaluation consisted of comparing the maximum detected concentration to the preliminary remediation goal (PRG) for an industrial land use scenario. The comparison indicated that uranium was below the PRG and, therefore, no additional evaluation was warranted.

The risk-based screening assessment for C-15-007 did not identify COPCs as a result of site activities. Polycyclic aromatic hydrocarbons (PAHs) were detected and were attributed to the asphalt parking area and the asphalt berm located adjacent to the site. The PAHs were evaluated by comparing the maximum detected concentration to their industrial PRGs.

3.4 ECOLOGICAL ASSESSMENT

In cooperation with the New Mexico Environmental Department and EPA Region 6, the ER Project is developing an approach for ecological risk assessment. Further discussion of ecological risk assessment methodology will be deferred until a methodology has been approved.

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

Samples were collected, processed, and analyzed in accordance with the ER Project Quality Assurance Project Plan Requirements for Sampling and Analysis (QAPP) (LANL 1996, 1292). The QA/QC samples used to determine the quality and usability of the soil sample data included method blanks, initial and continuing calibrations, surrogates, matrix spikes, laboratory control samples, and internal standards. These samples were analyzed according to the frequency outlined in EPA's functional guidelines for inorganic and organic data review (EPA 1994, 1205 and 1206). A review of the technical quality of the data (baseline validation) requires that the data be compared to numerical acceptance criteria established either by the analytical laboratory or EPA for the QA samples mentioned above. The data that do not meet these criteria are qualified to indicate to the data user those sample results that have potential issues associated with sampling handling and analysis.

The QA/QC data associated with this investigation indicated that 100% of the data are acceptable and defensible. Approximately 7% of the data were qualified as estimated undetected (UJ) or estimated (J); none of the data were qualified as unusable (R). The qualification of the data because of QA/QC problems did not affect the sufficiency of the data for decision-making purposes because the QA/QC problems did not affect the usability of the data. The qualified data represent data of good quality, reasonable confidence, and suitable for decision-making purposes (EPA 1989, ER ID No. 56023). The QA/QC mechanisms were effective in ensuring the reliability of measured data within expected limits of sampling and analytical error.

This chapter summarizes the results of the data quality evaluation performed on the sample results associated with PRSs C-15-001 and C-15-007. Soil samples from these PRSs were collected in accordance with the RFI work plan and/or the corresponding sampling plans. The samples from C-15-001 were analyzed for target analyte list (TAL) metals, uranium, and isotopic uranium, while the samples from C-15-007 were analyzed for TAL metals, uranium, SVOCs, and VOCs. The QA/QC problems associated with the soils data are summarized in Appendix B (Tables B-1 and B-2) according to request number, sample ID, and analytical suite, respectively.

4.1 ANALYSES FOR C-15-001 - SOIL PILE

4.1.1 Inorganics

Two surface soil samples were analyzed for TAL metals at this PRS. Chromium and iron in both samples are qualified as J because the laboratory control sample (LCS) recoveries were outside of the established limits of 80-120%. The percent recovery for iron was 76.2%, which was slightly below the established lower limit. The data are usable because the sample values for iron are approximately one-half of the background UTL so the potential low bias does not affect the data comparison. The percent recovery for chromium was 121%, which was slightly above the established upper limit. The data are usable because the results are potentially biased high and, therefore, may overestimate the true values for chromium.

Chromium in one sample had matrix spike duplicate recovery of 71.2%, which was below the established lower limit of 75%. The datum was not qualified based on the matrix spike duplicate because the matrix spike recovery was within the established limits of 75-125%.

Antimony, selenium, and silver in one sample and cadmium and silver in another sample were detected below the estimated detection limit (EDL) and are qualified as J. The sample results have a high degree of uncertainty because they cannot be accurately distinguished from the instrument "noise" levels. As a result, the data are usable as estimated values, but should be used with caution in the screening assessment because they cannot be accurately quantified (see Section 5.1.5).

Aluminum, barium, beryllium, cadmium, chromium, copper, iron, manganese, mercury, nickel, vanadium, and zinc were detected in the laboratory blanks associated with these samples at or below the method detection limits. The sample values for these analytes were greater than 5X the blank values, indicating that their presence is not due to contamination, and the data are not qualified.

4.1.2 Radionuclides

Two samples had QA/QC issues associated with the radionuclide data. The minimum detectable activities (MDAs) were less than the estimated quantitation limit (EQL) for uranium-235. The data are qualified as U (nondetect).

4.2 ANALYSES FOR C-15-007 - SOIL STAIN

4.2.1 Inorganics

Thirteen samples had a QA/QC problem with antimony, barium, and mercury because the spike recoveries were outside the established limits of 75-125%. The antimony and mercury data were undetected and are qualified as UJ. The antimony and mercury data are usable because the recoveries of 51.3% and 74.2% were within the range of 30-75%, which results in acceptable, but potentially biased low data (EPA 1994, 1206). Therefore, the recoveries were sufficient to detect and quantify the analytes if they were present. The recovery for barium of 126.2% was above the established upper limit of 125%; the detections are qualified as J+, and the nondetects are not qualified. These data are usable because the results are potentially biased high and, therefore, may overestimate the true values. In addition, post-digestion spikes for each analytes resulted in recoveries of 81.6% to 87.7%.

Thirteen samples had a QA/QC problem associated with the relative percent differences (RPDs) of the laboratory duplicates for several analytes and are qualified as P (professional judgment required). The RPDs were above the established limit of 20%. Further review of the data found that the results for beryllium and lead should not be qualified because the RPDs met EPA's control limits for soil (±35%, ±2X CRDL) (EPA 1994, 1206). The remaining inorganic data are qualified as UJ or J and are usable because the RPDs reflect soil heterogeneity and do not affect method precision.

4.2.2 Organics

Semivolatile Organic Compounds

Seven samples from one request number could not be concentrated by the laboratory to a 1 ml final volume during the extraction procedure. The samples concentrated to a 10 ml final volume and the analytes reported with elevated detection limits.

Analytes [PAHs and bis(2-ethyhexyl)phthalate)] detected below the estimated quantitation limits (EQLs) were qualified as J. The sample results have a high degree of uncertainty because they cannot be accurately distinguished from the instrument "noise" levels. As a result, the data are usable as estimated values, but should be used with caution in the screening assessment because they cannot be accurately quantified (see Section 5.2.7).

Volatile Organic Compounds

The area counts for the internal standard d4-1,4-dichlorobenzene were less than 50% of the area lower limit for three samples. The internal standards were reanalyzed and the area counts for d4-1,4-dichlorobenzene were less than 50% of the area lower limit for two samples. Based on the latter internal standard analyses, the data for two samples are qualified as UJ. The data are usable because area counts are between 37-44%, were not extremely low (<10%), and did not drop off abruptly, which would indicate a loss of sensitivity (EPA 1994, 1205). Although the data are potentially biased low, the instrument was still able to detect and quantify the analytes because its sensitivity and responsiveness were not compromised. In addition, the continuing calibrations, the internal standard retention times, and all other internal standard area counts were acceptable.

4.2.3 Radionuclides

The radionuclide data had no QA/QC problems associated with the analyses.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 PRS C-15-001, SOIL PILE

PRS C-15-001 is a soil pile in the area of Firing Site G. Two samples were collected in 1995, but they were not analyzed for isotopic uranium, which was necessary to adequately characterize the site. Four soil samples were collected from two locations in 1997 (Figure 5.1-1). The four samples collected in 1997 were taken from the same location as those samples collected in 1995. This addendum reflects the results from the collection of all of the samples and is considered a continuation of the Phase I sampling. In all, six samples were collected from two locations to characterize this PRS.

5.1.1 History

The history of the site is unknown. It was noted in a 1988 environmental restoration (ER) site reconnaissance visit.

5.1.2 Description

PRS C-15-001 is described in Section 8.5 of the OU 1086 RFI Work Plan (LANL 1993, 1087). That section states only that during the 1988 ER site reconnaissance visit, a soil pile contaminated with radionuclides was noted. This pile is denoted in the SWMU report as AOC C-15-001.

5.1.3 Previous Investigations

No previous investigations have been conducted at this site, prior to 1995.

5.1.4 Field Investigation

5.1.4.1 Results of Field Surveys

Radiological surveys were conducted immediately before sampling to help characterize the PRS and to establish health and safety conditions for on-site workers. No readings above background were reported from this radiological survey.

5.1.4.2 Results of Field Screening

HE spot tests were conducted at these sample locations prior to the start of any intrusive activities as required by DX Division. No positive results were obtained, and HE was not a COPC at this PRS, so no HE samples were collected for offsite laboratory analysis.

Radiological screening at the sample locations consisted of screening the actual soil being sampled. No readings were noted that would have entailed special labeling or packaging of samples being sent offsite for analysis.

5.1.4.3 Sample Collection and Submittal for Analysis

In 1995 the sampling objective at PRS C-15-001 was to determine whether contamination was present that could be associated with site activities. In 1997 the sampling objective was to determine if the uranium found in 1995 was natural or depleted in origin. Figure 5.1.4.3-1 shows the sample locations and results and Table 5.1.4.3-1 summarizes the sampling conducted at this PRS.

The samples collected were submitted to an offsite laboratory in accordance with the RFI Work Plan (LANL 1993, 1087). The two samples collected in 1995 were analyzed for TAL metals and total uranium.

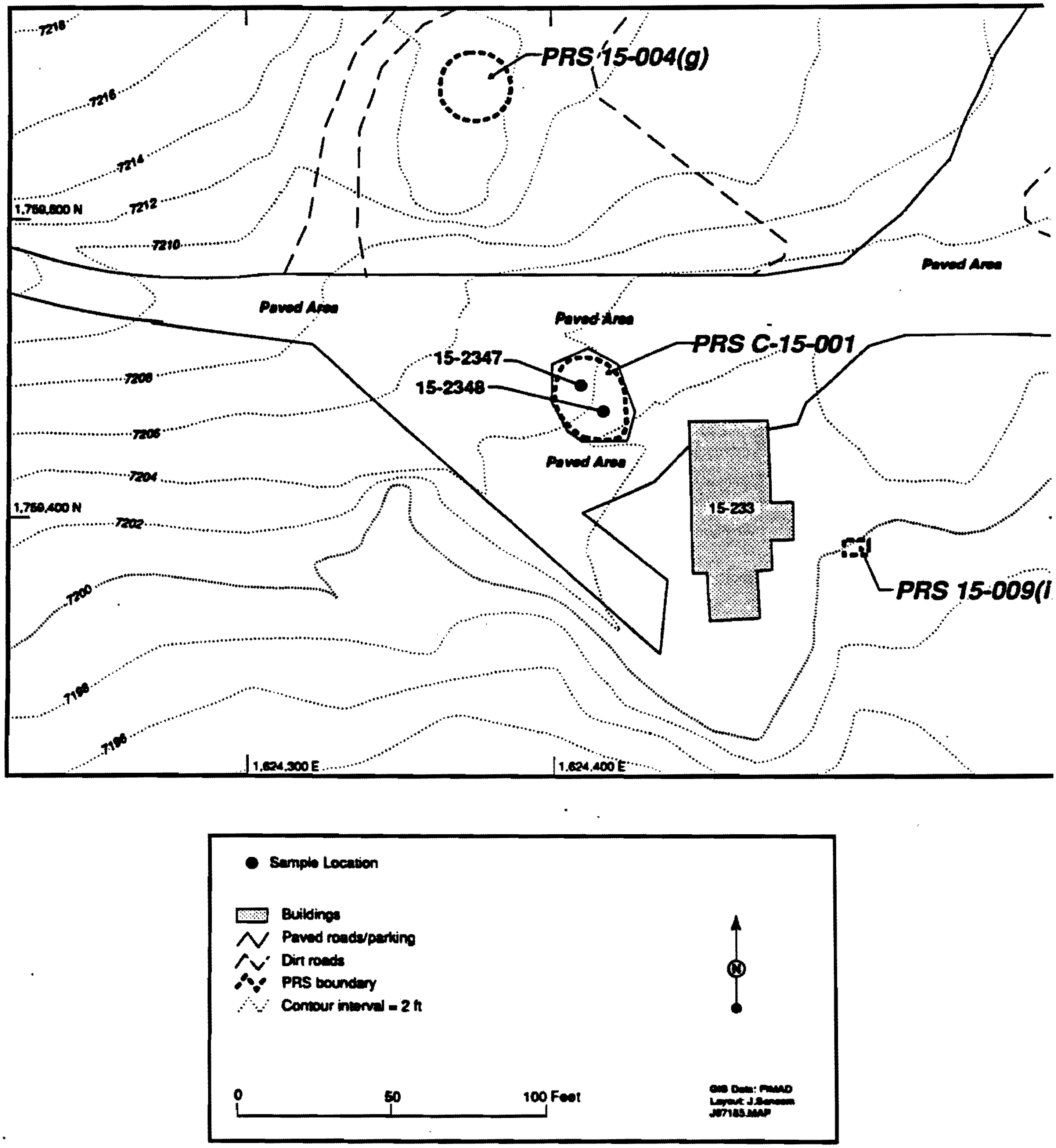

Figure 5.1-1 PRS C-15-001, Site map of sample locations

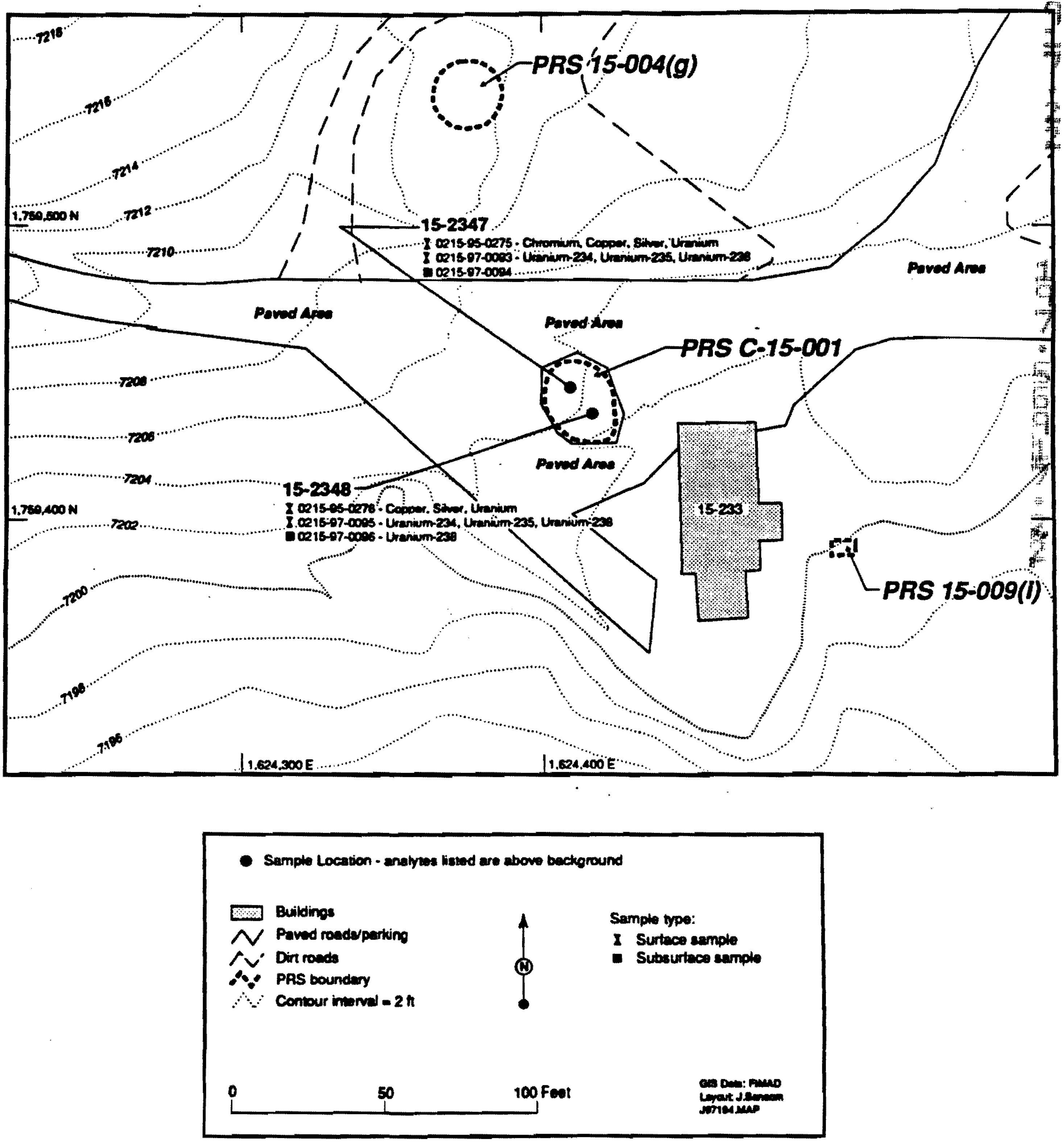

Figure 5.1.4.3-1 PRS C-15-001, Site map of sample locations with detected analytes

TABLE 5.1.4.3-1
SUMMARY OF SAMPLES TAKEN - PRS C-15-001

Location ID	Sample ID	Depth (in)	Date Collected	Matrix	TAL Metals@	Total Uranium@	Isotopic Uranium*
15-2347	0215-95-0275	0-3	7/13/95	Soil	9507269	9507269	NA
15-2347	0215-97-0093	0-4	8/18/97	Soil	NA	NA	3582R
15-2347	0215-97-0094	18-20	8/18/97	Soil	NA	NA	3582R
15-2348	0215-95-0276	0-6	7/13/95	Soil	9507269	9507269	NA
15-2348	0215-97-0095	0-6	8/18/97	Soil	NA	NA	3582R
15-2348	0215-97-0096	18-22	8/18/97	Soil	NA	NA	3582R

@ Batch Number
* Request Number

The four samples collected in 1997 were analyzed only for isotopic uranium. All samples were analyzed within the prescribed holding times.

5.1.5 Evaluation of Inorganic Chemicals

Chromium, copper, and uranium were detected in the surface soil at concentrations greater than their respective background UTLs (Table 5.1.5-1 and Figure 5.1.4.3-1). Silver, which does not have a background UTL, was also detected in the surface soil and qualified as J because the concentrations were below the EDLs (Section 4.1.1); these results are presented in Table 5.1.5-1. These inorganics were carried forward to the SAL comparison stage. All other inorganics, including the antimony and selenium data qualified as J (Section 4.1.1), were either undetected or detected below their respective background UTLs and were eliminated from further evaluation.

TABLE 5.1.5-1
INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR ABOVE BACKGROUND SCREENING VALUES FOR PRS C-15-001

Sample ID	Location ID	Depth (in)	Chromium (mg/kg)	Copper (mg/kg)	Silver (mg/kg)	Uranium (mg/kg)
SAL	N/A[a]	N/A[a]	210	2800	380	230[b]
soil UTL	N/A[a]	N/A[a]	19.3	15.5	Not Available	5.45
0215-95-0275	15-2347	0-3	22.6(J)	21.2	0.4(J)	55
0215-95-0276	15-2348	0-6	9.0(J)	20.6	0.4(J)	14.2

[a] N/A = not applicable
[b] SAL for uranium is based on systemic effects.
Note: Values in cells with bold borders are greater than background

5.1.6 Evaluation of Radionuclides

Isotopic uranium, uranium-234, uranium-235, and uranium-238, were detected in the surface soil at concentrations greater than their respective background UTLs (Table 5.1.6-1 and Figure 5.1.4.3-1).

Uranium, as mentioned in Section 5.15, was also detected at concentrations above its background UTL. These radionuclides were carried forward to the SAL comparison stage. The isotopic uranium ratios (U-238:U-234 was approximately 1:1) indicated that the uranium detected at this PRS was natural uranium. Therefore, based on the isotopic uranium data, uranium detected at C-15-001 was considered to be natural uranium and the comparison of uranium concentrations greater than background was to the natural uranium SAL of 29 mg/kg (Table 5.1.6-1). No other radionuclides were analyzed for at this PRS.

TABLE 5.1.6-1
RADIONUCLIDES WITH CONCENTRATIONS AT OR ABOVE BACKGROUND SCREENING VALUES FOR PRS C-15-001

Sample ID	Location ID	Depth (in)	Uranium-234 (pCi/g)	Uranium-235 (pCi/g)	Uranium-238 (pCi/g)	Uranium (mg/kg)
SAL	N/A[a]	N/A[a]	13	10	67	29[b]
soil UTL	N/A[a]	N/A[a]	1.94	0.084	1.82	5.45
0215-95-0275	15-2347	0-3	Not Analyzed	Not Analyzed	Not Analyzed	55
0215-95-0276	15-2348	0-6	Not Analyzed	Not Analyzed	Not Analyzed	14.2
0215-97-0093	15-2347	0-6	8.9	0.4	9.5	Not Analyzed
0215-97-0094	15-2347	18-24	1.4	0.05	1.4	Not Analyzed
0215-97-0095	15-2348	0-6	2.7	0.1	3.4	Not Analyzed
0215-97-0096	15-2348	18-24	1.9	0.08	1.9	Not Analyzed

[a] N/A = not applicable

[b] SAL for uranium is based on radionuclide effects for natural uranium.

Notes: Values in cells with bold borders are detections.
Values in shaded cells are detections greater than SALs.

5.1.7 Evaluation of Organic Chemicals

No organics were analyzed for at this PRS.

5.1.8 Risk-Based Screening Assessment

Chromium, copper, and silver were detected at concentrations below their respective SALs (Table 5.1.5-1). The chromium concentration above background was approximately an order of magnitude below its SAL, copper concentrations were approximately two orders of magnitude below its SAL, and silver concentrations were approximately three orders of magnitude below its SAL. These inorganics were submitted to a multiple chemical evaluation (MCE) for noncarcinogens.

Uranium was detected at a concentration greater than it natural uranium SAL of 29 mg/kg and was retained as a COPC (Table 5.1.6-1). Isotopic uranium, uranium-234, uranium-235, and uranium-238, was analyzed at a later date following additional Phase I sampling and was detected below the individual SALs (Table 5.1.6-1). The isotopic uranium was not submitted to an MCE for radionuclides because total uranium was retained as a COPC based on the SAL comparison.

Multiple Chemical Evaluation

The MCE included three analytes in the noncarcinogenic effects category (Table 5.1.8-1). The sum of the normalized concentrations for these analytes was 0.1, which is below the target value of 1.0. Based on this evaluation, it is unlikely that there was the potential for an unacceptable risk to human health from combined effects. Therefore, chromium, copper, and silver were not evaluated further.

TABLE 5.1.8-1
MULTIPLE CHEMICAL EVALUATION FOR SOIL SAMPLES FROM PRS C-15-001

Chemical	Location ID	Sample ID	Maximum Sample Value	Soil SAL	Normalized Values
Noncarcinogenic Effects (mg/kg)					
Chromium	15-2347	0215-095-0275	22.6(J)	210	0.1
Copper	15-2347	0215-095-0275	21.2	2800	0.008
Silver	15-2347	0215-095-0275	0.4(J)	380	0.001
				Total:	**0.1**

5.1.9 Human Health Risk Assessment

A preliminary risk evaluation was conducted at this PRS for natural uranium to determine if additional investigations were warranted. A preliminary remediation goal (PRG) for natural uranium was derived using RESRAD 5.70 (Appendix C). The PRG was calculated based on the expected land use, which is industrial or continued Laboratory use, for this site. LANL site-specific exposure input parameters were used in the model (LANL 1996, ER ID No. 54849) and included an exposure area of 21 m^2, a depth of 0.7 m, and an exposure limit of 15 mrem/yr. The PRG was calculated to be 496 mg/kg or 708 pCi/g.

The detected concentrations of uranium at this PRS were compared to the PRG derived using RESRAD 5.70. This comparison indicated that the maximum detected concentration (55 mg/kg) of natural uranium was well below the PRG based on an industrial land use and a 15 mrem/yr exposure limit. Therefore, the concentrations of uranium at this PRS do not pose an unacceptable risk to human health.

5.1.9.1 Review of COPCs and Extent of Contamination

The only COPC identified at this PRS by the Phase I sampling and the risk-based screening assessment was natural uranium. The PRS encompasses an area of approximately 21 m^2 and is surrounded by an asphalt road. The subsurface soil samples (18-24 in) recently collected and analyzed for isotopic uranium indicated that isotopic uranium concentrations were at or below background. Therefore, because the PRS is small with definite boundaries and the soil data indicated that the contamination was confined to the surface soil, the extent of contamination has been defined.

5.1.10 Preliminary Ecological Assessment

The PRS has not been evaluated for the potential for ecological risk. The PRS will be evaluated once the ecological risk assessment methodology has been implemented by the Laboratory.

5.1.11 Conclusions and Recommendations

Based on NFA Criterion 5, the PRS has been characterized and the available data indicated that contaminants of concern were either not present or were present at concentrations that would pose an acceptable level of risk under current and future land use (NMED et al. 1995, 1328), C-15-001 has been proposed for NFA based on human health.

5.2 PRS C-15-007, SOIL STAIN

PRS C-15-007 is a stained soil pile located under a metal transportainer designated TA-15-372. Sixteen soil samples were collected from seven locations in this Phase I sampling effort (Figure 5.2-1).

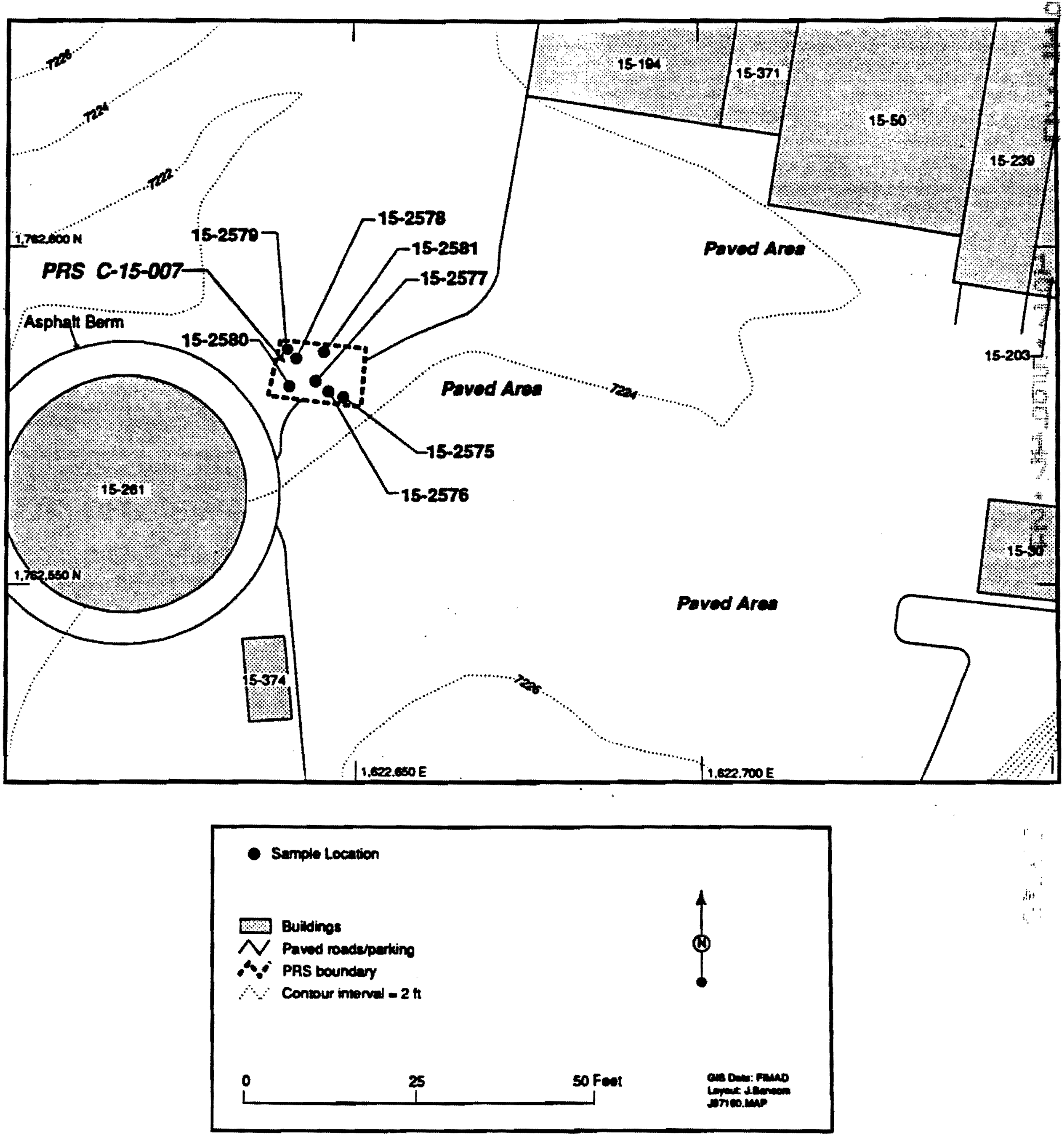

Figure 5.2-1 PRS C-15-007, Site map of sample locations

5.2.1 History

The history of the site is unknown. It was noted in a 1988 environmental restoration (ER) site reconnaissance visit.

5.2.2 Description

PRS C-15-007 is described in Section 10.1.2 in the OU 1086 RFI Work Plan (LANL 1993, 1087). That section states only that during the 1988 ER site reconnaissance visit, visibly stained soil was noted outside the west corner of building TA-15-194. Based on interviews with site personnel, it is believed that the stain was mineral oil, which, according to the Material Safety Data Sheet (MSDS), does not contain polychlorinated biphenyls (PCBs) or PAHs. The work plan also states that the area is now covered by a metal transportainer designated TA-15-372. PRS C-15-007 is immediately adjacent to an aboveground mineral oil storage tank, (TA-15-261), which is surrounded by an asphalt berm.

5.2.3 Previous Investigations

No previous investigations have been conducted at this site.

5.2.4 Field Investigation

5.2.4.1 Results of Field Surveys

Radiological surveys were conducted immediately before sampling to help characterize the PRS and to establish health and safety conditions for on-site workers. No elevated readings were reported from this radiological survey.

5.2.4.2 Results of Field Screening

HE spot tests were conducted at these sample locations prior to the start of any intrusive activities as required by DX Division. No positive results were obtained. Because HE was not a COPC at this PRS, no HE samples were collected for offsite laboratory analysis.

PID readings were conducted in a 8' x 16' grid within each 2' x 2' square prior to the start of any intrusive activities. No readings above background were detected. The grid was used only for PID determination, as an aid to determine where soil samples should be collected. Because no readings above background were detected, biasing of soil samples was done visibly, based on stained soil or drainage patterns.

Radiological screening at the sample locations consisted of screening the actual soil being sampled. No readings were encountered that would have entailed special labeling or packaging of samples being sent offsite for analysis.

5.2.4.3 Sample Collection and Submittal for Analysis

The objective of sampling at PRS C-15-007 was to determine whether contamination was present in the stained soil that could be associated with site activities. Figure 5.2.4.3-1 shows the sample locations and results, and Table 5.2.4.3-1 summarizes the sampling conducted at this PRS.

The samples collected were submitted to an offsite laboratory in accordance with the Sampling and Analysis Plan (SAP) for PRS C-15-007. The SAP required collection at 3 locations within the stain at two depths and 2 locations downgradient from the stain. After the transportainer was moved and apparent stains were visible, the field team increased the sample collection scheme to include additional samples,

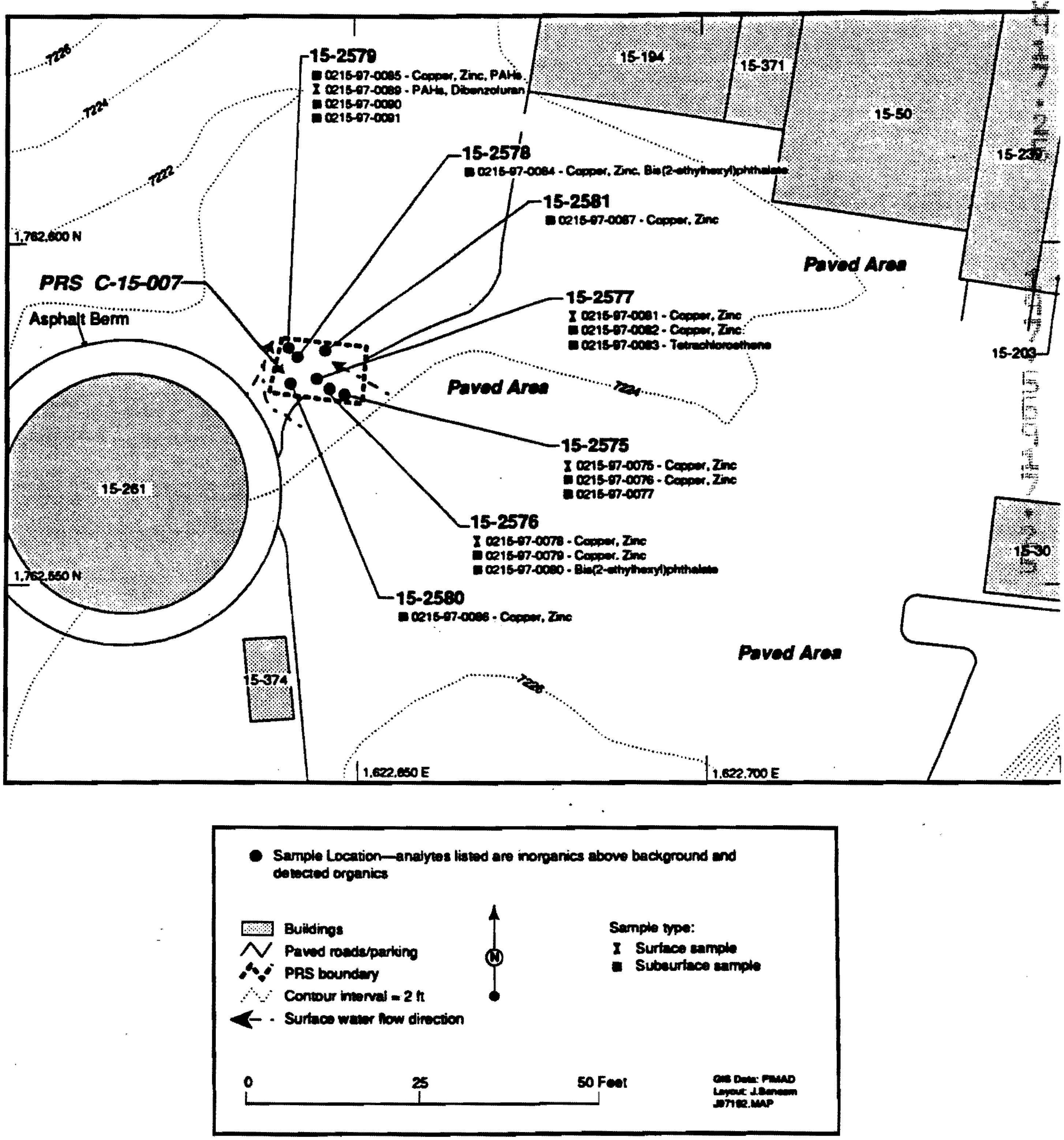

Figure 5.2.4.3-1 PRS C-15-007, Site map of sample locations with detected analytes

TABLE 5.2.4.3-1
SUMMARY OF SAMPLES TAKEN - PRS C-15-007

Location ID	Sample ID	Depth (in)	Date Collected	Matrix	TAL Metals*	Total Uranium*	SVOCs*	VOCs*
15-2575	0215-97-0075	0-6	8/18/97	Soil	3588R	3589R	3587R	NA
15-2575	0215-97-0076	12-16	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2575	0215-97-0077	24-28	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2576	0215-97-0078	0-6	8/18/97	Soil	3588R	3589R	3587R	NA
15-2576	0215-97-0079	12-18	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2576	0215-97-0080	24-30	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2577	0215-97-0081	0-6	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2577	0215-97-0082	12-18	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2577	0215-97-0083	30-35	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2578	0215-97-0084	6-12	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2579	0215-97-0085	15-21	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2580	0215-97-0086	6-12	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2581	0215-97-0087	15-21	8/18/97	Soil	3588R	3589R	3587R	3587R
15-2579	0215-97-0089	0-6	9/2/97	Soil	NA	NA	3655R	NA
15-2579	0215-97-0090	15-21	9/2/97	Soil	NA	NA	3655R	NA
15-2579	0215-97-0091	30-36	9/2/97	Soil	NA	NA	3655R	NA

* Request Number

both downgradient from the stains and within the stains. The stains appeared in several grid locations, and were not continuous, but spotty. The stains were small and slightly darker than the surrounding soil. Four sample locations (15-2575, 15-2576, 15-2577, and 15-2580) were collected from the stained soil, three from 3 depths, and the fourth from 1 depth. Three locations (15-2578, 15-2579, and 15-2581) were chosen downgradient of the stains. These locations were sampled at depth. When PAHs were reported by quick-turnaround fixed laboratory results at depth in location 15-2579, three additional samples were collected within 10 inches of the sample location at three depths to more fully characterize the nature and extent of these PAHs.

The thirteen initial samples collected were analyzed for TAL metals, total uranium, and SVOCs. The subsurface samples were additionally analyzed for VOCs. The three additional samples were analyzed for SVOCs only. All samples were analyzed within the prescribed holding times.

5.2.5 Evaluation of Inorganic Chemicals

Copper, lead, and zinc were detected in the surface soil (0-6 in) and the subsurface soil (12-21 in) at concentrations above their respective background UTLs (Table 5.2.5-1 and Figure 5.2.4.3-1). However, subsurface soil samples at depths of 24-30 inches did not detect any inorganics above background. Statistical analyses of the lead and zinc data from the samples collected between 0-21 inches indicated that the distributions of the site data for lead was not statistically different from background (Table 5.2.5-2). As a result, lead was not evaluated further, while copper and zinc were carried forward to the SAL comparison stage.

TABLE 5.2.5-1
INORGANIC CHEMICALS WITH CONCENTRATIONS AT OR ABOVE BACKGROUND SCREENING VALUES FOR PRS C-15-007

Sample ID	Location ID	Depth (in)	Copper (mg/kg)	Zinc (mg/kg)
SAL	N/A[a]	N/A[a]	2800	23,000
soil UTL	N/A[a]	N/A[a]	15.5	50.8
0215-97-0075	15-2575	0-6	19	58
0215-97-0076	15-2575	12-18	110	110
0215-97-0077	15-2575	24-30	3.3	39
0215-97-0078	15-2576	0-6	22	59
0215-97-0079	15-2576	12-18	49	75
0215-97-0080	15-2576	24-30	10	46
0215-97-0081	15-2577	0-6	270	71
0215-97-0082	15-2577	12-18	38	63
0215-97-0083	15-2577	24-30	4.5	40
0215-97-0084	15-2578	6-12	31	110
0215-97-0085	15-2579	15-21	37	77
0215-97-0086	15-2580	6-12	33	67
0215-97-0087	15-2581	15-21	16	53

[a] N/A = not applicable

Note: Values in cells with bold borders are greater than background

All other inorganics were either undetected or detected below their respective background UTLs and were eliminated from further evaluation.

TABLE 5.2.5-2
P-VALUES* FROM STATISTICAL TESTS FOR COMPARISON OF SITE DATA TO BACKGROUND FOR PRS C-15-007

Analytes	Gehan Test	Quantile Test	Slippage Test
Lead	0.6	0.6	1.0
Zinc	0.001	0.03	1.0

* See Section 3.2.1 of this report for an explanation of p-values.

5.2.6 Evaluation of Radionuclides

Uranium was detected at concentrations below its background UTL of 5.45 mg/kg in all samples collected from this PRS. Therefore, uranium was not evaluated further and no other radionuclides were analyzed for at this PRS.

5.2.7 Evaluation of Organic Chemicals

Tetrachloroethene was detected at a concentration of 0.01 mg/kg in one subsurface soil sample (0215-97-0083) at a depth of 24-30 inches (Figure 5.2.4.3-1). Bis(2-ethylhexyl)phthalate was detected in two subsurface soil samples (0215-97-0080 and 0215-97-0084) at concentrations of 0.05 mg/kg and 0.06 mg/kg (Figure 5.2.4.3-1) from 24-30 inches and 15-21 inches, respectively. In addition, dibenzofuran was detected at a concentration of 2.1 mg/kg in one surface soil sample (0215-97-0089) at a depth of 0-6 inches (Figure 5.2.4.3-1). These analytes were carried forward to the SAL comparison stage. Except as noted below, no other SVOCs or VOCs were detected in the surface or subsurface soil at this PRS.

Several PAHs were detected and reported in one subsurface soil sample (0215-97-0085) at a depth of 15-21 inches (Table 5.2.7-1 and Figure 5.2.4.3-1). The PAHs detected were benzo(a)pyrene, benzo(k)fluoranthene, fluoranthene, phenanthrene, and pyrene. The PAHs were detected in other samples collected and analyzed during the Phase I sampling. A review of the chromatograms associated with the samples indicated that a number of small peaks were identified as PAH compounds, but were not initially quantified by the laboratory due to the extremely small areas under the peaks. Upon request, the laboratory quantified the PAH volume for several samples. These concentrations were qualified as J because they were below the EQLs (Section 4.2.2). Therefore, PAHs appear to be present across the PRS at concentrations lower than those reported for sample 0215-97-0085. The sample location at which the higher PAHs were detected was resampled to obtain a vertical profile of the PAHs present. Samples were collected from within a foot of the original sample at 0-6 inches, 15-21 inches, and 24-36 inches. The PAHs were only detected in the surface soil sample (0215-97-0089) and not in the subsurface soil samples (Table 5.2.7-1 and Figure 5.2.4.3-1).

The presence of the PAHs at this PRS is not associated with site activities. The area has been covered by a transportainer containing a transformer with non-PCB oil and assorted equipment. An inspection of the interior and exterior of the transportainer indicated that there were no visible leaks from the transportainer onto the soil. The stained soil, which is the reason for sampling this area, was present at this site prior to the transportainer being placed there. The mineral oil that is stored adjacent to the PRS and used for electrical insulating does not contain any PCBs or PAHs based on the MSDS and is surrounded by an asphalt berm. No other source of PAHs is present at this facility other than runoff from the asphalt pavement adjacent to the soil, which drains in a northwesterly direction towards the area with the reported concentrations of PAHs, and the asphalt berm located approximately 6 ft from the site, which also drains towards the sample location with the reported PAHs (Figure 5.2.4.3-1). In addition, the fill material used in this area has been described as base course and may contain small pieces of asphalt. As mentioned in Section 3.2.3, the PAH compounds [e.g., benzo(a)pyrene, benzo(b)fluoranthene, pyrene, etc.) have been detected at many PRSs throughout the Laboratory and associated with asphalt runoff (e.g., paved areas and roofs) as well as from incomplete combustion (e.g., incinerators, forest fires, or vehicle exhaust) (ATSDR 1995; Bradley et al. 1994; Menzie et al. 1992; Butler et al. 1984; Edwards 1983). In most cases, these chemicals are detected in areas influenced by these types of non-PRS-related sources, e.g., storm water outfalls, ditches next or near paved driveways or roads, etc. The PAHs at C-15-007 are, therefore, not evaluated in the screening assessment (Section 5.2.8), because only those chemicals believed or suspected of being associated with a release from a PRS as a result of site activities are retained and subjected to the screening assessment process.

Although the PAHs were not evaluated by the screening assessment process, a preliminary risk evaluation of the PAHs was conducted to provide a perspective of the potential health risks. These risk

TABLE 5.2.7-1
PAHS DETECTED IN THE SOIL AT PRS C-15-007

Sample ID	Location ID	Depth (in)	Acenaphthene (mg/kg)	Anthracene (mg/kg)	Benzo(a)-anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)-fluoranthene (mg/kg)
SALs	N/A[a]	N/A[a]	2200	18,000	0.61	0.061	0.61
EQLs	N/A[a]	N/A[a]	0.4	0.4	0.4	0.4	0.4
0215-97-0079	15-2576	12-18	0.4(U)[b]	0.4(U)	0.2(J)	0.2(J)	0.2(J)
0215-97-0080	15-2576	24-30	0.4(U)	0.4(J)	0.01(J)	0.1(J)	0.1(J)
0215-97-0083	15-2577	24-30	0.4(U)	0.4(U)	0.4(U)	0.4(U)	0.4(U)
0215-97-0084	15-2578	15-21	3.9(U)	3.9(U)	0.4(J)	0.4(J)	0.4(J)
0215-97-0086	15-2580	6-12	3.8(U)	3.8(U)	0.4(J)	0.6(J)	0.6(J)
0215-97-0087	15-2581	15-21	0.4(U)	0.4(U)	0.0(J)	0.08(J)	0.06(J)
0215-97-0085	15-2579	15-21	0.4(U)	0.4(U)	0.4(U)	0.4	0.4(U)
0215-97-0089	15-2579	0-6	3.0	4.1	5.1	6.0	6.4

Sample ID	Location ID	Depth (in)	Benzo(g,h,i)-perylene (mg/kg)	Benzo(k)-fluoranthene (mg/kg)	Chrysene (mg/kg)	Indeno(1,2,3-cd)-pyrene (mg/kg)	Fluoranthene (mg/kg)
SALs	N/A[a]	N/A[a]	1900[c]	6.1	61	0.61	2600
EQLs	N/A[a]	N/A[a]	0.4	0.4	0.4	0.4	0.4
0215-97-0079	15-2576	12-18	0.4(U)	0.2(J)	0.2(J)	0.4(J)	0.3(J)
0215-97-0080	15-2576	24-30	0.05(J)	0.1(J)	0.1(J)	0.05(J)	0.2(J)
0215-97-0083	15-2577	24-30	0.4(U)	0.4(J)	0.4(U)	0.4(U)	0.06(J)
0215-97-0084	15-2578	15-21	3.9(U)	0.5(J)	0.5(J)	3.9(U)	0.9(J)
0215-97-0086	15-2580	6-12	3.8(U)	0.6(J)	0.5(J)	0.4(J)	1.0(J)
0215-97-0087	15-2581	15-21	0.4(U)	0.06(J)	0.07(J)	0.05(J)	1.0(J)
0215-97-0085	15-2579	15-21	0.4(U)	0.4	0.4(U)	0.4(U)	0.7
0215-97-0089	15-2579	0-6	3.0	3.3	5.9	3.0	14

[a] N/A = not applicable

[b] U indicates that the analyte was undetected at that detection limit.

[c] Toxicity criteria are not available for benzo(g,h,i)perylene; therefore, the toxicity criteria for pyrene were used as surrogates based on similarity in chemical structure.

TABLE 5.2.7-1
PAHS DETECTED IN THE SOIL AT PRS C-15-007
Continued

Sample ID	Location ID	Depth (in)	Fluorene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
SALs	N/A[a]	N/A[a]	2300	1000	18,000[c]	1900
EQLs	N/A[a]	N/A[a]	0.4	0.4	0.4	0.4
0215-97-0079	15-2576	12-18	0.4(U)[b]	0.4(U)	0.4(U)	0.3(J)
0215-97-0080	15-2576	24-30	0.4(U)	0.4(U)	0.1(J)	0.2(J)
0215-97-0083	15-2577	24-30	0.4(U)	0.4(U)	0.04(J)	0.05(J)
0215-97-0084	15-2578	15-21	3.9(U)	3.9(U)	0.6(J)	0.7(J)
0215-97-0086	15-2580	6-12	3.8(U)	3.8(U)	0.6(J)	0.8(J)
0215-97-0087	15-2581	15-21	0.4(U)	0.4(U)	0.06(J)	1.0(J)
0215-97-0085	15-2579	15-21	0.4(U)	0.4(U)	0.6	0.6
0215-97-0089	15-2579	0-6	3.4	5.8	17	12

[a] N/A = not applicable

[b] U indicates that the analyte was undetected at that detection limit.

[c] Toxicity criteria are not available for phenanthrene; therefore, the toxicity criteria for anthracene were used as surrogates based on similarity in chemical structure.

estimates are screening-level in nature and were calculated using the EPA Region 9 PRGs for industrial soil (EPA 1996, 1351). An estimate of the cancer risk range and hazard index range for the PAHs detected at this PRS were calculated by dividing the maximum detected concentrations by the industrial PRGs for each chemical (Table 5.2.7-2). The total carcinogenic risk and noncarcinogenic hazard index were estimated by summing the risk or hazard quotient for each chemical. The carcinogenic chemicals (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) were detected concentrations ranging from 0.01 mg/kg to 6.4 mg/kg. The industrial PRGs for these chemicals are 2.6 mg/kg, 0.26 mg/kg, 2.6 mg/kg, 26 mg/kg, 260 mg/kg, and 2.6 mg/kg, respectively (Table 5.2.7-2). The noncarcinogenic chemicals (acenaphthene, anthracene, benzo(g,h,i)perylene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene) were detected at concentrations ranging from 0.04 mg/kg to 17 mg/kg. The industrial PRGs for these chemicals are 11,000 mg/kg, 160,000 mg/kg, 20,000 mg/kg, 27,000 mg/kg, 18,000 mg/kg, 4400 mg/kg, 160,000 mg/kg, and 20,000 mg/kg, respectively (Table 5.2.7-2). The J qualified PAH data did not affect the risk evaluation because the concentrations were an order of magnitude below the maximum detected values used in the PRG comparison. The estimated cancer risk is approximately $3X10^{-5}$, which is in the middle of EPA's target risk range of 10^{-4} to 10^{-6} (EPA 1990, 0559). The estimated hazard index is approximately 0.002, which is below the target hazard index value of 1.0. Based on these comparisons, the PAHs detected at this PRS do not present an unacceptable risk to human health under the appropriate land use scenario, and are probably associated with the asphalt parking lot and berm adjacent to the PRS.

TABLE 5.2.7-2
INDUSTRIAL PRG COMPARISONS FOR PAHs DETECTED AT PRS C-15-007

Analytes	**Maximum Detected Concentrations**	**Industrial PRGs**	**Estimated Risk**
	Noncarcinogenic PAHs		
Acenaphthene	3.0	11,000	0.0003
Anthracene	4.1	160,000	0.00003
Benzo(g,h,i)perylene	3.0	20,000[a]	0.0002
Fluoranthene	14	27,000	0.0005
Fluorene	3.4	18,000	0.0002
Naphthalene	5.8	4400	0.001
Phenanthrene	17	160,000[b]	0.0001
Pyrene	12	20,000	0.0006
Hazard Index			**0.002**
	Carcinogenic PAHs		
Benzo(a)anthracene	5.1	2.6	$2X10^{-6}$
Benzo(a)pyrene	6.0	0.26	$2X10^{-5}$
Benzo(b)fluoranthene	6.4	2.6	$3X10^{-6}$
Benzo(k)fluoranthene	3.3	26	$1X10^{-7}$
Chrysene	5.9	260	$2X10^{-8}$
Indeno(1,2,3-cd)pyrene	3.0	2.6	$1X10^{-6}$
Estimated Cancer Risk			**$3X10^{-5}$**

[a] Toxicity criteria are not available for benzo(g,h,i) perylene; therefore, the toxicity criteria for pyrene were used as surrogates based on similarity in chemical structure.

[b] Toxicity criteria are not available for phenanthrene; therefore, the toxicity criteria for anthracene were used as surrogates based on similarity in chemical structure.

5.2.8 Risk-Based Screening Assessment

Copper and zinc were detected in ten soil samples at concentrations greater than background. The concentrations ranged from 16 mg/kg to 270 mg/kg for copper and 53 mg/kg to 110 mg/kg for zinc (Table

5.2.5-1). The copper concentrations were an order of magnitude below the SAL of 2800 mg/kg and the zinc concentrations were more than two orders of magnitude below the SAL of 23,000 mg/kg. These analytes were submitted to an MCE for noncarcinogens to determine if there was the potential for combined toxicity (Table 5.2.8-1).

Tetrachloroethene was detected in one subsurface soil sample at a concentration of 0.01 mg/kg, which was more than two orders of magnitude below the soil SAL of 5.4 mg/kg. The detected concentration of tetrachloroethene is associated with a cancer risk of approximately $2X10^{-9}$ (estimated by dividing the concentration by the residential preliminary remediation goal, i.e., the SAL value), which is below the lower end of EPA's target risk range (EPA 1990, 0559). Bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was detected at concentrations of 0.05 mg/kg and 0.06 mg/kg, which were more than two orders of magnitude below the soil SAL of 32 mg/kg. Dibenzofuran was detected in one surface soil sample at a concentration of 2.1 mg/kg, which was two orders of magnitude below the soil SAL of 250 mg/kg, i.e., a hazard quotient of 0.008 (the detected concentration divided by the residential preliminary remediation goal, i.e., the SAL value). Dibenzofuran was submitted to the MCE for noncarcinogens, while bis(2-ethylhexyl)phthalate and tetrachloroethene were submitted to an MCE for carcinogens related to site activities.

Multiple Chemical Evaluation

The MCEs included three analytes in the noncarcinogenic effects category and two analytes in the carcinogenic effects category (Table 5.2.8-1). The sum of the normalized concentrations for these analytes was 0.1 for noncarcinogens and 0.004 for carcinogens, which are below the target value of 1.0. Based on this evaluation, it is unlikely that there is the potential for an unacceptable risk to human health from combined effects.. Therefore, bis(2-ethylhexyl)phthalates, copper, dibenzofuran, tetrachloroethene, and zinc were not evaluated further.

TABLE 5.2.8-1
MULTIPLE CHEMICAL EVALUATION FOR SOIL SAMPLES FROM PRS C-15-007

Chemical	Location ID	Sample ID	Maximum Sample Value	Soil SAL	Normalized Values
Noncarcinogenic Effects (mg/kg)					
Copper	15-2577	0215-97-0081	270	2800	0.1
Dibenzofuran	15-2579	0215-97-0089	2.1	250	0.008
Zinc	15-2578	0215-97-0084	110	23,000	0.005
				Total:	**0.1**
Carcinogenic Effects (mg/kg)					
Bis(2-ethylhexyl)-phthalate	15-2578	0215-97-0084	0.06	32	0.002
Tetrachloroethene	15-2577	0215-97-0083	0.01	5.4	0.002
				Total:	**0.004**

5.2.9 Human Health Risk Assessment

No baseline human health risk assessment was performed for this PRS.

5.2.9.1 Review of COPCs and Extent of Contamination

The surface and subsurface soil within the PRS has been extensively sampled and no COPCs have been identified by the risk-based screening assessment.

5.2.10 Preliminary Ecological Assessment

The PRS has not been evaluated for the potential for ecological risk. The PRS will be evaluated once the ecological risk assessment methodology has been implemented by the Laboratory.

5.2.11 Conclusions and Recommendations

Based on NFA Criterion 5, the PRS has been characterized and the available data indicated that contaminants of concern were either not present or were present at concentrations that would pose an acceptable level of risk under future land use (NMED et al. 1995, 1328), C-15-007 is proposed for NFA based on human health.

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APPENDIX A
RFI CHARACTERIZATION DATA

The Phase I sampling data used to characterize the PRSs presented in this addendum to the TA-15 RFI report have not yet been loaded into the Facility Information Management and Display (FIMAD) database. Once the data has been edited and placed in FIMAD, the data can be provided upon request.

APPENDIX B
DATA QUALITY EVALUATION

TABLE B-1
DATA QUALITY EVALUATION OF SAMPLES COLLECTED FROM PRS C-15-001

Request Number	Sample ID	Suite	Comments
70088	0215-95-0275, -0276	Inorganics	Chromium had percent recovery in the laboratory control sample (LCS) outside of the established limits of 80-120%. The percent recovery for chromium was 121% and the data are qualified as J. The data are usable because the results are potentially biased high and, therefore, may overestimate the true values for chromium.
			Chromium had matrix spike duplicate recovery of 71.2%, which was below the established lower limit of 75%. The data is not qualified based on the matrix spike duplicate because the matrix spike recovery was within the established limits of 75-125%.
69184	0215-95-0275, -0276		Iron had percent recovery in the laboratory control sample (LCS) outside of the established limits of 80-120%. The percent recovery for iron was 76.2%, which is slightly below the established lower limit. The data are usable because the sample values for iron are approximately one-half of the background UTL so the potential low bias does not affect the data comparison.
			Antimony, selenium, and silver in 0215-95-0275 and cadmium and silver in 0215-95-0276 were detected below the estimated detection limits (EDLs) and are qualified as J. The sample results have a high degree of uncertainty because they cannot be accurately distinguished from the instrument "noise" levels. As a result, the data are usable as estimated values, but should be used with caution in the screening assessment because they cannot be accurately quantified.
			Aluminum, barium, beryllium, cadmium, chromium, copper, iron, manganese, mercury, nickel, vanadium, and zinc were detected in the laboratory blanks associated with these samples at or below the method detection limits. The sample values for these analytes were greater than 5X the blank values indicating that their presence is not due to contamination. The data are not qualified and are usable as reported in the screening assessment.

TABLE B-2
DATA QUALITY EVALUATION OF SAMPLES COLLECTED FROM PRS C-15-007

Request Number	Sample ID	Suite	Comments
3588R	0215-97-0075, -0076,-0077, -0078,-0079, -0080,-0081, -0082,-0083, -0084,-0085, -0086,-0087	Inorganics	Antimony, barium, and mercury had the spike recoveries were outside the established limits of 75-125%. The antimony and mercury data were undetected and should be qualified as UJ. The antimony and mercury data are usable because the recoveries of 51.3% and 74.2% were within the range of 30-74%, which results in acceptable, but potentially biased low data (EPA 1994, 1206). Therefore, the recoveries were sufficient to detect and quantify the analytes if they were present. The recovery for barium of 126.2% was above the established upper limit of 125% and the data were qualified as J+. These data are usable because the results are potentially biased high and, therefore, may overestimate the true values. In addition, post-digestion spikes for each analytes resulted in recoveries of 81.6% to 87.7%.
			Several analytes had relative percent differences (RPDs) of the laboratory duplicates were above the established limit of 20%. Further review of the data found that the results for beryllium and lead should not be qualified because the RPDs met EPA's control limits for soil (±35%, ±2X CRDL) (EPA 1994, 1206). The remaining inorganic data should be qualified as UJ or J and are usable because the RPDs reflect soil heterogeneity and do not affect method precision.
3587R	0215-97-0075, -0076,-0078, -0081,-0082, -0084,-0086	SVOCs	Samples could not be concentrated by the laboratory to a 1 ml final volume during the extraction procedure. The samples concentrated to a 10 ml final volume and the analytes reported with elevated detection limits.

TABLE B-2
DATA QUALITY EVALUATION OF SAMPLES COLLECTED FROM PRS C-15-007
Continued

Request Number	Sample ID	Suite	Comments
3587R	0215-97-0082, -0084	VOCs	The area counts for the internal standard d4-1,4-dichlorobenzene were less than 50% of the area lower limit for three samples. The internal standards were reanalyzed and the area counts for d4-1,4-dichlorobenzene were less than 50% of the area lower limit for two samples. Based on the latter internal standard analyses the data for two samples are qualified as UJ. The data are usable because area counts are between 37-44%, are not extremely low (<10%), and do not drop off abruptly, which would indicate a loss of sensitivity (EPA 1994, 1205). Although the data are potentially biased low, the instrument is still able to detect and quantify the analytes because its sensitivity and responsiveness were not compromised. In addition, the continuing calibrations, the internal standard retention times, and all other internal standard area counts were acceptable.

APPENDIX C
RISK CALCULATIONS

The printout from RESRAD 5.70 used to derive the industrial PRG for natural uranium is provided in this appendix.

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                 Dose Conversion Factor (and Related) Parameter Summary
                                  File: DOSFAC.BIN

  ³                                         ³ Current  ³       ³ Parameter
enu ³               Parameter                 ³  Value   ³ Default ³   Name
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1 ³ Dose conversion factors for inhalation, mrem/pCi:   ³          ³          ³
1 ³ Ac-227+D                                ³ 6.720E+00 ³ 6.720E+00 ³ DCF2( 1)
1 ³ Pa-231                                  ³ 1.280E+00 ³ 1.280E+00 ³ DCF2( 2)
1 ³ Pb-210+D                                ³ 2.320E-02 ³ 2.320E-02 ³ DCF2( 3)
1 ³ Ra-226+D                                ³ 8.600E-03 ³ 8.600E-03 ³ DCF2( 4)
1 ³ Th-230                                  ³ 3.260E-01 ³ 3.260E-01 ³ DCF2( 5)
1 ³ U-234                                   ³ 1.320E-01 ³ 1.320E-01 ³ DCF2( 6)
1 ³ U-235+D                                 ³ 1.230E-01 ³ 1.230E-01 ³ DCF2( 7)
1 ³ U-238+D                                 ³ 1.180E-01 ³ 1.180E-01 ³ DCF2( 8)
  ³                                         ³           ³           ³
1 ³ Dose conversion factors for ingestion, mrem/pCi:    ³           ³           ³
1 ³ Ac-227+D                                ³ 1.480E-02 ³ 1.480E-02 ³ DCF3( 1)
1 ³ Pa-231                                  ³ 1.060E-02 ³ 1.060E-02 ³ DCF3( 2)
1 ³ Pb-210+D                                ³ 7.270E-03 ³ 7.270E-03 ³ DCF3( 3)
1 ³ Ra-226+D                                ³ 1.330E-03 ³ 1.330E-03 ³ DCF3( 4)
1 ³ Th-230                                  ³ 5.480E-04 ³ 5.480E-04 ³ DCF3( 5)
1 ³ U-234                                   ³ 2.830E-04 ³ 2.830E-04 ³ DCF3( 6)
1 ³ U-235+D                                 ³ 2.670E-04 ³ 2.670E-04 ³ DCF3( 7)
1 ³ U-238+D                                 ³ 2.690E-04 ³ 2.690E-04 ³ DCF3( 8)
  ³                                         ³           ³           ³
34 ³ Food transfer factors:                              ³           ³           ³
34 ³ Ac-227+D , plant/soil concentration ratio, dimensionless  ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 1,1)
34 ³ Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 2.000E-05 ³ 2.000E-05 ³ RTF( 1,2)
34 ³ Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 2.000E-05 ³ 2.000E-05 ³ RTF( 1,3)
34 ³                                                            ³           ³           ³
34 ³ Pa-231   , plant/soil concentration ratio, dimensionless  ³ 1.000E-02 ³ 1.000E-02 ³ RTF( 2,1)
34 ³ Pa-231   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 5.000E-03 ³ 5.000E-03 ³ RTF( 2,2)
34 ³ Pa-231   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 2,3)
34 ³                                                            ³           ³           ³
34 ³ Pb-210+D , plant/soil concentration ratio, dimensionless  ³ 1.000E-02 ³ 1.000E-02 ³ RTF( 3,1)
34 ³ Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 8.000E-04 ³ 8.000E-04 ³ RTF( 3,2)
34 ³ Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 3.000E-04 ³ 3.000E-04 ³ RTF( 3,3)
34 ³                                                            ³           ³           ³
34 ³ Ra-226+D , plant/soil concentration ratio, dimensionless  ³ 4.000E-02 ³ 4.000E-02 ³ RTF( 4,1)
34 ³ Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 4,2)
34 ³ Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 4,3)
34 ³                                                            ³           ³           ³
34 ³ Th-230   , plant/soil concentration ratio, dimensionless  ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 5,1)
34 ³ Th-230   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 1.000E-04 ³ 1.000E-04 ³ RTF( 5,2)
34 ³ Th-230   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 5,3)
 4 ³                                                            ³           ³           ³
 4 ³ U-234    , plant/soil concentration ratio, dimensionless  ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 6,1)
 4 ³ U-234    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 6,2)
 4 ³ U-234    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 6,3)
 4 ³                                                            ³           ³           ³
 4 ³ U-235+D  , plant/soil concentration ratio, dimensionless  ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 7,1)
 4 ³ U-235+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)  ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 7,2)
 4 ³ U-235+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)   ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 7,3)
 4 ³
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            Dose Conversion Factor (and Related) Parameter Summary (continued)
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³                                          ³ Current ³       ³ Parameter
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34 ³ U-238+D  , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 8,1)
34 ³ U-238+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 3.400E-04 ³ 3.400E-04 ³ RTF( 8,2)
34 ³ U-238+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 6.000E-04 ³ 6.000E-04 ³ RTF( 8,3)
³                                          ³         ³         ³
5  ³ Bioaccumulation factors, fresh water, L/kg:     ³         ³         ³
5  ³ Ac-227+D , fish                         ³ 1.500E+01 ³ 1.500E+01 ³ BIOFAC( 1,1)
5  ³ Ac-227+D , crustacea and mollusks       ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 1,2)
5  ³                                         ³         ³         ³
5  ³ Pa-231   , fish                         ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 2,1)
5  ³ Pa-231   , crustacea and mollusks       ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC( 2,2)
5  ³                                         ³         ³         ³
5  ³ Pb-210+D , fish                         ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC( 3,1)
5  ³ Pb-210+D , crustacea and mollusks       ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 3,2)
5  ³                                         ³         ³         ³
5  ³ Ra-226+D , fish                         ³ 5.000E+01 ³ 5.000E+01 ³ BIOFAC( 4,1)
5  ³ Ra-226+D , crustacea and mollusks       ³ 2.500E+02 ³ 2.500E+02 ³ BIOFAC( 4,2)
5  ³                                         ³         ³         ³
5  ³ Th-230   , fish                         ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 5,1)
5  ³ Th-230   , crustacea and mollusks       ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC( 5,2)
5  ³                                         ³         ³         ³
5  ³ U-234    , fish                         ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 6,1)
5  ³ U-234    , crustacea and mollusks       ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 6,2)
5  ³                                         ³         ³         ³
5  ³ U-235+D  , fish                         ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 7,1)
5  ³ U-235+D  , crustacea and mollusks       ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 7,2)
5  ³                                         ³         ³         ³
5  ³ U-238+D  , fish                         ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC( 8,1)
5  ³ U-238+D  , crustacea and mollusks       ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC( 8,2)
ÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁÁ
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                              Site-Specific Parameter Summary

ª                                    ª User    ª         ª    Used by RESRAD       ª Parameter
nu ª              Parameter          ª  Input  ª Default ª (If different from user input) ª  Name
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11 ª Area of contaminated zone (m**2)            ª 2.100E+01 ª 1.000E+04 ª       ---        ª AREA
11 ª Thickness of contaminated zone (m)          ª 7.000E-01 ª 2.000E+00 ª       ---        ª THICK0
11 ª Length parallel to aquifer flow (m)         ª 1.000E+02 ª 1.000E+02 ª       ---        ª LCZPAQ
11 ª Basic radiation dose limit (mrem/yr)        ª 1.500E+01 ª 3.000E+01 ª       ---        ª BRDL
11 ª Time since placement of material (yr)       ª 0.000E+00 ª 0.000E+00 ª       ---        ª TI
11 ª Times for calculations (yr)                 ª 1.000E+00 ª 1.000E+00 ª       ---        ª T( 2)
11 ª Times for calculations (yr)                 ª 3.000E+00 ª 3.000E+00 ª       ---        ª T( 3)
11 ª Times for calculations (yr)                 ª 1.000E+01 ª 1.000E+01 ª       ---        ª T( 4)
11 ª Times for calculations (yr)                 ª 3.000E+01 ª 3.000E+01 ª       ---        ª T( 5)
11 ª Times for calculations (yr)                 ª 1.000E+02 ª 1.000E+02 ª       ---        ª T( 6)
11 ª Times for calculations (yr)                 ª 3.000E+02 ª 3.000E+02 ª       ---        ª T( 7)
11 ª Times for calculations (yr)                 ª 1.000E+03 ª 1.000E+03 ª       ---        ª T( 8)
11 ª Times for calculations (yr)                 ª not used  ª 0.000E+00 ª       ---        ª T( 9)
11 ª Times for calculations (yr)                 ª not used  ª 0.000E+00 ª       ---        ª T(10)
   ª                                             ª           ª           ª
12 ª Initial principal radionuclide (pCi/g): U-234  ª 5.070E-01 ª 0.000E+00 ª       ---        ª S1( 6)
12 ª Initial principal radionuclide (pCi/g): U-235  ª 2.300E-02 ª 0.000E+00 ª       ---        ª S1( 7)
12 ª Initial principal radionuclide (pCi/g): U-238  ª 4.700E-01 ª 0.000E+00 ª       ---        ª S1( 8)
12 ª Concentration in groundwater  (pCi/L): U-234   ª not used  ª 0.000E+00 ª       ---        ª W1( 6)
12 ª Concentration in groundwater  (pCi/L): U-235   ª not used  ª 0.000E+00 ª       ---        ª W1( 7)
12 ª Concentration in groundwater  (pCi/L): U-238   ª not used  ª 0.000E+00 ª       ---        ª W1( 8)
   ª                                             ª           ª           ª
13 ª Cover depth (m)                             ª 0.000E+00 ª 0.000E+00 ª       ---        ª COVER0
13 ª Density of cover material (g/cm**3)         ª not used  ª 1.500E+00 ª       ---        ª DENSCV
13 ª Cover depth erosion rate (m/yr)             ª not used  ª 1.000E-03 ª       ---        ª VCV
13 ª Density of contaminated zone (g/cm**3)      ª 1.600E+00 ª 1.500E+00 ª       ---        ª DENSCZ
13 ª Contaminated zone erosion rate (m/yr)       ª 1.000E-03 ª 1.000E-03 ª       ---        ª VCZ
13 ª Contaminated zone total porosity            ª 4.000E-01 ª 4.000E-01 ª       ---        ª TPCZ
13 ª Contaminated zone effective porosity        ª 2.000E-01 ª 2.000E-01 ª       ---        ª EPCZ
13 ª Contaminated zone hydraulic conductivity (m/yr) ª 4.400E+02 ª 1.000E+01 ª       ---        ª HCCZ
13 ª Contaminated zone b parameter               ª 4.050E+00 ª 5.300E+00 ª       ---        ª BCZ
13 ª Humidity in air (g/cm**3)                   ª not used  ª 8.000E+00 ª       ---        ª HUMID
13 ª Evapotranspiration coefficient              ª 9.990E-01 ª 5.000E-01 ª       ---        ª EVAPTR
13 ª Precipitation (m/yr)                        ª 4.800E-01 ª 1.000E+00 ª       ---        ª PRECIP
13 ª Irrigation (m/yr)                           ª 0.000E+00 ª 2.000E-01 ª       ---        ª RI
13 ª Irrigation mode                             ª overhead  ª overhead  ª       ---        ª IDITCH
13 ª Runoff coefficient                          ª 5.200E-01 ª 2.000E-01 ª       ---        ª RUNOFF
13 ª Watershed area for nearby stream or pond (m**2) ª 2.700E+07 ª 1.000E+06 ª       ---        ª WAREA
13 ª Accuracy for water/soil computations        ª 1.000E-03 ª 1.000E-03 ª       ---        ª EPS
   ª                                             ª           ª           ª
14 ª Density of saturated zone (g/cm**3)         ª 1.600E+00 ª 1.500E+00 ª       ---        ª DENSAQ
14 ª Saturated zone total porosity               ª 3.000E-01 ª 4.000E-01 ª       ---        ª TPSZ
14 ª Saturated zone effective porosity           ª 3.000E-01 ª 2.000E-01 ª       ---        ª EPSZ
14 ª Saturated zone hydraulic conductivity (m/yr) ª 1.000E+02 ª 1.000E+02 ª       ---        ª HCSZ
14 ª Saturated zone hydraulic gradient           ª 2.000E-02 ª 2.000E-02 ª       ---        ª HGWT
14 ª Saturated zone b parameter                  ª 4.050E+00 ª 5.300E+00 ª       ---        ª BSZ
14 ª Water table drop rate (m/yr)                ª 3.000E-01 ª 1.000E-03 ª       ---        ª VWT
14 ª Well pump intake depth (m below water table) ª 1.000E+01 ª 1.000E+01 ª       ---        ª DWIBWT
14 ª Model: Nondispersion (ND) or Mass-Balance (MB) ª ND     ª ND        ª       ---        ª MODEL
14 ª Well pumping rate (m**3/yr)                 ª 2.500E+02 ª 2.500E+02 ª       ---        ª UW
   ª                                             ª           ª           ª
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SRAD, V    n 5.70    T« Limit = 0.5 year       09/05/97  10:39    Page  5
nmary : RESRAD Default Parameters                     File: TA15001.RAD

                         Site-Specific Parameter Summary (continued)

³                                      ³  User     ³           ³     Used by RESRAD          ³ Parameter
nu ³             Parameter             ³  Input    ³  Default  ³ (If different from user input) ³  Name
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15 ³ Number of unsaturated zone strata     ³ not used  ³ 1         ³           —           ³ NS
15 ³ Unsat. zone 1, thickness (m)          ³ not used  ³ 4.000E+00 ³           —           ³ H(1)
15 ³ Unsat. zone 1, soil density (g/cm**3) ³ not used  ³ 1.500E+00 ³           —           ³ DENSUZ(1)
15 ³ Unsat. zone 1, total porosity         ³ not used  ³ 4.000E-01 ³           —           ³ TPUZ(1)
15 ³ Unsat. zone 1, effective porosity     ³ not used  ³ 2.000E-01 ³           —           ³ EPUZ(1)
15 ³ Unsat. zone 1, soil-specific b parameter ³ not used ³ 5.300E+00 ³         —           ³ BUZ(1)
15 ³ Unsat. zone 1, hydraulic conductivity (m/yr) ³ not used ³ 1.000E+01 ³     —           ³ HCUZ(1)
   ³                                       ³           ³           ³                       ³
15 ³ Unsat. zone 2, thickness (m)          ³ not used  ³ 0.000E+00 ³           —           ³ H(2)
15 ³ Unsat. zone 2, soil density (g/cm**3) ³ not used  ³ 1.500E+00 ³           —           ³ DENSUZ(2)
15 ³ Unsat. zone 2, total porosity         ³ not used  ³ 4.000E-01 ³           —           ³ TPUZ(2)
15 ³ Unsat. zone 2, effective porosity     ³ not used  ³ 2.000E-01 ³           —           ³ EPUZ(2)
15 ³ Unsat. zone 2, soil-specific b parameter ³ not used ³ 5.300E+00 ³         —           ³ BUZ(2)
15 ³ Unsat. zone 2, hydraulic conductivity (m/yr) ³ not used ³ 1.000E+01 ³     —           ³ HCUZ(2)
³                                          ³           ³           ³                       ³
16 ³ Distribution coefficients for U-234   ³           ³           ³                       ³
16 ³   Contaminated zone (cm**3/g)         ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCC( 6)
16 ³   Unsaturated zone 1 (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCU( 6,1)
16 ³   Unsaturated zone 2 (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCU( 6,2)
16 ³   Saturated zone (cm**3/g)            ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCS( 6)
16 ³   Leach rate (/yr)                    ³ 0.000E+00 ³ 0.000E+00 ³       4.109E-06       ³ ALEACH( 6)
16 ³   Solubility constant                 ³ 0.000E+00 ³ 0.000E+00 ³       not used        ³ SOLUBK( 6)
³                                          ³           ³           ³                       ³
16 ³ Distribution coefficients for U-235   ³           ³           ³                       ³
16 ³   Contaminated zone (cm**3/g)         ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCC( 7)
16 ³   Unsaturated zone 1 (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCU( 7,1)
16 ³   Unsaturated zone 2 (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCU( 7,2)
16 ³   Saturated zone (cm**3/g)            ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCS( 7)
16 ³   Leach rate (/yr)                    ³ 0.000E+00 ³ 0.000E+00 ³       4.109E-06       ³ ALEACH( 7)
16 ³   Solubility constant                 ³ 0.000E+00 ³ 0.000E+00 ³       not used        ³ SOLUBK( 7)
   ³                                       ³           ³           ³                       ³
16 ³ Distribution coefficients for U-238   ³           ³           ³                       ³
16 ³   Contaminated zone (cm**3/g)         ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCC( 8)
16 ³   Unsaturated zone 1 (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCU( 8,1)
16 ³   Unsaturated zone 2 (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCU( 8,2)
16 ³   Saturated zone (cm**3/g)            ³ 5.000E+01 ³ 5.000E+01 ³           —           ³ DCNUCS( 8)
16 ³   Leach rate (/yr)                    ³ 0.000E+00 ³ 0.000E+00 ³       4.109E-06       ³ ALEACH( 8)
16 ³   Solubility constant                 ³ 0.000E+00 ³ 0.000E+00 ³       not used        ³ SOLUBK( 8)
³                                          ³           ³           ³                       ³
16 ³ Distribution coefficients for daughter Ac-227 ³   ³           ³                       ³
16 ³   Contaminated zone (cm**3/g)         ³ 2.000E+01 ³ 2.000E+01 ³           —           ³ DCNUCC( 1)
16 ³   Unsaturated zone 1 (cm**3/g)        ³ 2.000E+01 ³ 2.000E+01 ³           —           ³ DCNUCU( 1,1)
16 ³   Unsaturated zone 2 (cm**3/g)        ³ 2.000E+01 ³ 2.000E+01 ³           —           ³ DCNUCU( 1,2)
16 ³   Saturated zone (cm**3/g)            ³ 2.000E+01 ³ 2.000E+01 ³           —           ³ DCNUCS( 1)
16 ³   Leach rate (/yr)                    ³ 0.000E+00 ³ 0.000E+00 ³       1.025E-05       ³ ALEACH( 1)
16 ³   Solubility constant                 ³ 0.000E+00 ³ 0.000E+00 ³       not used        ³ SOLUBK( 1)
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                         Site-Specific Parameter Summary (continued)

 ³                                   ³  User   ³          ³   Used by RESRAD              ³ Parameter
enu ³           Parameter            ³  Input  ³ Default  ³ (If different from user input) ³  Name
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16 ³ Distribution coefficients for daughter Pa-231   ³          ³          ³                                ³
16 ³  Contaminated zone (cm**3/g)        ³ 5.000E+01 ³ 5.000E+01 ³     ---                        ³ DCNUCC( 2)
16 ³  Unsaturated zone 1 (cm**3/g)       ³ 5.000E+01 ³ 5.000E+01 ³     ---                        ³ DCNUCU( 2,1)
16 ³  Unsaturated zone 2 (cm**3/g)       ³ 5.000E+01 ³ 5.000E+01 ³     ---                        ³ DCNUCU( 2,2)
16 ³  Saturated zone (cm**3/g)           ³ 5.000E+01 ³ 5.000E+01 ³     ---                        ³ DCNUCS( 2)
16 ³  Leach rate (/yr)                   ³ 0.000E+00 ³ 0.000E+00 ³  4.109E-06                     ³ ALEACH( 2)
16 ³  Solubility constant                ³ 0.000E+00 ³ 0.000E+00 ³  not used                      ³ SOLUBK( 2)
 ³                                       ³           ³           ³                                ³
16 ³ Distribution coefficients for daughter Pb-210   ³          ³          ³                                ³
16 ³  Contaminated zone (cm**3/g)        ³ 1.000E+02 ³ 1.000E+02 ³     ---                        ³ DCNUCC( 3)
16 ³  Unsaturated zone 1 (cm**3/g)       ³ 1.000E+02 ³ 1.000E+02 ³     ---                        ³ DCNUCU( 3,1)
16 ³  Unsaturated zone 2 (cm**3/g)       ³ 1.000E+02 ³ 1.000E+02 ³     ---                        ³ DCNUCU( 3,2)
16 ³  Saturated zone (cm**3/g)           ³ 1.000E+02 ³ 1.000E+02 ³     ---                        ³ DCNUCS( 3)
16 ³  Leach rate (/yr)                   ³ 0.000E+00 ³ 0.000E+00 ³  2.056E-06                     ³ ALEACH( 3)
16 ³  Solubility constant                ³ 0.000E+00 ³ 0.000E+00 ³  not used                      ³ SOLUBK( 3)
 ³                                       ³           ³           ³                                ³
16 ³ Distribution coefficients for daughter Ra-226   ³          ³          ³                                ³
16 ³  Contaminated zone (cm**3/g)        ³ 7.000E+01 ³ 7.000E+01 ³     ---                        ³ DCNUCC( 4)
16 ³  Unsaturated zone 1 (cm**3/g)       ³ 7.000E+01 ³ 7.000E+01 ³     ---                        ³ DCNUCU( 4,1)
16 ³  Unsaturated zone 2 (cm**3/g)       ³ 7.000E+01 ³ 7.000E+01 ³     ---                        ³ DCNUCU( 4,2)
16 ³  Saturated zone (cm**3/g)           ³ 7.000E+01 ³ 7.000E+01 ³     ---                        ³ DCNUCS( 4)
16 ³  Leach rate (/yr)                   ³ 0.000E+00 ³ 0.000E+00 ³  2.936E-06                     ³ ALEACH( 4)
16 ³  Solubility constant                ³ 0.000E+00 ³ 0.000E+00 ³  not used                      ³ SOLUBK( 4)
 ³                                       ³           ³           ³                                ³
16 ³ Distribution coefficients for daughter Th-230   ³          ³          ³                                ³
16 ³  Contaminated zone (cm**3/g)        ³ 6.000E+04 ³ 6.000E+04 ³     ---                        ³ DCNUCC( 5)
16 ³  Unsaturated zone 1 (cm**3/g)       ³ 6.000E+04 ³ 6.000E+04 ³     ---                        ³ DCNUCU( 5,1)
16 ³  Unsaturated zone 2 (cm**3/g)       ³ 6.000E+04 ³ 6.000E+04 ³     ---                        ³ DCNUCU( 5,2)
16 ³  Saturated zone (cm**3/g)           ³ 6.000E+04 ³ 6.000E+04 ³     ---                        ³ DCNUCS( 5)
16 ³  Leach rate (/yr)                   ³ 0.000E+00 ³ 0.000E+00 ³  3.429E-09                     ³ ALEACH( 5)
16 ³  Solubility constant                ³ 0.000E+00 ³ 0.000E+00 ³  not used                      ³ SOLUBK( 5)
 ³                                       ³           ³           ³                                ³
17 ³ Inhalation rate (m**3/yr)           ³ 1.490E+04 ³ 8.400E+03 ³     ---                        ³ INHALR
17 ³ Mass loading for inhalation (g/m**3)    ³ 9.000E-05 ³ 2.000E-04 ³     ---                    ³ MLINH
17 ³ Dilution length for airborne dust, inhalation (m)³ 3.000E+00 ³ 3.000E+00 ³     ---           ³ LM
17 ³ Exposure duration                   ³ 2.500E+01 ³ 3.000E+01 ³     ---                        ³ ED
17 ³ Shielding factor, inhalation        ³ 4.000E-01 ³ 4.000E-01 ³     ---                        ³ SHF3
17 ³ Shielding factor, external gamma        ³ 7.000E-01 ³ 7.000E-01 ³     ---                    ³ SHF1
17 ³ Fraction of time spent indoors        ³ 1.840E-01 ³ 5.000E-01 ³     ---                      ³ FIND
17 ³ Fraction of time spent outdoors (on site) ³ 4.600E-02 ³ 2.500E-01 ³     ---                  ³ FOTD
17 ³ Shape factor flag, external gamma       ³ 1.000E+00 ³ 1.000E+00 ³ 1 shows circular AREA.     ³ FS
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                        Site-Specific Parameter Summary (continued)

³                                    ³  User   ³        ³     Used by RESRAD        ³  Parameter
nu ³              Parameter                ³  Input   ³ Default ³ (If different from user input) ³   Name
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17 ³ Radii of shape factor array (used if FS = -1):  ³          ³            ³                                ³
17 ³   Outer annular radius (m), ring  1:           ³ not used ³ 5.000E+01 ³              —                ³ RAD_SHAPE( 1)
17 ³   Outer annular radius (m), ring  2:           ³ not used ³ 7.071E+01 ³              —                ³ RAD_SHAPE( 2)
17 ³   Outer annular radius (m), ring  3:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 3)
17 ³   Outer annular radius (m), ring  4:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 4)
17 ³   Outer annular radius (m), ring  5:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 5)
17 ³   Outer annular radius (m), ring  6:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 6)
17 ³   Outer annular radius (m), ring  7:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 7)
17 ³   Outer annular radius (m), ring  8:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 8)
17 ³   Outer annular radius (m), ring  9:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE( 9)
17 ³   Outer annular radius (m), ring 10:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE(10)
17 ³   Outer annular radius (m), ring 11:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE(11)
17 ³   Outer annular radius (m), ring 12:           ³ not used ³ 0.000E+00 ³              —                ³ RAD_SHAPE(12)
³                                        ³          ³            ³
17 ³ Fractions of annular areas within AREA:      ³          ³           ³                                ³
17 ³   Ring  1                              ³ not used ³ 1.000E+00 ³              —                ³ FRACA( 1)
17 ³   Ring  2                              ³ not used ³ 2.732E-01 ³              —                ³ FRACA( 2)
17 ³   Ring  3                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 3)
17 ³   Ring  4                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 4)
17 ³   Ring  5                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 5)
17 ³   Ring  6                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 6)
17 ³   Ring  7                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 7)
17 ³   Ring  8                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 8)
17 ³   Ring  9                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA( 9)
17 ³   Ring 10                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA(10)
17 ³   Ring 11                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA(11)
17 ³   Ring 12                              ³ not used ³ 0.000E+00 ³              —                ³ FRACA(12)
³                                        ³          ³            ³
18 ³ Fruits, vegetables and grain consumption (kg/yr) ³ not used ³ 1.600E+02 ³          —                ³ DIET(1)
18 ³ Leafy vegetable consumption (kg/yr)        ³ not used ³ 1.400E+01 ³              —                ³ DIET(2)
18 ³ Milk consumption (L/yr)                    ³ not used ³ 9.200E+01 ³              —                ³ DIET(3)
18 ³ Meat and poultry consumption (kg/yr)       ³ not used ³ 6.300E+01 ³              —                ³ DIET(4)
18 ³ Fish consumption (kg/yr)                   ³ not used ³ 5.400E+00 ³              —                ³ DIET(5)
18 ³ Other seafood consumption (kg/yr)          ³ not used ³ 9.000E-01 ³              —                ³ DIET(6)
18 ³ Soil ingestion rate (g/yr)                 ³ 3.650E+01 ³ 3.650E+01 ³             —                ³ SOIL
18 ³ Drinking water intake (L/yr)               ³ not used ³ 5.100E+02 ³              —                ³ DWI
18 ³ Contamination fraction of drinking water   ³ not used ³ 1.000E+00 ³              —                ³ FDW
18 ³ Contamination fraction of household water  ³ 0.000E+00 ³ 1.000E+00 ³             —                ³ FHHW
18 ³ Contamination fraction of livestock water  ³ not used ³ 1.000E+00 ³              —                ³ FLW
18 ³ Contamination fraction of irrigation water ³ not used ³ 1.000E+00 ³              —                ³ FIRW
18 ³ Contamination fraction of aquatic food     ³ not used ³ 5.000E-01 ³              —                ³ FR9
18 ³ Contamination fraction of plant food       ³ not used ³-1          ³              —                ³ FPLANT
18 ³ Contamination fraction of meat             ³ not used ³-1          ³              —                ³ FMEAT
18 ³ Contamination fraction of milk             ³ not used ³-1          ³              —                ³ FMILK
³                                        ³          ³            ³
19 ³ Livestock fodder intake for meat (kg/day)  ³ not used ³ 6.800E+01 ³              —                ³ LFI5
19 ³ Livestock fodder intake for milk (kg/day)  ³ not used ³ 5.500E+01 ³              —                ³ LFI6
19 ³ Livestock water intake for meat (L/day)    ³ not used ³ 5.000E+01 ³              —                ³ LWI5
19 ³ Livestock water intake for milk (L/day)    ³ not used ³ 1.600E+02 ³              —                ³ LWI6
19 ³ Livestock soil intake (kg/day)             ³ not used ³ 5.000E-01 ³              —                ³ LSI
19 ³ Mass loading for foliar deposition (g/m**3) ³ not used ³ 1.000E-04 ³             —                ³ MLFD
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                         Site-Specific Parameter Summary (continued)

 ³                              ³  User    ³          ³     Used by RESRAD          ³  Parameter
nu ³           Parameter             ³  Input   ³  Default  ³ (If different from user input) ³   Name
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19 ³ Depth of soil mixing layer (m)                ³ 1.500E-01 ³ 1.500E-01 ³         —          ³ DM
19 ³ Depth of roots (m)                            ³ not used  ³ 9.000E-01 ³         —          ³ DROOT
19 ³ Drinking water fraction from ground water     ³ 0.000E+00 ³ 1.000E+00 ³         —          ³ FGWDW
19 ³ Household water fraction from ground water    ³ not used  ³ 1.000E+00 ³         —          ³ FGWHH
19 ³ Livestock water fraction from ground water    ³ 0.000E+00 ³ 1.000E+00 ³         —          ³ FGWLW
19 ³ Irrigation fraction from ground water         ³ not used  ³ 1.000E+00 ³         —          ³ FGWIR
 ³                                                 ³           ³           ³
4  ³ C-12 concentration in water (g/cm**3)         ³ not used  ³ 2.000E-05 ³         —          ³ C12WTR
4  ³ C-12 concentration in contaminated soil (g/g) ³ not used  ³ 3.000E-02 ³         —          ³ C12CZ
4  ³ Fraction of vegetation carbon from soil       ³ not used  ³ 2.000E-02 ³         —          ³ CSOIL
4  ³ Fraction of vegetation carbon from air        ³ not used  ³ 9.800E-01 ³         —          ³ CAIR
4  ³ C-14 evasion layer thickness in soil (m)      ³ not used  ³ 3.000E-01 ³         —          ³ DMC
4  ³ C-14 evasion flux rate from soil (1/sec)      ³ not used  ³ 7.000E-07 ³         —          ³ EVSN
4  ³ C-12 evasion flux rate from soil (1/sec)      ³ not used  ³ 1.000E-10 ³         —          ³ REVSN
4  ³ Fraction of grain in beef cattle feed         ³ not used  ³ 8.000E-01 ³         —          ³ AVFG4
4  ³ Fraction of grain in milk cow feed            ³ not used  ³ 2.000E-01 ³         —          ³ AVFG5
 ³                                                 ³           ³           ³
OR ³ Storage times of contaminated foodstuffs (days): ³        ³           ³                    ³
OR ³   Fruits, non-leafy vegetables, and grain     ³ not used  ³ 1.400E+01 ³         —          ³ STOR_T(1)
OR ³   Leafy vegetables                            ³ not used  ³ 1.000E+00 ³         —          ³ STOR_T(2)
OR ³   Milk                                        ³ not used  ³ 1.000E+00 ³         —          ³ STOR_T(3)
OR ³   Meat and poultry                            ³ not used  ³ 2.000E+01 ³         —          ³ STOR_T(4)
OR ³   Fish                                        ³ not used  ³ 7.000E+00 ³         —          ³ STOR_T(5)
OR ³   Crustacea and mollusks                      ³ not used  ³ 7.000E+00 ³         —          ³ STOR_T(6)
OR ³   Well water                                  ³ not used  ³ 1.000E+00 ³         —          ³ STOR_T(7)
OR ³   Surface water                               ³ not used  ³ 1.000E+00 ³         —          ³ STOR_T(8)
OR ³   Livestock fodder                            ³ not used  ³ 4.500E+01 ³         —          ³ STOR_T(9)
 ³                                                 ³           ³           ³
21 ³ Thickness of building foundation (m)          ³ 1.500E-01 ³ 1.500E-01 ³         —          ³ FLOOR
21 ³ Bulk density of building foundation (g/cm**3) ³ 2.400E+00 ³ 2.400E+00 ³         —          ³ DENSFL
21 ³ Total porosity of the cover material          ³ not used  ³ 4.000E-01 ³         —          ³ TPCV
21 ³ Total porosity of the building foundation     ³ 1.000E-01 ³ 1.000E-01 ³         —          ³ TPFL
21 ³ Volumetric water content of the cover material ³ not used ³ 5.000E-02 ³         —          ³ PH2OCV
21 ³ Volumetric water content of the foundation    ³ 3.000E-02 ³ 3.000E-02 ³         —          ³ PH2OFL
21 ³ Diffusion coefficient for radon gas (m/sec):  ³           ³           ³                    ³
21 ³   in cover material                           ³ not used  ³ 2.000E-06 ³         —          ³ DIFCV
21 ³   in foundation material                      ³ 3.000E-07 ³ 3.000E-07 ³         —          ³ DIFFL
21 ³   in contaminated zone soil                   ³ 2.000E-06 ³ 2.000E-06 ³         —          ³ DIFCZ
21 ³ Radon vertical dimension of mixing (m)        ³ 2.000E+00 ³ 2.000E+00 ³         —          ³ HMIX
21 ³ Average annual wind speed (m/sec)             ³ 3.000E+00 ³ 2.000E+00 ³         —          ³ WIND
21 ³ Average building air exchange rate (1/hr)     ³ 1.000E+00 ³ 5.000E-01 ³         —          ³ REXG
21 ³ Height of the building (room) (m)             ³ 2.500E+00 ³ 2.500E+00 ³         —          ³ HRM
21 ³ Building interior area factor                 ³ 0.000E+00 ³ 0.000E+00 ³ code computed (time dependent) ³ FAI
21 ³ Building depth below ground surface (m)       ³ 0.000E+00 ³-1.000E+00 ³         —          ³ DMFL
21 ³ Emanating power of Rn-222 gas                 ³ 2.500E-01 ³ 2.500E-01 ³         —          ³ EMANA(1)
21 ³ Emanating power of Rn-220 gas                 ³ not used  ³ 1.500E-01 ³         —          ³ EMANA(2)
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        Summary of Pathway Selections

        Pathway            ³  User Selection
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
  1 -- external gamma      ³    active
  2 -- inhalation (w/o radon)³  active
  3 -- plant ingestion     ³  suppressed
  4 -- meat ingestion      ³  suppressed
  5 -- milk ingestion      ³  suppressed
  6 -- aquatic foods       ³  suppressed
  7 -- drinking water      ³  suppressed
  8 -- soil ingestion      ³    active
  9 -- radon               ³    active
||||||||||||||||||||||||||||||||||||||||||||||||||||
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 Contaminated Zone Dimensions          Initial Soil Concentrations, pCi/g
 ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ             ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
   Area:   21.00 square meters          U-234    5.070E-01
hickness:    0.70 meters               U-235   2.300E-02
ver Depth:     0.00 meters              U-238    4.700E-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)
         ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
(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):  2.090E-02  2.090E-02  2.090E-02  2.091E-02  2.091E-02  2.097E-02  2.115E-02  0.000E+00
   M(t):  1.394E-03  1.394E-03  1.394E-03  1.394E-03  1.394E-03  1.398E-03  1.410E-03  0.000E+00

ximum TDOSE(t):  2.118E-02 mrem/yr   at t =   389.2 ñ 0.4 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 =  389.2  years

                     Water Independent Pathways (Inhalation excludes radon)

       Ground          Inhalation         Radon           Plant           Meat            Milk            Soil
dio- ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄ
clide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
ÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄ
34   1.805E-04 0.0085  6.526E-03 0.3081  1.690E-04 0.0080  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.559E-05 0.0012
35   1.922E-03 0.0907  4.099E-04 0.0194  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.885E-06 0.0001
38   6.551E-03 0.3093  5.374E-03 0.2537  5.843E-08 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.228E-05 0.0011
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al   8.654E-03 0.4085  1.231E-02 0.5811  1.690E-04 0.0080  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.975E-05 0.0023


            Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
                    As mrem/yr and Fraction of Total Dose At t =  389.2  years

                               Water Dependent Pathways

        Water            Fish           Radon           Plant           Meat            Milk       All Pathways*
dio- ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄ
clide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
ÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄ
34   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  6.901E-03 0.3258
35   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  2.334E-03 0.1102
38   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  1.195E-02 0.5640
ÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ ÍÍÍÍÍÍÍÍÍ ÍÍÍÍÍÍ
l    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  2.118E-02 1.0000

m of all water independent and dependent pathways.
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        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)

    Ground         Inhalation        Radon            Plant           Meat            Milk            Soil
llo- AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAA
clide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
AAAAA AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAA
34   2.355E-05 0.0011  6.487E-03 0.3103  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.529E-05 0.0012
35   1.914E-03 0.0915  2.742E-04 0.0131  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.083E-06 0.0001
38   6.782E-03 0.3244  5.376E-03 0.2572  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.229E-05 0.0011
|| |||||||| ||||| |||||||| ||||| |||||||| ||||| |||||||| ||||| |||||||| ||||| |||||||| |||||
al   8.719E-03 0.4171  1.214E-02 0.5806  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.867E-05 0.0023


        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

     Water           Fish            Radon           Plant           Meat            Milk        All Pathways*
dio- AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAA
clide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
AAAAA AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAAAAAA AAAAAA  AAAAAA
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  6.536E-03 0.3127
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  2.189E-03 0.1047
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  1.218E-02 0.5826
|| |||||||| ||||| |||||||| ||||| |||||||| ||||| |||||||| ||||| |||||||| ||||| |||||||| |||||
al   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  2.090E-02 1.0000

um of all water independent and dependent pathways.
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              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)

        Ground          Inhalation          Radon           Plant          Meat           Milk           Soil
idio- AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAA
iclide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAA
234   2.355E-05 0.0011 6.487E-03 0.3103 1.528E-09 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.530E-05 0.0012
235   1.914E-03 0.0915 2.743E-04 0.0131 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.084E-06 0.0001
238   6.782E-03 0.3244 5.376E-03 0.2572 1.229E-15 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.229E-05 0.0011
lll lllllllll llllll lllllllll llllll lllllllll llllll lllllllll llllll lllllllll llllll lllllllll llllll
tal  8.719E-03 0.4171 1.214E-02 0.5806 1.528E-09 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 4.867E-05 0.0023

              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

        Water            Fish            Radon           Plant          Meat           Milk        All Pathways*
idio- AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAA
iclide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAA
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 6.536E-03 0.3127
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 2.189E-03 0.1047
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 1.218E-02 0.5826
lll lllllllll llllll lllllllll llllll lllllllll llllll lllllllll llllll lllllllll llllll lllllllll llllll
tal  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 2.090E-02 1.0000

um of all water independent and dependent pathways.
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              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)

      Ground         Inhalation         Radon            Plant            Meat            Milk            Soil
dio-  AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA
34    2.356E-05 0.0011  6.487E-03 0.3103  1.374E-08 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.530E-05 0.0012
35    1.914E-03 0.0915  2.744E-04 0.0131  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.086E-06 0.0001
38    6.782E-03 0.3244  5.376E-03 0.2572  3.596E-14 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.229E-05 0.0011
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al    8.719E-03 0.4171  1.214E-02 0.5806  1.374E-08 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.867E-05 0.0023


              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

      Water           Fish             Radon            Plant            Meat            Milk          All Pathways*
dio-  AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAA4AA AAAAAA
34    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  6.536E-03 0.3127
35    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  2.189E-03 0.1047
38    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  1.218E-02 0.5826
|| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| ||||||||| ||||||
al    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  2.090E-02 1.0000

m of all water independent and dependent pathways.
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            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
idio- AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAA
iclide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAA
234   2.367E-05 0.0011  6.488E-03 0.3103  1.522E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.530E-05 0.0012
235   1.914E-03 0.0915  2.753E-04 0.0132  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.093E-06 0.0001
238   6.781E-03 0.3244  5.376E-03 0.2571  1.334E-12 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.229E-05 0.0011
|||||| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| |||||||||
tal   8.719E-03 0.4170  1.214E-02 0.5806  1.522E-07 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.868E-05 0.0023

            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*
dio-  AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAA
clide  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAA
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  6.537E-03 0.3127
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  2.190E-03 0.1048
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  1.218E-02 0.5826
|||||| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| ||||||||| |||||| |||||||||
al    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  2.091E-02 1.0000

im of all water independent and dependent pathways.
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            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)

      Ground          Inhalation          Radon            Plant            Meat             Milk             Soil
llo- AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAA
:34   2.459E-05 0.0012  6.490E-03 0.3103  1.357E-06 0.0001  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.530E-05 0.0012
:35   1.915E-03 0.0915  2.794E-04 0.0134  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.123E-06 0.0001
:38   6.781E-03 0.3242  5.376E-03 0.2570  3.569E-11 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.229E-05 0.0011
II IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII
al   8.720E-03 0.4169  1.214E-02 0.5807  1.357E-06 0.0001  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.871E-05 0.0023


            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

      Water            Fish             Radon            Plant            Meat             Milk         All Pathways*
llo- AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAA
:34   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  6.541E-03 0.3127
:35   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  2.195E-03 0.1050
:38   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  1.218E-02 0.5823
II IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII IIIIIIII IIIII
al   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  2.091E-02 1.0000

im of all water independent and dependent pathways.
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              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)

        Ground          Inhalation          Radon            Plant             Meat             Milk             Soil
idio-  AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
iclide mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAA
234   3.494E-05 0.0017  6.497E-03 0.3098  1.453E-05 0.0007  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.533E-05 0.0012
235   1.921E-03 0.0916  3.023E-04 0.0144  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  1.262E-06 0.0001
238   6.778E-03 0.3232  5.375E-03 0.2563  1.278E-09 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  2.229E-05 0.0011

tal   8.734E-03 0.4165  1.217E-02 0.5805  1.453E-05 0.0007  0.000E+00 0.0000  0.000E+00 0.0000  0.000E+00 0.0000  4.888E-05 0.0023

              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

        Water            Fish             Radon            Plant             Meat             Milk        All Pathways*
dio-   AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.  mrem/yr  fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAA
34    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  6.572E-03 0.3134
35    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  2.225E-03 0.1061
38    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  1.218E-02 0.5806

al    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  2.097E-02 1.0000

m of all water independent and dependent pathways.
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          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
dio- AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAA
:34   1.206E-04 0.0057 6.517E-03 0.3081 1.123E-04 0.0053 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.548E-05 0.0012
:35   1.928E-03 0.0911 3.767E-04 0.0178 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.692E-06 0.0001
:38   6.672E-03 0.3155 5.374E-03 0.2541 2.982E-08 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.228E-05 0.0011
ll lllllllll lllll lllllllll lllll lllllllll lllll lllllllll lllll lllllllll lllll lllllllll lllll
al    8.720E-03 0.4123 1.227E-02 0.5800 1.123E-04 0.0053 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 4.946E-05 0.0023

          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*
dio- AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAA AAAAA
clide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
AAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAAAAA AAAAAA AAAAAA
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 6.775E-03 0.3203
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 2.306E-03 0.1090
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 1.207E-02 0.5706
ll lllllllll lllll lllllllll lllll lllllllll lllll lllllllll lllll lllllllll lllll lllllllll lllll
tal   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 2.115E-02 1.0000

um of all water independent and dependent pathways.
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             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
dio- ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄ
clide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
ÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄ
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
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
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
ÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ
tal   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*
dio- ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄ
clide mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.  mrem/yr fract.
ÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄ ÄÄÄÄÄ
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
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
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
ÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ ÌÌÌÌÌÌÌÌ ÌÌÌÌ
al    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

ım of all water independent and dependent pathways.
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                  Dose/Source Ratios Summed Over All Pathways
             Parent and Progeny Principal Radionuclide Contributions Indicated

'ent  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
AAAAA AAAAAAA AAAAAAAAA    AAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA
:34  U-234   1.000E+00   1.289E-02 1.289E-02 1.289E-02 1.289E-02 1.289E-02 1.288E-02 1.286E-02 0.000E+00
:34  Th-230  1.000E+00   0.000E+00 2.865E-07 8.596E-07 2.865E-06 8.594E-06 2.863E-05 8.576E-05 0.000E+00
:34  Ra-226  1.000E+00   0.000E+00 5.288E-09 4.756E-08 5.272E-07 4.714E-06 5.106E-05 4.127E-04 0.000E+00
:34  Pb-210  1.000E+00   0.000E+00 8.469E-14 2.251E-12 7.903E-11 1.847E-09 4.510E-08 5.754E-07 0.000E+00
:34  ãDSR(j)            1.289E-02 1.289E-02 1.289E-02 1.289E-02 1.290E-02 1.296E-02 1.336E-02 0.000E+00

:35  U-235   1.000E+00   9.517E-02 9.517E-02 9.516E-02 9.516E-02 9.515E-02 9.513E-02 9.442E-02 0.000E+00
:35  Pa-231  1.000E+00   0.000E+00 3.105E-06 9.314E-06 3.104E-05 9.310E-05 3.100E-04 9.261E-04 0.000E+00
:35  Ac-227  1.000E+00   0.000E+00 2.901E-07 2.556E-06 2.643E-05 1.965E-04 1.285E-03 4.915E-03 0.000E+00
:35  ãDSR(j)            9.517E-02 9.517E-02 9.518E-02 9.522E-02 9.544E-02 9.672E-02 1.003E-01 0.000E+00

:38  U-238   1.000E+00   2.591E-02 2.591E-02 2.591E-02 2.591E-02 2.591E-02 2.590E-02 2.567E-02 0.000E+00
:38  U-234   1.000E+00   0.000E+00 3.655E-08 1.096E-07 3.654E-07 1.096E-06 3.653E-06 1.095E-05 0.000E+00
:38  Th-230  1.000E+00   0.000E+00 4.062E-13 3.655E-12 4.061E-11 3.655E-10 4.059E-09 3.648E-08 0.000E+00
:38  Ra-226  1.000E+00   0.000E+00 4.588E-15 1.343E-13 4.984E-12 1.338E-10 4.843E-09 1.183E-07 0.000E+00
:38  Pb-210  1.000E+00   0.000E+00 2.336E-18 6.261E-16 5.705E-16 4.100E-14 3.585E-12 1.507E-10 0.000E+00
:38  ãDSR(j)            2.591E-02 2.591E-02 2.591E-02 2.591E-02 2.591E-02 2.591E-02 2.568E-02 0.000E+00
inch Fraction is the cumulative factor for the j'th principal radionuclide daughter:  CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
 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

clide
     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
AAAAA    AAAAAAAAA   AAAAAAAAA   AAAAAAAAA   AAAAAAAAA   AAAAAAAAA   AAAAAAAAA   AAAAAAAAA   AAAAAAAAA
:34       1.164E+03   1.164E+03   1.164E+03   1.163E+03   1.163E+03   1.157E+03   1.122E+03  *6.245E+09
:35       1.576E+02   1.576E+02   1.576E+02   1.575E+02   1.572E+02   1.551E+02   1.496E+02  *2.160E+06
:38       5.788E+02   5.788E+02   5.788E+02   5.789E+02   5.789E+02   5.790E+02   5.842E+02  *3.360E+05
 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 =   389.2 ñ 0.4 years

clide  Initial       tmin      DSR(i,tmin) G(i,tmin) DSR(i,tmax) G(i,tmax)
     pCi/g       (years)                  (pCi/g)              (pCi/g)
AAAAA AAAAAAAAA AAAAAAAAAAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA AAAAAAAAA
:34  5.070E-01    549.6 ñ 0.5     1.396E-02  1.074E+03  1.361E-02  1.102E+03
:35  2.300E-02    482.4 ñ 0.5     1.023E-01  1.467E+02  1.015E-01  1.478E+02
:38  4.700E-01     0.000E+00      2.591E-02  5.788E+02  2.542E-02  5.901E+02
```

```
                 Individual Nuclide Dose Summed Over All Pathways
                  Parent Nuclide and Branch Fraction Indicated

clide 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
ÄÄÄÄÄ ÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ    ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄÄ
:34  U-234  1.000E+00   6.536E-03 6.536E-03 6.536E-03 6.535E-03 6.534E-03 6.531E-03 6.522E-03 0.000E+00
:34  U-238  1.000E+00   0.000E+00 1.718E-08 5.153E-08 1.718E-07 5.152E-07 1.717E-06 5.144E-06 0.000E+00
:34  äDOSE(j):          6.536E-03 6.536E-03 6.536E-03 6.535E-03 6.535E-03 6.533E-03 6.527E-03 0.000E+00

230  U-234  1.000E+00   0.000E+00 1.453E-07 4.358E-07 1.453E-06 4.357E-06 1.452E-05 4.348E-05 0.000E+00
230  U-238  1.000E+00   0.000E+00 1.909E-13 1.718E-12 1.909E-11 1.718E-10 1.908E-09 1.715E-08 0.000E+00
230  äDOSE(j):          0.000E+00 1.453E-07 4.358E-07 1.453E-06 4.357E-06 1.452E-05 4.350E-05 0.000E+00

226  U-234  1.000E+00   0.000E+00 2.681E-09 2.411E-08 2.673E-07 2.390E-06 2.589E-05 2.092E-04 0.000E+00
226  U-238  1.000E+00   0.000E+00 2.156E-15 6.310E-14 2.343E-12 6.287E-11 2.276E-09 5.559E-08 0.000E+00
226  äDOSE(j):          0.000E+00 2.681E-09 2.411E-08 2.673E-07 2.390E-06 2.589E-05 2.093E-04 0.000E+00

210  U-234  1.000E+00   0.000E+00 4.294E-14 1.141E-12 4.007E-11 9.366E-10 2.286E-08 2.917E-07 0.000E+00
210  U-238  1.000E+00   0.000E+00 1.098E-18 2.942E-18 2.681E-16 1.927E-14 1.685E-12 7.084E-11 0.000E+00
210  äDOSE(j):          0.000E+00 4.294E-14 1.141E-12 4.007E-11 9.367E-10 2.287E-08 2.918E-07 0.000E+00

:35  U-235  1.000E+00   2.189E-03 2.189E-03 2.189E-03 2.189E-03 2.189E-03 2.188E-03 2.172E-03 0.000E+00

231  U-235  1.000E+00   0.000E+00 7.141E-08 2.142E-07 7.140E-07 2.141E-06 7.130E-06 2.130E-05 0.000E+00

227  U-235  1.000E+00   0.000E+00 6.672E-09 5.879E-08 6.080E-07 4.520E-06 2.956E-05 1.130E-04 0.000E+00

38   U-238  1.000E+00   1.218E-02 1.218E-02 1.218E-02 1.218E-02 1.218E-02 1.217E-02 1.206E-02 0.000E+00
=(i) is the branch fraction of the parent nuclide.
```

```
                  Individual Nuclide Soil Concentration
                Parent Nuclide and Branch Fraction Indicated

clide Parent   BRF(i)                         S(j,t), pCi/g
  (j)          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
ÄÄÄÄÄ ÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ   ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ ÄÄÄÄÄÄÄÄÄ
34  U-234  1.000E+00   5.070E-01 5.070E-01 5.070E-01 5.070E-01 5.069E-01 5.066E-01 5.059E-01 5.035E-01
34  U-238  1.000E+00   0.000E+00 1.332E-06 3.997E-06 1.332E-05 3.997E-05 1.332E-04 3.991E-04 1.325E-03
34  äS(j):             5.070E-01 5.070E-01 5.070E-01 5.070E-01 5.069E-01 5.068E-01 5.063E-01 5.048E-01

230 U-234  1.000E+00   0.000E+00 4.564E-06 1.369E-05 4.564E-05 1.369E-04 4.560E-04 1.366E-03 4.528E-03
230 U-238  1.000E+00   0.000E+00 5.997E-12 5.397E-11 5.997E-10 5.396E-09 5.993E-08 5.387E-07 5.957E-06
230 äS(j):             0.000E+00 4.564E-06 1.369E-05 4.564E-05 1.369E-04 4.561E-04 1.366E-03 4.534E-03

226 U-234  1.000E+00   0.000E+00 9.884E-10 8.893E-09 9.871E-08 8.857E-07 9.739E-06 8.508E-05 8.546E-04
226 U-238  1.000E+00   0.000E+00 7.949E-16 2.327E-14 8.651E-13 2.330E-11 8.562E-10 2.260E-08 7.753E-07
226 äS(j):             0.000E+00 9.884E-10 8.893E-09 9.871E-08 8.857E-07 9.739E-06 8.510E-05 8.553E-04

210 U-234  1.000E+00   0.000E+00 1.016E-11 2.701E-10 9.483E-09 2.217E-07 5.411E-06 6.904E-05 8.047E-04
210 U-238  1.000E+00   0.000E+00 2.598E-16 6.964E-16 6.345E-14 4.561E-12 3.988E-10 1.677E-08 7.073E-07
210 äS(j):             0.000E+00 1.016E-11 2.701E-10 9.483E-09 2.217E-07 5.412E-06 6.906E-05 8.054E-04

35  U-235  1.000E+00   2.300E-02 2.300E-02 2.300E-02 2.300E-02 2.300E-02 2.299E-02 2.297E-02 2.291E-02

231 U-235  1.000E+00   0.000E+00 4.866E-07 1.460E-06 4.866E-06 1.459E-05 4.859E-05 1.454E-04 4.796E-04

227 U-235  1.000E+00   0.000E+00 7.665E-09 6.755E-08 6.985E-07 5.193E-06 3.396E-05 1.301E-04 4.646E-04

38  U-238  1.000E+00   4.700E-01 4.700E-01 4.700E-01 4.700E-01 4.699E-01 4.698E-01 4.694E-01 4.681E-01
F(i) is the branch fraction of the parent nuclide.
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APPENDIX D
GRAPHS FOR STATISTICAL BACKGROUND COMPARISON

Figure 1. Histograms, boxplots, and density estimates for Lead, Laboratory Background and Site Data

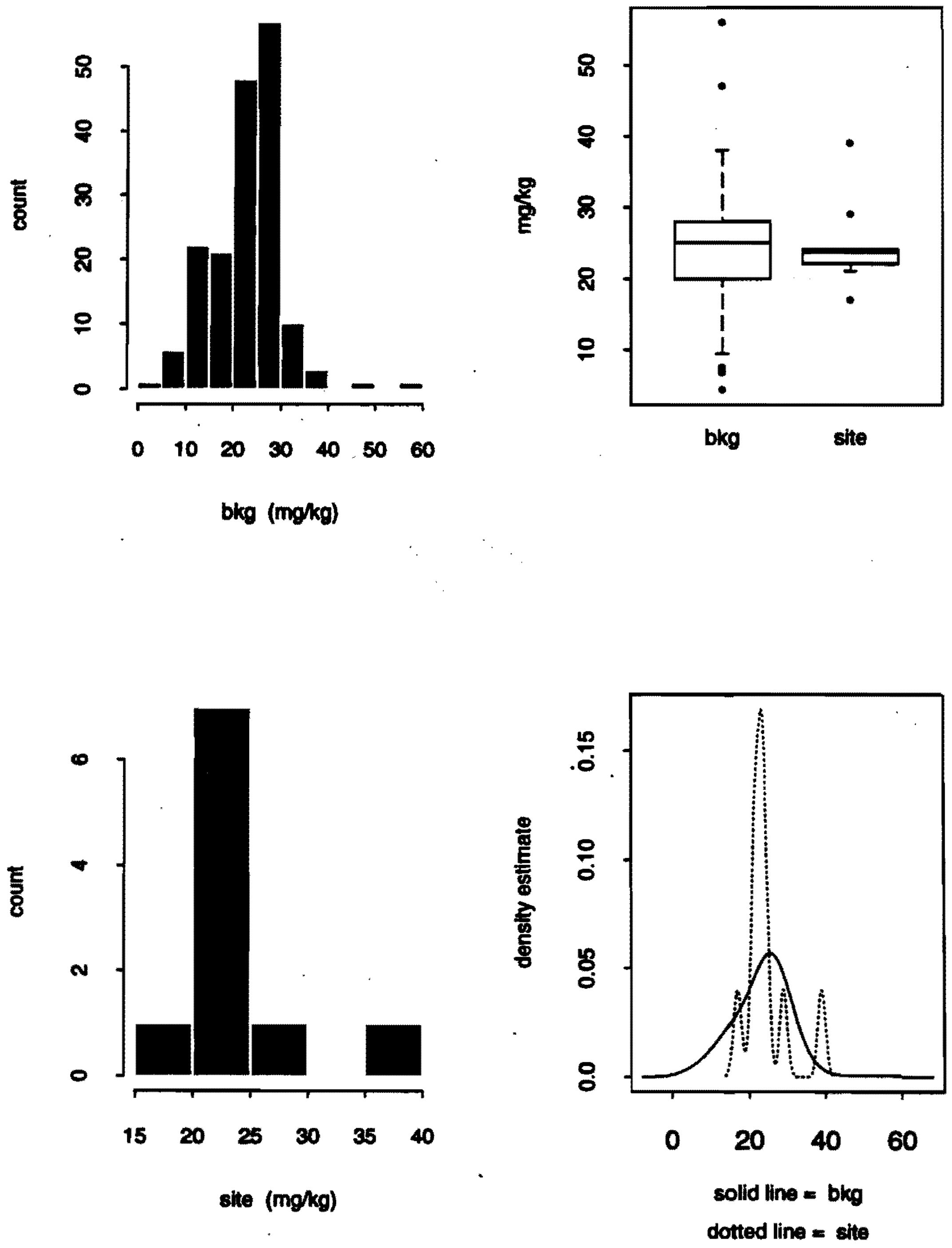

Figure 2. Histograms, boxplots, and density estimates for Zinc, Laboratory Background and Site Data