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1	Letter	10/31/2003	Submittal of the Voluntary Corrective Measure (VCM) Completion Report for Solid Waste Management Unit (SWMU) 21-011(K) at Technical Area (TA) 21 (w/enclosures a/s) ER2003-0672 ER2003-0672 N/A		
2	VCM Report	10/1/2003	Voluntary Corrective Measure Completion Report for Solid Waste Management Unit 21-011(k) at Technical Area 21 LA-UR-03-7293 ER2003-0633 N/A		
28	Drawing	10/28/2003	Media Place Holder Target for Drawing: Figure 2.6-1 Radionuclides Detected Above Background in Confirmation Samples at SWMU 21-011(k) (all units in pci/g) N/A N/A N/A		
375	Form	10/28/2003	ER Project Document Signature Form ER2003-0672 re Submittal of the VCM Completion Report for SWMU 21-011(k) at TA-21 N/A N/A N/A		
376	Form	10/30/2003	ER Project Document Signature Form ER2003-0633 re VCM Completion Report for SWMU 21-011(k) N/A N/A N/A		

#82260

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Date: October 31, 2003
Refer to: ER2003-0672

RECEIVED OCT 2003 Hazardous Waste Bureau

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: SUBMITTAL OF THE VOLUNTARY CORRECTIVE MEASURE (VCM) COMPLETION REPORT FOR SOLID WASTE MANAGEMENT UNIT 21-011(K) AT TECHNICAL AREA 21

Dear Mr. Young:

Enclosed please find the Certification and two copies of the *Voluntary Corrective Measure (VCM) Completion Report for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area 21*. All analytical data for the VCM Completion Report is provided as an appendix to the report. Additional copies are available upon request.

If you have any questions, please contact Mark Thacker at (505) 665-5342 or Woody Woodworth at (505) 667-5820.

Sincerely,

David McInroy, Deputy Project Director
Remediation Services
Los Alamos National Laboratory

Sincerely,

David Gregory, Project Manager
Department of Energy
Los Alamos Site Operations

RECEIVED FEB 1 2 2004

DM/DG/PB/am

Enclosure: 1) VCM Completion Report for SWMU 21-011(k) at TA-21
2) Certification

Cy:(w/enc)
P. Bertino, RRES-RS, MS M992
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M. Leavitt, NMED-SWB
S. Martin, NMED-HWB
C. Voorhees, NMED-OB

LA-UR-03-7293
October 2003
ER2003-0633

Voluntary Corrective Measure Completion Report for Solid Waste Management Unit 21-011(k) at Technical Area 21

Los Alamos
NATIONAL LABORATORY
Los Alamos NM 87545

This document contains data regarding radioactive wastes, the management of which is regulated under the Atomic Energy Act and specifically excluded from regulation under the Resource Conservation and Recovery Act and the New Mexico Hazardous Waste Act. These data are provided to the New Mexico Environment Department for information purposes only.

Prepared by Risk Reduction and Environmental Stewardship–Remediation Services

LA-UR-03-7293
ER2003-0633

VCM Completion Report for SWMU 21-011(k) at TA-21

October 2003

Responsible project leader:

Printed Name	Signature	Title	Organization	Date
Mark Thacker	Mark S. Thacker	Project Team Leader	RRES-RS	10/30/03

Responsible UC representative:

Printed Name	Signature	Title	Organization	Date
David McInroy		Acting Deputy Project Director	RRES-RS	10/30/03

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
David Gregory	David R. Gregory	Project Manager	DOE-LASO	10/30/03

EXECUTIVE SUMMARY

This voluntary corrective measure (VCM) completion report addresses the characterization and remediation of Solid Waste Management Unit (SWMU) 21-011(k) at Los Alamos National Laboratory (LANL or the Laboratory). SWMU 21-011(k) is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit.

SWMU 21-011(k) was the National Pollution Discharge Elimination System (NPDES)-permitted outfall (NPDES outfall no. EPA 050 050) for treated industrial wastewater from the former wastewater treatment plants (WWTPs) (Buildings 21-35 and -157) at Technical Area (TA) 21. The SWMU consisted of a single drainline from two treated wastewater holding tanks (Structures 21-112 and -113) and an outfall area on the north-facing slope of Delta Prime (DP) Canyon. Discharges of treated industrial wastewater to the outfall were discontinued in July 1986. Building 21-257 has been used since 1986 for the treatment of tritiated wastewater from the Tritium Study Test Assembly (TSTA) facility (Building 21-155). The wastewater is stored in holding tanks 21-112 and -113 and is routinely transported by tanker truck to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50.

The purpose of the VCM at SWMU 21-011(k) was to remove the drainline from holding tanks 21-112 and -113 from the north fence line of Material Disposal Area (MDA) T to the outfall area on the north facing slope of DP Canyon and to remove radiologically contaminated soil and tuff from the outfall area to levels that satisfy cleanup levels for the recreational trail-user scenario. VCM activities at SWMU 21-011(k) included the removal of 1,845 cubic yards (yd^3) of contaminated soil and tuff from the SWMU. The VCM also included the removal and characterization of a 4-in. drainline from holding tanks 21-112 and -113 and surrounding material that ran beneath DP Road, from the MDA T fenceline to the outfall discharge point. This contaminated material was disposed of at TA-54. Confirmation samples were collected from the excavated outfall slope and drainline trench after remediation activities to confirm achievement of cleanup levels.

Confirmation sample results show that the cleanup levels were achieved. Residual Radioactivity (RESRAD) model calculations using confirmation sample data show that the final site conditions yield a dose rate of 3.8 milli rem per year (mrem/yr) to a human receptor under the recreational trail-user scenario and 5.6 mrem/yr under the extended back yard scenario. No unacceptable radiological dose to human and/or ecological receptors is posed by the levels of residual contamination present at the site after the completion of the VCM. Therefore, no further action (NFA) is recommended based on NFA Criterion 5 (Table ES-1). This criterion states that if a SWMU has been remediated in accordance with applicable state or federal regulations and that the available data indicate that chemicals of concern are either not present or are present at concentrations that would not pose a potential unacceptable risk to human health or the environment under projected land use, no further action is required (NMED 1998, 57897).

Table ES-1
Summary of Proposed Actions

SWMU/AOC Number	Description	HSWA[a,b]	Radionuclide Component	Proposed Action	Rationale for Recommendation	Section Number
21-011(k)	Outfall	Yes	Yes	NFA[c]	No potential unacceptable risk to human and ecological receptors	2.0

[a] Hazardous and Solid Waste Amendments

[b] Is the site listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, 01585)?

[c] NFA Criteria are listed in Section II.B.4.a.(4).(b) (NMED 1998, 57897).

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1.0 INTRODUCTION

The Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by the University of California (UC). The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons. These canyons contain ephemeral and intermittent streams that flow from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft. The eastern portion of the plateau stands 300–900 ft above the Rio Grande.

The Laboratory's Risk Reduction and Environmental Stewardship–Remediation Services (RRES–RS) Project (formerly the Environmental Restoration [ER] Project) is involved in a national DOE effort to clean up facilities that had been involved in weapons development. The goal of RRES–RS is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County. To achieve that goal, RRES-RS is investigating sites that were potentially contaminated by past Laboratory operations.

This voluntary corrective measure (VCM) completion report addresses the remediation of Solid Waste Management Unit (SWMU) 21-011(k), which is located within the Laboratory at Technical Area (TA) 21 (Figure 1.0-1). This SWMU consists of an inactive drainline and contaminated outfall slope. SWMU 21-011(k) is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, 01585; EPA 1994, 44146).

The VCM addressed radionuclide contaminated soil and tuff only. Hazardous constituents were not a concern at this site; however, this VCM was completed and this report is submitted to support a no further action (NFA) determination and removal from Module VII of the Laboratory's Hazardous Waste Facility Permit. Radionuclide contamination is regulated by DOE Order 5400.5, "Radiation Protection of the Public and the Environment." Methodologies described in the approved installation work plan (IWP) (LANL 1998, 62060.4) and the approved VCM plan were followed during this corrective action (LANL 2003, 76903).

The objectives of this VCM were to

- excavate, remove, and dispose of the inactive drainline that delivered effluent from holding tanks 21-112 and -113, to the north-facing slope of Delta Prime (DP) Canyon;
- determine the nature and extent of radiological soil and tuff contamination beneath the inactive drainline and throughout the outfall area;
- remove radiologically contaminated soil and tuff to target cleanup levels of 150 pico curies per gram (pCi/g) for cesium-137 and 170 pCi/g for americium-241; and
- assess the potential radiological dose to human and ecological receptors from residual contamination at the site.

Section 2.0 of this report describes the site and its operational history, remedial activities, analytical results for the soil and tuff samples, and human health and ecological assessments. Section 3.0 describes site waste management activities. References are listed in Section 4.0.

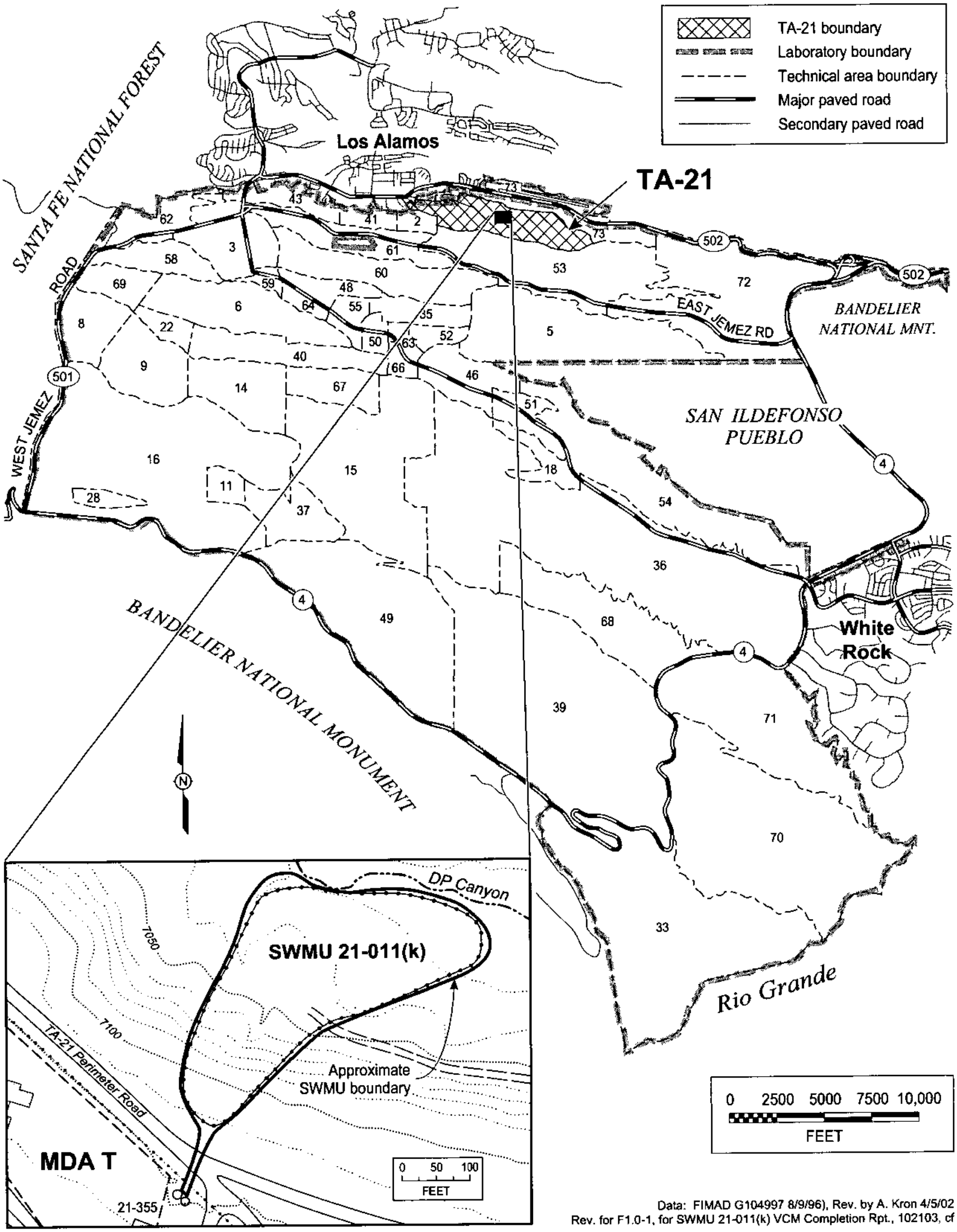


Figure 1.0-1. Location of TA-21 with respect to Laboratory technical areas and surrounding land holdings

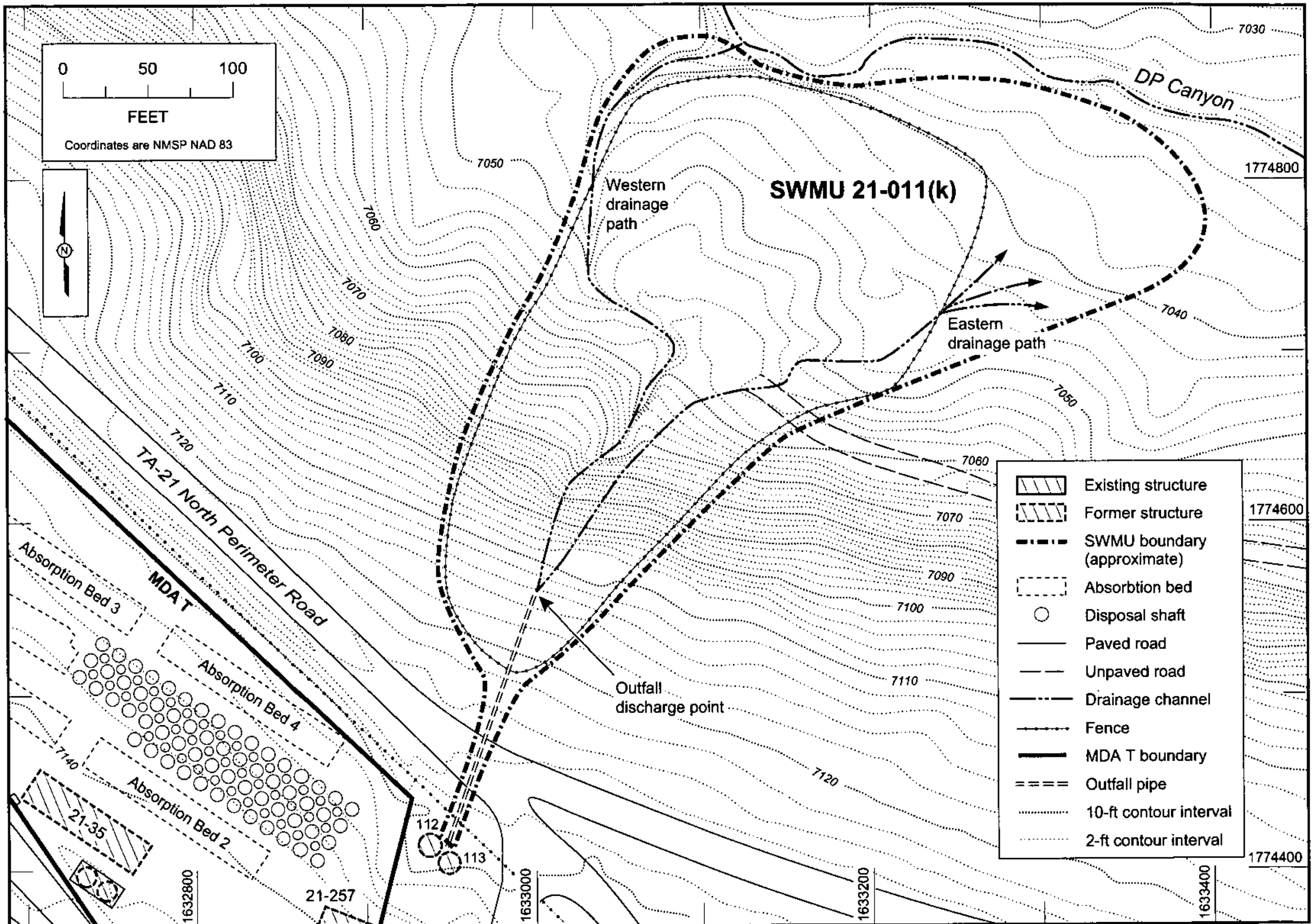
Appendix A contains a list of acronyms, a glossary of terms, and a conversion table (metric to English measurements). Appendix B describes the site's operational and environmental setting. Appendix C includes the complete data quality assurance/ quality control (QA/QC) results for the VCM analytical samples. Appendix D provides the analytical data for the confirmation samples collected and analyzed during and at the completion of the corrective action. Appendix E details the statistical analyses used in this report. Appendix F includes the ecological scoping checklist and the Residual Radioactivity (RESRAD) model output. Appendix G includes the planned versus actual cost comparison for completion of the SWMU 21-011(k) VCM. Appendix H includes a copy of the approved VCM plan for SWMU 21-011(k) (LANL 2003, 76903). Appendix I contains photographs of VCM activities. Appendix J contains all relevant records of communication (ROCs) with the New Mexico Environment Department (NMED). Appendix K includes analytical results from confirmation samples collected after removal of a contaminated sediment package in the south bank of the DP stream channel east of SWMU 21-011(k); this removal will be formally reported under separate cover as part of the ongoing characterization of DP Canyon by the Laboratory. Appendix L contains of waste characterization results for the soil removed from SWMU 21-011(k). Appendix M summarizes radiological air-sampling network monitoring activities conducted in the vicinity of SWMU 21-011(k) by Risk Reduction and Environment Stewardship-Meteorology and Air Quality (RRES-MAQ) during implementation of the VCM.

2.0 INACTIVE DRAINLINE AND OUTFALL SWMU 21-011(k)

2.1 Site Description and Operational History

SWMU 21-011(k) was the National Pollutant Discharge Elimination System (NPDES)-permitted outfall (NPDES outfall no. EPA 050050) for treated industrial wastewater from the former wastewater treatment plants (WWTPs) (Buildings 21-35 and -157) at TA-21. The SWMU consisted of a drainline from two holding tanks containing treated wastewater (Structures 21-112 and -113) and an outfall area on the north-facing slope of DP Canyon. The original drainline from tanks 21-112 and -113 consisted of a 4-in. vitrified clay pipe (VCP) that discharged to an outfall ditch excavated into soil and tuff (LANL 1991, 07528). The VCP was replaced in 1976 with a 4-in. cast iron drainline that was installed within the same trench as the original drainline. The discharge end of the 4-in. cast iron drainline was located approximately 80 ft north of the TA-21 perimeter road. A gently sloping, rocky surface extends from the end of the outfall drainline approximately 30 ft to the south rim of DP Canyon (Figure 2.1-1).

TA-21 is the former plutonium processing facility at the Laboratory. The first WWTP (Building 21-35) was activated in 1952 and operated until 1967 when the new industrial WWTP (Building 21-257) came online. Both facilities treated wastes from DP West and DP East consisting of liquids remaining after plutonium extraction and processing of radioactive materials for nuclear weapons and aeronautical research projects. The treatment process mixed raw waste with lime, ferric sulfate, and coagulant aids. The waste was then pumped to a flocculator and on to a settling tank. Settled effluent was pumped through a pressure filter and sampled to verify adequate treatment. When the effluent was adequately treated, it was pumped to two final holding tanks (structures 21-112 and -113). From the tanks, the effluent was piped northeast toward DP Canyon and discharged on the north side of DP Mesa to what is now SWMU 21-011(k). This effluent contained a variety of radionuclides and chemicals. Discharges of treated industrial wastewater to the outfall were discontinued in July 1986 (LANL 2002, 73115). Building 21-257 has been used since 1986 for the treatment of tritiated wastewater from the Tritium Systems Test Assembly (TSTA) facility (Building 21-155). The wastewater is stored in holding tanks 21-112 and -113 and is routinely transported by tanker truck to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50.



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Rev. for F2.1-1, VCM Compl. Rpt. for SWMU 21-011(k), 103003, cf

Figure 2.1-1. Location of SWMU 21-011(k) and associated structures within Laboratory Technical Area 21

In January 2001, approximately 55 gal. of partially treated tritiated wastewater were unintentionally released from holding tank 21-113 through the SWMU 21-011(k) drainline when a faulty gauge caused the tank to overfill. The wastewater in the tank originated from the TSTA facility (LANL 2002, 73116). The released wastewater infiltrated into the ground within 50 ft of the end of the drainline within the outfall area of SWMU 21-011(k). The Release/Discharge Notification (Attachment 1 of the VCM plan) submitted to NMED and U.S. Environmental Protection Agency (EPA) Region 6, indicates that the wastewater did not reach a watercourse. The area impacted was approximately 2 ft x 50 ft and was covered with snow. After the discharge was stopped, a sample of wastewater was immediately collected from tank 21-113 and screened for tritium and for gross alpha and beta activity. The screening results were reported as tritium = 630 nano-curies per liter (nCi/L), gross alpha = 0.14 nCi/L, and gross beta = 2.2 nCi/L (LANL 2001, 72667). Tritium is exclusively a beta emitting radionuclide (with a half-life of approximately 12 yr), which accounts for the elevated gross beta activity result. These results are from the liquid wastewater that remained in the tank and are not indicative of the residual concentrations in the soil. Residual tritium concentrations in the area of the spill were initially diluted with the snow pack and then reduced through sublimation from the snow surface. Tritium concentrations were further reduced by evapotranspiration during the following spring and summer. Subsequent drought conditions resulted in the evaporation of the available near-surface moisture along with the tritium. Therefore this release deemed to have no impact on the VCM (LANL 2003, 76903). The outfall line from holding tanks 21-112 and -113 was permanently plugged in January 2001 as part of the release response (LANL 2001, 72667).

2.2 Previous Activities

Investigations involving radiation surveys and sample collection and analysis were conducted in 1988 by DOE, and by the Laboratory in 1992, 1993, 2000, and 2001. Investigations prior to 2000 were conducted to characterize SWMU 21-011(k); the data collected was used to plan an interim action (IA) conducted at the site in 1996. Two radiation surveys of the outfall area were performed in 2000 and additional characterization samples were collected and analyzed in March 2001 to confirm the nature and extent of contamination at the site in anticipation of the current VCM. The activities completed prior to the current VCM are briefly summarized below and are discussed in Section 2 of the approved VCM plan (LANL 2003, 76903). Analytical results from previous activities conducted at SWMU 21-011(k) were presented in Appendix G of the approved VCM plan (LANL 2003, 76903).

2.2.1 Previous Investigations

SWMU 21-011(k) was sampled during a 1988 DOE headquarters environmental survey of the Laboratory (DOE 1988, 15363). In 1992, SWMU 21-011(k) was investigated in accordance with the TA-21 operable unit (OU) Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan, which involved a radiological field survey and collection of soil samples for fixed laboratory analysis (LANL 1991, 07528). Additional site investigation, consisting of a second radiological survey and collection of additional soil samples was conducted in 1993 to confirm the elevated radioactivity levels measured in 1992 and to replace volatile organic compound (VOC) data that was rejected from the 1992 sampling effort due to missed analytical sample holding time requirements (Figure 2.2-1) (LANL 1994, 52350). All of the above investigations post-date inactivation of the outfall in July 1986 (LANL 2002, 73115).

2.2.2 1996 Interim Action

An IA was implemented at SWMU 21-011(k) in 1996. The objectives of the IA were to remove a substantial portion of the source term from the areas of the outfall slope area exhibiting the greatest levels of radioactivity, and install stormwater control measures as a best management practice (BMP) to mitigate the migration of contaminated soil and sediment into the main channel of DP Canyon.

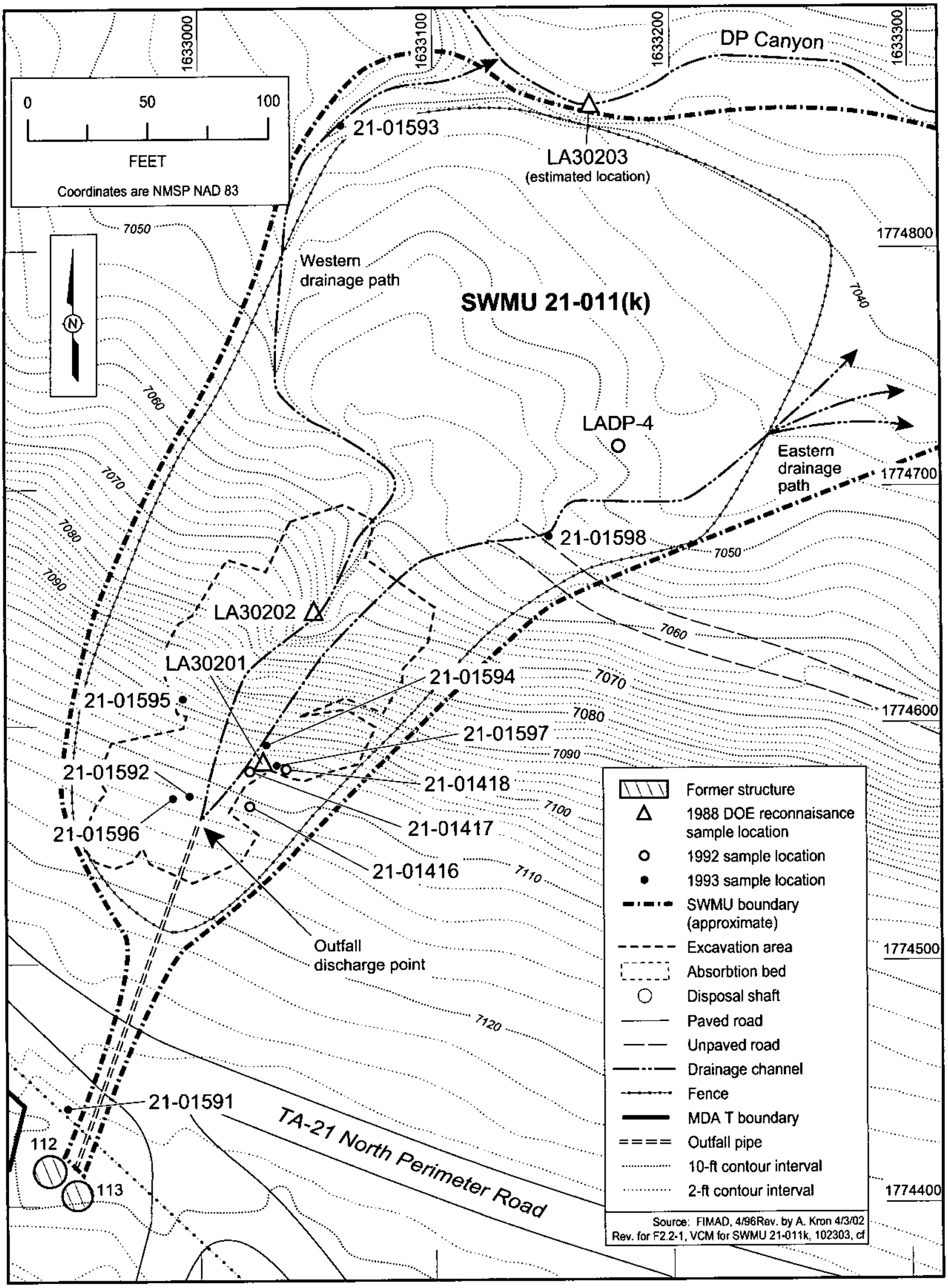

Figure 2.2-1. Sampling locations from 1988, 1992, and 1993 at SWMU 21-011(k)

During the 1996 IA, approximately 390 yd^3 of soil were removed over an area of approximately 11,600 ft^2 from the upper drainage/outfall area of SWMU 21-011(k). Upon completion of the soil removal in November 1996, ten surface soil confirmation samples from six locations were collected and submitted for offsite contract laboratory analysis of isotopic plutonium, strontium-90, cesium-137, and americium-241 (Figure 2.2-2). Data from the confirmation samples was presented in the IA completion report (LANL 1997, 55648) and in the approved VCM plan (LANL 2003, 76903). Results of a post-excavation radiological survey indicated that the gross gamma activity in soil, sediment, and tuff was reduced from greater than 500,000 counts per minute (cpm) to less than 100,000 cpm over the entire upper drainage area of the site (LANL 1996, 54790; LANL 1997, 55648).

2.2.3 2000 Chemrad and In Situ Gross Gamma Surveys and Pre-VCM Characterization Sampling

A walkover gross gamma survey was conducted of the outfall area of SWMU 21-011(k) in July 2000. This survey defined the lateral extent of radionuclide contamination at the site and showed that migration of contaminated soil had not occurred since the 1996 IA. Based on this survey, an in situ gamma spectroscopy survey and additional sampling were conducted at the site in March 2001. These data were used to develop depth profiles for radionuclide contamination and to confirm that mixed waste would not be generated during the current VCM.

Summary

The 1996 post-IA confirmation sample data, July 2000 Chemrad and November 2000 in situ gamma survey data, and March 2001 pre-VCM characterization data confirm that radionuclides are the primary chemicals of potential concern (COPCs) at the site, and identified areas with elevated concentrations that were addressed during the VCM. The July 2000 Chemrad and November 2000 in situ gamma survey results show a clear boundary between the northern edge of SWMU 21-011(k) and the DP Canyon stream channel and indicate that radionuclides have not migrated to the channel since the completion of the 1996 IA. The VCM addressed source removal and dose reduction of the radionuclide contamination at SWMU 21-011(k). Assessment of the contamination in the canyon floor is being conducted as part of the Los Alamos/Pueblo Canyon Surface Aggregate Report.

2.3 Preliminary Conceptual Model

SWMU 21-011(k) is an outfall where treated industrial wastewater was discharged onto the north side of DP mesa. The wastewater contained a variety of radioactive and chemical constituents. The COPCs in the effluent would have been largely in solution, however, due to their geochemical characteristics, most would have adsorbed onto sediment particles or organic colloids on the colluvial slope of DP Canyon (Langmuir 1997, 56037). COPCs in the effluent that were deposited onto the toe of the slope would have encountered mainly coarse-grained sediment and adsorption of the radionuclides would have been onto small amounts of other components within the coarse-grained sediment (e.g., organic matter, iron oxide, or clay particles).

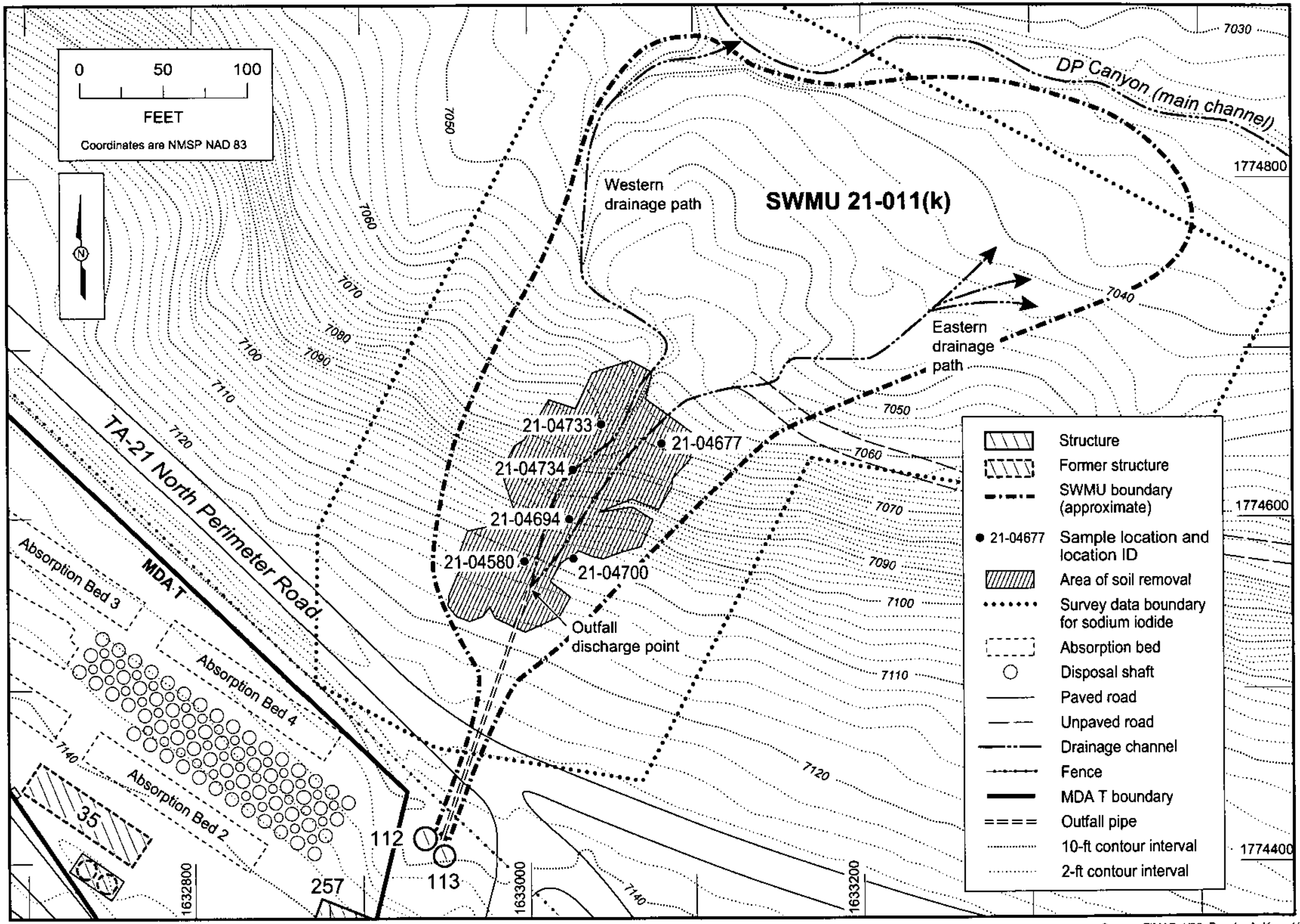

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Figure 2.2-2. Soil removal confirmation samples and area of soil removal from 1996 Interim Action

While the outfall was active, contaminant inventories would have built up incrementally. Later development of a gully on the slope below the outfall discharge area allowed erosion of some of the contaminated sediment into the DP Canyon channel (LANL 1999, 63915).

The surface water, air, and mass wasting transport pathways do not contribute significantly to current transport. The site has been protected by stormwater run-on and runoff controls since they were installed in 1996 and upgraded in 1999 so the only water contacting the contaminated soil is rain or snow falling directly on the site. Therefore, contaminant transport via stormwater or snowmelt run-on and runoff has been controlled and on-site infiltration reduced to the absolute minimum.

The volume of water that flowed through the drainlines is unknown. The entire system was gravity driven (i.e., not under pressure); therefore, soil overlying drainlines was not expected to be contaminated. Potential release mechanisms from such a system include seepage through porous joints or cracks in the drainlines and the intentional release from the outfall onto the sloping edge of the mesa and areas below.

The three complete potential exposure pathways for human receptors are similar to those of a surface soil contaminated site and include external irradiation, inhalation of fugitive dust, and incidental soil ingestion. For ecological receptors, the potentially complete exposure pathways from the drainline and outfall area at SWMU 21-011(k) are root uptake for plants and external irradiation, incidental soil ingestion, and inhalation of particulates for animals (Figure 2.3-1).

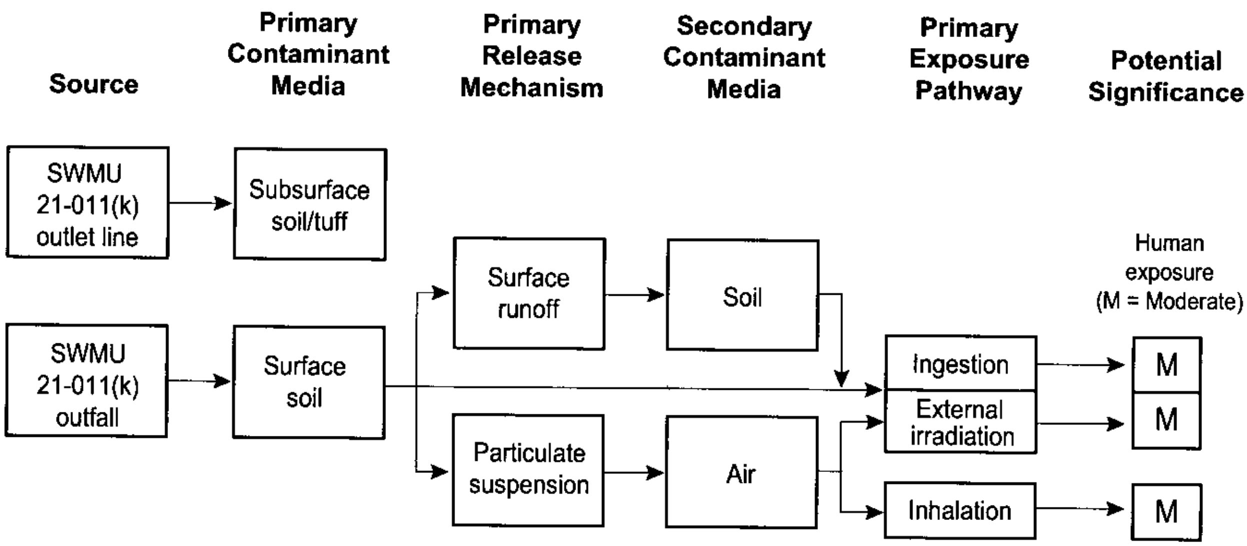


Figure 2.3-1. Preliminary conceptual model of contaminant transport for SWMU 21-011(k)

2.4 Remediation Activities

Remediation activities at SWMU 21-011(k) began in September 2002. Work was conducted according to the approved VCM plan for SWMU 21-011(k) (LANL 2003, 76903). Based on characterization results from previous investigations at the site discussed in Section 2.2.1 above and presented in the approved VCM plan, the nature and extent of organic and inorganic chemicals have been determined for SWMU

21-011(k) and radionuclides (primarily cesium-137 and americium-241) were the risk drivers at the site (LANL 2003, 76903). Therefore, this VCM was directed solely at the remediation of the radiological contamination present at SWMU 21-011(k).

Cleanup levels for radionuclides were established based on the recreational trail user scenario, as defined in the Laboratory's "Standard Human Health Risk Assessment Scenarios" document (LANL 2000, 66801). This scenario represents an individual working at TA-21 who is assumed to visit the site 140 times per year for 30 yrs and to stay for one hour per visit. Based on the exposure assumptions used to develop the recreational trail-user scenario, single radionuclide soil guidelines (SRSGs) were calculated for each of the five radionuclide chemicals of potential concern (COPCs) that potentially contribute to the dose at the site (cesium-137, strontium-90, americium-241, plutonium-238, and plutonium-239). Attainment of the mixture derived concentration guideline (DCGL) is confirmed when the sum of the ratios of each individual radionuclide and its SRSG is less than 1 (DOE Order 5400.5).

As specified in the VCM plan, target cleanup levels for the VCM were 150 pCi/g for cesium-137 and 170 pCi/g for americium-241 (LANL 2003, 76903). These targets were selected to ensure that the recreational trail-user cleanup levels would be achieved. While cesium-137 and americium-241 are not the only radionuclides present at the site, they contribute the bulk of the dose at the site. Also, the levels of these radionuclides could be readily estimated in the field using screening techniques described below to guide the excavation activities. Based on a review of the existing data and the correlation of contaminants, it was determined that the cleanup levels for cesium-137 and americium-241 were sufficiently restrictive to ensure that the other radionuclide contaminants present in site soils and tuff were also remediated (LANL 2003, 76903, Appendix F).

In accordance with the screening approach described in the approved November 18, 2002, record of communication (ROC) (LANL 2002, 73725), screening in the field was conducted following WGII SOP-10.15, Rev.0 (*Use of Gamma Scintillation Detectors for Soil Screening*) (WGII 2002, 76842). In this procedure, soil, sediment, and tuff samples were placed in plastic dishes of consistent shape and volume. The mass of each sample was determined in the field using a triple beam balance. Two different detectors, depending on the target radionuclide, were used for two-minute counts on each sample. A PG-2 detector was utilized to estimate the americium-241 level in each sample and a 2-in. x 2-in. sodium iodide detector was utilized to estimate the cesium-137 level in each sample. Each detector was surrounded by lead brick shielding to reduce background influence. All sample screening was performed in a designated room of the site trailer.

As part of the review and approval process for the VCM plan, NMED requested that air monitoring be conducted during the 21-011(k) VCM. Air sampling was conducted by the Laboratory's air quality group (RRES-MAQ). Prior to the start of field activities, RRES-RS informed RRES-MAQ of the scope and schedule of the project. Based on the information, RRES-MAQ determined that the Laboratory's existing air monitoring program was appropriate to verify whether the VCM at 21-011(k) caused an air release of contaminated material. RRES-MAQ reviewed the results of the air sampling data from the appropriate radiological air-sampling network (AIRNET) sample stations and determined that the VCM did not cause a release that was a threat to the general public. A map showing air monitoring locations relative to SWMU 21-011(k), the data collected from the stations prior to, during, and immediately following the VCM, and a discussion of the findings are included in Appendix M.

2.4.1 Outfall Drainline Removal and Confirmation Sampling Activities

Mobilization to the site began on September 24, 2002. Initial activities included the improvement of the existing access road into DP Canyon and the removal of five rolloff bins containing vegetation cleared from the site during the summer of 2002 in preparation for the VCM.

Excavation and removal of the outfall drainline began on November 21, 2002, using a tracked hydraulic excavator. The discharge pipe ran beneath DP Road, from tanks 21-112 and –113 within the Material Disposal Area (MDA) T boundary, to the outfall discharge at the southern edge of DP Canyon. The line ran beneath the ground surface at depths ranging from 1 ft near the outfall to almost 7 ft at the MDA T fence line, and had a total length of approximately 80 ft. The scope of the VCM did not include removal of the outlet drainline south of the MDA T fenceline. Approximately 15 ft of the drainline was left in place south of the MDA T fence, and will be removed with the two tanks following the decommissioning of the TSTA facility.

Upon excavation, the drainline, which passed through a subsurface concrete support/retaining wall north of DP Road, was intact and in good condition. The wall was approximately 6 ft wide by 4 ft high by 8 in. thick and supported the drainline where it had to be angled downward to follow the site topography. Photographs documenting the condition of the drainline are provided in Appendix I (Photos I-1 to I-8). All observed breaks in the line were the direct result of excavation activities and were witnessed during excavation. The drainline was in 5-ft lengths with bell joint connections sealing each 5-ft section with lead collars.

Grab samples of fill material were collected directly beneath each joint of the drainline. These samples were screened in the site trailer for americium-241 and cesium-137 (WGII 2002, 76842). Fixed geometry screening resulted in estimated contaminant concentrations ranging from 10 to 810 pCi/g for americium-241 and lower than background to 330 pCi/g for cesium-137 in tuff directly adjacent to the drainline. After the pipe was removed from the excavation, lead rings were extracted from the joints. The rings were decontaminated and released by Health, Safety, and Radiation (HSR)-1. The excavated drainline was bagged in plastic and stored in a rolloff bin for disposal. The excavated trench was backfilled after pipe removal so that the preliminary contaminant data could be reviewed prior to planning additional removal to ensure compliance with approved cleanup levels.

On February 6, 2003, the trench from which the pipe was removed, north of the subsurface concrete wall, was reopened. At this time, all contaminated soil and tuff above cleanup levels was removed from the trench, and confirmation samples were collected. Removal of contaminated medias was guided by direct real-time gross gamma screening within the excavation using a 2-in. x 2-in. sodium iodide detector. Gross gamma screening allowed for rapid identification of the material above cleanup levels. Grab samples of these materials were collected for field screening in the site trailer (WGII 2002, 76842). Screening results indicated that the contaminant release from the drainline was localized and a minimal amount of contaminated material would need to be removed.

Once screening results indicated that all contaminated soil and tuff above cleanup levels had been removed, confirmation samples were collected to ensure that the nature and extent of contamination had been determined and that cleanup levels had been achieved around the removed drainline. Confirmation samples were biased towards areas of elevated contaminant concentrations based on real-time screening within the excavation.

Confirmation samples were collected at three locations (21-03-21394, -21396, and -21398) along the length of the drainline trench north of the subsurface concrete wall (Figure 2.4-1). These three locations contained the highest contaminant concentrations along this length of the drainline based on real-time gross gamma screening. A total of six confirmation samples were collected 28 ft north of the subsurface concrete wall (21-03-21392, -21393 and -21395) from three locations at two-depth intervals (all depths are relative to the bottom of the outfall drainline): 0–1 ft and 2–3 ft directly beneath the bottom of the drainline trench (depth below ground surface varied due to the sloping topography). Two additional samples were collected at a depth of 0–1 ft beneath the pipe's path; one of these samples was collected 52 ft north of the subsurface concrete wall (location 21-03-21396, 0–1 ft beneath drainline) and the other was collected 80 ft north of the wall (location 21-03-21398, 0–1 ft beneath drainline). Samples were only collected from one depth interval at these locations due to low contaminant concentrations.

Field screening data indicated that the lateral extent of contamination had not been established within the area located 28 ft north of the subsurface concrete wall at sample location 21-03-21393. Therefore an additional sample was collected at location 21-03-21395 to establish decreasing lateral contaminant concentrations at this interval of the drainline's subsurface path. This additional sample was collected on April 3, 2003, by hand auger, 28 ft north of the subsurface concrete wall, at a location 10 ft west of the pipe's path, at a depth of 0–1 ft below the depth of the pipe.

The drainline trench south of the subsurface concrete wall to the MDA T fenceline was reopened on March 13, 2003, to remove soil and tuff with contamination above cleanup levels and to collect confirmation samples. Once screening results indicated that site cleanup levels had been achieved, confirmation samples were collected from three locations within the drainline trench between the subsurface concrete wall and the MDA T fenceline (location IDs 21-03-21382, -21388, and -21391). These three locations contained the highest contaminant concentrations along this section of the drainline based upon real-time gross gamma screening. Confirmation samples were also collected 5 ft. directly east and west of the three drainline trench locations (location IDs 21-03-21380, -21381, -21386, -21387, -21389, and -21390), to ensure that the nature and extent of contamination had been determined and that cleanup levels had been achieved. Samples were collected from two depth intervals (8–9 ft and 10–11 ft depths bgs) at all nine locations south of the subsurface wall. The sample locations were 3 ft, 16 ft, and 55.3 ft north of the MDA T fence line (Figure 2.4-1).

All confirmation samples collected beneath and adjacent to the outfall drainline were screened for gross alpha, beta, and gamma radiation, and submitted for offsite contract laboratory analysis of cesium-137 by gamma spectroscopy, americium-241 by alpha spectroscopy, isotopic plutonium, and strontium-90 by gas proportional counting. A summary of post-VCM confirmation samples collected and requested analyses is presented in Table 2.5-1.

Following the collection of samples, the road was backfilled and paved in accordance with the Laboratory's Engineering Standards (LIR 220-03-01.2).

2.4.2 Contaminated Soil/Tuff Removal and Confirmation Sampling Activities in Outfall Area

A preliminary site-wide gross gamma radiation survey was conducted prior to the excavation activities that began in December 2002, and provided guidance in determining areas of soil and tuff that would be removed from the site (Figure 2.4-2). Within the boundary of SWMU 21-011(k), cesium-137 levels ranged from less than instrument background to 2372.2 pCi/g, and americium-241 levels ranged from less than instrument background to 2129.1 pCi/g, based on the field screening results conducted in the site trailer (WGII 2002, 76842).

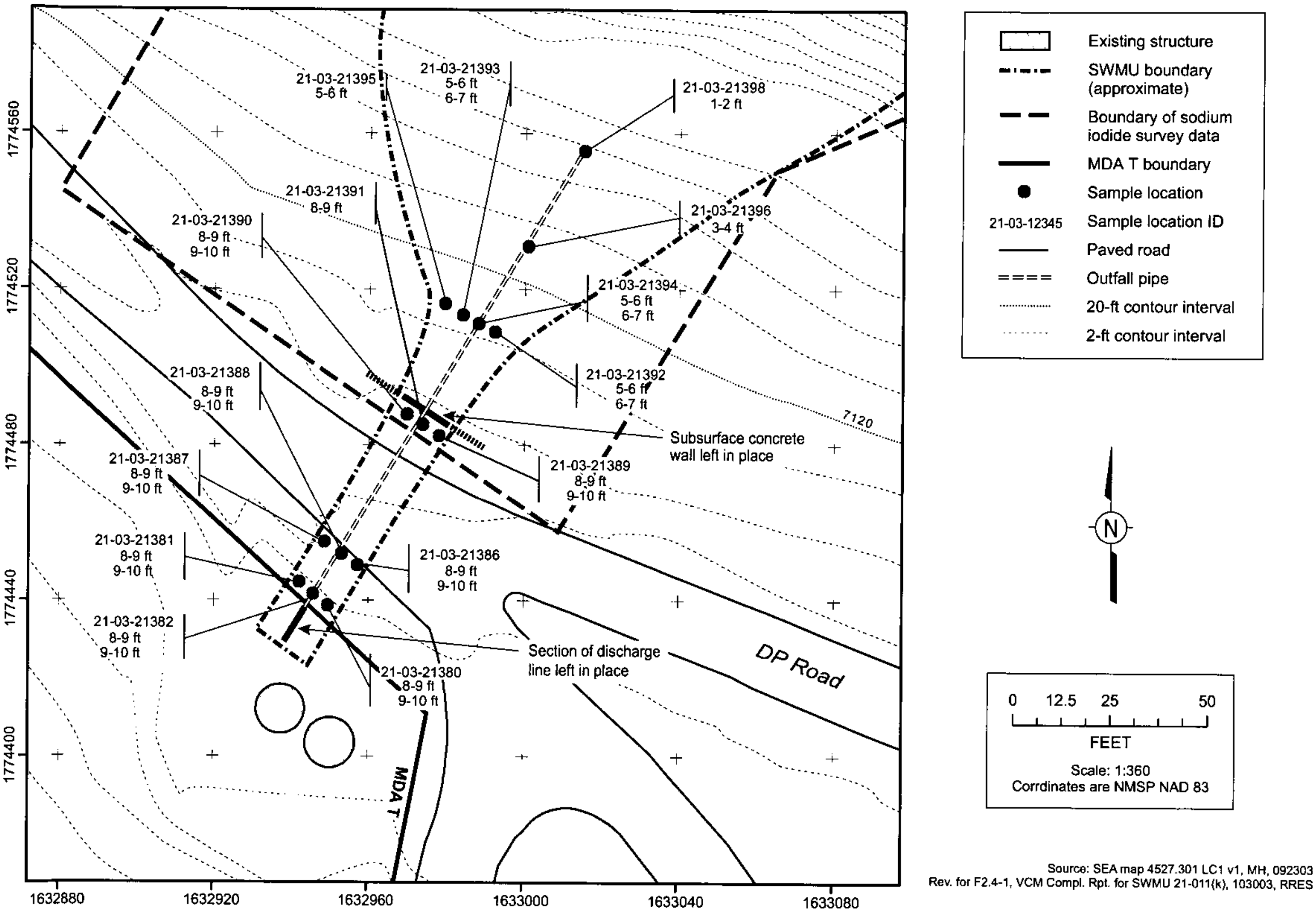


Figure 2.4-1. Confirmation sample locations along the removed outlet line at SWMU 21-011(k)

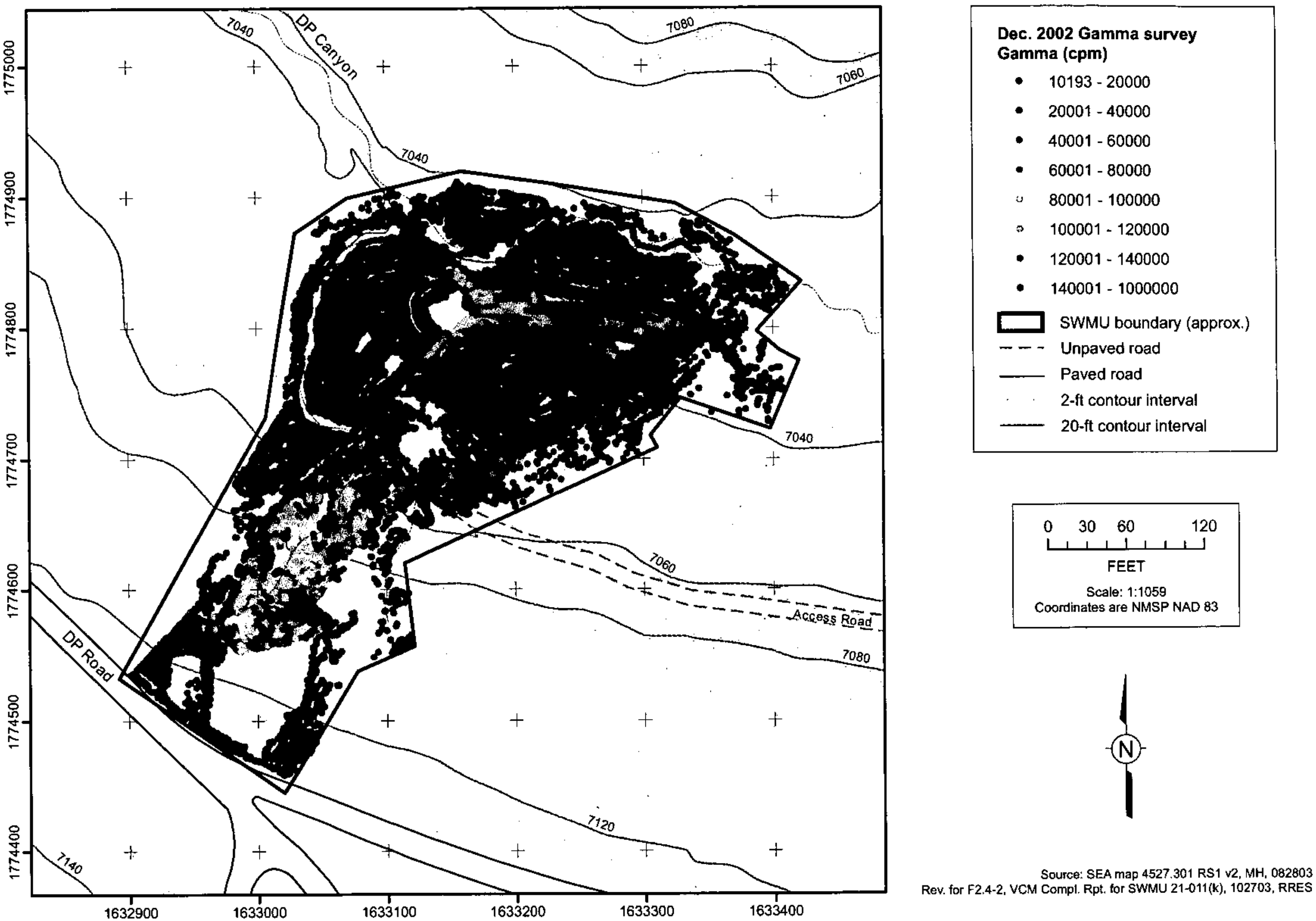


Figure 2.4-2. Preliminary walk-over gross gamma survey at SWMU 21-011(k), December 2002

The target cleanup levels for the site were 150 pCi/g for cesium-137 and 170 pCi/g for americium-241 as presented in the VCM plan (LANL 2003, 76903). Any soil and tuff identified through field screening as containing contamination above these target cleanup levels was removed (WGII 2002, 76842).

Excavation of contaminated soil and tuff downgradient from the outfall drainline discharge point began on December 11, 2002, using a track-mounted hydraulic excavator. Photographs documenting the field activities are provided in Appendix I, (Photos I-9 to I-28).

Direct real-time gross gamma surveys of the excavation areas were conducted using a 2-in. x 2-in. sodium iodide analyzer to guide the progress of excavation. To further guide excavation activities, soil samples were continuously collected for field screening. The direct gross gamma surveys and field screening of soil samples substantially increased excavation efficiency of contaminated soil and tuff by allowing excavation decisions to be made in real-time in the field. By April 2003, approximately 1,800 cubic yards (yd^3) of material had been excavated and stockpiled at the site. The majority of the excavated material was removed from six main areas of the site (Figure 2.4-2), represented by areas above approximately 100001 cpm.

To identify any remaining areas, and guide final excavations of soil and tuff with contaminant concentrations above the cleanup levels, a site-wide gross gamma survey was completed on April 28, 2003, over the entire outfall slope area. The survey was conducted using an Eberline 2-in. x 2-in. sodium-iodide analyzer, integrated with a global positioning satellite unit to provide geodetic coordinates for all measurements taken by the probe. The survey was completed on a 1-meter grid across the entire site. Survey results identified seven discrete areas where contamination possibly remained above target cleanup levels (Figure 2.4-3).

Samples were collected from the seven areas identified with elevated activity during the April survey and were field screened in the site trailer. Results showed that only four of the locations actually contained cesium-137 and americium-241 concentrations above the target cleanup levels. Further, confirmation sample results (discussed below), identified additional locations with contamination above cleanup levels. All additional material with contamination above target cleanup levels set for the project was excavated, yielding an additional 45 yd^3 of soil and tuff.

At completion, a total of 1845 yd^3 of contaminated material was removed from SWMU 21-011(k), which is roughly three times the original estimate of 560 yd^3 (LANL 2003, 76903). In accordance with the approved VCM plan, contaminated soil and tuff that had been excavated was placed in individual stockpiles at the site. In accordance with the no-longer-contained-in determination received from NMED on November 25, 2002, a sample was collected from each 100 yd^3 of excavated material and submitted for off-site contract laboratory analysis of Appendix VIII VOCs (NMED 2002, 73720). A total of 19 samples were collected from the excavated material and submitted for VOC analysis. The results were provided to NMED for review and approval prior to disposal of the material at Area G at TA-54.

All of the waste sample results indicated that VOC concentrations in the excavated material were consistent with those presented in the no-longer-contained-in determination request. After VOC sample results were reviewed and approved by NMED, the associated stockpiles of excavated material were loaded into lined rolloff bins and disposed of at Area G at TA-54. Removal of stockpiled contaminated soil and tuff began on February 10, 2003, and was completed on July 22, 2003; a total of 153 rolloff bins of contaminated material were removed from SWMU 21-011(k). Results of the waste characterization samples and the associated field QC samples are included in Appendix L.

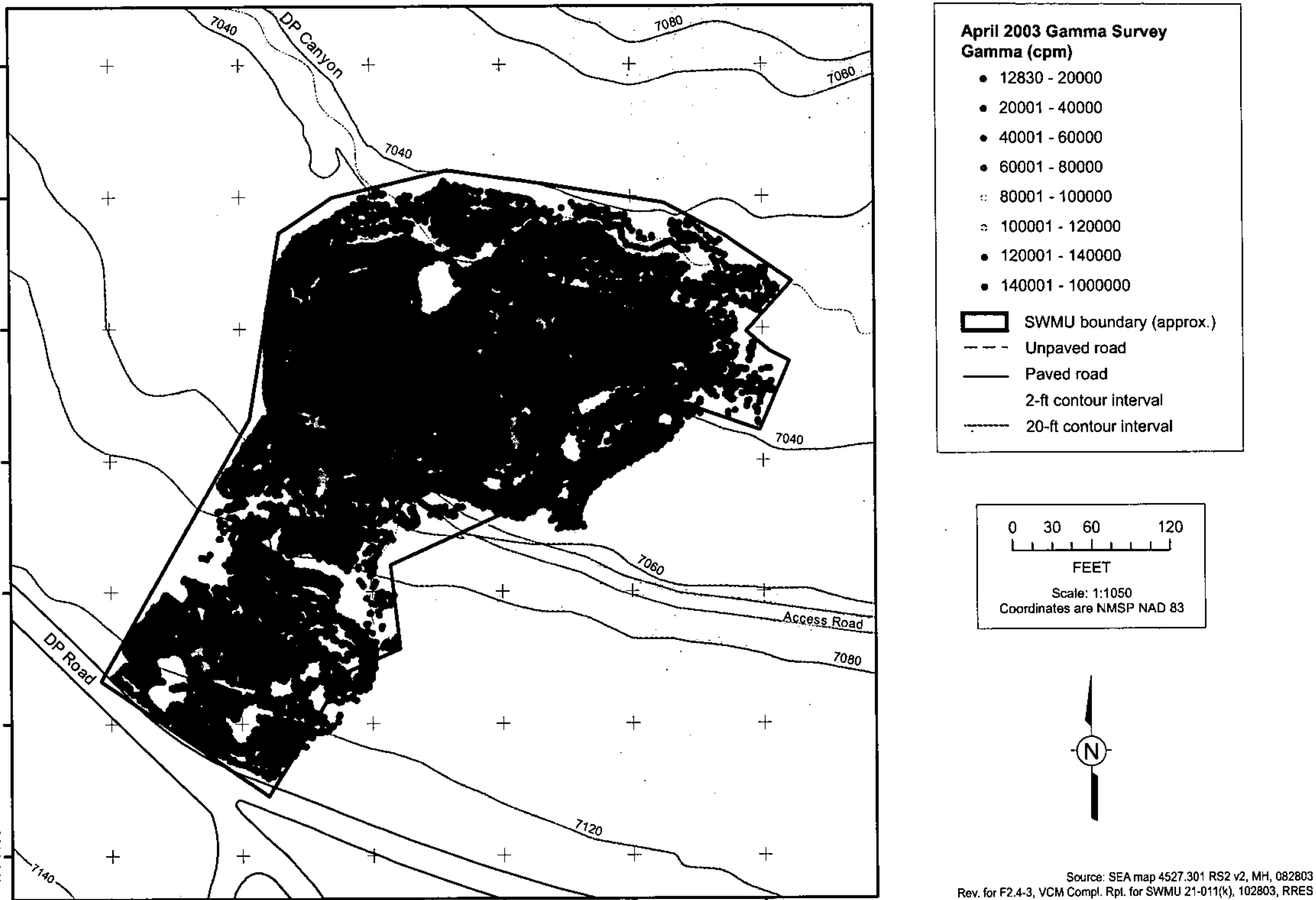


Figure 2.4-3. Post-excavation walk-over gross gamma survey at SWMU 21-011(k), April 2003

The increased volume of excavated material is due to the identification of a larger volume of contaminated material during the VCM than originally estimated. Once the remediation commenced it became apparent that material with concentrations of contaminants greater than the VCM cleanup goals persisted to greater depths than originally estimated based on preliminary sampling. This was especially true for the drainage along the west side of the site and previously disturbed areas of the base of the steep north-facing slope. Data presented in the approved VCM plan indicated that the bulk of the contamination would be encountered in the top 2 ft of soil/tuff at the site. During implementation of the VCM, the highest contaminant concentrations were encountered at depths of less than 2 ft in 80% of the areas excavated at the site. However, contaminated soil/tuff removed from the remainder of the site was found at depths up to 5 ft bgs.

Areas of deep (2-5 ft) contaminant migration seen at SWMU 21-011(k) can be attributed to stormwater flow, fractures in tuff, and previously disturbed areas of the site. Geologic indicators present within stormwater accumulation areas included buried clayey silt layers, high in organic content, bounded vertically by silty sand and colluvium. Fractures were generally clay filled, and contained small amounts of organic materials and plant roots. In situ gross gamma surveying on the outfall slope indicated that fractures provided a vertical transport pathway for contaminants. Field screening of fracture fill material resulted in estimated concentrations as high as 1,700 pCi/g for americium-241 and 2,120 pCi/g for cesium-137, while tuff located 1 ft away from the fractures would contain one-third the contaminant concentration. Photo I-17 displays a large clay filled fracture within the outfall slope. Previously disturbed areas of the site were easily identified by poorly consolidated soils, and a high vegetative content with little decomposition.

After removal of the contaminated soil, sediment, and tuff, a confirmation sample grid was established (Figure 2.4-4) over each remediated area within SWMU 21-011(k). Surveyors staked a grid on a 5-m spacing over each remediated area. A five-point (minimum) composite sample was collected from each grid-element within each remediated area. Composite samples were utilized for their ability to better represent the final surface conditions inside of each grid. In each discretely remediated area, a minimum of one surface confirmation was collected regardless of the area's size. For remediated areas larger than 25 m^2 samples were collected at a density of one sample per 25 m^2 of remediated area to meet the requirements for confirmation sampling of radiological remediation sites established in DOE Order 5400.5, as discussed in the VCM plan for this project (Appendix H).

Surveyors also staked random locations throughout all non-excavated areas of the site at a density of one location per 500 m^2 of non-excavated area. A five-point (minimum) composite sample was collected within the immediate vicinity (2-m radius) of each staked, random location. This sampling density also meets the sampling requirements for non-excavated areas within radiological remediation sites established in DOE order 5400.5.

All samples were obtained at depths of 0–0.5 ft. On the outfall slope a lack of accessible sample material required collection of a composite containing material from more than five separate locations. A more aggressive form of sample collection above spade and scope could not be performed on the slope due to fall protection requirements for worker safety which precluded the use of hand augering equipment. A total of 75 composite samples were collected from remediated areas, and a total of 14 composite samples were collected from non-remediated areas. In addition, 15 quality assurance (QA) samples were collected in the form of field duplicates.

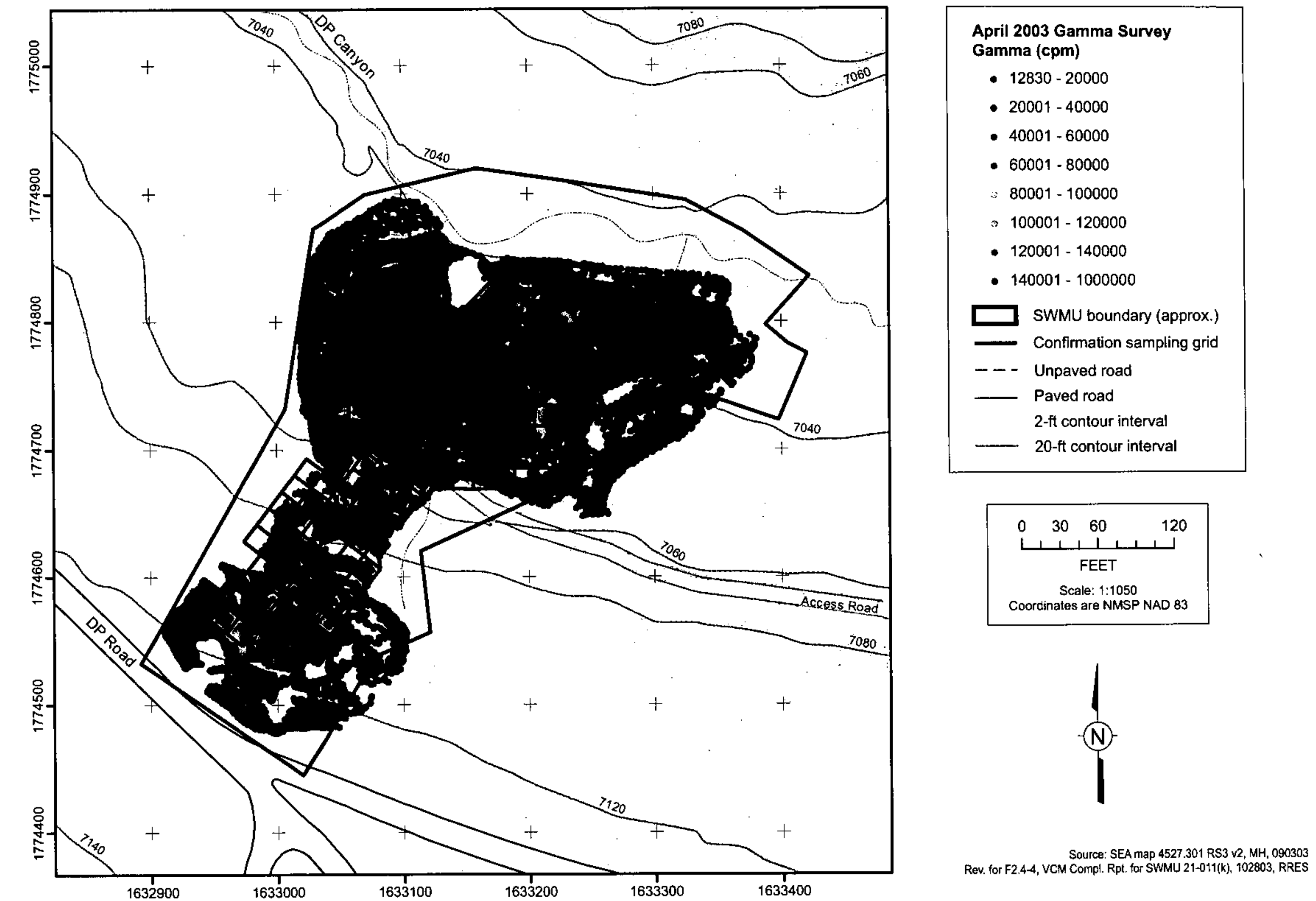


Figure 2.4-4. Confirmation sampling grid with April 2003 gross gamma survey at SWMU 21-011(k)

The field screening results for americium-241, cesium-137, and the corresponding offsite contract laboratory results for samples collected from the same locations are presented in Table 2.4-1. The correlation between confirmation sample field screening results with the actual laboratory results are presented in Figures 2.4-5 and 2.4-6. Figure 2.4-5 shows that the correlation of the field estimates for americium-241 were not close but were biased high. All Laboratory results for americium-241 were below the target cleanup level of 170 pCi/g. Figure 2.4-6 shows that the correlation of the field estimates for cesium-137 were good, particularly below the target cleanup level of 150 pCi/g.

Table 2.4-1
Summary of Field Screening Results and
Off-Site Contract Laboratory Results for Americium-241 and Cesium-137

Grid Location	Sample Location	Estimated Concentration Am-241 (pCi/g)	Actual Concentration Am-241 (pCi/g)	Estimated Concentration Cs-137 (pCi/g)	Actual Concentration Cs-137 (pCi/g)
Remediated Areas (all samples 0–0.5 ft bgs)					
9[a]	21-22210	5.70	1.238	4.75	61.410
10	21-22209	4.40	0.358	1.28	18.235
11	21-22211	1.30	1.036	2.28	26.945
12	21-22212	5.40	0.992	4.44	54.841
13	21-22213	5.70	1.124	20.50	22.071
14	21-22214	7.20	1.091	28.60	35.582
15	21-22222	23.00	9.570	107.00	118.890
16	21-22221	21.00	9.548	128.00	134.200
17	21-22224	13.00	4.506	78.10	94.123
18	21-22227	7.40	2.016	30.70	32.062
19	21-22228	7.90	1.830	10.50	15.648
20	21-22225	27.00	10.636	95.40	99.529
21	21-22226	20.00	6.870	82.90	86.036
22	21-22229	9.10	2.430	13.40	15.286
23	21-22220	17.00	3.250	92.30	100.320
24	21-22223	14.00	5.089	63.90	67.681
25	21-22215	77.00	13.671	34.60	48.873
26	21-22216	17.00	5.383	6.95	4.589
27	21-22219	16.00	3.471	86.90	92.148
28	21-22218	8.08	1.121	4.30	7.734
29	21-22217	12.00	41.631	22.90	31.614
30	21-22289	120.00	24.129	103.00	114.440
31	21-22277	20.00	1.582	61.80	51.336
32	21-22285	1.90	1.237	38.90	44.588
33	21-22276	11.00	1.405	80.60	91.215
34	21-22280	LTB[b]	0.578	19.90	21.669
35	21-22286	15.00	1.921	59.80	76.246

Table 2.4-1 (continued)

Grid Location	Sample Location	Estimated Concentration Am-241 (pCi/g)	Actual Concentration Am-241 (pCi/g)	Estimated Concentration Cs-137 (pCi/g)	Actual Concentration Cs-137 (pCi/g)
36	21-22279	6.20	1.000	64.70	66.177
37	21-22278	3.90	0.685	29.00	30.662
38	21-22260	LTB	3.462	19.90	25.800
39	21-22284	13.00	1.645	103.00	113.950
40	21-22283	LTB	0.182	LTB	1.786
41	21-22282	5.80	1.431	17.50	25.637
42	21-22281	10.00	2.053	48.10	62.686
43, 44, 45, 46, 47[c]	21-22261	LTB	0.508	8.63	12.520
48	21-22288	19.00	4.282	58.80	70.148
49	21-22259	LTB	3.260	17.80	29.696
50	21-22258	LTB	0.315	12.80	3.893
51	21-22287	13.00	1.644	44.60	69.223
52	21-22253	33.00	37.429	130.00	158.460
53	21-22254	37.00	9.266	125.00	168.090
54	21-22257	LTB	1.224	4.22	10.882
55	21-22256	LTB	0.308	8.07	12.014
56	21-22255	LTB	0.109	LTB	0.325
57	21-22250	4.60	2.865	17.30	20.162
58	21-22249	50.00	15.555	33.90	52.079
59	21-22251	1.30	3.307	11.70	20.176
60	21-22237	6.70	1.598	57.00	84.683
61	21-22252	1.90	0.561	42.00	53.705
62	21-22244	13.00	2.228	24.30	12.419
63	21-22245	130.00	99.824	56.30	75.477
64	21-22246	11.00	2.741	9.76	17.302
65	21-22247	16.00	5.041	61.60	69.285
66	21-22235	13.00	0.467	68.40	99.154
67	21-22236	11.00	2.217	55.40	79.602
68	21-22240	2.80	1.486	4.42	2.856
69	21-22241	91.00	28.901	85.60	78.824
70	21-22242	17.00	7.772	60.30	62.948
71	21-22243	5.30	1.339	23.70	26.869
72	21-22233	6.60	0.232	41.70	45.292
73	21-22234	11.00	0.295	71.20	76.963
74	21-22238	9.40	9.655	8.17	16.069
75	21-22239	51.00	7.910	24.50	24.915
76	21-22231	13.00	5.081	26.50	36.575

Table 2.4-1 (continued)

Grid Location	Sample Location	Estimated Concentration Am-241 (pCi/g)	Actual Concentration Am-241 (pCi/g)	Estimated Concentration Cs-137 (pCi/g)	Actual Concentration Cs-137 (pCi/g)
77	21-22232	3.30	1.339	2.40	26.869
78	21-22275	20.00	0.049	163.00	83.218
79	No excavation occurred within grid[d]				
80	21-22292	140.00	40.866	156.00	105.380
81	21-22264	94.00	44.929	120.00	157.340
82	21-22265	16.00	20.680	33.10	36.202
83	21-22274	35.00	4.338	144.00	180.210
84	21-22230	13.00	3.562	40.40	55.469
85	21-22268	7.50	5.494	22.40	34.654
86	21-22269	41.00	23.248	25.20	37.045
87	21-22270	16.00	0.944	71.70	43.306
88	21-22262	18.00	9.821	58.30	69.032
89	21-22263	9.50	0.944	45.40	43.306
90	21-22266	85.00	56.329	58.70	68.167
91	21-22267	10.00	1.774	54.00	63.899
92	21-22290	21.00	6.608	65.90	78.391
93	21-22291	18.00	2.084	86.90	88.195
94	21-22248	11.00	1.757	14.30	16.940
Nonremediated Areas (all samples 0–0.5 ft bgs)					
TBD[5] 1	21-22273	7.60	2.242	34.10	38.042
TBD 2	21-22272	26.00	8.996	70.20	93.169
TBD 3	21-22271	11.00	3.065	5.17	7.429
TBD 4	21-22201	13.00	4.916	47.30	46.187
TBD 5	21-22200	0.58	0.424	LTB	0.627
TBD 6	21-22199	2.00	0.968	11.80	15.854
TBD 7	21-22202	18.00	25.166	4.89	11.195
TBD 8	21-22203	LTB	0.310	4.69	1.420
TBD 9	21-22198	5.70	3.458	36.20	39.790
TBD 10	21-22204	LTB	0.144	0.74	0.084
TBD 11	21-22205	LTB	0.146	LTB	0.911
TBD 12	21-22207	1.60	0.823	9.30	15.957
TBD 13	21-22206	1.00	0.130	3.55	0.498
TBD 14	21-22208	1.80	1.056	5.41	3.751
Outfall Pipe Sampling (depth below pipe)					
0-1'	21-03-21382	13	0.365	72.8	57.882
2-3'	21-03-21382	2.6	2.348	0.295	1.696
2-3'	21-03-21381	4.7	0.126	1.99	1.666

Table 2.4-1 (continued)

Grid Location	Sample Location	Estimated Concentration Am-241 (pCi/g)	Actual Concentration Am-241 (pCi/g)	Estimated Concentration Cs-137 (pCi/g)	Actual Concentration Cs-137 (pCi/g)
0-1'	21-03-21386	8.3	0.112	2.26	1.699
2-3'	21-03-21386	3.1	0.07	1.15	1.647
0-1'	21-03-21387	4.3	0.037	0.942	1.873
2-3'	21-03-21387	4.7	0.046	4.29	1.339
0-1'	21-03-21388	2.6	1.473	72.8	64.603
2-3'	21-03-21388	4.7	0.073	4.29	1.079
0-1'	21-03-21389	13	0.368	7.72	6.793
2-3'	21-03-21389	5.6	0.648	6.65	7.367
0-1'	21-03-21390	4.1	0.102	2	1.549
2-3'	21-03-21390	3.2	0.098	1.6	0.311
0-1'	21-03-21391	7.7	0.914	11.6	12.642
0-1'	21-03-21392	5.2	0.328	12.2	2.87
2-3'	21-03-21392	10.3	0.437	6.1	5.971
0-1'	21-03-21393	12	0.811	98.9	66.341
2-3'	21-03-21393	7	0.095	12.7	1.138
0-1'	21-03-21394	5.2	0.197	1.22	9.29
2-3'	21-03-21394	5.4	0.626	LTB	14.394
0-1'	21-03-21395	5.8	0.358	LTB	3.044
0-1'	21-03-21396	1.9	1.223	13	11.729
0-1'	21-03-21398	7.2	1.047	4.19	4.52
Backfill Material Screening					
Fill 1	N/A[e]	LTB	N/A	1.9	N/A
Fill 2	N/A	LTB	N/A	LTB	N/A
Fill 3	N/A	LTB	N/A	LTB	N/A
Fill 4	N/A	29.7	N/A	9.1	N/A

[a] Grids number 1–8 were not staked. Sampling began with Grid 9.

[b] LTB = Less than background.

[c] Each grid contained only a small area of excavation. Therefore these grids were combined to create one sample representing 5 m^2 of excavated area.

[d] Grid 79 was staked in an area in which no excavation had occurred. Therefore this area fell under the 500 m^2 sampling plan and no sample was collected from within the grid.

[e] N/A = Not applicable.

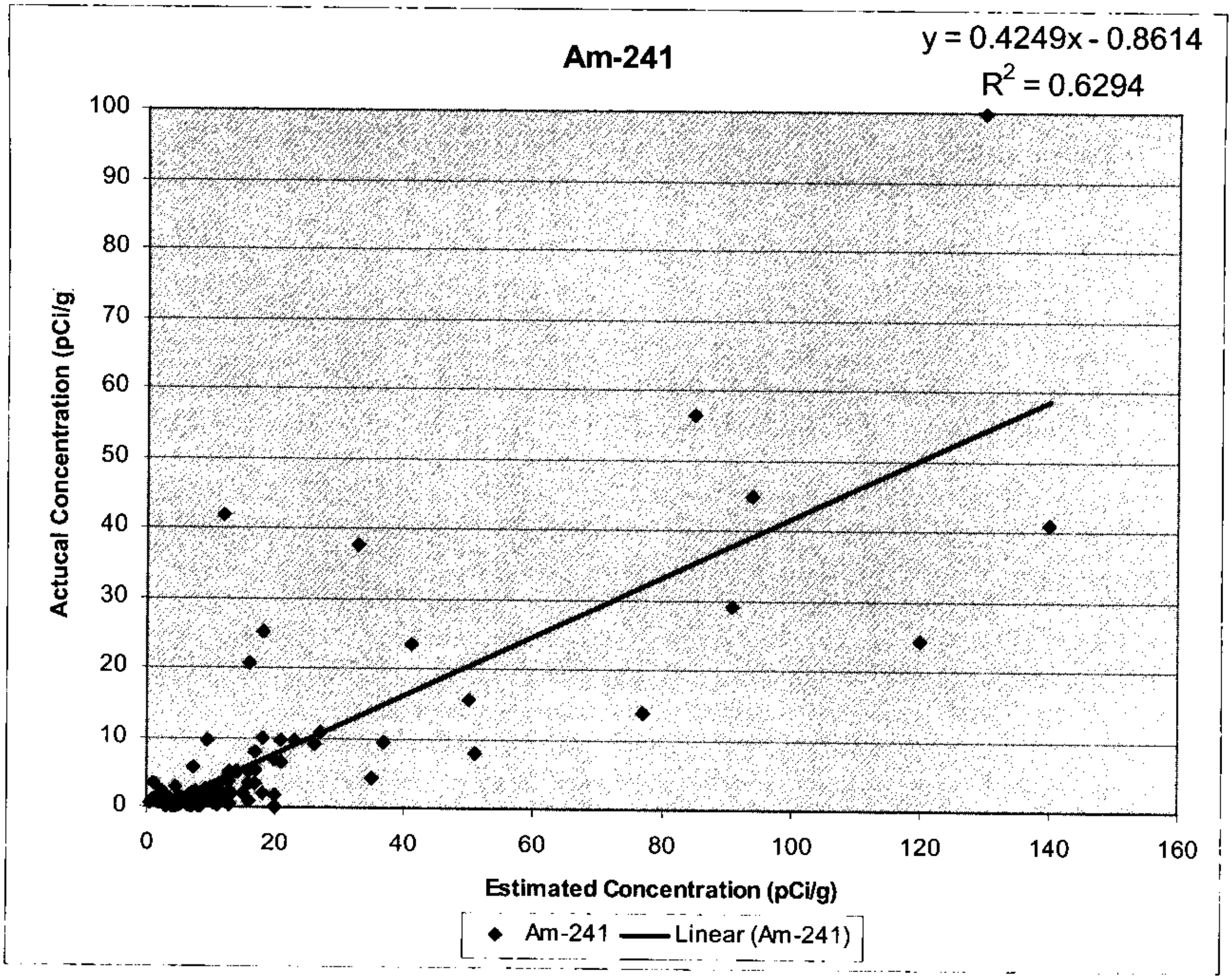


Figure 2.4-5. Correlation of field estimates of americium-241 with fixed Laboratory results

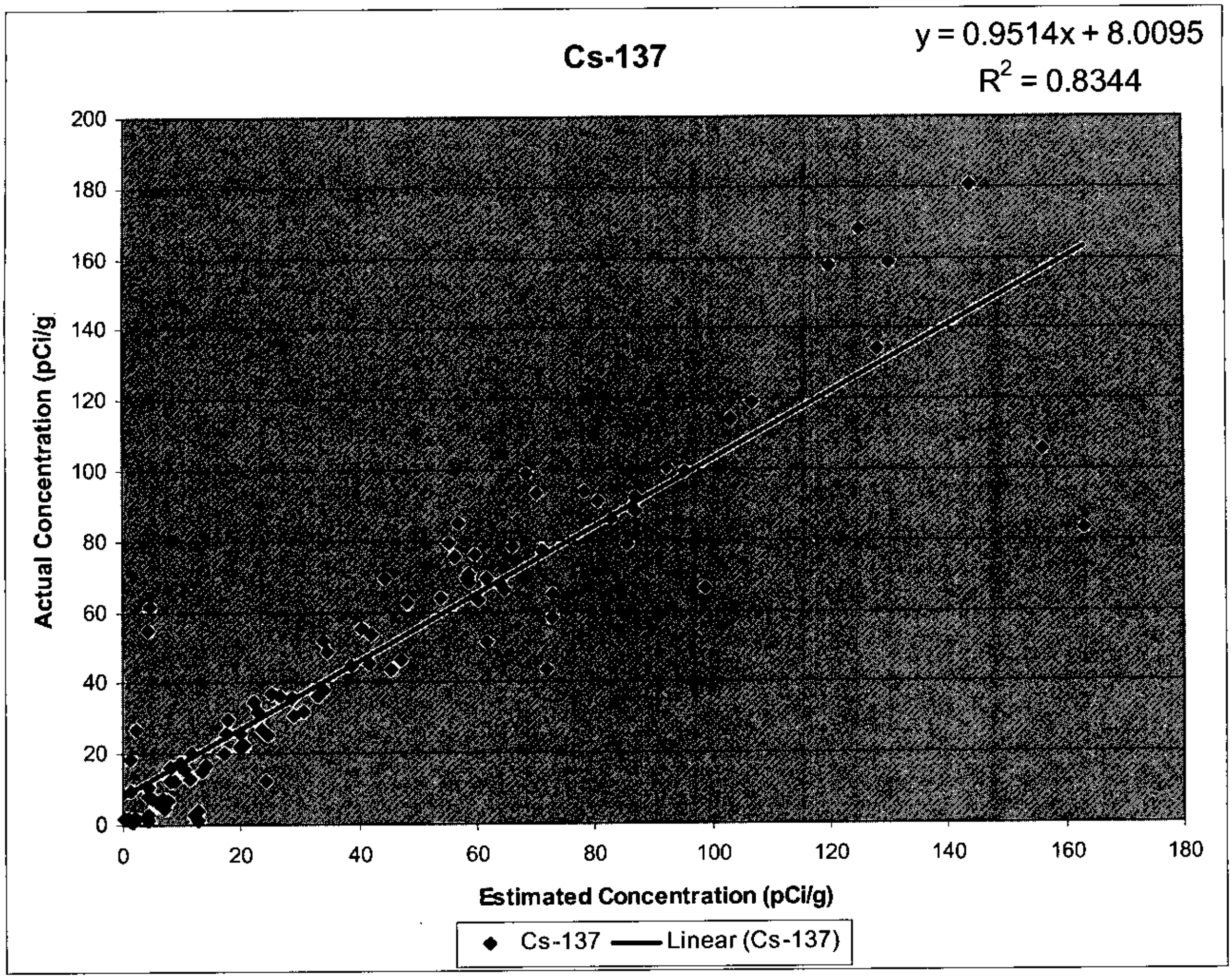


Figure 2.4-6. Correlation of field estimates of cesium-137 with fixed Laboratory results

All confirmation samples collected from the outfall slope area of SWMU 21-011(k) were screened for gross alpha, beta, and gamma radiation, and submitted for offsite contract laboratory analysis of cesium-137 by gamma spectroscopy, americium-241 by alpha spectroscopy, isotopic plutonium, and strontium-90 by gas proportional counting. A summary of post-VCM confirmation samples collected and the requested analyses is presented in Table 2.5-1.

In summary, the following steps were performed to ensure that radiologically contaminated soil and tuff were remediated to concentrations that meet the cleanup levels in the approved VCM plan for SWMU 21-011(k) (LANL 2003, 76903):

- gross gamma mapping of the site in December 2002 to identify and confirm areas requiring removal
- removal of contaminated soil and tuff above cleanup levels, guided by direct gross gamma screening within each excavated area

- screening of samples using fixed geometry field screening measurements in accordance with WGII SOP-10.15 Rev. 1 (WGII 2002, 76842)
- collection of confirmation samples submitted for off-site contract laboratory analysis
- post-remediation and post-restoration gross gamma mapping surveys of the site.

Some deviations from the approved VCM Plan occurred. Table 2.4-2 outlines the VCM Plan/ROC specification, the actual field work performed, and the rationale for the required deviation.

Table 2.4-2
Summary of VCM Plan Specifications, Fieldwork, and Rationale for Deviations

VCM Plan/ROC Specification(s)		Actual Fieldwork Performed		
Number of Samples	**Analytes Measured**	**Number of Samples**	**Analytes Measured**	**Rationale for Deviation**
10 confirmation samples from two depth intervals (0–12 in and 24–36 in. beneath an elevation equal to the bottom of the drainline) at 5 locations along outfall drainline.	cesium-137 by gamma spec., americium-241 by alpha spec., isotopic plutonium, and strontium-90.	27 confirmation samples from 15 locations. 6 of the 15 sample locations within drainline trench; 9 of the 15 sample locations east and west of trench 12 of the 15 locations were sampled at multiple depths: 0–12 in. and 24–36 in. beneath an elevation equal to bottom of drainline.	cesium-137 by gamma spec., americium-241 by alpha spec., isotopic plutonium, and strontium-90.	Additional confirmation samples were collected to determine horizontal and vertical extent of contamination and to verify that cleanup levels were met.
The final site-wide gross gamma walkover survey will be completed after site restoration and revegetation.		The final site-wide gross gamma walkover survey was completed after all remediated areas had been covered with clean fill, but before revegetation.		Performing the survey before revegetation allowed for better site access, and had any high levels of contaminants been found, they would have been easier to remediate.
Field work was planned to be complete by July 31, 2003.		Final demobilization from the site not completed until October 1, 2003.		Delay due to the winter weather conditions which slowed progress, increased volume of soil removed, the resulting increase in area to be restored, and the increased area to be revegetated.

During the VCM, it was decided that a small area within Reach DP-2 with a cesium-137 concentration exceeding the target cleanup level of 150 pCi/g would be remediated. Reach DP-2 is contiguous with SWMU 21-011(k). The area selected for remediation comprised a portion of a c3 geomorphic unit previously mapped and characterized by the Canyons Investigation Team, and had a cesium-137 value of 441 pCi/g (LANL 1999, 63915). The area was located on the south channel bank approximately 250 ft downstream of SWMU 21-011(k). Excavation of this area was guided by the same approach used at SWMU 21-011(k). A total volume of 12 yd^3 of sediment was removed. Confirmation samples were collected and the results are shown in Appendix K. A full assessment of the entire Los Alamos/Pueblo

Canyon watershed, including the DP Canyon reaches, will be presented in the Los Alamos/Pueblo Canyon Investigation Report currently in preparation, and scheduled for submittal to the NMED in 2004.

2.4.3 Site Restoration Activities

Site restoration activities began on May 20, 2003. Photographs documenting site restoration activities are provided in Appendix I (Photos I-29 to I-46). The objectives of the site restoration were to fill all remediated areas with clean fill, recontour the site, install BMPs, and revegetate the site. The DP Canyon slope area is made up of tuff bedrock and is too steep for heavy equipment to cut in benches for the placement of fill. Therefore, the remediation design was modified to reflect the operational problems faced in the field.

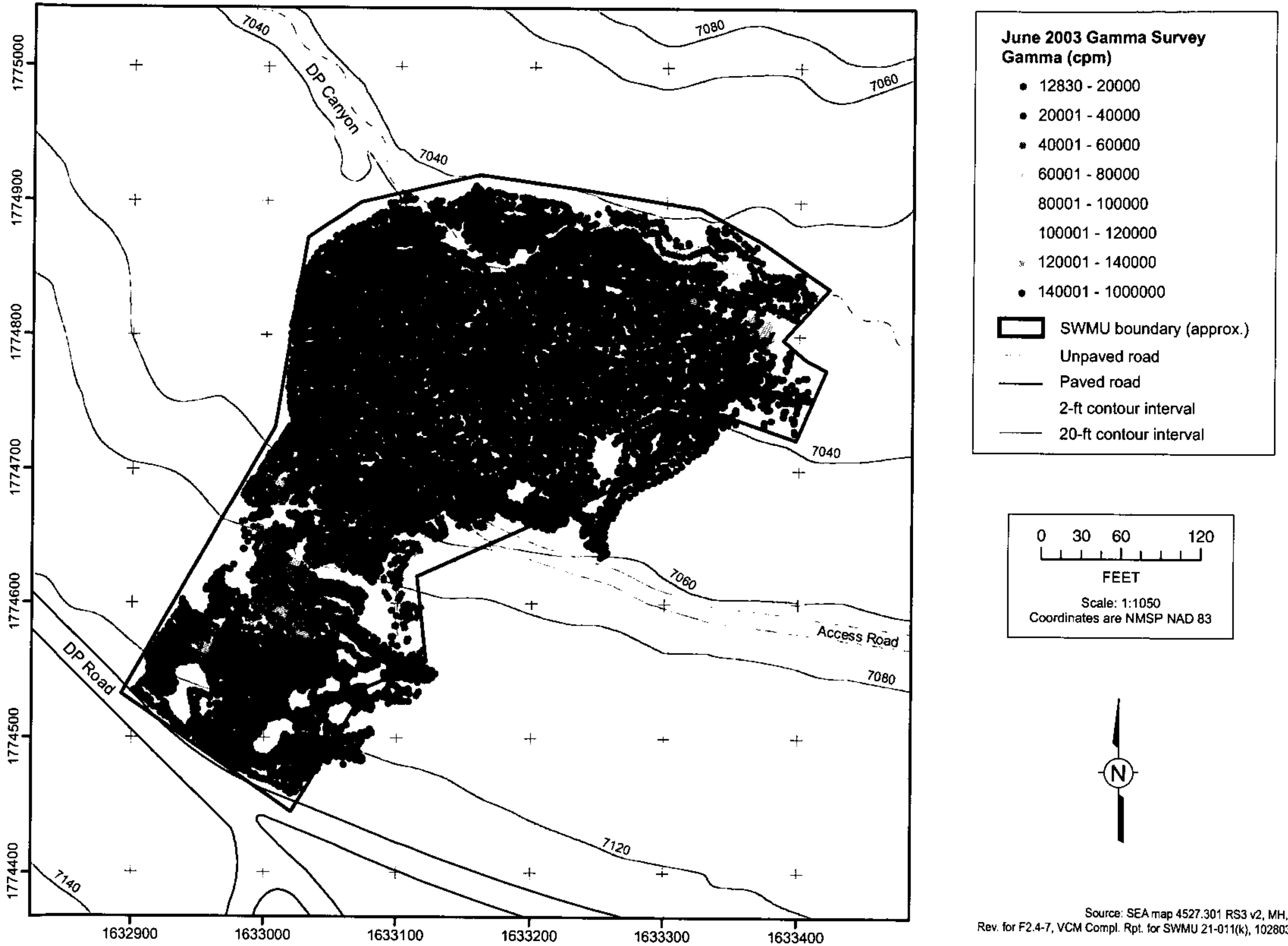
The first phase in restoration involved placement of logs and tree stumps, stockpiled during the site preparation activities, into the bottom of the deepest excavations. Clean fill was placed on top of these logs and stumps and was compacted. To facilitate the delivery of clean fill, a loop road was constructed through the site to allow large 18-wheel trucks with end-dump trailers to easily access the north end of the site. A total of 900 yd^3 of clean fill was delivered to the site from two sources. Approximately one-third of the fill originated from excavations within the Quemazon housing development on the Pajarito Plateau, a location distant from historical Laboratory operations; the other two-thirds originated from a mixed fill stockpile owned by the site work contractor (SG Western Construction Inc.) in San Juan, New Mexico.

Upon arrival on site, all fill was screened for radionuclide contamination using a combination of gross gamma direct surveys and field screening (Table 2.4-1). All surveying and field screening results for the fill material were below the local background concentrations of radionuclide activities used for the remediation process. Therefore, all fill was deemed acceptable for use in the restoration.

In addition, all fill brought to the site was classified using the American Society for Testing and Materials (ASTM) Visual-Manual Procedure for the classification of soils. Fill used in the restoration ranged in classification from SM (silty sand with gravel) to SC (clayey sand with gravel). Moisture content of the fill material ranged from dry to slightly moist. Therefore, all fill used conformed to the specifications outlined in ASTM D2488, and was deemed acceptable for use in the restoration of SWMU 21-011(k). Once the larger remediated areas were filled and compacted, the remaining fill was used to recontour the site.

Following recontouring, stormwater run-on and runoff controls were implemented across the site in accordance with the stormwater pollution prevention plan (LANL 2002, 73189). These activities included reinforcement of the berm along the northern perimeter of the site near the DP Canyon channel, backfilling of the excavated western drainage channel, and placement and construction of numerous BMPs to control runoff and soil erosion. In addition, a diversion ditch was excavated along the southern perimeter of the site, north of DP Road, to prevent stormwater from running onto the slope and divert it away from the site.

In June 2003, the final walk-over gross gamma survey was performed to document the post-VCM count rates across the site (Figure 2.4-7). This survey indicated that all areas of elevated contaminant concentrations had been remediated, and that no additional "hot spots" had been exposed during restoration activities. Nearly 15,000 gross gamma counts were recorded during this survey with an average of 23,285 cpm. This count rate roughly corresponds to a contaminant concentration of 40 pCi/g for cesium-137 based on known correlations between real-time gross gamma screening and fixed laboratory analysis reported in Appendix F of the SWMU 21-011(k) VCM Plan.



Source: SEA map 4527.301 RS3 v2, MH, 082803
Rev. for F2.4-7, VCM Compl. Rpt. for SWMU 21-011(k), 102803, RRES

Figure 2.4-7. Final walk-over gross gamma survey at SWMU 21-011(k), June 2003

Revegetation of the site was conducted in accordance with the restoration design that was developed by a landscape architect licensed in the state of New Mexico. Revegetation activities began on August 6, 2003. Soil amendments were incorporated across the site, followed by hydroseeding with a native seed mix. After seeding was completed, a total of 72 ponderosa pine trees and 125 gamble oaks were planted on site to complete the revegetation. Four hydrous gel packs, which provide water during periods of low precipitation, were installed with each plant. The gel packs will help ensure establishment of each plant. The plantings will be inspected in the spring of 2004. At that time, winter-killed pines and oaks will be replaced.

2.5 Data Review

All relevant site data for radionuclides are reviewed in this section to identify any COPCs remaining at SWMU 21-011(k) following completion of the VCM. This includes all confirmation samples and samples from previous characterization activities that were not excavated as part of the VCM. The COPC identification process is conducted by comparing site data with

- naturally occurring Laboratory soil and tuff background concentrations for non-fallout radionuclides and
- atmospheric fallout background concentrations for those radionuclides present in atmospheric fallout (applies to 0–6-in. bgs soil samples only).

All radionuclide COPCs identified through the data review are retained for further evaluation in the site assessment presented in Section 2.7. It is important to note that the identification and retention of a COPC for further assessment does not explicitly indicate that cleanup levels for the site have not been attained.

Data from multiple sampling events are used in this report to identify COPCs and to confirm that the VCM at SWMU 21-011(k) was successful. The data is comprised of post-VCM confirmation samples and previously collected samples from locations that were not excavated as part of the VCM. The evaluated data are therefore representative of current conditions at the site. The analytical suites for the RFI, IA, and VCM confirmation samples varied from location to location, and from field campaign to field campaign. Table 2.5-1 presents a summary of samples collected and analytical suites requested.

The confirmation data set is comprised of analytical results from a total of 65 soil samples and 57 tuff (Qbt 3) samples. All confirmation sample results are presented in Appendix D. The data quality, including description of data qualifiers, is discussed in Appendix C.

2.5.1 Radionuclide Comparison with Background/Fallout Radionuclide Concentration

The radionuclide data for SWMU 21-011(k) are of good quality and sufficient for identifying COPCs and assessing the site. To facilitate data evaluation and COPC identification, the radionuclide analytical data are summarized in Table 2.5-2; for each analyte, the table lists the medium-specific Laboratory background value (BV) or fallout value (FV), concentration range, and the frequency of detections greater than the BV. Note that BVs have not been established for some radionuclides, regardless of the sample medium or sample depth horizon. For these radionuclides the sample- and analyte-specific minimum detectable activity is used as the threshold value for identifying COPCs. Table 2.5-3 presents the sample-by-sample analytical range for each COPC detected at concentrations above the BV or FV.

Table 2.5-1
Summary of Confirmation Samples Collected and Analysis Suites Requested during the VCM at SWMU 21-011(k)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241 by Alpha Spectroscopy	Cesium-137 by Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90 by Gas Proportional Counting
Drainline Confirmation Samples										
MD21-03-49651	21-03-21380	8–9	Qbt3	1699S[a]	1699S	—[b]	1699S	—	—	1699S
MD21-03-49652	21-03-21380	9–10	Qbt3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49654	21-03-21381	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49655	21-03-21382	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49656	21-03-21382	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49663	21-03-21386	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49664	21-03-21386	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49665	21-03-21387	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49666	21-03-21387	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49667	21-03-21388	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49668	21-03-21388	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49669	21-03-21389	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49670	21-03-21389	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49671	21-03-21390	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49672	21-03-21390	9–10	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49673	21-03-21391	8–9	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49675	21-03-21392	5–6	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49676	21-03-21392	6–7	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49677	21-03-21393	5–6	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49678	21-03-21393	6–7	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49679	21-03-21394	5–6	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49680	21-03-21394	6–7	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49681	21-03-21395	5–6	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49699	21-03-21395	5–6	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49683	21-03-21396	3–4	Qbt 3	1699S	1699S	—	1699S	—	—	1699S
MD21-03-49687	21-03-21398	1–2	Qbt 3	1699S	1699S	—	1699S	—	—	1699S

Table 2.5-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241 by Alpha Spectroscopy	Cesium-137 by Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90 by Gas Proportional Counting
1996 IA Confirmation Samples and 2001 pre-VCM samples										
0121-96-0803	21-04600	0–0.5	Soil	—	2751	—	2751	—	—	2751
0121-96-0809	21-04856	0–0.5	Soil	—	2751	—	2751	—	—	2751
MD21-01-0034	21-11205	4–5	Soil	—	8448R	—	8448R	—	—	8448R
21-011(k) VCM Confirmation Grid Samples										
MD21-03-51509	21-22198	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51572	21-22198	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51510	21-22199	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51571	21-22199	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51511	21-22200	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51570	21-22200	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51512	21-22201	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51569	21-22201	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51513	21-22202	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51514	21-22203	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51515	21-22204	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51516	21-22205	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51517	21-22206	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51518	21-22207	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51519	21-22208	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51520	21-22209	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51521	21-22210	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51522	21-22211	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51523	21-22212	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51524	21-22213	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51525	21-22214	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51526	21-22215	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51527	21-22216	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51528	21-22217	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51529	21-22218	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51530	21-22219	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51531	21-22220	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S

Table 2.5-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241 by Alpha Spectroscopy	Cesium-137 by Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90 by Gas Proportional Counting
MD21-03-51532	21-22221	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51533	21-22222	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51534	21-22223	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51535	21-22224	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51536	21-22225	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51537	21-22226	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51538	21-22227	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51539	21-22228	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51540	21-22229	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51541	21-22230	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-0351542	21-22231	0–0.5	Qbt 3	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51543	21-22232	0–0.5	Qbt 3	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51544	21-22233	0–0.5	Qbt 3	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51545	21-22234	0–0.5	Qbt 3	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51546	21-22235	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51573	21-22235	0–0.5	Soil	1757S	1757S	—	1757S	—	—	1757S
MD21-03-51547	21-22236	0–0.5	Soil	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51548	21-22237	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51549	21-22238	0–0.5	Soil	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51550	21-22239	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51551	21-22240	0–0.5	Soil	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51552	21-22241	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51553	21-22242	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51554	21-22243	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51555	21-22244	0–0.5	Soil	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51556	21-22245	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51557	21-22246	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51558	21-22247	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51559	21-22248	0–0.5	Soil	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51560	21-22249	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51561	21-22250	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51562	21-22251	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S

Table 2.5-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241 by Alpha Spectroscopy	Cesium-137 by Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90 by Gas Proportional Counting
MD21-03-51563	21-22252	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51564	21-22253	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51565	21-22254	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51566	21-22255	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51567	21-22256	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51568	21-22257	0–0.5	Qbt 3	1758S	1758S	—	1758S	—	—	1758S
MD21-03-51574	21-22258	0–0.5	Qbt 3	1759S	1759S	—	1759S	—	—	1759S
MD21-03-51575	21-22259	0–0.5	Qbt 3	1759S	1759S	—	1759S	—	—	1759S
MD21-03-51576	21-22260	0–0.5	Soil	1759S	1759S	—	1759S	—	—	1759S
MD21-03-51577	21-22261	0–0.5	Soil	1759S	1759S	—	1759S	—	—	1759S
MD21-03-51634	21-22261	0–0.5	Soil	1759S	1759S	—	1759S	—	—	1759S
MD21-03-51578	21-22262	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51579	21-22263	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51580	21-22264	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51581	21-22265	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51582	21-22266	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51583	21-22267	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51584	21-22268	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51585	21-22269	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51586	21-22270	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51587	21-22271	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51588	21-22272	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51589	21-22273	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51590	21-22274	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51591	21-22275	0–0.5	Qbt 3	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51592	21-22276	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51593	21-22277	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51594	21-22278	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51595	21-22279	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51596	21-22280	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51597	21-22281	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51635	21-22281	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S

Table 2.5-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241 by Alpha Spectroscopy	Cesium-137 by Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90 by Gas Proportional Counting
MD21-03-51598	21-22282	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51599	21-22283	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51636	21-22283	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51600	21-22284	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51601	21-22285	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51637	21-22285	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51602	21-22286	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51603	21-22287	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51638	21-22287	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51604	21-22288	0–0.5	Soil	1760S	1760S	—	1760S	—	—	1760S
MD21-03-51605	21-22289	0–0.5	Soil	1761S	1761S	—	1761S	—	—	1761S
MD21-03-51606	21-22290	0–0.5	Soil	1761S	1761S	—	1761S	—	—	1761S
MD21-03-51607	21-22291	0–0.5	Soil	1761S	1761S	—	1761S	—	—	1761S
MD21-03-51608	21-22292	0–0.5	Qbt 3	1761S	1761S	—	1761S	—	—	1761S

[a] Analytical request number.

[b] — =Analysis not requested.

Table 2.5-2
Frequency of Detected Radionuclides in Post-VCM Confirmation at SWMU 21-011(k)

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	BV/FV[a] (pCi/g)	Frequency of Detects above Background/ Fallout Value
Americium-241	Soil	63	63	0.13 to 41.631	0.013	63/63
Americium-241	Qbt 3	59	59	0.037 to 99.824	NA[b]	59/59
Cesium-134	Soil	62	1	[-0.267 to 0.27][c]	NA	1/62
Cesium-134	Qbt 3	59	2	[-0.359] to 0.506	NA	2/59
Cesium-137	Soil	63	63	0.084 to 134.2	1.65	58/63
Cesium-137	Qbt 3	59	59	0.311 to 180.21	NA	59/59
Cobalt-60	Soil	62	0	[-0.024 to 0.016]	NA	0/62
Cobalt-60	Qbt 3	59	0	[-0.026 to 0.032]	NA	0/59
Europium-152	Soil	62	44	[-0.2] to 0.814	NA	44/62
Europium-152	Qbt 3	59	45	[0.028] to 0.542	NA	45/59
Plutonium-238	Soil	63	61	[0.014] to 4.754	0.023	58/63
Plutonium-238	Qbt 3	59	47	[0] to 7.338	NA	47/59
Plutonium-239	Soil	63	63	0.165 to 29.006	0.054	63/63
Plutonium-239	Qbt 3	59	59	0.063 to 59.369	NA	59/59
Ruthenium-106	Soil	62	0	[-0.329 to 0.3]	NA	0/62
Ruthenium-106	Qbt 3	59	0	[-0.334 to 0.414]	NA	0/59
Sodium-22	Soil	62	0	[-0.02 to 0.025]	NA	0/62
Sodium-22	Qbt 3	59	0	[-0.027 to 0.028]	NA	0/59
Strontium-90	Soil	63	57	[0.209] to 48.209	1.31	52/63
Strontium-90	Qbt 3	59	54	[-0.095] to 43.706	NA	54/59
Thorium-228	Soil	1	1	1.38 to 1.38	2.28	0/1
Thorium-230	Soil	1	1	1.42 to 1.42	2.29	0/1
Thorium-232	Soil	1	1	1.45 to 1.45	2.33	0/1
Tritium	Soil	1	1	0.113 to 0.113	NA	1/1
Uranium-234	Soil	1	1	1.4 to 1.4	2.59	0/1
Uranium-235	Soil	63	48	[0.036 to 0.429]	0.2	47/63
Uranium-235	Qbt 3	59	44	[0.076] to 0.56	0.09	43/59
Uranium-238	Soil	1	1	1.26 to 1.26	2.29	0/1

Note: Field duplicates are not included in data summary.

[a] Source: LANL (1998, 59730).

[b] NA = BV/FV not available or not applicable.

[c] Brackets indicate minimum detectable activity (i.e., detection limits) for non-detected results.

Table 2.5-3
Radionuclide COPCs Exceeding BV/FV in Post-VCM Confirmation Samples at SWMU 21-011(k)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
Outlet Line Confirmation Samples												
MD21-03-49651	21-03-21380	8.00–9.00	Qbt 3	0.135	—[b]	2.272	0.186	0.036	0.201	1.827	—	-
MD21-03-49652	21-03-21380	9.00–10.00	Qbt 3	0.107	—	1.522	0.276	-	0.154	0.751	—	0.211
MD21-03-49654	21-03-21381	9.00–10.00	Qbt 3	0.126	—	1.666	—	-	0.127	1.96	—	—
MD21-03-49655	21-03-21382	8.00–9.00	Qbt 3	2.348	—	57.882	—	0.178	6.877	23.039	—	—
MD21-03-49656	21-03-21382	9.00–10.00	Qbt 3	0.365	—	1.696	—	0.055	0.301	1.569	—	—
MD21-03-49663	21-03-21386	8.00–9.00	Qbt 3	0.112	—	1.699	—	—	0.237	2.548	—	—
MD21-03-49664	21-03-21386	9.00–10.00	Qbt 3	0.079	—	1.647	—	—	0.081	2.14	—	—
MD21-03-49665	21-03-21387	8.00–9.00	Qbt 3	0.037	—	1.873	—	—	0.063	1.956	—	—
MD21-03-49666	21-03-21387	9.00–10.00	Qbt 3	0.046	—	1.339	—	0.035	0.139	0.915	—	—
MD21-03-49667	21-03-21388	8.00–9.00	Qbt 3	1.473	—	64.603	—	0.186	7.511	23.111	—	—
MD21-03-49668	21-03-21388	9.00–10.00	Qbt 3	0.073	—	1.079	—	—	0.194	4.683	—	—
MD21-03-49669	21-03-21389	8.00–9.00	Qbt 3	0.368	—	6.793	—	0.146	0.965	6.243	—	—
MD21-03-49670	21-03-21389	9.00–10.00	Qbt 3	0.648	—	7.367	—	0.138	1.366	4.909	—	—
MD21-03-49671	21-03-21390	8.00–9.00	Qbt 3	0.102	—	1.549	—	—	0.372	—	—	—
MD21-03-49672	21-03-21390	9.00–10.00	Qbt 3	0.098	—	0.311	—	—	0.273	—	—	—
MD21-03-49673	21-03-21391	8.00–9.00	Qbt 3	0.914	—	12.642	—	0.346	1.441	3.325	—	—
MD21-03-49675	21-03-21392	5.00–6.00	Qbt 3	0.328	—	2.87	—	0.03	1.759	—	—	—
MD21-03-49676	21-03-21392	6.00–7.00	Qbt 3	0.437	—	5.971	—	0.115	2.668	1.213	—	—
MD21-03-49677	21-03-21393	5.00–6.00	Qbt 3	0.811	—	66.341	—	0.114	3.594	12.952	—	—

Table 2.5-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
MD21-03-49678	21-03-21393	6.00–7.00	Qbt 3	0.095	—	1.138	—	—	0.257	—	—	—
MD21-03-49679	21-03-21394	5.00–6.00	Qbt 3	0.197	—	9.29	—	—	0.641	5.851	—	—
MD21-03-49680	21-03-21394	6.00–7.00	Qbt 3	0.626	—	14.349	—	0.148	6.34	4.322	—	—
MD21-03-49681	21-03-21395	5.00–6.00	Qbt 3	0.358	—	3.044	—	0.131	3.744	1.065	—	—
MD21-03-49699[c]	**21-03-21395**	**5.00–6.00**	**Qbt 3**	**0.122**	**—**	**3.004**	**—**	**—**	**1.059**	**0.768**	**—**	**—**
MD21-03-49683	21-03-21396	3.00–4.00	Qbt 3	1.223	—	11.729	—	0.247	12.261	5.475	—	—
MD21-03-49687	21-03-21398	1.00–2.00	Qbt 3	1.047	—	4.52	—	0.155	8.216	2.184	—	—
Pre-VCM Samples Remaining following the VCM												
AAA4009	21-01591	0.00–0.50	Soil	8.963	—	42.64	—	0.859	12.773	8.6	0.113	—
MD21-01-0034	21-11205	4.00–5.00	Soil	6.9	—	3.78	—	0.21	1.01	—	—	—
Confirmation Samples from Excavated Areas and Areas that Did Not Require Excavation												
MD21-03-51509	21-22198	0.00–0.50	Soil	3.485	—	39.79	—	0.385	4.097	—	—	—
MD21-03-51572	**21-22198**	**0.00–0.50**	**Soil**	**2.72**	**—**	**38.963**	**0.21**	**0.322**	**3.375**	**4.449**	**—**	**—**
MD21-03-51510	21-22199	0.00–0.50	Soil	0.968	—	15.854	0.483	0.149	1.269	3.454	—	0.285
MD21-03-51571	**21-22199**	**0.00–0.50**	**Soil**	**1.06**	**—**	**14.834**	**0.268**	**0.164**	**1.414**	**2.482**	**—**	**0.289**
MD21-03-51511	21-22200	0.00–0.50	Soil	0.424	—	—	0.447	0.09	1.047	—	—	0.254
MD21-03-51570	**21-22200**	**0.00–0.50**	**Soil**	**0.238**	**—**	**—**	**0.242**	**0.053**	**1.402**	**—**	**—**	**0.316**
MD21-03-51512	21-22201	0.00–0.50	Soil	4.916	—	46.187	—	0.32	1.897	—	—	0.286
MD21-03-51569	**21-22201**	**0.00–0.50**	**Soil**	**4.529**	**—**	**40.077**	**0.261**	**0.414**	**2.413**	**8.616**	**—**	**—**
MD21-03-51513	21-22202	0.00–0.50	Soil	25.166	—	11.195	0.337	1.187	4.733	3.836	—	0.278
MD21-03-51514	21-22203	0.00–0.50	Soil	0.31	—	—	0.246	0.056	0.65	—	—	0.285

Table 2.5-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
MD21-03-51515	21-22204	0.00–0.50	Soil	0.144	—	—	—	0.033	8.517	—	—	—
MD21-03-51516	21-22205	0.00–0.50	Soil	0.146	—	—	—	—	1.627	—	—	—
MD21-03-51517	21-22206	0.00–0.50	Soil	0.13	—	—	—	—	0.963	—	—	0.268
MD21-03-51518	21-22207	0.00–0.50	Soil	0.823	—	15.957	—	0.203	1.625	3.598	—	0.299
MD21-03-51519	21-22208	0.00–0.50	Soil	1.056	—	3.751	0.404	0.105	0.481	—	—	0.299
MD21-03-51520	21-22209	0.00–0.50	Soil	0.358	—	18.235	—	0.132	0.782	3.258	—	—
MD21-03-51521	21-22210	0.00–0.50	Soil	1.238	—	61.41	—	0.511	20.404	9.498	—	0.271
MD21-03-51522	21-22211	0.00–0.50	Soil	1.036	—	26.945	—	0.199	1.416	5.553	—	0.254
MD21-03-51523	21-22212	0.00–0.50	Soil	0.992	—	54.841	0.382	0.255	1.572	8.475	—	0.24
MD21-03-51524	21-22213	0.00–0.50	Soil	1.124	—	22.071	—	0.281	1.49	4.991	—	0.264
MD21-03-51525	21-22214	0.00–0.50	Soil	1.091	—	35.592	0.255	0.206	1.402	6.518	—	0.209
MD21-03-51526	21-22215	0.00–0.50	Soil	13.671	—	43.873	0.139	2.907	13.322	13.602	—	—
MD21-03-51527	21-22216	0.00–0.50	Soil	5.383	—	4.598	0.145	0.961	3.229	2.244	—	0.243
MD21-03-51528	21-22217	0.00–0.50	Soil	41.631	—	31.614	0.169	4.754	29.006	18.754	—	—
MD21-03-51529	21-22218	0.00–0.50	Soil	1.121	—	7.734	0.396	0.06	1.423	8.44	—	0.264
MD21-03-51530	21-22219	0.00–0.50	Soil	3.471	—	92.148	0.265	0.312	6.214	31.969	—	0.354
MD21-03-51531	21-22220	0.00–0.50	Soil	3.25	—	100.32	0.3	1.531	6.224	16.264	—	0.295
MD21-03-51532	21-22221	0.00–0.50	Soil	9.548	—	134.2	0.313	2.493	11.303	21.841	—	0.28
MD21-03-51533	21-22222	0.00–0.50	Soil	9.57	—	118.89	0.365	2.13	14.022	26.844	—	—
MD21-03-51534	21-22223	0.00–0.50	Soil	5.089	—	67.681	0.229	1.063	5.698	8.295	—	0.269
MD21-03-51535	21-22224	0.00–0.50	Soil	4.506	—	94.123	—	1.932	6.819	16.929	—	0.265

Table 2.5-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
MD21-03-51536	21-22225	0.00–0.50	Soil	10.636	—	99.529	—	1.554	10.116	22.659	—	0.271
MD21-03-51537	21-22226	0.00–0.50	Soil	6.87	—	86.036	0.408	1.5	9.17	16.846	—	0.264
MD21-03-51538	21-22227	0.00–0.50	Soil	2.016	—	32.062	0.348	0.597	3.946	6.21	—	—
MD21-03-51539	21-22228	0.00–0.50	Soil	1.83	—	15.648	0.31	0.322	2.456	4.321	—	0.281
MD21-03-51540	21-22229	0.00–0.50	Soil	2.43	—	15.286	0.533	0.184	1.711	3.119	—	0.245
MD21-03-51541	21-22230	0.00–0.50	Soil	3.562	—	55.496	0.629	0.223	8.167	20.731	—	—
MD21-03-51542	21-22231	0.00–0.50	Qbt 3	5.081	—	36.575	0.406	0.378	7.99	8.752	—	0.304
MD21-03-51543	21-22232	0.00–0.50	Qbt 3	1.267	—	24.989	0.228	0.05	1.794	9.115	—	0.276
MD21-03-51544	21-22233	0.00–0.50	Qbt 3	0.232	—	45.292	0.271	—	0.667	25.54	—	0.223
MD21-03-51545	21-22234	0.00–0.50	Qbt 3	0.295	—	76.936	0.312	0.031	1.163	41.12	—	0.246
MD21-03-51546	21-22235	0.00–0.50	Soil	0.467	0.083	99.154	0.387	0.046	1.459	48.209	—	0.33
MD21-03-51573	**21-22235**	**0.00–0.50**	**Soil**	**0.439**	**—**	**89.117**	**0.371**	**0.08**	**1.842**	**44.047**	**—**	**0.283**
MD21-03-51547	21-22236	0.00–0.50	Soil	2.217	—	79.602	0.814	0.124	3.913	24.107	—	0.315
MD21-03-51548	21-22237	0.00–0.50	Qbt 3	1.598	—	84.683	0.467	0.105	1.911	29.755	—	0.294
MD21-03-51549	21-22238	0.00–0.50	Soil	9.655	—	16.069	0.379	0.364	11.891	3.047	—	—
MD21-03-51550	21-22239	0.00–0.50	Qbt 3	7.91	—	24.915	—	1.335	5.645	12.012	—	0.449
MD21-03-51551	21-22240	0.00–0.50	Soil	1.486	—	2.856	0.234	0.151	2.789	—	—	—
MD21-03-51552	21-22241	0.00–0.50	Qbt 3	28.901	—	78.824	0.214	2.96	11.839	29.353	—	0.444
MD21-03-51553	21-22242	0.00–0.50	Qbt 3	7.772	—	62.948	—	0.312	10.052	16.948	—	—
MD21-03-51554	21-22243	0.00–0.50	Qbt 3	1.339	—	26.869	0.486	0.078	1.669	9.711	—	0.321
MD21-03-51555	21-22244	0.00–0.50	Soil	2.228	—	12.419	—	0.167	2.228	5.518	—	—

Table 2.5-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
MD21-03-51556	21-22245	0.00–0.50	Qbt 3	99.824	—	75.477	—	7.338	27.602	41.673	—	—
MD21-03-51557	21-22246	0.00–0.50	Qbt 3	2.741	—	17.302	—	0.406	1.809	6.129	—	0.316
MD21-03-51558	21-22247	0.00–0.50	Qbt 3	5.041	—	69.285	0.248	0.271	6.644	20.007	—	0.307
MD21-03-51559	21-22248	0.00–0.50	Soil	1.757	—	16.94	0.294	0.167	2.063	13.742	—	0.364
MD21-03-51560	21-22249	0.00–0.50	Qbt 3	15.551	—	52.079	—	2.392	16.815	18.529	—	0.385
MD21-03-51561	21-22250	0.00–0.50	Qbt 3	2.865	—	20.162	0.405	0.307	1.644	6.585	—	0.337
MD21-03-51562	21-22251	0.00–0.50	Qbt 3	3.307	—	20.176	0.542	0.137	3.534	8.647	—	0.277
MD21-03-51563	21-22252	0.00–0.50	Qbt 3	0.561	—	53.705	0.358	0.04	1.182	27.346	—	0.357
MD21-03-51564	21-22253	0.00–0.50	Qbt 3	37.429	—	158.46	0.247	3.12	35.707	43.706	—	0.461
MD21-03-51565	21-22254	0.00–0.50	Qbt 3	9.266	—	168.09	—	2.263	11.838	35.244	—	0.56
MD21-03-51566	21-22255	0.00–0.50	Qbt 3	0.109	—	0.325	0.217	—	0.163	—	—	—
MD21-03-51567	21-22256	0.00–0.50	Qbt 3	0.308	—	12.014	0.232	0.137	3.534	1.969	—	0.266
MD21-03-51568	21-22257	0.00–0.50	Qbt 3	1.224	—	10.882	0.354	0.04	1.182	1.331	—	0.342
MD21-03-51574	21-22258	0.00–0.50	Qbt 3	0.315 (J-)[d]	—	3.839	0.266	0.043	0.229	1.887	—	—
MD21-03-51575	21-22259	0.00–0.50	Qbt 3	3.26 (J-)	0.506	29.696	—	0.104	0.728	5.306	—	—
MD21-03-51576	21-22260	0.00–0.50	Soil	3.462 (J-)	—	25.8	0.548	0.168	3.969	3.822	—	0.362
MD21-03-51577	21-22261	0.00–0.50	Soil	0.508 (J-)	—	13.142	0.318	0.086	0.854	2.103	—	0.202
MD21-03-51634	**21-22261**	**0.00–0.50**	**Soil**	**0.296 (J-)**	**—**	**12.52**	**0.244**	**—**	**0.783**	**3.392**	**—**	**—**
MD21-03-51578	21-22262	0.00–0.50	Qbt 3	9.821	—	69.032	0.323	0.517	9.139	24.427	—	0.265
MD21-03-51579	21-22263	0.00–0.50	Soil	0.944	—	43.306	0.288	0.178	4.171	12.849	—	0.393
MD21-03-51580	21-22264	0.00–0.50	Qbt 3	44.929	—	157.34	—	2.924	18.523	35.315	—	0.454

Table 2.5-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
MD21-03-51581	21-22265	0.00–0.50	Qbt 3	20.68	—	36.202	—	0.67	9.296	11.444	—	—
MD21-03-51582	21-22266	0.00–0.50	Qbt 3	56.329	—	68.167	0.122	5.749	59.369	26.295	—	0.338
MD21-03-51583	21-22267	0.00–0.50	Qbt 3	1.774	—	63.899	0.342	0.246	3.509	25.249	—	—
MD21-03-51584	21-22268	0.00–0.50	Qbt 3	5.494	—	34.654	0.292	0.349	14.694	6.113	—	0.253
MD21-03-51585	21-22269	0.00–0.50	Qbt 3	23.248	—	37.045	0.102	2.722	25.443	20.801	—	0.258
MD21-03-51586	21-22270	0.00–0.50	Qbt 3	33.157	—	76.039	—	4.759	37.683	26.956	—	0.312
MD21-03-51587	21-22271	0.00–0.50	Soil	3.065	—	7.429	0.521	0.264	8.825	—	—	0.27
MD21-03-51588	21-22272	0.00–0.50	Soil	8.996	—	93.169	—	0.864	23.509	21.391	—	0.283
MD21-03-51589	21-22273	0.00–0.50	Soil	2.242	—	38.042	0.245	0.346	4.823	7.668	—	0.247
MD21-03-51590	21-22274	0.00–0.50	Qbt 3	4.338	—	180.21	0.304	0.392	15.323	36.913	—	0.269
MD21-03-51591	21-22275	0.00–0.50	Qbt 3	0.049	—	83.218	0.354	0.026	0.997	18.302	—	0.283
MD21-03-51592	21-22276	0.00–0.50	Soil	1.405	—	91.215	0.349	0.545	5.251	8.706	—	0.265
MD21-03-51593	21-22277	0.00–0.50	Soil	1.582	—	51.336	0.255	0.568	4.235	7.27	—	0.206
MD21-03-51594	21-22278	0.00–0.50	Soil	0.685	—	30.662	0.229	0.204	1.799	4.704	—	0.287
MD21-03-51595	21-22279	0.00–0.50	Soil	1	—	66.177	0.374	0.388	3.24	8.527	—	—
MD21-03-51596	21-22280	0.00–0.50	Soil	0.578	—	21.669	0.191	0.217	2.051	3.352	—	0.266
MD21-03-51597	21-22281	0.00–0.50	Soil	2.053	—	62.686	0.279	0.522	7.053	11.394	—	0.286
MD21-03-51635	**21-22281**	**0.00–0.50**	**Soil**	**1.339**	**—**	**57.372**	**0.263**	**0.752**	**5.191**	**13.769**	**—**	**0.238**
MD21-03-51598	21-22282	0.00–0.50	Soil	1.431	—	25.637	0.349	0.362	2.727	3.623	—	0.262
MD21-03-51599	21-22283	0.00–0.50	Soil	0.182	—	1.786	0.204	—	0.165	—	—	0.25
MD21-03-51636	**21-22283**	**0.00–0.50**	**Soil**	**—**	**—**	**1.931**	**0.34**	**0.036**	**0.107**	**—**	**—**	**0.261**

Table 2.5-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239	Strontium-90	Tritium	Uranium-235
Soil BV				**0.013**	**NA[a]**	**1.65**	**NA**	**0.023**	**0.054**	**1.31**	**0.766**	**0.2**
Qbt 2,3,4 BV				**0.05**	**NA**	**0.1**	**NA**	**0.05**	**0.05**	**1**	**NA**	**0.09**
SRSGs				**424**	**NA**	**294**	**NA**	**496**	**447**	**8288**	**NA**	**NA**
MD21-03-51600	21-22284	0.00–0.50	Soil	1.645	—	113.95	0.273	0.828	6.991	10.992	—	0.295
MD21-03-51601	21-22285	0.00–0.50	Soil	1.237	—	44.588	—	0.306	2.948	7.389	—	—
MD21-03-51637	**21-22285**	**0.00–0.50**	**Soil**	**1.149**	**—**	**38.59**	**0.234**	**0.439**	**9.132**	**5.698**	**—**	**0.235**
MD21-03-51602	21-22286	0.00–0.50	Soil	1.921	—	76.246	0.311	0.46	5.023	8.398	—	0.303
MD21-03-51603	21-22287	0.00–0.50	Soil	1.644	—	69.223	0.267	0.195	2.876	15.786	—	0.231
MD21-03-51638	**21-22287**	**0.00–0.50**	**Soil**	**1.838**	**—**	**64.723**	**—**	**0.213**	**3.734**	**21.031**	**—**	**—**
MD21-03-51604	21-22288	0.00–0.50	Soil	4.282	—	70.148	—	0.645	4.349	18.98	—	0.341
MD21-03-51605	21-22289	0.00–0.50	Soil	24.129	—	114.44	—	2.086	8.642	25.954	—	0.414
MD21-03-51606	21-22290	0.00–0.50	Soil	6.608	—	78.391	—	0.556	15.635	30.432	—	0.335
MD21-03-51607	21-22291	0.00–0.50	Soil	2.084	—	88.195	0.289	0.196	8.242	17.776	—	0.304
MD21-03-51608	21-22292	0.00–0.50	Qbt 3	40.866	—	105.38	—	4.931	20.643	38.013	—	—

Note: All values are pCi/g.

[a] NA = Not available.

[b] — = Result was not detected, does not exceed BV/FV, or was not analyzed.

[c] Sample IDs in bold are field duplicates.

[d] J- = Estimated, biased low.

Six radionuclides were detected at levels exceeding their BVs/FVs: americium-241, cesium-137, plutonium-238, plutonium-239, strontium-90, and uranium-235. Cesium-134 and europium-152 were retained as COPCs because they were detected and do not have published BVs/FVs. Tritium, which was not screened against its BV, was also detected in pre-VCM samples not removed during the VCM. All nine of these radionuclides are retained as COPCs. The frequency of detection is typically high (>70% of the samples), with the exception of cesium-134, which was detected in less than 4% of the samples. This very high frequency of detection is an expected outcome of this VCM and is a result of the initial, elevated radionuclide concentrations at the site and the use of the trail-user scenario based cleanup levels, which are higher than background values.

2.5.2 Summary of COPCs at SWMU 21-011(k)

Table 2.5-4 summarizes the results of the data review for soil and tuff samples at SWMU 21-011(k). The table lists all radionuclides for which the site confirmation samples were analyzed that are retained as COPCs, and describes the basis for the decision to retain an analyte as a COPC.

Table 2.5-4
Summary of Radionuclides Retained as COPCs

COPC	Rationale
Americium-241	Exceeds FV in 63 soil, 57 tuff samples
Cesium-134	No BV. Detected in 1 soil, 2 tuff samples
Cesium-137	Exceeds FV in 58 soil, 57 tuff samples
Europium-152	No BV. Detected in 44 soil, 43 tuff samples
Plutonium-238	Exceeds FV in 60 soil, 46 tuff samples
Plutonium-239	Exceeds FV in 63 soil, 57 tuff samples
Strontium-90	Exceeds FV in 52 soil, 52 tuff samples
Tritium	No BV. Detected in 1 soil sample
Uranium-235	Exceeds BV in 48 soil, 42 tuff samples

Note: All other radionuclides were eliminated as COPCs because they were not detected or not detected above BV/FV.

2.6 Revised Site Conceptual Model

Characterization and remediation activities at the site confirmed that the preliminary conceptual model was correct and that no changes to the model are needed.

2.6.1 Nature and Extent of Contamination

Data used in this evaluation are from site-wide gross gamma surveys and from analytical results from post-VCM confirmation samples collected beneath the former outfall drainline and within the outfall area that extends along the canyon slope and bottom.

Nine radionuclide COPCs have been identified for SWMU 21-011(k) as shown in Table 2.5-4. Concentrations of these COPCs are shown in Figures 2.6-1 (large enclosed map) and 2.6-2 based on the results of confirmation sampling.

Media Place Holder Target

This target represents media that was not microfilmed. The original media can be obtained through the Records Processing Facility.

ER ID # 82260

Box # ______

Record Type: DRAWING

Date: 10-28-03

Symbol: —

Subject:

FIGURE 2.6-1 Radionuclides Detected Above Background in Confirmation Samples at SWMU 21-011(K) (all units in pCi/g)

28

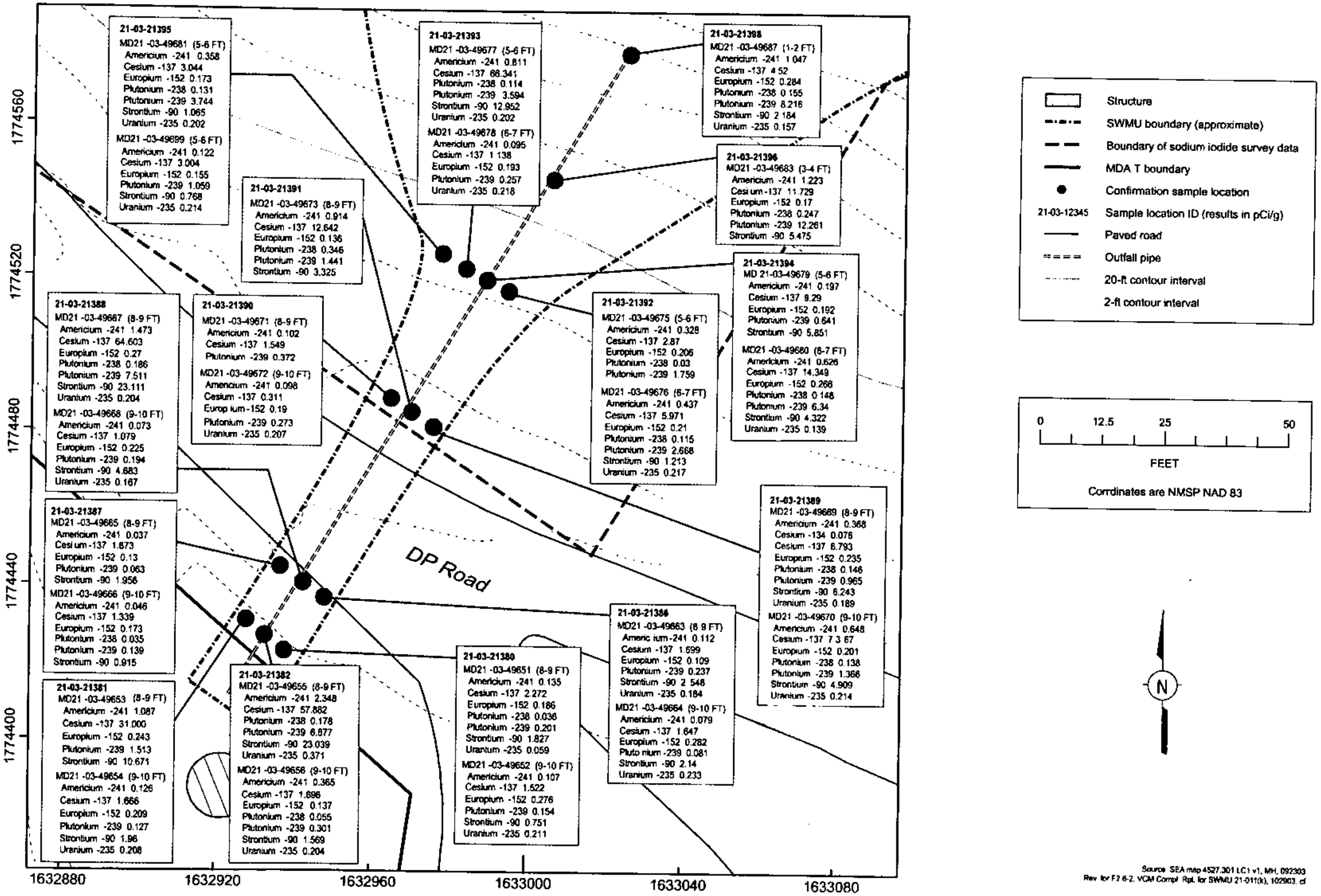


Figure 2.6-2. Radionuclides detected above background or fallout value along the removed outlet line at SWMU 21-011(k)

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2.6.1.1 Canyon Slope and Bottom

A gross gamma surface survey was conducted across the canyon slope and bottom of SWMU 21-011(k) site in December 2002. The purpose of this survey was to confirm the lateral extent of radionuclide contamination. Results of the December 2002 survey (Figure 2.4-2) correspond well with a previous in situ gamma spectrometry survey conducted in November 2000 (LANL 2003, 76903). Combined, these surveys delineated the areas of SWMU 21-011(k) that contained concentrations of radionuclide contamination that required remediation. Regions containing gross gamma counts at or below local gross gamma background count rates bounded all areas of elevated gross gamma levels. Both surveys provided the preliminary guidance for the excavation of radionuclide contaminants in accordance with the approved VCM plan for SWMU 21-011(k) (LANL 2003, 76903).

A second gross gamma survey was conducted in April 2003 to screen for possible elevated radionuclide concentrations after approximately 1800 yd^3 of soil at SWMU 21-011(k) had been removed for disposal. The survey indicated that the majority of the contamination had been removed, but small isolated areas still existed that contained elevated gross gamma levels. However, gross gamma levels at or below BVs laterally bounded all areas in which contamination remained. The results of the April 2003 survey are provided in Figure 2.4-3.

After the April 2003 gross gamma survey and the final soil and tuff removals that followed, 105 confirmation samples were collected from the canyon slope and bottom. Figure 2.6-1 presents the radionuclide data above background in samples collected from the canyon slope and bottom. The 2003 confirmation sampling results showed that no location sampled at the site contained more than 72 percent of the total allowable residual contamination presented in the VCM plan (LANL 2003, 76903). Site-wide, the average value of residual contamination is 26 percent of the total allowed for the trail-user scenario.

The vertical extent of radionuclide contamination was characterized during the pre-VCM investigation conducted in 2001. Cesium-137 concentrations as a function of depth was presented in Figure F1-3 of the approved VCM plan (LANL 2003, 76903), and demonstrated that radionuclide contaminants decrease in concentration with increase in depth. Radiological field screening and fixed laboratory analyses conducted during remediation confirmed the results of the pre-VCM characterization. Radionuclide contamination was detected at highest concentrations at depths less than 2 ft, and declined in concentration as depth increased.

Furthermore, the remediation approach essentially ensured the establishment of decreasing lateral and vertical trends in radionuclide concentrations because the excavation and removal of contaminated material began in locations exceeding the field cleanup levels of either 150 pCi/g cesium-137 or 170 pCi/g americium-241 and continued vertically and laterally until the field cleanup levels had been achieved.

In summary, the lateral extent of radionuclide contamination has been defined at SWMU 21-011(k) by a sequence of site-wide gross gamma surveys. Confirmation sampling established that the cleanup levels described in the approved VCM plan (LANL 2003, 76903) were achieved. In addition, the vertical extent of radionuclide contamination at SWMU 21-011(k) has been defined through pre-VCM characterization that showed a decreasing trend in concentration values with depth. This trend was confirmed by results of radionuclide field screening during the remediation process, and fixed laboratory analysis.

2.6.1.2 Outfall Drainline

The nature and extent of radionuclide contamination in tuff along the subsurface path of the outfall drainline was defined by 27 confirmation samples. Sample locations are presented in Figure 2.4–1 and discussed in Section 2.4.1. Samples were collected in the area directly beneath and adjacent to the drainline to define the nature of contamination, and from predetermined distances and depths away from the drainline to ensure the extent of contamination had been determined and that cleanup levels had been met.

Sampling results indicated that minor releases occurred from the drainline into the subsurface tuff. However, most samples collected from predetermined distances (5–10 ft) and from depths (2–3 ft) below the drainline showed decreasing trends in radionuclide values. Therefore, the nature and extent of radionuclide contamination associated with the subsurface path of the outfall drainline has also been defined. Figure 2.6-2 presents the radionuclide data above background in samples collected from along and adjacent to the removed drainline.

2.6.2 Environmental Fate and Transport

The discussion of environmental fate addresses the chemical processes that affect the persistence of a chemical in the environment. The evaluation of transport addresses the physical processes that affect mobility of a contaminant along a given migration pathway.

In terms of mobility, one of the most important physicochemical parameters is soil-water distribution coefficient (Kd). The soil-water distribution coefficient is defined as the ratio of the concentration associated with a solid inorganic chemical or radionuclide to it's concentration in a surrounding aqueous solution when the system is at equilibrium (EPA 1996, 76872). Therefore, the coefficient value is inversely related to mobility, i.e., an inorganic chemical or radionuclide with a low Kd is more mobile than one with a high Kd. The Kd of a radionuclide is independent of the isotopic form of the element but is affected by many geochemical parameters and processes, including pH, sorption to clays, organic matter, iron oxide, and other soil constituents; oxidation/reduction conditions; major ion chemistry; and the chemical form of the radionuclide. Site-specific information on these parameters is limited, but Nyhan et al. reported pH on the mesa tops ranges from 6.5 to 7.8 (Nyhan et al. 1978, 05702). Impacts of these parameters and differences in experimental methods leads to a high degree of variability in measured Kd values and Kds used in empirical models should be measured on a site-specific basis. Literature-derived Kds for the SWMU 21-011(k) COPCs present on site in a solid form indicate that uranium and strontium are the most mobile radionuclides. Tritium, in contrast to the solid-form radionuclides, exists in the environment as a component of a water molecule; therefore, tritium's mobility is identical to normal water and is governed by advective-dispersive processes. As a result, tritium is more mobile than any of the solid form radionuclides.

Cesium-137, europium-152, strontium-90, and tritium have relatively short half-lives (30 yr or less) and therefore persist in the environment for a relatively short period of time compared to other radionuclide COPCs such as plutonium-239 (with a half-life of 24,000 yrs). As shown in Figure 2.3-1, these radionuclides move by both surface runoff and particulate suspension. Of these mechanisms, surface runoff is dominant.

Table 2.6-1 presents distribution coefficient and half-life data for COPCs at SWMU 21-011(k).

Table 2.6-1
Physicochemical Properties of COPCs at SWMU 21-011(k)

Analyte	Soil-Water Distribution Coefficient (Kd)[a] (ml/g)	Radiological half-life[b] (yr)
Americium-241	5 (based on Pu)	432
Cesium-137 and -134	10	30 and 2.06
Europium-152	NA[c]	13
Plutonium-238 and -239	5	88 and 24000
Strontium-90	1	29
Tritium	0	12
Uranium-235	0.4	700000000

[a] Based on the elemental form of the radionuclide. Source: EPA (1996, 76872).

[b] Source: EPA (1996, 76872).

[c] NA = Information not available.

There is evidence that radionuclide contamination derived from SWMU 21-011(k) has migrated beyond the SWMU boundary. Radionuclide contaminated soil and sediment were identified in the DP Canyon stream channel and a single sediment package exceeding the 21-011(k) cesium-137 cleanup level was removed according to VCM plan guidelines. Confirmation sampling results for this removal action are presented in Appendix K and will be further evaluated as part of ongoing investigations of DP Canyon. Furthermore, elevated concentrations of strontium-90 have been observed in wells LAUZ-1 and –2 located immediately downstream from the site; this will also be addressed in additional investigations in DP Canyon (LANL 1999, 63915).

Gross gamma surveys conducted following the 1996 IA indicate that the BMPs established as part of the IA had largely stabilized the site (LANL 2003, 76903). Further, this VCM removed the bulk of the radionuclide source-term, installed run-on controls, graded the site for positive drainage, and revegetated the site with trees, shrubs and native grasses. Therefore, the potential for any future off-site migration of radionuclides from this SWMU has been significantly reduced.

2.7 Site Assessments

2.7.1 Human Health Dose Assessment

2.7.1.1 Scoping

These assessments include scenarios for recreational trail user and extended backyard, which are the current reasonable and foreseeable future potential uses of the site. The recreational scenario, the goal proposed for the site, is based on an adult who regularly walks on the site. The extended backyard scenario is a more conservative scenario and is for a child receptor playing on the area for a portion of a day. Evaluation of the extended backyard scenario is included for comparison purposes to further demonstrate the success of the VCM. The RESRAD model generates SRSGs, in pCi/g, for each radionuclide of interest (COPC) for a given scenario, based on a target dose criterion, set forth by DOE, of 15 mrem/yr total effective dose equivalent (TEDE). This dose limit is the authorized limit for release of real property for unrestricted use (DOE 2000, 67489). The target dose of 15 mrem/yr is above the dose received from background sources. SRSGs were developed using RESRAD 6.21 simulations for time = 0 yr, the time of maximum dose for each land-use scenario that was considered. Selected parameters used in RESRAD for each scenario are shown in Table 2.7-1. SRSGs for the recreational trail-user and extended backyard scenarios are provided in Table 2.7-2.

Table 2.7-1
Parameters for Derivation of SRSGs Under the Selected Scenarios

Parameter	Value Used – Recreational Trail-User Scenario	Values Used – Extended Backyard Scenario
Pathways Active	**External Gamma, Inhalation (w/o radon), Soil Ingestion**	
Area of contaminated zone	7412 m2 [a]	7412 m2 [a]
Thickness of contaminated zone	2 mb [b]	2 mb [b]
Fraction of time spent outdoors (onsite)	0.016 yr/yr [c]	0.0228 yr/yr [c]
Soil ingestion rate	587 g/yr [c]	626 g/yr [c]
Inhalation rate	14,000 m3/yr [c]	10,500 m3/yr [c]
Mass loading for inhalation	2.0 E-5 g/m3 [c]	2.0 E-5 g/m3 [c]
Density of contaminated zone	1.5 g/cm3 [b]	1.5 g/cm3 [b]
Humidity in Air	5.55 g/m3 [c]	5.55 g/m3 [c]
Annual average wind speed	3 m/s [c]	3 m/s [c]
Evapotranspiration coefficient	0.999 (unitless) [c]	0.999 (unitless) [c]
Precipitation	0.35 m/yr [c]	0.35 m/yr [c]
Basic radiation dose limit	15 mrem/yr [c]	15 mrem/yr [c]

[a] Site-specific parameters. Derivation of these parameters is shown in Section F-3.0.
[b] Default parameter from the RESRAD model.
[c] LANL-specified scenario parameters (LANL 2000, 66867).

Table 2.7-2
SRSGs Derived for Each Land-Use Scenario

Radionuclide	Recreational Trail User SRSG (pCi/g)	Extended Backyard SRSG (pCi/g)
Americium-241	427	268
Cesium-137	294	206
Plutonium-238	496	311
Plutonium-239	447	280
Strontium-90	8,288	5,581

The basic criterion for releasing a site for use without radiological restrictions is the dose limit. DOE has set a dose limit for Laboratory sites of 15 mrem/yr for site-related dose (DOE 2000, 67489). The dose limit is independent of land use; it applies to all land uses. The dose limit is converted to SRSGs, using the RESRAD model, in order to develop guidelines (in pCi/g) for comparison to site levels. SRSGs are based on the dose limit and exposure parameters directly related to land use and, therefore, are directly related to land use scenario. For example, a resident is expected to have a different breathing rate than a worker or a recreational trail user. SRSGs are developed such that meeting each SRSG will ensure that a site-related dose will not exceed 15 mrem/yr.

In order to demonstrate that the radionuclide activities at the site from all COPCs also meet the 15 mrem/yr criterion, the following exercise is performed using results from each sample location: The result for each COPC is divided by the appropriate SRSG to generate a ratio. The ratios for the COPCs are summed. If the sum is equal to or less than 1, then the cumulative dose estimate is 15 mrem/yr or less. This is stated in greater detail below.

For any (hypothetical) homogeneous contaminated zone,

$$M(t) = \sum_{i} S_i\,(0)/G_i(t)<1,\ t_r<t<t_h$$

where

$M(t)$ = average mixture sum at time t (dimensionless),

$S_i\,(0)$ = initial concentration of the ith principal radionuclide within a homogeneous contaminated zone (pCi/g), and

$G_i(t)$ = SRSG for the ith principal radionuclide in a uniformly contaminated zone at time t (pCi/g).

Mixture sum of ratios is shown in Table F-1.0-1 in Appendix F for the radionuclides of concern that were identified in the approved VCM plan (LANL 2003, 76903) and is performed for data from each sample to determine whether the SRSGs were exceeded either individually or cumulatively. The average mixture sum is 0.18. As a result, the data demonstrate that the SRSGs were not exceeded for the COPCs in either scenario for any sample.

2.7.1.2 Dose Evaluation

The 95% upper confidence limits (UCLs) of the mean for each COPC are used as input in the RESRAD model. These data are from the remediated and unremediated portions of the site and do not include the samples from beneath the outlet lines. Radionuclide 95% UCLs are provided in Table 2.7-3. No correction was made for background concentrations of these radionuclides. RESRAD was run to generate dose estimates for both the recreational trail user and extended back yard receptor. Receptor-specific parameters used in the model are provided in Table 2.7-1. The RESRAD printouts for each scenario are provided in Appendix F.

Dose estimates produced by the RESRAD model for the recreational trail-user scenario and the extended back yard scenario are 3.8 mrem/yr and 5.6 mrem/yr, respectively. These dose estimates are below the target dose limit of 15 mrem/yr. The RESRAD output files are provided in Appendix F.

2.7.1.3 Uncertainty

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. Aspects of data evaluation and COPC identification, exposure assessment, toxicity assessment, and the additive approach all contribute to uncertainties in the risk assessment process.

Table 2.7-3
RESRAD Input for Post-VCM Radionuclide Soil Concentrations

Radionuclide	Residual Soil Concentration 95% UCL (pCi/g)
Americium-241	11.0
Cesium-134	0.07
Cesium-137	60.1
Europium-152	0.3
Plutonium-238	1.1
Plutonium-239	8.4
Strontium-90	15.5
Tritium	0.1
Uranium-235	0.3

(a) Data Evaluation and COPC Identification Process

Uncertainties associated with the data include sampling errors, laboratory analysis errors, and data analysis errors. For this SWMU, these uncertainties are expected to have a negligible effect on the results.

(b) Exposure Assessment

Three main uncertainties were identified in the exposure assessment process.

Identification of Receptors. Land-use and activity patterns are adequately represented by activities assumed in both the recreational trail-user and extended backyard scenarios. Therefore, few uncertainties in the assessment of risk to human receptors are introduced.

Exposure Pathway Assumptions. For each exposure pathway, input parameter, routes of exposure, amounts of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure were assumed. In the absence of site-specific data, the exposure assumptions used were consistent with EPA-approved parameters and default values (EPA 2002, 73691). Although this site was disturbed during remediation, the timeframe was short relative to the exposure assumptions used in the dose calculations. This results in an overestimate of potential exposure and dose. User supplied input parameters are provided in Table 2.7-1. It is unlikely that use of these parameters underestimates dose since each was chosen to provide a conservative input. Scenario-specific inputs were selected in order to provide consistency with previous reports that utilized the same land-use scenarios.

Derivation of Exposure Point Concentrations. Some uncertainty was introduced in the aggregation of data for estimating the representative COPC concentrations at the site. The 95% UCLs were calculated using the 0–0.5 ft confirmation sample results. The 95% UCL represents the overall exposure of the receptors to COPC concentrations across the entire site, rather than the exposure at a single location. The use of the 95% UCL is intended to provide an upper (i.e., conservative) bound on the average COPC concentration at the site, potentially leading to an overestimation of the concentration representative of average exposure over the entire site. This may also result in an overestimation of the potential dose to humans at the site.

(c) Dose Assessment

Use of the RESRAD model, in general, is not associated with high uncertainty. The model has been subjected to rigorous review, benchmarking, verification, and validation. The model has been widely used by the DOE, the NRC, the EPA, and other governmental agencies. It is widely used by industrial firms, universities, and institutions. RESRAD 6 represents the sixth major version of the RESRAD code since it was first issued in 1989.

The RESRAD model used dose conversion factors to calculate route-specific dose. These dose conversion factors are based on adult receptors and, therefore, may underestimate or overestimate dose to a child (as in the extended backyard scenario).

2.7.1.4 Interpretation

Dose estimates were less than 15 mrem/yr for both scenarios representing the current and future land uses of the outfall slope area. There are no exposure pathways to receptors on the mesa top where the outlet line was removed because the residual contamination is subsurface and beneath the road. Therefore the SWMU has been successfully remediated and the outfall slope area is available for use by a trail user and the activities related to the extended backyard scenario.

2.7.2 Ecological Screening Assessment

The approach for conducting ecological assessments is described in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783).

2.7.2.1 Scoping

The scoping evaluation establishes the breadth and focus of the screening assessment. One result of the scoping process is the ecological conceptual site model (ECSM) for the site. The ecological scoping checklist, included in the VCM plan (LANL 2003, 76903) and in Appendix F of this document, was completed early in the assessment process and was a useful tool for organizing existing ecological information. This information was used to confirm whether ecological receptors might be affected, to identify the types of receptors that might be present, and to develop the ECSM for the site.

The site is located in a moderately disturbed area of the top of DP Mesa and is moderately vegetated. The vegetation consists predominantly of grasses and young trees. Habitat suitable for threatened or endangered species was not identified at the site; however, the site borders core habitat for the Mexican spotted owl.

Potential for contamination of surface water or aquatic receptors is unlikely because there are no permanent surface water bodies in or near the SWMU. Stream flow in the canyon is ephemeral. Groundwater transport is feasible because of the shallow depth of the alluvial aquifer, but such transport is limited. Soil ingestion by burrowing animals and root uptake are potential exposure pathways for terrestrial ecological receptors (see the ecological scoping checklist in Appendix F), as well as food web transfer. However, burrowing activity is limited by a relatively thin soil/weathered tuff zone overlying bedrock; only a few burrows were observed at the site.

2.7.2.2 Screening Evaluation

The ecological screening evaluation is designed to identify chemicals of potential ecological concern (COPECs) and is based primarily on the comparison of representative COPC concentrations to chemical concentrations determined to not be potentially harmful to ecological receptors. This comparison is summarized in the calculation of hazard quotients (HQs) for all COPCs and all appropriate screening receptors. The ecological screening methodology uses COPC concentrations to a depth of 5 ft and assumes terrestrial ecological receptors do not contact soils below this depth (LANL 1999, 64783). A similar approach was used in this assessment using data in the 0- to 0.5-ft interval only. Data from this depth interval comprises almost all of the confirmation data.

The HQ is defined as the ratio of the representative contaminant concentration in the exposure medium being investigated to the dose determined acceptable to a given ecological receptor (i.e., ecological screening levels [ESLs]). Chemicals with HQs greater than 0.3 and chemicals without associated ESLs are identified as COPECs and are further evaluated (LANL 1999, 64783). The hazard index (HI) is the sum of HQs; an HI greater than 1.0 is considered an indication of potential adverse impacts to a given receptor due to exposure to multiple chemicals at a site. In this assessment, representative soil concentrations (95% UCL on the mean) and minimum ESLs were used to calculate an HQ for each COPC (Table 2.7-4). ESLs were obtained from the Laboratory's ECORISK database, version 1.5 (LANL 2002, 73702).

Table 2.7-4
Final ESL Comparisons for SWMU 21-011(k)

Analyte	95% UCL (pCi/g)	Final ESL (pCi/g)	Receptor	HQ	COPEC Yes/No
Radionuclides					
Americium-241	11	44	Earthworm	0.25	No
Cesium-134	0.07	320	Red fox	0.0002	No
Cesium-137	60.1	680	Red fox	0.09	No
Europium-152	0.3	380	Earthworm	0.0008	No
Plutonium-238	1.1	44	Earthworm	0.03	No
Plutonium-239	8.7	47	Earthworm	0.19	No
Strontium-90	15.5	560	Red fox	0.03	No
Tritium	0.11*	36000	Plant	<0.00001	No
Uranium-235	0.3	55	Earthworm	0.005	No

*Only a single sample was taken for tritium and this value is the associated result.

No COPECs were identified for further evaluation because the HQs based on the 95% UCL soil concentrations and minimum ESLs were all less than 0.3 (Table 2.7-4).

2.7.2.3 Uncertainty Analysis

Uncertainty is inherent in all aspects of the risk process, including the selection of indicator species, the estimation of exposure of the selected receptors, the characterization of potential ecological effects related to exposure, and the final evaluation of risk to the receptors. For this screening assessment, conservatism was incorporated at many points in the process to ensure the uncertainties do not lead to an underestimation of the potential risk to the site's ecological receptors. Conservatisms most likely lead to an overestimation of the potential risks posed by COPCs at the site. This is especially true when multiple conservatisms are used, resulting in an additive effect on the estimation of risk. Key uncertainties in this screening assessment have been identified and are discussed below.

Data Evaluation and COPC Identification Process. Uncertainties associated with the data can include errors in sampling, laboratory analysis, and data analysis. These uncertainties are expected to have a negligible effect on the results for this SWMU. All radionuclides that were detected at activities greater than BVs or FVs were retained for analysis in this assessment.

Derivation of Exposure Point Concentrations. The data used are made up of the 0–0.5 ft confirmation samples collected for the VCM. Deeper confirmation sample data from beneath the removed outlet line were not used because the depth of the samples and the fact that the location of the samples beneath the road make exposure unlikely. Some uncertainty was introduced in the aggregation of data for estimating representative, site-specific COPC concentrations. The 95% UCL represents overall receptor exposure to COPC concentrations across the entire site, rather than exposure at a single location. The use of the 95% UCL is intended to provide an upper bound on the average COPC concentration at the site, potentially leading to an overestimation of the concentration representative of average exposure over the entire site. This practice may also result in an overestimation of potential risk to ecological receptors at the site.

The majority of sampling data were from the 0–0.5-ft depth interval. These data were used to estimate the 95% UCL. Use of data in only the 0–0.5-ft depth interval does not underestimate exposure to ecological receptors; in fact, data from this depth interval resulted in higher 95% UCLs than those from the data set comprised of data from medium All Horizons (soil). Use of the 0–0.5-ft data therefore results in a conservative overestimate of exposure and potential risk.

Selection of ESL Benchmarks. ESLs for the vertebrate terrestrial receptors were based on species similar to those common to Laboratory habitats and were derived from experimentally determined no-observed-adverse-effect levels (NOAELs), lowest-observed-adverse-effect levels, lowest-observed-effect concentrations, or doses or concentrations lethal to 50% of the test populations. Receptor-specific toxicological data are often unavailable; in these cases, effects are extrapolated from laboratory animals to site receptors. Laboratory studies are often limited to evaluation of a single chemical and exposure pathway, conducted in controlled conditions, and performed on laboratory animals obtained from artificial and maintained populations. Thus, extrapolating laboratory studies to wild populations introduces many uncertainties in the thresholds determined to potentially cause adverse effects to ecological receptors associated with the site and may overestimate risk.

Chemical Form of COPCs. The investigation of SWMU 21-011(k) did not identify the exact chemical forms of the COPECs. Laboratory-derived toxicological data, as used in this assessment, typically are based on chemical forms not found in the environment (e.g., text substances are often the most toxic and/or bioavailable chemical species). COPCs are not expected to be 100% bioavailable in the natural environment due to complexing with other chemicals and adsorption to soil matrix surfaces.

2.7.2.4 Interpretation

No COPCs identified at SWMU 21-011(k) had HQs greater than 0.3; therefore, no COPECs were identified. Based on this ecological screening evaluation, there are no potential risks to ecological receptors from residual levels of COPCs at SWMU 21-011(k).

2.8 Conclusions and Recommendations

SWMU 21-011(k) has been investigated and remediated by the RRES-RS Project. Characterization activities in 1988, 1992, 1993, and 2000 defined the nature and extent of contamination at the site through sample analysis and radiological surveys. The IA completed in 1996 removed a large portion of the source term at the site and installed BMPs to limit the potential for erosion of contaminated material from the site. The outlet line from tanks 21-112 and -113 to the north fence line of MDA T and a total of 1845 yd^3 of contaminated soil and tuff were removed from the site as part of the current VCM. The field screening methodology utilized to guide the VCM was successful in meeting the cleanup levels of 150 pCi/g for cesium 137 and 170 pCi/g for americium 241. The SRSGs and DOE dose limit of 15 mrem/yr were successfully met by the VCM. The VCM achieved the goal of reducing residual contamination to levels appropriate for a trail-user land-use scenario and also meets the extended backyard scenario.

The screening assessments for human health and the environment do not indicate a potential unacceptable risk to human or ecological receptors. Therefore, SWMU 21-011(k) is recommended for NFA based on Criterion 5, "The SWMU has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57897).

3.0 WASTE MANAGEMENT

The following waste streams were generated and disposed of as part of this VCM: contaminated soil, tuff, and sediment; metal outfall drainline; lead drainline collars; mixed vegetation debris (tree stumps, slash, and wood debris); personal protective equipment (PPE), plastic, and other investigation-derived contact wastes (IDW); petroleum-contaminated soil (PCS) and absorbent materials; and miscellaneous uncontaminated solid wastes.

All wastes were managed in accordance with applicable Federal, State, DOE, and Laboratory requirements. The waste streams, regulatory classification, amounts, and disposal pathways are shown in Table 3.0-1. A description of the sources and components of each waste stream is included below.

Table 3.0-1
Waste Streams from SWMU 21-011(k) Voluntary Corrective Measure

Waste Stream	Waste Type	Volume	Shipped To
Contaminated soil, tuff and sediment	Solid, low-level waste (LLW)	1,845 yd^3	LANL, TA-54, Area G
Metal outfall drainline	Solid, LLW	150 lin. ft	LANL, TA-54, Area G
Lead drainline collars	Solid, hazardous	1.25 ft^3	LANL, TA-54, Area L
Vegetation	Solid, LLW	97 yd^3	LANL, TA-54, Area G
PPE, plastic, and other IDW	Solid, LLW	134 ft^3	LANL, TA-54, Area G
PCS and absorbent material	Solid	7.4 ft^3	Waste Management of Rio Rancho, NM
Uncontaminated solids (miscellaneous items)	Commercial solid waste	0.7 ft^3	Los Alamos County Landfill

Waste characterization for the VCM waste streams was based on waste characterization samples collected in 2000 and 2001, as well as site screening and confirmation sample results.

Contaminated soil, tuff, and sediment: This waste stream was generated from the excavation of soil, tuff, and sediment throughout the site with concentrations of cesium and americium above the cleanup levels. The waste stream is treated as low-level waste (LLW) due to the presence of radionuclides (principally cesium-137, strontium-90, americium-241 and plutonium-239) in the waste stream.

Metal outfall drainline: This waste stream was generated from the removal of the outfall drainline north of the MDA T fence line to the slope where it historically discharged. The waste stream is treated as LLW due to the potential presence of radionuclides (principally cesium-137, strontium-90, americium-241 and plutonium-239) in the waste stream.

Lead drainline collars: This waste steam was generated from removing the lead collars from the excavated drainline. The lead drainline collars were decontaminated by removing the soil component; screened by the HSR-1 radiation control technician and free-released with no detectable activity. The lead collars were the managed as hazardous waste EPA hazardous waste number D008 was applied to the lead collars.

Vegetation: This waste stream was generated during pre-mobilization activities that required the clearing and grubbing of the site for road construction. The vegetation originated on-site and is treated as LLW due to the potential presence of radionuclides (principally cesium-137, strontium-90, americium-241 and plutonium-239) in the waste stream.

Plastics, PPE, and other IDW: This waste stream consisted of a variety of IDW, including various types of plastic sheeting, polyvinyl chloride (PVC), PPE, and disposable sampling supplies such as plastic scoops, plastic bags, and dry decontamination wipes. IDW was generated during all phases of the fieldwork including excavation, sampling, and site restoration activities. These materials were managed as LLW due to direct contact with contaminated environmental media and debris. IDW was packaged into 55-gal. drums for transport and disposal.

PCS, and absorbent material: A spill of hydraulic fluid on clean base coarse was cleaned up, sampled for total petroleum hydrocarbons and found to be below New Mexico special waste (NMSW) regulatory levels. A spill of diesel fuel into the plastic-lined secondary containment berm around the generator was cleaned up with absorbent materials and disposed as NMSW.

As discussed in section 2.4.2, contaminated soil and tuff that had been excavated was placed in individual stockpiles at the site. In accordance with no longer contain-in determination received from NMED on November 25, 2002, a sample was collected from each 100 yd^3 of excavated material and submitted for offsite contract laboratory analysis of Appendix VIII VOCs (NMED 2002, 73720). A total of 19 samples were collected from the excavated material and submitted for VOCs analysis. The results were provided to NMED for review and approval prior to disposal of the material at Area G at TA-54.

All of the waste sample results indicated that VOC concentrations in the excavated material were consistent with those presented in the no-longer-contained-in determination request. After VOC sample results were reviewed and approved by NMED, the associated stockpiles of excavated material were loaded into lined rolloff bins and disposed of at Area G at TA-54. Additional waste samples were collected independently by TA-54 to confirm that the excavated soil generated as part of the VCM was profiled appropriately. The results of the samples collected by TA-54 indicated that the profiling of the excavated soil was appropriate. Hard copies of the VOC analytical results and the Area G waste profile results for the excavated soil are presented in Appendix L.

4.0 REFERENCES

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Copies of the reference library are maintained at NMED-HWB, the DOE Los Alamos Area Office, EPA Region VI, and RRES-RS. This library is a living collection of documents that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this document. However, documents previously submitted to the administrative authority are not included in the reference library.

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Appendix A

Acronyms, Glossary, and Metric Conversion Tables

APPENDIX A ACRONYMS, GLOSSARY, AND METRIC CONVERSION TABLES

A-1.0 ACRONYMS AND ABBREVIATIONS

AIRNET	radiological air-sampling network
ALARA	as low as reasonably achievable
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	best management practice
BV	background value
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
cpm	counts per minute
DCGL	derived concentration guideline
DP	Delta Prime
DL	detection limit
DOE	(US) Department of Energy
DOT	Department of Transportation
dpm	disintegrations per minute
ECSM	ecological conceptual site model
EPA	(US) Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
ESL	ecological screening level
FV	fallout value
HSWA	Hazardous and Solid Waste Amendments of 1984
HI	hazard index
HQ	hazard quotient
IA	interim action
ID	(sample or location) identification
IDW	investigation-derived waste
IWP	installation work plan
Kd	distribution coefficient
LANL	Los Alamos National Laboratory
LLW	low-level waste
MDA	material disposal area

nCi/L	pico-curies per liter
NFA	no further action
NMED	New Mexico Environment Department
NMSW	New Mexico special waste
NOAEL	no observed adverse effect level
NPDES	National Pollution Discharge Elimination System
OU	operable unit
PCS	petroleum-contaminated soil
PPE	personal protective equipment
PRS	potential release site
PVC	polyvinyl chloride
QA	quality assurance
Qbt	Quaternary Bandelier tuff
QC	quality control
QL	quantitation limit
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radiation model
RfD	reference dose
RFI	RCRA facility investigation
RLWTF	Radioactive Liquid Waste Treatment Facility
ROC	record of communication
RPF	records processing facility
RRES-MAQ	Risk Reduction and Environmental Stewardship-Meteorology and Air Quality
RRES-RS	Risk Reduction and Environmental Stewardship-Remediation Services
SAL	screening action level
SF	slope factor
SOP	standard operating procedure
SRSG	single radionuclide soil guidelines
SWMU	Solid Waste Management Unit
TA	Technical Area
TAL	target analyte list
TEDE	total effective dose equivalent
TSTA	Tritium Systems Test Assembly
UC	University of California

UCL	upper confidence limit
UTL	upper threshold limit
VCM	voluntary corrective measure
VCP	vitrified clay pipe
VOC	volatile organic compound
UC	University of California
WGII	Washington Group International, Inc.
WWTPs	waste water treatment plants

A-2.0 GLOSSARY

Administrative authority (AA). The Director of the New Mexico Environment Department, or his/her designee, or the U.S. Environmental Protection Agency.

Alluvium. Clay, silt, sand, and gravel transported by water and deposited on streambeds, flood plains, and alluvial fans.

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

Background value (BV). The upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. When a UTL cannot be calculated, either the detection limit or the maximum reported value is used as a BV; BVs are used as simple threshold numbers to identify potentially contaminated site sample results that are greater than background levels in that geological sample medium (or group of media). All inorganic chemicals and radionuclides have BVs.

Baseline risk assessment (also known as risk assessment). A site-specific analysis of the potential adverse effects of hazardous substances that are released from a site in the absence of any control or mitigation actions. A baseline risk assessment consists of four steps: data collection and analysis, exposure assessment, toxicity assessment, and risk characterization.

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

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

Cold vapor atomic absorption (CVAA). An analytical technique used for measuring mercury; it is described in EPA Methods 7470A (Mercury in Liquid Waste) and 7471A (Mercury in Solid or Semisolid Waste). The technique is based on the absorption of radiation at 253.7-nm by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

Data validation. Systematic process that applies a defined set of performance-based criteria to a body of data; may result in qualification of the data. The data validation process is performed independently of the analytical laboratory that generates the data set and occurs before conclusions are drawn from the data. The process may comprise a standardized data review (routine data validation) and/or a problem-specific data review (focused data validation).

Department of Energy (DOE). Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

Detection limit. Minimum concentration that can be determined by a single measurement by an instrument; implies a specified statistical confidence that the analytical concentration is greater than zero.

Dose. Quantity of radiation that is absorbed, per unit of mass, by the body or by any portion of the body.

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

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

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

Estimated detection limit (EDL). The detection limit required by the Laboratory statement of work (SOW) for analytical services (RFP No. 9-XS1-Q4257). The Laboratory value reflect the contract-required detection limits (CRDLs) of the Contract Laboratory Program (CLP) methods.

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

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

Exposure pathway. Mode by which a receptor may be exposed to contaminants in environmental media (e.g., drinking water, ingesting food, or inhaling dust).

External standard. External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards.

Fallout radionuclides. Radionuclides that are present at globally elevated levels in the environment as a result of the fallout from atomic weapons tests. The Laboratory background data sets consist of Environmental Surveillance samples taken from marginal and regional locations for the following radionuclides associated with fallout: tritium, cesium-137, americium-241, plutonium-238, plutonium-239/240, and strontium-90. Samples were collected from regional and marginal locations in the vicinity of the Laboratory that are (1) representative of geological media found within Laboratory boundaries and (2) were not impacted by Laboratory operations.

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

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

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

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

Groundwater. Water in a subsurface saturated zone; water beneath the regional water table.

Hazard quotient (HQ). The ratio of a calculated exposure (E) to or dose (D) from a given contaminant (I) to a given receptor (j) over a reference value (TRV) for contaminant (I) determined to be protective of receptor (j), i.e., $HQ_{ij} = E_{ij}$ [or D_{ij}]TRV_{ij}.

Hazardous and Solid Waste Amendments (HSWA). The Hazardous and Solid Waste Amendments of 1984 (Public Law No. 98-616, 98 Stat. 3221), which amended the Resource Conservation and Recovery Act of 1976, 42 U.S.C. § 6901 et seq.

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

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

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

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

Inductively coupled plasma emission spectroscopy (ICPES). ICPES determines trace elements, including metals, in solutions. The instrument measures characteristic emission spectra by optical spectrometry. Samples are nebulized, and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and photosensitive devices are used to monitor the intensities of the emission lines.

Inductively coupled plasma mass spectroscopy (ICPMS). ICPMS is applicable to the determination of sub-mg/l concentrations of a large number of elements in water samples and in waste extracts or digests. When dissolved constituents are required, samples must be filtered and acid preserved before analysis. No digestion is required before analysis for dissolved elements in water samples. The method measures ions produced by a radio-frequency inductively coupled plasma. Analyte species originating in a liquid are nebulized, and the resulting aerosol transported by argon gas into the plasma torch. The ions produced are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-change ratios and quantified with a channel electron multiplier.

Internal standards. Compounds added to the sample after sample preparation for qualitative and quantitative instrument analysis—the compounds serve as a standard of retention time and response, which is invariant from run to run with the instruments. (Handbook of Environmental Analysis, by Roy-Keith Smith, 3rd ed.)

Laboratory control sample (LCS). A known matrix that has been spiked with compound(s) representative of the target analytes. The LCS is used to document laboratory performance. The acceptance criteria for LCSs are method specific.

Laboratory qualifier (or laboratory flag). Codes applied to the data by the contract analytical laboratory to indicate, on a gross scale, a verifiable or potential data deficiency. These flags are applied using the Environmental protection Agency (EPA) contract laboratory program (CLP) guidelines.

Matrix spike. An aliquot of sample spiked with a known concentration of target analyte(s). Matrix spike samples are used to measure the ability to recover prescribed analytes from a native sample matrix. The spiking typically occurs before sample preparation and analysis.

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

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

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

Minimum detectable activity. For the *analysis* of *radionuclides*, the minimum detectable activity is the lowest detectable radioactivity for a given analytical technique. The following equation shall be used to calculate the MDA unless otherwise noted or approved by the Laboratory:

$$MDA = \frac{4.65(BKG)^{0.5} + 2.71}{2.22 \times EFF \times V \times T_S \times Y}$$

where BKG = the total background counts,
EFF = the fraction detector efficiency,
V = the volume or unit weight,
T_s = the *sample* count duration, and
Y = the fractional *chemical* recovery obtained from the *tracer* recovery.

Depending on the type of *analysis*, other terms may also be required in the denominator (e.g., gamma abundance).

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

No further action (NFA). A recommendation that not further investigation or remediation is warranted based on specific criteria.

Nondetect. Sample result that is less than the MDL. The laboratory reports nondetects as undetected at the EQL.

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

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

Polychlorinated biphenyls (PCBs). Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substances. PCBs are colorless, odorless compounds that are chemically, electrically, and thermally stable and have proven to be toxic to both humans and animals.

Potential release site (PRS). A site suspected of releasing or having the potential to release contaminants into the environment. PRS is a generic term that includes solid waste management units, hazardous waste sites listed in Module 7 of the Laboratory's Hazardous Waste Facility Permit, and sites that have been identified as potentially contaminated by radioactivity.

Quality assurance. All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily in service.

Quality control (QC). (1) All those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements. QC is the process through which actual quality performance is measured and compared with standards. (2) All methods and procedures used to obtain accurate and reliable results from environmental sampling and analysis. Includes rules for when, where, and how samples are taken; sample storage, preservation and transport; and the use of blanks, duplicates, and split samples during the analysis.

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

RCRA facility investigation (RFI). The investigation that determines if a release has occurred and the nature and extent of the contamination at a hazardous waste facility. The RFI is generally equivalent to the remedial investigation portion of the Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) process.

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

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

Regional aquifer. Geologic material(s) or unit(s) of regional extent whose saturated portion yields significant quantities of water to wells, contains the regional zone of saturation, and is characterized by the regional water table or potentiometric surface.

Release. Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous waste or hazardous constituents into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any hazardous wastes or hazardous constituents).

Reporting limit. The numerical value that an analytical laboratory (in conjunction with its client) selects to determine if a target analyte is detected. Results below the RL are considered not detected, while results greater than the RL are considered detected. The RLs are not necessarily based on instrument sensitivity. RLs can be established at the instrument detection limit, method detection limit, estimated quantitation limit, and contract-required detection limit.

Resource Conservation and Recovery Act (RCRA). The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976. (40 CFR 270.2)

Runoff. The portion of the precipitation on a drainage area that is discharged from the area either by sheet flow or adjacent stream channels.

Run-on. Surface water flowing onto an area as a result of runoff occurring higher up the slope.

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

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

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

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

Sediment. (1) A mass of fragmented inorganic solid that comes from the weathering of rock and is carried or dropped by air, water, gravity, or ice; or a mass that is accumulated by any other natural agent and that forms in layers on the earth's surface such as sand, gravel, silt, mud, fill, or loess. (2) A solid material that is not in solution and either is distributed through the liquid or has settled out of the liquid.

Site characterization. Defining the pathways and methods of migration of the hazardous waste or constituents, including the media affected, the extent, direction and speed of the contaminants, complicating factors influencing movement, concentration profiles, etc. (U.S. Environmental Protection Agency, May 1994. "RCRA Corrective Action Plan, Final," Publication EPA-520/R-94/004, Office of Solid Waste and Emergency Response, Washington, DC)

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

Solid waste management unit (SWMU). Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. This definition includes regulated units (i.e., landfills, surface impoundments, waste piles, and land treatment units) but does not include passive leakage or one-time spills from production areas and units in which wastes have not been managed (e.g., product storage areas).

Spring. The site where groundwater discharges to the ground surface.

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

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

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

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

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

Tentatively identified compound (TIC). Chemical compound detected in a sample that is not a target analyte, IS, or surrogate compound. Up to 30 chromatographic peaks may be subject to mass spectral matching for identification as TICs.

Topography. The physical configuration of the land surface in an area.

Total propagated uncertainty (TPU). The range of concentrations (expressed as plus or minus the measured concentration) that include the theoretical or true concentration of an analyte with a specific degree of confidence. Radiochemical results are required to be accompanied by sample-specific uncertainty bounds (TPU) that reflect the 67% confidence level (1-sigma TPU). The TPU includes not only the measurement or counting error but also the technique-specific error term that includes uncertainty values for each contributing measurement process and a sample-specific contribution reflecting specific chemical recoveries, detectors used, etc. All radiochemical result uncertainties incorporate terms for technique-related and sample-specific measurement errors.

Tracer. A substance, usually a radioactive isotope, added to a sample to determine the efficiency (chemical or physical losses) of the chemical extraction, reaction, or analysis. The tracer is assumed to behave in the same manner as that of the target radionuclides. Recovery guidelines for tracer results are 30% to 110% under the current contract laboratory statement of work and will be 40% to 105% under the new statement of work. Correction of the analytical results for the tracer recovery is performed for each sample. The concentration of the tracer added needs to be sufficient to result in a maximum of 10% uncertainty at the 95% confidence level in the measured recovery.

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

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

(a) farm or residential tank of 1,100 gallons or less capacity used for storing motor fuel for noncommercial purposes;

(b) tank used for string heating oil for consumptive use on the premises where stored;

(c) septic tank;

(d) pipeline facility (including gathering lines) regulated under

  (i) the Natural Gas Pipeline Safety Act of 1968 (49 USC App. 1671 et seq.),

  (ii) the Hazardous Liquid Pipeline Safety Act of 1979 (49 USC App. 2001 et seq.), or

  (iii) which is an intrastate pipeline facility regulated under state laws comparable to the provisions of law referred to in Clause (i) or (ii) of this subparagraph;

(e) surface impoundment, pit, pond, or lagoon;

(f) storm-water or wastewater collection system;

(g) flow-through process tank;

(h) liquid trap or associated gathering lines directly related to oil or gas production and gathering operations; or

(i) storage tank situated in an underground area (such as a basement, cellar, mine working, drift, shaft, or tunnel) if the storage tank is situated upon or above the surface of the floor.

US Department of Energy (DOE). Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

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

Vadose zone. The unsaturated zone. Portion of the subsurface above the regional water table in which pores are not fully saturated.

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

A-3.0 METRIC CONVERSION TABLES

Metric to English Conversions

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (μg/g)	1	parts per million (ppm)
liters (l)	0.26	gallons (gal.)
milligrams per liter (mg/l)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

Metric Prefixes

Term	Power of 10	Symbol
mega-	10^6	M
kilo-	10^3	k
deci-	10^{-1}	d
centi-	10^{-2}	c
milli-	10^{-3}	m
micro-	10^{-6}	μ
nano-	10^{-9}	n
pico-	10^{-12}	p

Appendix B

Technical Area 21
Operational and Environmental Setting

APPENDIX B TECHNICAL AREA 21 OPERATIONAL AND ENVIRONMENTAL SETTING

B-1.0 OPERATIONAL HISTORY AND LAND USE

Technical Area (TA) 21 is located on DP Mesa on the northern boundary of Los Alamos National Laboratory (the Laboratory) and is immediately east-southeast of the Los Alamos townsite (Figure 1.2-1, Section 1). It extends from the mesa top to the stream channels in the adjacent canyons, with DP Canyon to the north and Los Alamos Canyon to the south.

During World War II, the Laboratory was established for the research, development, and testing of the first deliverable nuclear weapon. In 1945, the operations for establishing the chemical and metallurgical properties of the nuclear material necessary to achieve and sustain the required nuclear fission reaction were transferred to the newly built facilities at TA-21.

SWMU 21-011(k) was the NPDES-permitted outfall (NPDES outfall no. EPA 050050) for treated industrial wastewater from the former wastewater treatment plants (WWTPs) (Buildings 21-35 and -157) at TA-21. The SWMU consisted of a drainline from two treated wastewater holding tanks (Structures 21-112 and -113) and an outfall area on the north-facing slope of DP Canyon. The initial drainline from tanks 21-112 and -113 consisted of a 4-in. vitrified clay pipe (VCP) that reportedly discharged to an "outfall ditch" excavated into soil and tuff (LANL 1991, 07528.1). The VCP was replaced in 1976 with a 4-in. cast iron drainline that was installed within the VCP drainline excavation and outfall ditch. The discharge end of the 4-in. cast iron drainline was located approximately 80 ft north of the TA-21 perimeter road where the outfall ditch previously ended. A gently sloping, rocky surface extends from the end of the outfall drainline approximately 30 ft to the south rim of DP Canyon.

TA-21 is currently under Department of Energy (DOE) control. The land has historically been used for industrial applications. Although portions of TA-21 are slated for transfer from DOE to other entities (e.g., Los Alamos County), the area around SWMU 21-011(k) will remain under DOE control indefinitely. Future land use will remain industrial. Future and current land use maps can be found in the 1995 update to the Laboratory site development plan (LANL 1995, 57224).

B-2.0 CLIMATE

Los Alamos County has a semiarid, temperate mountain climate. Annual precipitation, including rain and snow, averages about 18 in. Recorded extremes in annual precipitation are 6.8 in. and 30.3 in. An average of 40% of the annual precipitation falls during thunderstorms in July and August, often in brief, high-intensity rains. Significant amounts of surface water often run off during these rainfall events. Daily rainfall extremes of 1 in. or greater occur in most years, and the estimated 100-yr daily rainfall extreme is about 2.5 in. Snowstorms with accumulations exceeding 4 in. are common in Los Alamos. Snowfall is greatest from December through March; heavy snowfall is infrequent in other months (Bowen 1990, 6899). The average annual snowfall is 51 in.

Summers are generally sunny, with warm days and cool nights. Summer afternoon temperatures in Los Alamos County are typically in the 70s and 80s (°F), infrequently reaching 90°F; nighttime temperatures are typically in the 50s (°F). Typical winter temperatures range between 30°F and 50°F during the day and 15°F and 25°F during the night, occasionally dropping to 0°F or below (Bowen 1990, 6899).

Strong winds occur predominantly in the spring. The predominant wind direction, especially for strong winds, is south-southwest. Because of complex terrain, surface winds in Los Alamos often vary greatly with time of day and location. The winds toward the eastern edge of the Pajarito Plateau near the Rio Grande Valley differ from those at the western edge adjacent to the mountains. Along the eastern edge, the daily wind cycle is a moderate southwesterly upvalley wind during the day and either a light northwesterly to northerly drainage wind or moderate southwesterly wind at night. Along the western edge, the predominant winds are southerly to northwesterly during the day and southwesterly and northeasterly at night toward the Rio Grande Valley.

TA-21 is located approximately midway between the western and eastern edges of the Pajarito Plateau. No tornadoes have been reported to have touched down in Los Alamos County. Strong dust devils can produce winds up to 75 mph at isolated spots in the county, especially at lower elevations. Strong winds with gusts exceeding 60 mph are common during the spring.

B-3.0 GEOLOGY

TA-21 is centrally located on the Pajarito Plateau, approximately midway between the flanks of the Jemez Mountains to the west and the Rio Grande to the east. The geology of the area and the specific geology of TA-21 are summarized in this section. Additional information on the geologic setting of the TA-21 area and information on the Pajarito Plateau can be found in the installation work plan (LANL 1998, 62060), the TA-21 operable unit work plan (LANL 1991, 7528), and the hydrogeologic work plan (LANL 1998, 59599).

B-3.1 Stratigraphy

The following sections describe the rock units below the TA-21 area; these units were encountered during environmental restoration investigations at the TA. The descriptions begin with the oldest (deepest) unit and proceed to the youngest (topmost) unit (Figure B-3.1-1).

B-3.1.1 Santa Fe Group

The Santa Fe Group consists of predominately fluvial, slightly consolidated sedimentary rocks that crop out in the lower reaches of Los Alamos Canyon, along White Rock Canyon, and in extensive areas east of the Rio Grande. Galusha and Blick (1971, 21526) subdivided the Santa Fe Group into formations and members based on geologic mapping and faunal assemblages of late tertiary mammals. Manley (1979, 11714) refined their stratigraphy based on additional mapping and dates on interbedded volcanic ash layers, lava flows, and dikes. Cavazza (1989, 21501) proposed changes in stratigraphic nomenclature based on sedimentary facies pattern. In the vicinity of the Pajarito Plateau, the Santa Fe Group consists of the Tesuque Formation and overlying Chamita Formation.

Tesuque Formation. The Tesuque Formation is a massive, thick unit consisting of arkosic sediments, derived primarily from Precambrian basement and Tertiary volcanic sources to the east and northeast. This unit is a light pink-to-buff siltstone and silty sandstone with a few lenses of pebbly conglomerate and clay. It is poorly to moderately consolidated and has an age range of about 7 to 21 million years (Manley 1979, 11714; Cavazza 1989, 21501). This formation exists in deep well boreholes under the Pajarito Plateau and is the primary aquifer for municipal and industrial water supply in Los Alamos County. Regional cross sections suggest that it does not exist beneath TA-21.

Chamita Formation. The Chamita Formation overlies and interfingers with the Tesuque Formation. It consists of arkosic siltstones, sandstones, pebbly conglomerate, and includes two prominent beds of white ash. Because of similarities of appearance and interfingering relations, the differentiation of Chamita from Tesuque deposits is difficult in borehole investigations, and it does not outcrop in the area of TA-21. Regional cross sections suggest that it does not exist beneath TA-21. The estimated age ranges from 4.5 to 12 million years (MacFadden 1977, 21569; Manley 1979, 11714).

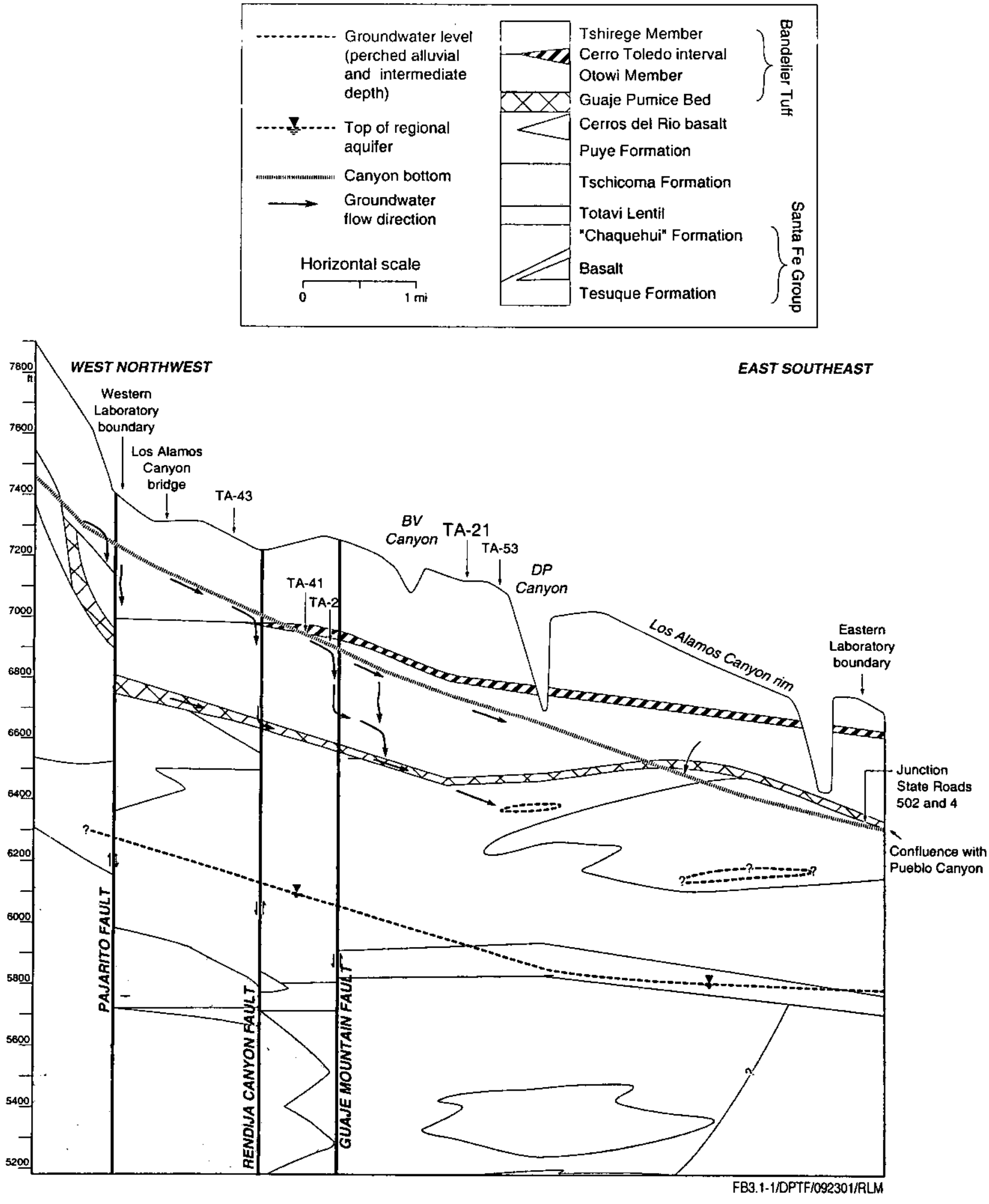

Figure B-3.1-1. Generalized stratigraphy beneath TA-21

Chaquehui Formation. Purtymun (1995, 45344) describes a trough of late Miocene coarse-grained sediments at the top of the Santa Fe Group that postdates the Chamita Formation. Purtymun called these deposits the Chaquehui Formation; they are important for the development of high-yield, low-drawdown municipal and industrial water supply wells for the Los Alamos area. The trough is 3–4 mi wide and extends 7–8 mi from the northeast to the southwest. It is filled with up to 1,500 ft of gravels, cobbles, and boulders derived from highlands to the north and east. Regional cross sections suggest that this unit exists beneath TA-21 and most of the Laboratory.

B-3.1.2 The Puye Formation

The Puye Formation is a fanglomerate deposit consisting of poorly sorted boulders, cobbles, and coarse sands made up of dacitic to latitic debris eroded from the contemporaneous Tschicoma Formation (Turbeville et al. 1989, 21587; Spell et al. 1990, 21586). In the lower reaches of Los Alamos Canyon and along the Rio Grande, the Puye Formation also contains basaltic debris derived from contemporaneous volcanism and erosion of the Cerros del Rio volcanic field. The Puye Formation contains numerous interbedded lapilli tuff beds and laharic deposits. Lacustrine deposits are volumetrically significant in the distal parts of the fan. Regional cross sections show this deposit under TA-21.

The lower part of the Puye Formation includes the Totavi lentil (Griggs 1964, 8795), a deposit of well-rounded cobbles and boulders of Precambrian quartzites and crystalline rocks. The Totavi lentil probably represents channel deposits of the ancestral Rio Grande, and it may interfinger with the fanglomerate facies of the Puye Formation along White Rock Canyon.

B-3.1.3 The Bandelier Tuff

The Bandelier Tuff under TA-21 consists of the Otowi and Tshirege Members, which are stratigraphically separated in many places by the tephras and volcaniclastic sediments of the Cerro Toledo interval. The Bandelier Tuff was emplaced during cataclysmic eruptions of the Valles Caldera between 1.61 and 1.22 million years ago. The tuff is composed of pumice, minor rock fragments, and crystals supported in an ashy matrix. It is a prominent cliff-forming unit because of its generally strong consolidation. Because the Bandelier Tuff is the most prominent rock type on the Pajarito Plateau, its detailed stratigraphy is of considerable importance and is discussed further below (see also Broxton and Reneau 1995, 49726).

Otowi Member. Griggs (1964, 8795), Smith and Bailey (1966, 21584), Bailey et al. (1969, 21498), and Smith et al. (1970, 9752) describe the nature and extent of the Otowi Member. It consists of moderately consolidated (indurated), porous, and nonwelded vitric tuff (ignimbrite) that forms gentle colluvium-covered slopes along the base of canyon walls. The Otowi ignimbrites contain light gray-to-orange pumice that is supported in a white-to-tan ash matrix (Broxton et al. 1995, 50119; Broxton et al. 1995, 50121; Goff 1995, 49682). The ash matrix consists of glass shards, broken pumice and crystal fragments, and fragments of perlite.

The Guaje Pumice Bed occurs at the base of the Otowi Member, making a significant and extensive marker horizon. The Guaje Pumice Bed (Bailey et al. 1969, 21498; Self et al. 1986, 21579) contains well-sorted pumice fragments whose mean size varies between 0.8 and 1.6 in. Its thickness averages approximately 28 ft below most of the plateau with local areas of thickening and thinning. Its distinctive white color and texture make it easily identifiable in borehole cuttings and core, and it is an important marker bed for the base of the Bandelier Tuff.

Tephras and Volcaniclastic Sediments of the Cerro Toledo Interval. The Cerro Toledo interval is an informal name given to a sequence of volcaniclastic sediments and tephras of mixed provenance that separates the Otowi and Tshirege Members of the Bandelier Tuff (Broxton et al. 1995, 50121; Broxton and Reneau 1995, 49726; Goff 1995, 49682). Although it is intercalated between the two members of the Bandelier Tuff, the Cerro Toledo interval is not considered part of that formation (Bailey et al. 1969, 21498). Outcrops of the Cerro Toledo interval generally occur wherever the top of the Otowi Member appears in Los Alamos Canyon and in canyons to the north; the interval outcrops in the TA-21 area. The unit contains primary volcanic deposits normally assigned to the Cerro Toledo rhyolite, as described by Smith et al. (1970, 9752), as well as intercalated and reworked volcaniclastic sediments not normally included in the Cerro Toledo rhyolite. The occurrence of the Cerro Toledo interval is widespread; however, its thickness is variable, ranging between several feet and more than 100 ft.

The predominant rock types in the Cerro Toledo interval at TA-21 are rhyolitic tuffaceous sediments and tephra (Broxton et al. 1995, 50121; Goff 1995, 49682; Heiken et al. 1986, 48638; Stix et al. 1988, 49680). The tuffaceous sediments are the reworked equivalents of Cerro Toledo rhyolite tephra that erupted from the Cerro Toledo and Rabbit Mountain rhyolite domes located in the Sierra de los Valles. At TA-21, oxidation and clay-rich horizons suggest that at least two periods of soil development occurred within the Cerro Toledo deposits. Because these soils are rich in clay, they may act as barriers to the movement of vadose zone groundwater. Some of the epiclastic tuffaceous deposits contain both crystal-poor and crystal-rich varieties of pumice. The ashy matrix of these deposits is commonly rich with crystals and contains subhedral sanadine and quartz. The mixed pumice and the crystal-rich nature of the matrix suggest that these reworked tuffs were derived from both the Cerro Toledo rhyolite and the underlying Otowi Member. The pumice falls tend to form porous and permeable horizons within the Cerro Toledo interval; they may provide locally important pathways for moisture transport in the vadose zone. A subordinate lithology within the Cerro Toledo interval includes clast-supported gravel, cobble, and boulder deposits made up of porphyritic dacite derived from the Tschicoma Formation that are interbedded with the tuffaceous rocks. In some deposits, dacitic materials are volumetrically more important than rhyolitic detritus (Broxton and Reneau 1996, 55429; Broxton et al. 1995, 50121; Goff 1995, 49682).

Tshirege Member. The Tshirege Member is the upper member of the Bandelier Tuff and is the most widely exposed bedrock unit of the Pajarito Plateau (Bailey et al. 1969, 21498; Griggs 1964, 8795; Smith and Bailey 1966, 21584; Smith et al. 1970, 9752). Emplacement of this unit occurred during eruptions of the Valles Caldera approximately 1.2 million years ago (Izett and Obradovich 1994, 48817; Spell et al. 1996, 55542). The Tshirege Member is a multiple-flow, ash-and-pumice sheet that forms the prominent cliffs in most of the canyons on the Pajarito Plateau and at TA-21. It is a compound-cooling unit whose physical properties vary vertically and laterally. The consolidation in this member is largely due to compaction and welding at high temperatures after the tuff was emplaced. The Tshirege Member's light brown, orange brown, purplish, and white cliffs have numerous, mostly vertical fractures (called joints) that average between several feet and several tens of feet in length. The Tshirege Member includes thin but distinctive layers of bedded, sand-sized particles called surge deposits that demark separate flow units within the tuff. The Tshirege Member is generally over 200 ft thick.

The Tshirege Member differs from the Otowi Member most notably in its generally greater degree of welding compaction. Time breaks between the successive emplacement of flow units caused the tuff to cool as several distinct cooling units. For this reason, the Tshirege Member is a compound cooling unit, consisting of at least four cooling subunits that display variable physical properties vertically and horizontally (Smith and Bailey 1966, 21584; Crowe et al. 1978, 5720; Broxton et al. 1995, 50121). These variations in physical properties reflect zonal patterns of varying degrees of welding and glass crystallization that accompany welding (Smith 1960, 48819; Smith 1960, 48820). The welding and crystallization variabilities in the Tshirege Member produce recognizable vertical variations in its properties such as density, porosity, hardness, composition, color, and surface weathering patterns. The subunits are mappable based on a combination of hydrologic properties and lithologic characteristics.

There is a certain amount of confusion because of the inconsistent use of subunit names for the Tshirege Member (Baltz et al. 1963, 8402; Weir and Purtymun 1962, 11890; Crowe et al. 1978, 5720; Vaniman and Wohletz 1990, 21589; Vaniman 1991, 9995; Goff 1995, 49682; Broxton et al. 1995, 50121). To avoid confusion, this discussion follows the nomenclature of Broxton and Reneau (1995, 49726), which has been adopted by the Risk Reduction and Environmental Stewardship Division–Remediation Services (RRES–RS) Program, formerly the Environmental Restoration (ER) Project.

Broxton et al. (1995, 50121) provide extensive descriptions of the Tshirege Member cooling units. The following paragraphs describe, in ascending order, subunits of the Tshirege Member.

The Tsankawi Pumice Bed forms the base of the Tshirege Member. Where exposed, it is commonly 20–30 in. thick. This pumice-fall deposit contains moderately well-sorted pumice lapilli (diameters reaching about 2.5 in.) in a crystal-rich matrix. Several thin ash beds are interbedded with the pumice-fall deposits.

Qbt 1g is the lowermost subunit of the thick ignimbrite sheet overlying the Tsankawi Pumice Bed. It consists of porous, nonwelded, and poorly sorted ash-flow tuffs. The *g* in this designation stands for glass because none of the glass in ash shards and pumices shows crystallization by devitrification or vapor-phase crystallization. This unit is poorly indurated but nonetheless forms steep cliffs because of a resistant bench near the top of the unit; the bench forms a harder, protective cap over the softer underlying tuffs. A thin (4–10 in.) pumice-poor surge deposit commonly occurs at the base of this unit.

Qbt 1v forms alternating cliff-like and sloping outcrops composed of porous, nonwelded, crystallized tuffs. The *v* stands for vapor-phase crystallization, which, together with in situ devitrification, has converted much of the glass in shards and pumices into microcrystalline aggregates. The base of this unit is a thin, horizontal zone of preferential weathering that marks the abrupt transition from glassy tuffs below (in Unit 1g) to the crystallized tuffs above. This feature forms a widespread marker horizon (locally termed the vapor-phase notch) throughout the Pajarito Plateau, which is readily visible in canyon walls at TA-21. The lower part of Qbt 1v is orange brown, resistant to weathering, and has distinctive columnar (vertical) joints; therefore, the term *colonnade tuff* is appropriate for its description. A distinctive white band of alternating cliff- and slope-forming tuffs overlies the colonnade tuff. The tuffs of Qbt 1v are commonly nonwelded (pumices and shards retain their initial equant shapes) and have an open, porous structure.

Qbt 2 forms a distinctive, medium brown, vertical cliff that stands out in marked contrast to the slope-forming, lighter-colored tuffs above and below at TA-21. It displays the greatest degree of welding in the Tshirege Member. A series of surge beds commonly mark its base. It is typically nonporous and has low permeability relative to the other units of the Tshirege Member. Vapor-phase crystallization of flattened shards and pumice is extensive in this unit.

Qbt 3 is a nonwelded to partially welded, vapor-phase-altered tuff that forms many of the upper cliffs in the TA-21 area. Its base consists of a purple gray, unconsolidated, porous, and crystal-rich nonwelded tuff that underlies a broad, gently-sloping bench developed on top of Qbt 2. This basal, nonwelded portion forms relatively soft outcrops that weather into low rounded mounds with a white color that contrast with the cliffs of partially welded tuff in the middle and upper portions of Qbt 3.

B-3.2 Geochemistry

Certain minerals present in Bandelier Tuff are important in terms of sorption of chemical species from water. Among them are alkali feldspar and a combination of three silica polymorphs (i.e., quartz, cristobalite, and tridymite). These minerals are found throughout the thickness of the Bandelier Tuff; their absolute abundance throughout the tuff can have a significant effect on the retardation of several TA-21 contaminants. Less important in terms of transport are organic materials, which can react with certain constituents to form relatively mobile compounds. The organic content of geologic materials on the Pajarito Plateau mesas is typically less than 1 wt %; however, the fractures can contain higher organic concentrations than the tuff matrix.

In addition to the minerals found in the tuff matrix, clay minerals are found in abundance in fractures and interbeds in the Bandelier Tuff. The primary clay minerals are smectites, with lesser amounts of kaolinite. The clay minerals have high sorptive capacity for many TA-21 contaminants. Hematite (i.e., iron oxide) coatings are also found but with less frequency than clay coatings. Hematite has a very large surface area for binding certain metals and is therefore also important when considering transport in fractures.

B-3.3 Seismology and Fractures

There are three major faults that are considered significant with respect to seismic potential across the Laboratory complex: the Pajarito, the Guaje Mountain, and the Rendija Canyon faults. Figure B-3.3-1 shows the location of major faults in the Laboratory complex with respect to TA-21.

The Pajarito fault system has experienced Holocene movement and historic seismicity (Gardner and House 1987, 6682; Gardner et al. 1990, 48813). Characterized by northerly trending normal faults that intertwine along their traces, the Pajarito fault system shows dominantly down-to-the-east movement and produces a series of prominent fault scarps west of the Laboratory. The vertical throw on this fault system is over several hundred feet south and west of the Laboratory but decreases northward of Los Alamos Canyon where the fault system is less prominent.

The Rendija Canyon and Guaje Mountain faults are also normal faults, are downthrown to the west, and are considered secondary faults within the Pajarito fault system. The Rendija Canyon fault is located 3 mi east of the Pajarito fault, and the Guaje Mountain fault is located about 1.2 mi east of the Rendija Canyon fault. The Rendija Canyon fault crosses Pueblo Canyon near its confluence with Acid Canyon and Los Alamos Canyon near TA-41 but does not have clear surface expression south of Sandia Canyon. The Guaje Mountain fault parallels the Rendija Canyon fault and is projected to cross Los Alamos Canyon near TA-2, although there is no clear offset of the Tshirege Member south of North Mesa. North of the Laboratory, both of these faults have zones of gouge and breccia up to several meters wide and produce visible offsets of stratigraphic horizons and recognizable scarps; however, these features are not apparent within most of the Laboratory and TA-21. Vaniman and Wohletz (1990, 21589) and Wohletz (1995, 54404) project these faults south of Los Alamos Canyon based on Tshirege Member rock fracture density variations, orientations, and sizes.

Geologic evidence reveals that the Pajarito fault has ruptured within the past 1.2 million years, perhaps as recently as 50,000 years ago. Field investigations show that the Rendija Canyon fault has ruptured within the past 10,000 years and that the Guaje Mountain fault has ruptured within the past 6000 years. The recurrence interval of seismic events along the Rendija Canyon and Guaje Mountain faults is estimated to be between 10,000 and 150,000 years.

A number of small-to-moderate earthquakes not associated with mapped faults (termed "background earthquakes") have occurred in north-central New Mexico within the past 100 years. Since 1973, local seismicity has been monitored by the Los Alamos Seismograph Network. Measured events have not exceeded a magnitude of 4, which is relatively weak compared with earthquakes producing damage to buildings and structures. Details of a seismic hazard evaluation that was completed for the Laboratory can be found in a report by Wong et al. (1995, 70097), Chapters 8 through 11.

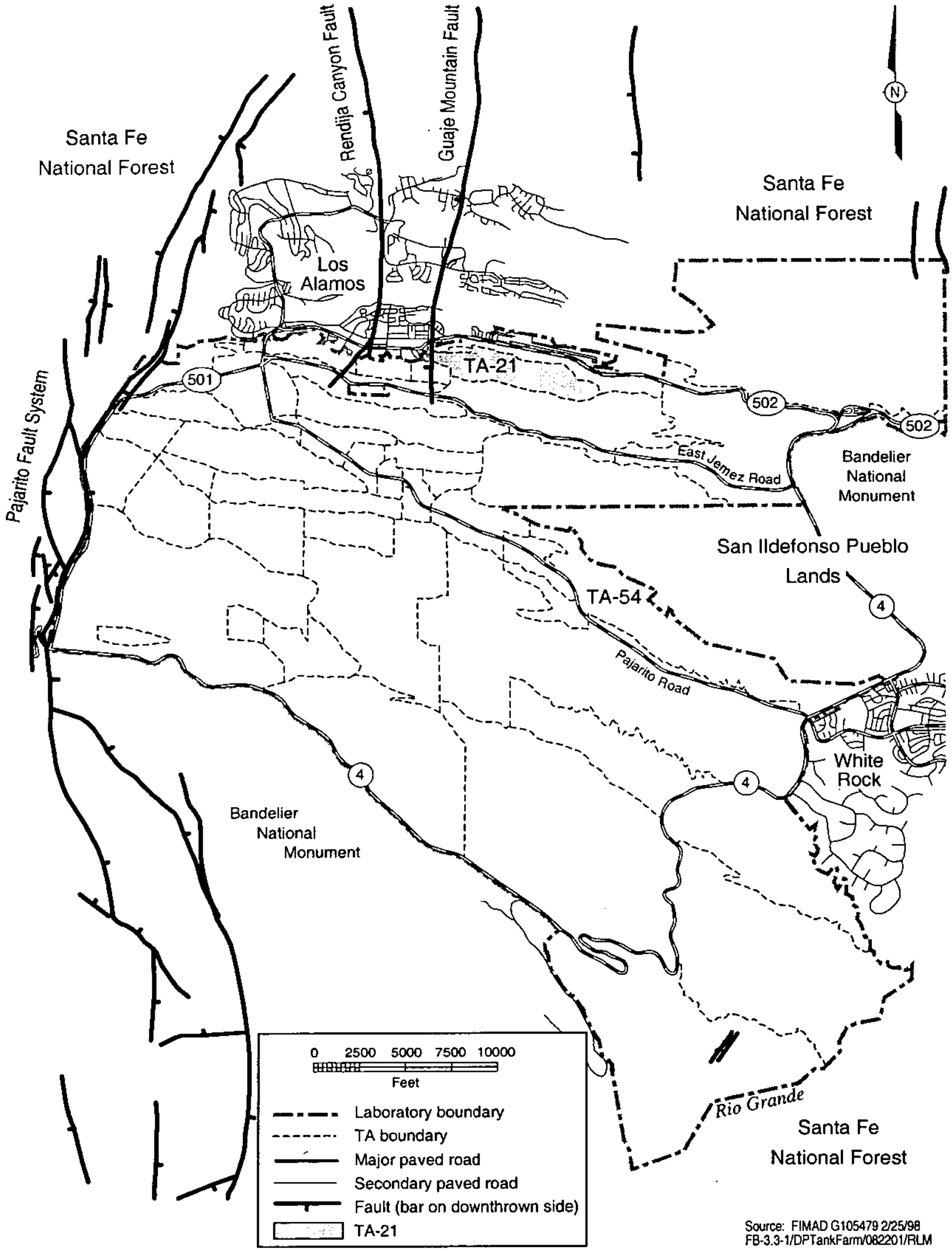

Figure B-3.3-1. Locations of major faults in Laboratory complex relative to TA-21

Abundant fractures extend through the upper units of the Bandelier Tuff, including the Tshirege Unit 3 ignimbrite. The origin of the fractures has not been fully determined; however, the most probable cause is brittle failure of the tuff caused by cooling contraction soon after initial emplacement (Vaniman 1991, 9995; Wohletz 1995, 54404). It is probable that past tectonic activity on the Pajarito fault system and the Guaje Mountain Fault Zone has also caused fracture development, reorientation, and extension (Wohletz 1995, 54404).

B-3.3.1 Fractures at TA-21

An extensive field survey of fractures in the Bandelier Tuff at TA-21 was conducted in 1992. Wohletz (1995, 54404) measured strike, dip, and aperture in 1,662 fractures in Unit 2 of the Tshirege Member of the Bandelier Tuff (Qbt 2) exposed on cliffs below TA-21 in Los Alamos Canyon. The fracture traverse was 7,312 ft long, extending east from a starting point 1,200 ft east of the access gate to TA-21 and roughly due south of the eastern end of the DP Tank Farm site. Fractures were plotted on photomosaic maps of the canyon wall and their horizontal position calculated relative to the starting point of the fracture traverse. Linear fracture densities for 10-ft and 100-ft intervals, cumulative fracture width (sum of all fracture apertures within a given interval) for 10-ft and 100-ft intervals, and the relative fracture dips from vertical were calculated from the field data.

The average background fracture spacing at TA-21 is about 5 ft. A 1,500-ft-wide zone starting near the gated entrance to TA-21 and extending to the east has a fracture spacing of 1–2 ft. The spacing decreases abruptly near the entrance to TA-21 and then increases gradually, reaching the 5-ft background value about 1,500 ft to the east. Wohletz suggested that this fracture zone represents a fabric of the Pajarito Fault Zone. Measured strikes show that the fractures in this zone make up two conjugate sets: one trending northwest and the other northeast. The northeast-trending set (988 fractures) has a mean strike of N43E, and the northwest-trending set (674 fractures) has a mean strike of N33W. Fracture dips range between nearly horizontal and vertical, although most are steeply dipping. The majority of fractures in both the northeast- and northwest-trending sets dip steeply toward the north, with mean dips of 73° and 74° from the horizontal, respectively.

Fracture apertures range from 0 to 15 cm. The northeast and northwest sets of fractures have mean apertures of 0.82 cm and 0.93 cm, respectively. These mean apertures increase to 1.1 cm and 1.5 cm within the fracture zone. The background cumulative fracture width is about 0.5 m of fracture opening per 100-ft interval. This value increases to about 1.4 m per 100-ft interval within the fracture zone. Fracture apertures decrease both above and below Unit 2, although no data were recorded for those units. Fracture fillings were described as sparse to absent in Unit 2 but prominent in Unit 3 (Qbt 3).

B-3.4 Soils

Soils on the Pajarito Plateau were initially mapped and described by Nyhan et al. (1978, 5702). The Nyhan study included only Laboratory-controlled lands and certain U.S. Forest Service lands within Los Alamos County.

Soils were formed in a semiarid climate and were derived from chemical, biological, and physical weathering of local bedrock units, fallout pumice deposits, eolian deposits, and sediments derived from these geological materials (Nyhan et al. 1978, 5702). A large variety of soils have developed on the Pajarito Plateau as a result of interactions of the underlying bedrock, slope, and climate. The mineral components of the soils are in large part derived from the Bandelier Tuff, but dacitic lavas of the Tschicoma Formation, basalts of the Cerros del Rio volcanic field, and sedimentary rocks of the Puye

Formation are locally important. Alluvium derived from the Pajarito Plateau and from the east side of the Jemez Mountains contributes to soils in the canyons and also to those on some of the mesa tops.

The soils on the slopes between the mesa tops and canyon floors have been mapped as mostly steep rock outcrops consisting of approximately 90% bedrock outcrop and patches of shallow, undeveloped colluvial soils. South-facing canyon walls are steep and usually have little or no soil material or vegetation; in contrast, the north-facing walls generally have areas of very shallow dark-colored soils and are more heavily vegetated. The canyon floors generally contain poorly developed, deep, well-drained soils (Nyhan et al. 1978, 5702).

Soils in the vicinity of TA-21 are typical of those across the Pajarito Plateau and are generally poorly developed, derived from Bandelier Tuff bedrock, and formed in a semiarid climate. Soils on the TA-21 mesa top are mainly shallow, well-drained sandy loams of the Hackroy series. As described by Nyhan et al. (1978, 5702), "the surface layer of the Hackroy soils is a brown sand loam, or loam, about 10 cm thick. The subsoil is a reddish brown clay, gravelly clay, or clay loam, about 20-cm thick. The depth to bedrock and the effective rooting depth are 20 to 50 cm." Hackroy soils are classified as Alfisols, in part reflecting the clayey subsurface horizons. Intermixed with the Hackroy soils on the mesa tops are small areas of deeper loams of the Nyjack series and patches of bedrock. The Nyjack soils are texturally similar to Hackroy soils and are distinguished by thicknesses of 7.9–40.2 in. (50–102 cm) and by the common presence of pumice fragments in the lower soil (Nyhan et al. 1978, 5702). Areas of exposed rock are predominant toward the east end of the mesa and TA-21 development. At TA-21, there are typically between one and several feet of soil and/or fill overlying Qbt 3.

B-4.0 HYDROLOGY

The hydrogeology of the Pajarito Plateau is generally separable in terms of mesas and canyons forming the plateau. Mesas are generally devoid of water, both on the surface and within the rock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional streamflow and may lack alluvial groundwater. Intermediate perched groundwater has been found at certain locations on the plateau at depths of 100–400 ft (30–122 m). The regional aquifer is found at depths of about 600–1,200 ft (180–360 m).

B-4.1 Hydrological Conceptual Model

The hydrogeologic model (Figure B-4.1-1) shows that, under natural conditions, relatively small volumes of water move beneath mesa tops; this is because of low rainfall, high evaporation, and efficient water use by vegetation. Atmospheric evaporation may extend deeper into mesas, further inhibiting downward flow.

The amount of mesa top recharge along the western portion of the Laboratory is uncertain. Higher rainfall, increased vegetative cover, and increased welding and jointing of the tuff might lead to different recharge rates than those observed in better-studied portions of the Laboratory. If surface conditions are disturbed, mesa top recharge can be locally significant. Such change occurs when the soil is compacted, when the vegetation is disturbed, or when more water is artificially added to the hydrologic system by features such as blacktop, lagoons, or effluent disposal. Fractures within mesas do not enhance the movement of dissolved contaminants unless saturated conditions develop. Contaminants in vapor form readily migrate through mesas. Vapors denser than air will sink.

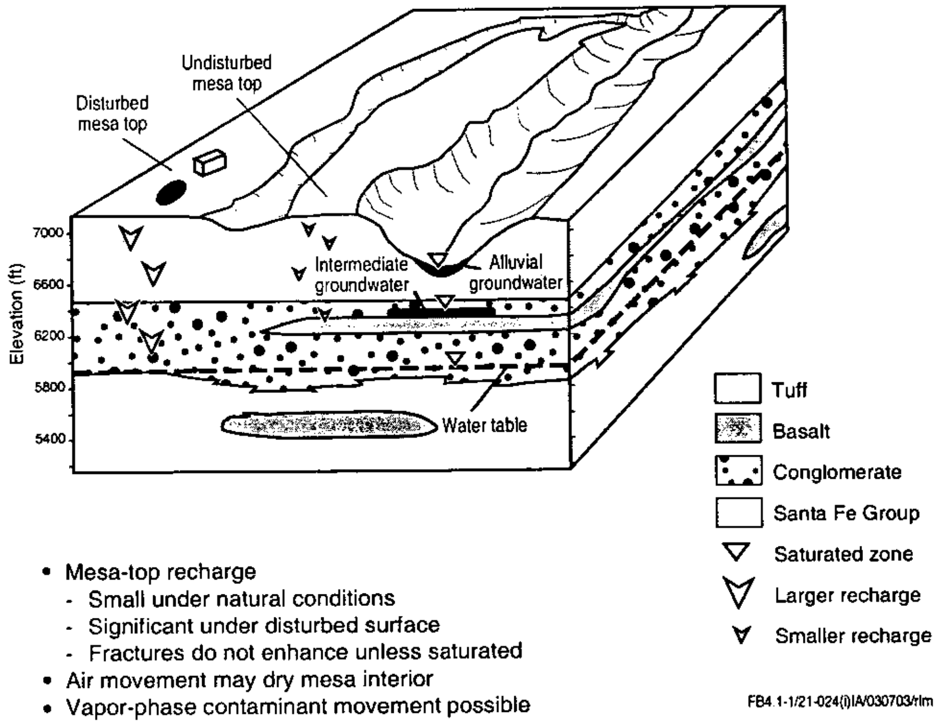

Figure B-4.1-1. Hydrogeologic conceptual model for Laboratory mesa tops

B-4.2 Surface Water

The Rio Grande is the primary river in north-central New Mexico. All surface water drainage and groundwater discharge from the plateau ultimately arrives at the Rio Grande (Figure B-4.2-1). Most Los Alamos surface water occurs as ephemeral, intermittent, or interrupted (ephemeral, intermittent, and perennial reaches) streams in canyons cut into the Pajarito Plateau. Ephemeral streams flow in response to precipitation; intermittent streams flow in response to the availability of snowmelt or groundwater discharge. Perennial streams flow at all times except during extreme drought. Springs on the flanks of the Jemez Mountains, west of the Laboratory's western boundary, supply flow to the upper reaches of Cañon de Valle and to Guaje, Los Alamos, Pajarito, and Water Canyons (Purtymun 1975, 11787; Stoker 1993, 56021). These springs discharge water perched in the Bandelier Tuff and Tschicoma Formation at rates of 2–135 gal./minute (Abeele et al. 1981, 6273). The volume of flow from the springs maintains natural perennial reaches of varying lengths in each of the canyons.

Perennial flow has historically occurred in the upper reaches (west of the Laboratory) of Los Alamos Canyon and in the lower reaches downstream of the confluence with Pueblo Canyon. In the past, the reservoir operated as a throughput for runoff originating in the upper watershed. The outflow would result in nearly continuous surface water flow in Los Alamos Canyon from the reservoir to downstream locations, sometimes all the way to the Laboratory boundary, for several weeks to several months each year (LANL 1995, 50290). It is not clear, however, how the impacts of the Cerro Grande fire and future reservoir management practices will affect surface water flow in Los Alamos Canyon. For most of the year, the only surface flow in Los Alamos Canyon is in the lower part of the canyon, due to discharge from the Los Alamos County Sewage Treatment Plant (LANL 1995, 50290) (Figure B-4.2-2). Surface water in Los Alamos Canyon rarely flows across the length of the Laboratory. Most often surface waters are depleted by infiltration into canyon alluvium, creating saturated zones of seasonally variable extent (LANL 1995, 50290).

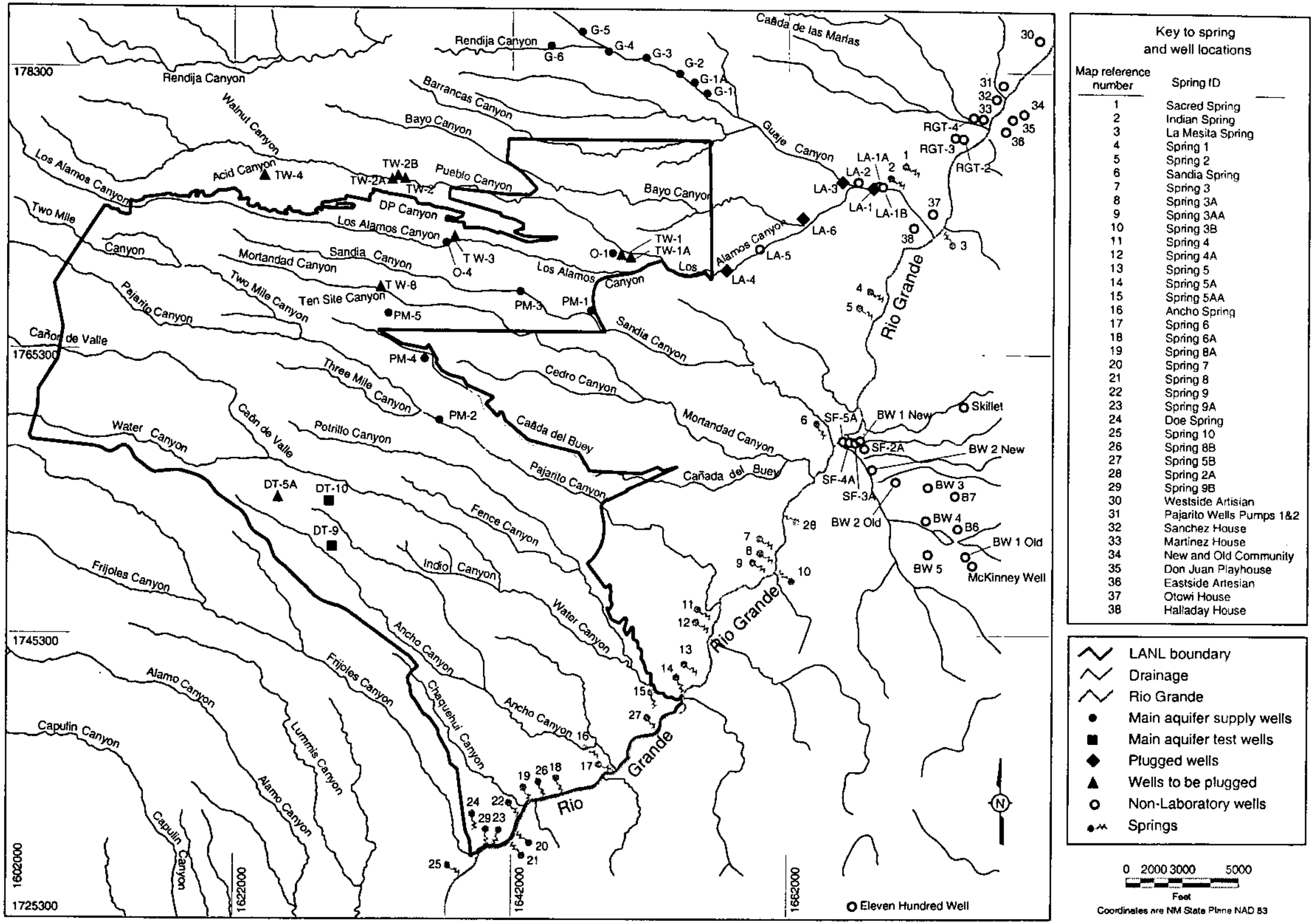

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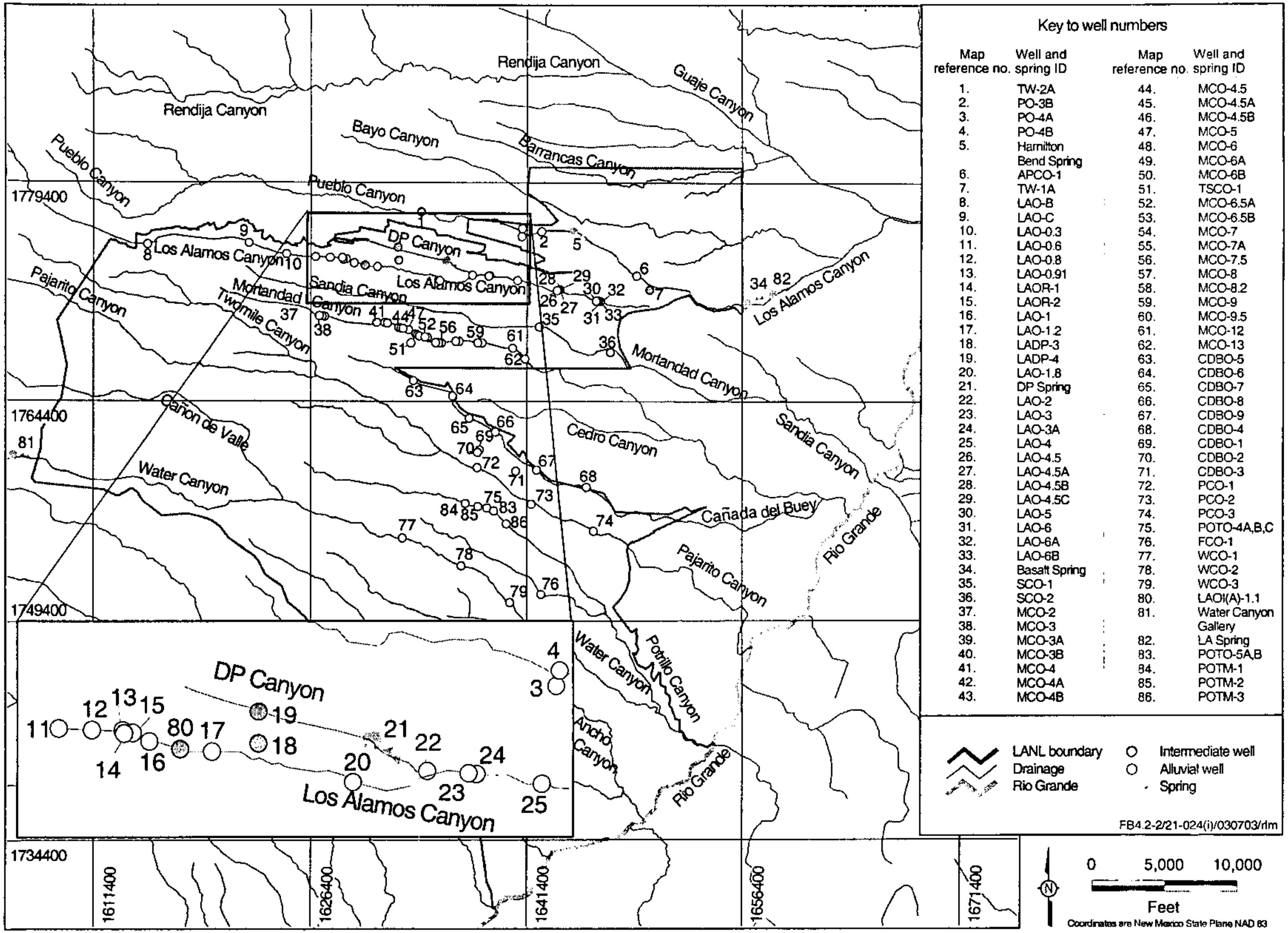
Figure B-4.2-1. Surface water drainage to Rio Grande and well locations



Key to well numbers

Map reference no.	Well and spring ID	Map reference no.	Well and spring ID
1.	TW-2A	44.	MCO-4.5
2.	PO-3B	45.	MCO-4.5A
3.	PO-4A	46.	MCO-4.5B
4.	PO-4B	47.	MCO-5
5.	Hamilton Bend Spring	48.	MCO-6
		49.	MCO-6A
6.	APCO-1	50.	MCO-6B
7.	TW-1A	51.	TSCO-1
8.	LAO-B	52.	MCO-6.5A
9.	LAO-C	53.	MCO-6.5B
10.	LAO-0.3	54.	MCO-7
11.	LAO-0.6	55.	MCO-7A
12.	LAO-0.8	56.	MCO-7.5
13.	LAO-0.91	57.	MCO-8
14.	LAOR-1	58.	MCO-8.2
15.	LAOR-2	59.	MCO-9
16.	LAO-1	60.	MCO-9.5
17.	LAO-1.2	61.	MCO-12
18.	LADP-3	62.	MCO-13
19.	LADP-4	63.	CDBO-5
20.	LAO-1.8	64.	CDBO-6
21.	DP Spring	65.	CDBO-7
22.	LAO-2	66.	CDBO-8
23.	LAO-3	67.	CDBO-9
24.	LAO-3A	68.	CDBO-4
25.	LAO-4	69.	CDBO-1
26.	LAO-4.5	70.	CDBO-2
27.	LAO-4.5A	71.	CDBO-3
28.	LAO-4.5B	72.	PCO-1
29.	LAO-4.5C	73.	PCO-2
30.	LAO-5	74.	PCO-3
31.	LAO-6	75.	POTO-4A,B,C
32.	LAO-6A	76.	FCO-1
33.	LAO-6B	77.	WCO-1
34.	Basalt Spring	78.	WCO-2
35.	SCO-1	79.	WCO-3
36.	SCO-2	80.	LAOI(A)-1.1
37.	MCO-2	81.	Water Canyon Gallery
38.	MCO-3		
39.	MCO-3A	82.	LA Spring
40.	MCO-3B	83.	POTO-5A,B
41.	MCO-4	84.	POTM-1
42.	MCO-4A	85.	POTM-2
43.	MCO-4B	86.	POTM-3

Figure B-4.2-2. Locations of wells and springs near TA-21

Surface flow in DP Canyon, a tributary to Los Alamos Canyon that runs along the north side of TA-21, is generated by rainfall and snowmelt events. DP Spring located in DP Canyon (Figure B-4.2-2), discharges continuously, except for a dry period during the winter and spring of 1996.

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

B-4.2.1 LANL ER-SOP 2.01 Assessments

The Laboratory's RRES-RS Project has developed standard operating procedure (SOP) 2.01 to assess sediment transport and erosion concerns at SWMUs and other areas of concern (AOCs). The Laboratory has adopted the term "potential release sites" (PRSs) to refer to SWMUs and AOCs collectively. SOP 2.01 provides a basis for prioritizing and scheduling actions to control erosion of potentially contaminated soils at specific PRSs. The procedure is a two-part evaluation. Part A is a compilation of existing analytical data, site maps, and knowledge-of-process information. Part B is an assessment of the erosion/sediment transport potential at the site. Erosion potential is numerically rated from 1 to 100 using a matrix system. Sites that score below 40 to 60 have a low erosion potential. Part A of this assessment is initiated and completed by the Laboratory's Environmental Characterization and Remediation Group (RRES-ECR); Part B is completed by the Laboratory's Water Quality and Hydrology Group (RRES-WQH). A Surface Water Assessment Team, which includes representatives from RRES Division, the DOE, the DOE Oversight Bureau, and the New Mexico Environment Department (NMED), evaluates each completed assessment. If necessary, a best management practice (BMP) or other action is implemented based on the results of the assessment. The SOP 2.01 assessment for SWMU 21-011(k) is attached at the end of this appendix. The score for this SWMU is 52.2.

B-4.3 Groundwater

In the Los Alamos area, groundwater occurs as (1) water in shallow alluvium in some of the larger canyons, (2) intermediate perched groundwater (a perched groundwater body lies above a less permeable layer and is separated from the underlying aquifer by an unsaturated zone), and (3) the regional aquifer of the Los Alamos area. Numerous wells have been installed over the past several decades at the Laboratory and in the surrounding area to investigate the presence of groundwater in these zones and to monitor groundwater quality. The locations of the existing wells around TA-21 are shown in Figure B-4.2-2.

The Laboratory has formulated a comprehensive groundwater protection plan (LANL 1995, 50124) for an enhanced set of characterization and monitoring activities. The hydrogeologic work plan (LANL 1998, 59599) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by past and present Laboratory operations, such as those at TA-21.

B-4.3.1 Alluvial Waters

Intermittent and ephemeral streamflows in the canyons of the Pajarito Plateau have deposited alluvium that can be up to 100 ft thick. The alluvium in canyons that head on the Jemez Mountains is generally composed of sands, gravels, pebbles, cobbles, and boulders derived from the Tschicoma Formation and the Bandelier Tuff. The alluvium in canyons that head on the plateau is comparatively more fine-grained, consisting of clays, silts, sands, and gravels derived from the Bandelier Tuff. Saturated hydraulic conductivity of the alluvium typically ranges from 10^{-2} cm/s for a sand to 10^{-4} cm/s for a silty sand (Abeele et al. 1981, 6273).

In contrast to the underlying volcanic tuff and sediments, alluvium is quite permeable. Ephemeral runoff in some canyons infiltrates the alluvium until downward movement is impeded by the less permeable sediments or tuff and results in the buildup of a shallow alluvial groundwater body. Depletion by evapotranspiration and movement into the underlying rocks limit the horizontal and vertical extent of the alluvial water (Purtymun et al. 1977, 11846). The limited saturated thickness and extent of the alluvial groundwater preclude its use as a viable source of water for municipal and industrial needs. Lateral flow of the alluvial perched groundwaters is in an easterly, down-canyon direction.

Two saturated zones are known to exist in the alluvium of Los Alamos Canyon. The first is in the upper part of Los Alamos Canyon and extends eastward from the Los Alamos Reservoir to the vicinity of observation well LAO-4.5 west of State Road 4 (Figure B-4.2-2). The second is in the lower part of Los Alamos Canyon and extends from Basalt Spring to the Rio Grande (Figure B-4.2-2). In middle and upper Los Alamos Canyon, the saturated thickness in the alluvium varies seasonally from a few feet in the winter months to 25 ft in the spring and summer months, when recharge is the greatest (Environmental Protection Group 1994, 45363).

Alluvial groundwater has been found in DP Canyon at wells LAUZ-1 and LAUZ-2, which were installed for environmental investigations at TA-21. The wells were drilled to a depth of 15 ft. Alluvial water was encountered in both wells at approximately 4.5 ft below the surface. The saturated zone at the time was approximately 3.5 ft thick.

B-4.3.2 Intermediate Perched Waters

Two intermediate perched zones, one beneath the other, have been encountered in Los Alamos Canyon between TA-21 and the confluence with DP Canyon. The upper intermediate perched zone occurs within the Guaje Pumice Bed. This zone was encountered in boreholes LADP-3 (at 325 ft) and LAOI(A)-1.1 (at 295 ft) (Broxton and Eller 1995, 58207; Longmire et al. 1996, 54168) (Figure B-4.3-1). The saturated thickness of this zone decreases from west to east, ranging from 22 ft at LAOI(A)-1.1 to 5 ft at LADP-3.

A deeper intermediate perched zone was encountered in LAOI(A)-1.1 in the Puye Formation at about 317 ft. Possibly the same zone was also observed at a depth of 253 ft in the Puye Formation during development of water supply well O-4 (Stoker et al. 1992, 12017) (Figure B-4.2-1). However, no intermediate perched zone was found at LADP-3 in the approximately 19 ft of the Puye Formation that was penetrated. Another hole was drilled from the mesa top near the gated entrance to TA-21 to investigate the lateral extent of the Guaje Pumice intermediate perched zone under DP Mesa; the location of this well is approximately midway between LAOI(A)-1.1 and LADP-3. There was no perched water in the hole.

B-4.3.3 Regional Aquifer

The regional aquifer of the Los Alamos area is the only aquifer in the area capable of large-scale municipal water supply (Purtymun 1984, 6513). The surface of the regional aquifer rises westward from the Rio Grande within the Santa Fe Group into the lower part of the Puye Formation beneath the central and western parts of the Pajarito Plateau. The depths to groundwater below the mesa tops range from about 1,200 ft along the western margin of the plateau to about 600 ft at the eastern margin. Figure B-4.3-2 shows the location of wells and generalized water-level contours on top of the regional aquifer. The regional aquifer is typically separated from the alluvial groundwater and intermediate perched zone groundwater by 350–620 ft of tuff, basalt, and sediments (Environmental Protection Group 1993, 23249).

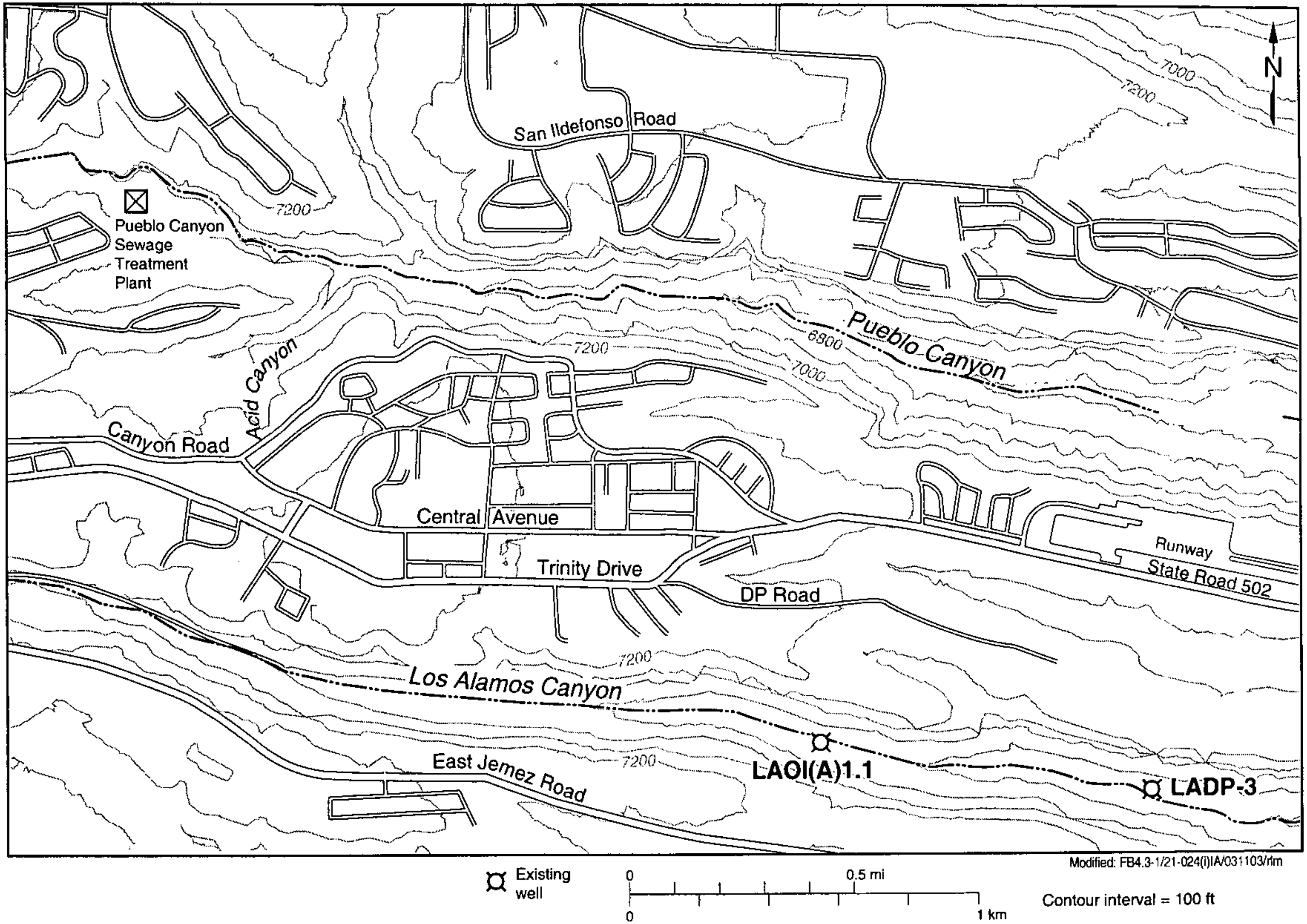


Figure B-4.3-1. Locations of wells LAOI(A)1.1 and LADP-3, where perched water has been encountered

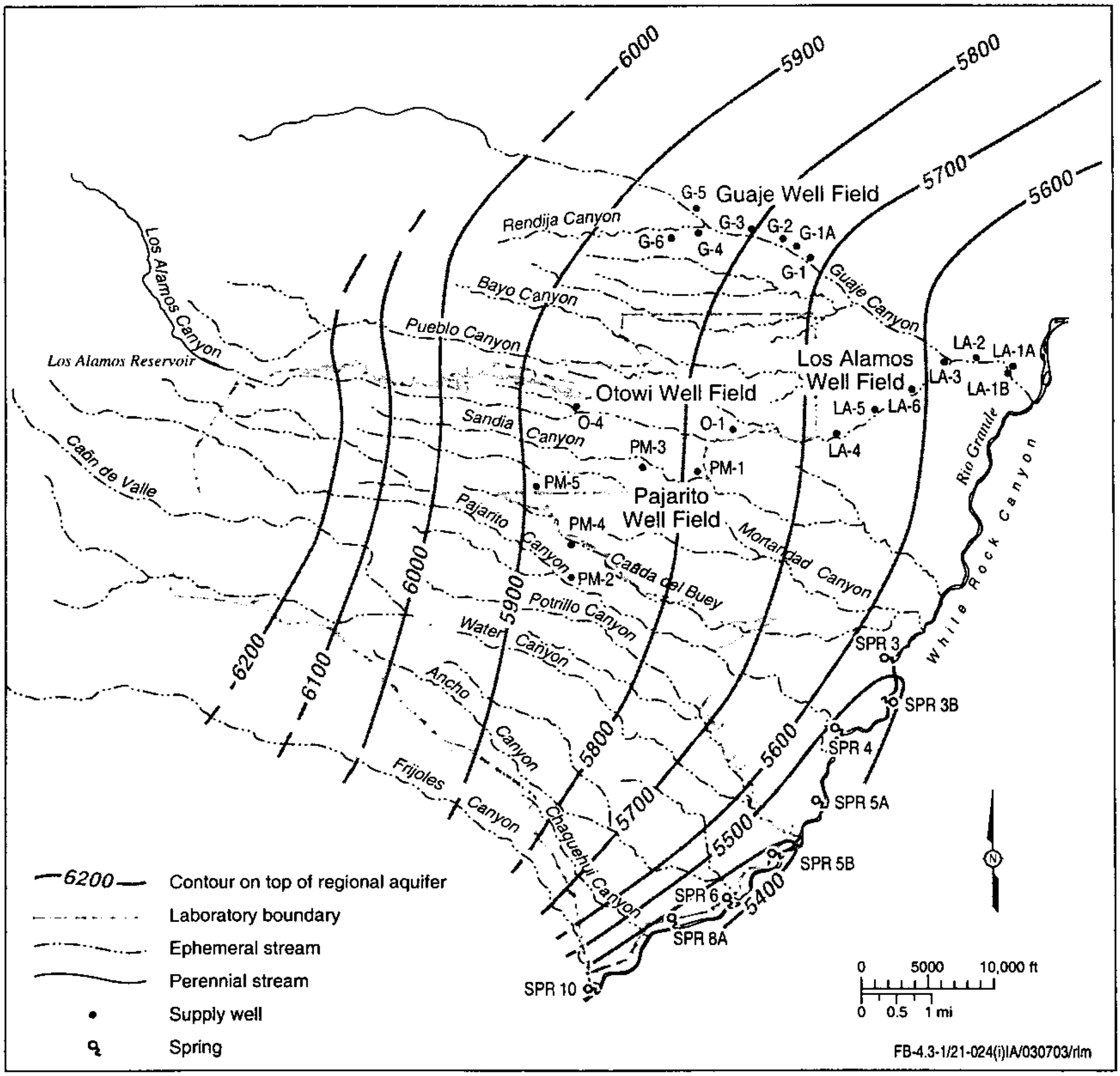


Figure B-4.3-2. Locations of wells and generalized water-level contours on top of the regional aquifer (modified from Purtymun 1984, 6513)

The regional aquifer beneath TA-21 is at an elevation of approximately 5,900 ft above sea level, or approximately 1,100 ft below the ground surface, and is located chiefly within sediments of the Puye and Tesuque Formations (Broxton and Eller 1995, 58207). Therefore, for mesa top sites at TA-21, more than 1,100 ft of tuff and volcaniclastic sediments separate the surface from the regional aquifer.

B-4.4 Vadose Zone

The region beneath the mesa surface and above the regional aquifer is referred to as the vadose zone. The source of moisture for the vadose zone is precipitation; however, much of it runs off, evaporates, or is absorbed by plants. The subsurface vertical movement of the remaining water (often referred to as recharge) is influenced by properties and conditions of the vadose zone.

Two properties of rock that influence fluid flow are the degree of welding and devitrification; both are effects of prolonged presence of residual gases and high temperatures when the rock was deposited. Because different units of the Bandelier Tuff were deposited at different temperatures and because individual units were laid out in variable thicknesses over different landscapes, cooling was not uniform. Consequently, welding varies spatially, both between and within separate depositional layers. Welded tuffs tend to be more fractured than nonwelded tuffs. While water moves slowly through the unsaturated tuff matrix, it can move relatively rapidly through fractures if nearly saturated conditions exist (Hollis et al. 1997, 63131). Modeling studies indicate that when fractures disappear at contacts between stratigraphic subunits, when fracture fills are encountered, or when coatings are disturbed or broken, moisture is absorbed into the matrix. Thus, fractures may provide conduits for fluid flow but only in discrete, disconnected intervals of the subsurface. Because they are open to the passage of both air and water, fractures can have both wetting and drying effects, depending on the relative abundance of water in the fractures and matrix. Devitrification is vapor-phase crystallization. The variability of welding and crystallization in the Tshirege Member produces recognizable vertical variations in its properties such as density, porosity, hardness, composition, color, and surface weathering patterns.

As a rule, the Bandelier Tuff is very dry and does not readily transmit moisture. Most of the pore spaces in the tuff are of capillary size and have a strong tendency to hold water against gravity by surface-tension forces. Moisture content is generally more variable near the top of the mesa than in the central portions because of variations in temperature, humidity, and evapotranspiration. Vegetation is very effective at removing moisture near the surface. During the summer rainy season when rainfall is highest, near-surface moisture content is variable because of higher rates of evaporation and of transpiration by vegetation, which flourishes during this time.

The various units of the Bandelier Tuff tend to have relatively high porosities. Porosity ranges from 30% to 60% by volume, generally decreasing for more highly welded tuff. Permeability varies for each cooling unit of the Bandelier Tuff. Values for the Tshirege Member of the Bandelier Tuff at TA-54, determined using in situ vacuum and water injection tests and laboratory analyses of cores, range from 0.1 to 0.6 darcies. No specific TA-21 data are available. Moisture content of native tuff is low, generally less than 5% by volume throughout the profile. Previous studies at TA-21 where liquid has been added have shown that moisture content changes little below 40 ft. The specific retention of the tuff ranges from 18% to 38% by volume, indicating a considerable field capacity for holding moisture (Purtymun and Stoker 1990, 7508; Kearl et al. 1986, 15368).

Hydraulic conductivity is dependent on the porous medium and the fluid. Saturated tuff has a hydraulic conductivity in the range of 0.02 cm/hr for welded tuff to 1.12 cm/hr for nonwelded tuff. The hydraulic conductivity of unsaturated tuff varies with moisture content and has values two to five orders of magnitude lower than saturated tuff (Purtymun and Stoker 1990, 7508).

The moisture characteristic curve is important in unsaturated porous media in relating water content to suction, tension, or negative pressure head. However, tests have only been done on crushed Bandelier Tuff; the applicability of these results to intact tuff remains in question.

B-5.0 ECOLOGICAL RESOURCES

Biological resource field surveys were conducted within OU 1106 (TA-21) and OU 1078 (TA-1) for compliance with the Federal Endangered Species Act of 1973; New Mexico Wildlife Conservation Act;

Executive Order 11990, "Protection of Wetlands"; Executive Order 11988, "Floodplain Management"; CFR Title 10 Part 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements"; and DOE Order 5400.1, "General Environmental Protection Program" (Bennett 1996, 58236).

The Pajarito Plateau is a biologically diverse area. This diversity is due partly to the dramatic 5,000-ft elevation gradient from the Rio Grande to the Jemez Mountains (a distance of 12 mi) and partly to the many steep canyons that dissect the area. The pronounced east-west canyon and mesa orientations, with concomitant differences in soils, moisture, and solar radiation, produce an interlocking finger effect among ecological life zones, resulting in many transitional overlaps of plant and animal communities within small areas.

B-5.1 Flora

The elevation of TA-21 ranges from 6,680 to 7,220 ft above mean sea level. The topography is varied, ranging from steep canyon walls or cliffs to gently sloping mesa tops. Mesa tops are characterized by development and disturbance. Canyon areas are relatively free from development and disturbance.

TA-21 is primarily a mesa top site in a developed, industrialized area. The preurban natural overstory of the mesa was a ponderosa pine community; no overstory now exists at the site. The understory currently present includes grasses and forbs commonly found in disturbed soils: western wheat grass, Canada bluegrass, bottlebrush squirrel tail, cheat grass, sand dropseed, summer cypress, prickly lettuce, and horseweed. It is similar to the understory that existed before the site became industrialized.

The overstory of Los Alamos Canyon is described as a ponderosa pine forest with a variety of shrubs. The understory for Los Alamos Canyon is characterized by numerous grasses such as mountain muhly, brome grass, bluegrass and blue grama, and a variety of composites and other forbs.

The overstory of DP Canyon is a ponderosa pine forest with a dominant shrub species of Gambel's oak and codominance of mountain mahogany. The understory of DP Canyon is characterized by numerous grasses (e.g., brome grass, mountain muhly, and bluegrass), upland sedges, and a variety of forbs.

B-5.2 Fauna

The mesa top provides limited habitat for biota and does not contain sensitive habitats. Threatened or endangered species are not present on the mesa top or in Los Alamos and DP Canyons, according to Bennett (1996, 58236). However, more recent evaluations indicate that the Mexican spotted owl core habitat may occur in portions of Los Alamos and DP Canyons.

B-5.3 Floodplains and Wetlands

Los Alamos Canyon has stretches of riverine and palustrine wetlands. There is a palustrine wetland just south of the west end of DP Mesa in Los Alamos Canyon and a riverine wetland just south of the gated entrance to TA-21 in Los Alamos Canyon. Floodplains also exist within Los Alamos Canyon.

B-6.0 CULTURAL RESOURCES

Pursuant to the National Historic Preservation Act of 1966 (amended), a cultural resource survey was conducted at TA-21 (formerly OU 1106) during the summer of 1991 (McGehee et al. 1992, 28310). There are no archeological sites in the TA-21 area that are eligible for inclusion in the National Register of Historic Places.

B-7.0 REFERENCES

The following list includes all references cited in this appendix. Parenthetical information following each reference provides the author, publication date, and the ER record identification (ER ID) number. This information also is included in the citations in the text. ER ID numbers are assigned by the Laboratory's RRES-RS Records Processing Facility (RPF) are used to locate copies of the actual documents at the RPF and, where applicable, with the ER Project reference library titled "Reference Set for Material Disposal Areas, Technical Area 21".

Copies of the reference library are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Area Office; United States EPA, Region VI; and RRES-RS. This library is a living collection of documents that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this document. However, documents previously submitted to the administrative authority are not included.

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Los Alamos National Laboratory

Environment, Safety & Health Division
ESH-18 Water Quality & Hydrology Group

Surface Water Assessment Erosion Matrix for PRS 21-011(k)

CRITERIA EVALUATED	Value	Erosion/Sediment Transport Potential Low 0.1	Medium 0.5	High 1.0	Calculated Score
Site Setting (43)					
On mesa top	1	Defined based on topographic setting			
Within bench of canyon	4				
Within the canyon floodplain but not watercourse	13				13.0
Within bottom of canyon channel in watercourse	17				
Estimated % ground and canopy cover	13	>75%	25-75%	<25%	6.5
Slope	13	0-10%	10-30%	>30%	6.5
Surface Water Factors-Run-off (46)					
Visible evidence of runoff discharging? (Yes/No)	5	If no, score of 0 for runoff section.			5.0
		If yes, score 5 and proceed with section.			
Where does runoff terminate?	19	Other	Bench Setting	Drainage/Wetland	19.0
Has runoff caused visible erosion? (Yes/No)	22	Sheet	Rill	Gully	2.2
		If no, score as 0. If yes, calculate as appropriate.			
Surface Water Factors-Run-on (11)					
Structures adversely affecting run-on (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
Current operations adversely impacting (Yes/No)	4	If yes, score as 4. If no, score as 0.			0.0
Natural drainages onto site (Yes/No)	7*	If yes, score as 7. If no, score as 0.			0.0
**Select either structures or natural drainages.*					
MAX. POSSIBLE EROSION MATRIX SCORE:	**100**			**Total Score**	52.2**

REVISED PART B

** Indicates BMPs in place. Erosion potential without BMPs may be greater.

Report Printed 10/2/2003 9:15:01 AM.

Los Alamos National Laboratory
SURFACE WATER
SITE ASSESSMENT

Revised Part B. Please discard previous.

SITE INFORMATION

1a) PRS Number 21-011(k) **1b) Structure Number** **1c) FMU Number** ER

2. Date/Time (M/D/Y H:M am/pm) 9/10/2003

SITE SETTING (check all that apply)

3. ○ **On mesa top (a).** ◉ **In the canyon floor, but not in an established channel (c).**

◉ **Within a bench of a canyon (b).** ○ **Within established channel in the canyon floor (d).**

Explanation: Upper slope is where outfall is located. Discharges had previously reached lower canyon floor. Remediation and restoration completed.

4. Estimated ground and/or canopy cover at site: (deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.)

(illustration) (a) (b) (c)

Estimated % of ground/canopy cover: ○ 0% to 25% ◉ 25% to 75% ○ 75% to 100%

Explanation: Grass, shrubs, rock outcrop, straw mulch exist with recent hydromulching and replanting of shrub oak and pondersoa pines.

5. Steepest slope at the area impacted:

(a) (b) (c)

○ Less than 10% ◉ 10% to 30% ○ 30% and greater

Explanation: Upper section steeper with gradual slope towards canyon bottom.

RUNOFF FACTORS

Y / N

☑ ☐ **6. Is there visible evidence of runoff discharging from site? If yes, answer a) - c) below:**

☑ ☐ 6a) Is runoff channelized? If yes, describe: ○ Man-made channel. ◉ Natural channel.

Explanation: Upper section has BMPs to divert run-on to site. Lower section has excavated area that directs flow towards the east.

RUNOFF FACTORS, CONT'D

6b) Where does evidence of runoff terminate?

- (●) **Drainage or wetland (name)** DP Canyon
- ( ) **Within bench of canyon setting (name)**
- ( ) **Other (i.e., retention pond, meadow, mesa top)**

Explanation: Runoff from large storm events terminate in DP Canyon. Runoff from normal storm events would remain on site.

Y / N

☑ ☐ 6c) Has runoff caused visible erosion at the site? If yes, explain below: (●) Sheet ( ) Rill ( ) Gully

Explanation: Lower section westside has BMPs that mitigates erosion. East side of site is showing early signs of channelization.

RUN-ON FACTORS

Please rate the potential for storm water to run on to this site: **(Check EITHER #7 or #9)**

☐ ☑ **7.** Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation: None

☐ ☑ **8.** Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation: Fire hydrant located south of upper secton along roadside. Discharges from testing should be diverted away from site.

☐ ☑ **9.** Are natural drainage patterns directing stormwater onto site?

Explanation: None

ASSESSMENT FINDING:

☑ ☐ **10. Based on the above criteria and the assessment of this site, does soil erosion potential exist? (REFER TO EROSION POTENTIAL MATRIX.)**

S. Veenis

11. Signature of Water Quality/Hydrology Representative

SV Initials of independent reviewer.

Check here when information is entered in database: ☑

This page is for ESH-18 notes, recommendations, and photos.

Y / N

12. a) ○ ◉ Is there visible trash/debris on the site?

b) ○ ◉ Is there visible trash/debris in a watercourse?

Description of existing BMPs:

Site restoration was completed during summer of 2003. Extensive BMPs were installed including run-on diversion, sediment retention (wattles, log check dams), hydromulching, regrading and vegetative planting.

◉ ○ Are BMPs being properly maintained? If no, describe in "Other Internal Notes."

◉ ○ Are BMPs effectively keeping sediment in place and reducing erosion potential?

OTHER INTERNAL NOTES:

Site Assessment re-calculated due to site remediation and restoration activities. Original score of 72 was completed on 5/22/1997 11:40:00 AM.

Appendix C

Results of Quality Assurance/Quality Control Activities

APPENDIX C RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

C-1.0 SUMMARY OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

This appendix presents an assessment of the quality of analytical results obtained during activities completed in 1993, 2001 and 2003 under the Voluntary Corrective Measures (VCM) Plan for SWMU 21-011(k) at Technical Area (TA) 21. This project consisted of the excavation and removal of the discharge pipe that ran beneath Delta Prime (DP) Road, from wastewater holding tanks 21-112 and -113 within Material Disposal Area (MDA) T to the outfall at the southern edge of DP Canyon and removal of contaminated soil from the slope below the outfall. The discharge pipe was the inactive National Pollution Discharge Elimination System (NPDES)-permitted outfall EPA 050050 for treated industrial wastewater from the former wastewater treatment plants (WWTPs) (Buildings 21-35 and -157) at TA-21. The effluent was process wastewater generated from the purification of plutonium and contained a variety of radioactive and chemical constituents. SWMU 21-011(k) received industrial effluent from the WWTP in Building 21-35 from 1952 until 1967; it received industrial effluent from the WWTP in Building 21-257 (that replaced the treatment plant at Building 21-35) from 1967 until the early 1990s, when the outfall was left in place. Table C-1.0-1 presents the analytical suites analyzed for the samples collected at SWMU 21-011(k) during this investigation. One hundred thirty-two samples were collected for this investigation.

Table C-1.0-1
Analytical Methods for Samples Collected at SWMU 21-011(k)

Chemical Category	Analyte List	Analytical Method
Inorganic chemicals	Target analyte metals	SW-846 Method 6010 SW-846 Method 7471
	Perchlorate	EPA* Method 300
Organic chemicals	Volatile organic compounds	SW-846 Method 8260
	Polychlorinated biphenyls	SW-846 Method 8080
	Pesticides	SW-846 Method 8081
Radionuclides	Americium-241	HASL-300
	Gamma spectroscopy	EPA Method 901.1
	Isotopic plutonium	HASL-300
	Isotopic thorium	HASL-300
	Isotopic uranium	HASL-300
	Strontium-90	EPA Method 905.0
	Tritium	EPA Method 906.0

*EPA = U.S. Environmental Protection Agency.

Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the Laboratory guidance (LANL 1996, 54609) and the analytical services statements of work (SOWs) for contract laboratories (LANL 1995, 49738; LANL 2000, 71233). The results of the QA/QC activities were used to estimate accuracy, bias, and precision of the analytical measurements. QC samples (e.g., method blanks, laboratory control samples [LCSs], matrix spikes, and duplicates) were used to assess accuracy and bias. Internal standards, surrogates, and tracers were also used to assess accuracy. The type and frequency of QC analyses are described in the analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233). Other QC factors, such as sample preservation and holding times, were also assessed. The requirements for sample preservation and holding times are provided in

LANL-ER-SOP-1.02, Rev. 1, "Sample Containers and Preservation". The applicable procedures to perform the validation are the data analysis and assessment SOPs (LANL-ER-SOP 15.01-15.07).

C-1.1 Samples Collected

A summary of the samples collected for analyses is presented in Table C-1.1-1.

Table C-1.1-1
Summary of All Samples Analyzed at SWMU 21-011(k)

Request No.	Collection Date	Sample ID	Analytical Suite	Analytical Laboratory
Inorganic Chemicals				
8446R	March 2001	MD21-01-0034	Target analyte metals SW-846 Method 6010 Mercury SW-846 Method 7471	Paragon Analytics, Inc.
8447R	March 2001	MD21-01-0034	Perchlorate EPA Method 300	General Engineering
Organic Chemicals				
8445R	March 2001	MD21-01-0034	Volatile organic compounds SW-846 Method 6020	Paragon Analytics, Inc.
8445R	March 2001	MD21-01-0034	Polychlorinated biphenyls SW-846 Method 8080	Paragon Analytics, Inc.
8445R	March 2001	MD21-01-0034	Pesticides SW-846 Method 8081	Paragon Analytics, Inc.
Radionuclides				
15379	July 1993	AAA4009	Americium-241 Isotopic plutonium Isotopic thorium Isotopic uranium HASL-300 Gamma spectroscopy EPA Method 901.1 Tritium EPA Method 906.0	Rust Geotech
8448R	March 2001	MD21-01-0030 MD21-01-0034	Isotopic plutonium HASL-300 Gamma spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	Paragon Analytics, Inc.

Table C-1.1-1 (continued)

Request No.	Collection Date	Sample ID	Analytical Suite	Analytical Laboratory
1699S	March 2003	MD21-03-49654 MD21-03-49655 MD21-03-49656 MD21-03-49663 MD21-03-49664 MD21-03-49665 MD21-03-49666 MD21-03-49667 MD21-03-49668 MD21-03-49669 MD21-03-49670 MD21-03-49671 MD21-03-49672 MD21-03-49673 MD21-03-49675 MD21-03-49676 MD21-03-49677 MD21-03-49678 MD21-03-49679 MD21-03-49680 MD21-03-49681 MD21-03-49683 MD21-03-49687 MD21-03-49699	Americium-241 Isotopic plutonium HASL-300 Gamma spectroscopy (EPA Method 901.1) Strontium-90 (EPA Method 905.0)	American Radiation Services - Primary
1757S	May 2003	MD21-03-51509 MD21-03-51510 MD21-03-51511 MD21-03-51512 MD21-03-51513 MD21-03-51514 MD21-03-51515 MD21-03-51516 MD21-03-51517 MD21-03-51518 MD21-03-51519 MD21-03-51520 MD21-03-51521 MD21-03-51522 MD21-03-51523 MD21-03-51524 MD21-03-51525 MD21-03-51526 MD21-03-51527 MD21-03-51528 MD21-03-51529 MD21-03-51530 MD21-03-51531 MD21-03-51532 MD21-03-51533 MD21-03-51534 MD21-03-51535	Americium-241 Isotopic plutonium HASL-300 Gamma spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	American Radiation Services - Primary

Table C-1.1-1 (continued)

Request No.	Collection Date	Sample ID	Analytical Suite	Analytical Laboratory
1757S (cont.)	May 2003	MD21-03-51536 MD21-03-51537 MD21-03-51538 MD21-03-51539 MD21-03-51540 MD21-03-51541 MD21-03-51542 MD21-03-51543 MD21-03-51544 MD21-03-51545 MD21-03-51546 MD21-03-51569 MD21-03-51570 MD21-03-51571 MD21-03-51572 MD21-03-51573	Americium-241 Isotopic plutonium HASL-300 Gamma spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	American Radiation Services - Primary
1758S	May 2003	MD21-03-51547 MD21-03-51548 MD21-03-51549 MD21-03-51550 MD21-03-51551 MD21-03-51552 MD21-03-51553 MD21-03-51554 MD21-03-51555 MD21-03-51556 MD21-03-51557 MD21-03-51558 MD21-03-51559 MD21-03-51560 MD21-03-51561 MD21-03-51562 MD21-03-51563 MD21-03-51564 MD21-03-51565 MD21-03-51566 MD21-03-51567 MD21-03-51568	Americium-241 Isotopic plutonium HASL-300 Gamma spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	American Radiation Services - Primary RECRA Labnet
1759S	May 2003	MD21-03-51574 MD21-03-51575 MD21-03-51576 MD21-03-51577 MD21-03-51634	Americium-241 Isotopic plutonium HASL-300 Gamma spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	American Radiation Services - Primary

Table C-1.1-1 (continued)

Request No.	Collection Date	Sample ID	Analytical Suite	Analytical Laboratory
1760S	May 2003	MD21-03-51578 MD21-03-51579 MD21-03-51580 MD21-03-51581 MD21-03-51582 MD21-03-51583 MD21-03-51584 MD21-03-51585 MD21-03-51586 MD21-03-51587 MD21-03-51588 MD21-03-51589 MD21-03-51590 MD21-03-51591 MD21-03-51592 MD21-03-51593 MD21-03-51594 MD21-03-51595 MD21-03-51596 MD21-03-51597 MD21-03-51598 MD21-03-51599 MD21-03-51600 MD21-03-51601 MD21-03-51602 MD21-03-51603 MD21-03-51604 MD21-03-51635 MD21-03-51636 MD21-03-51637 MD21-03-51638	Americium-241 Isotopic plutonium HASL-300 Gamma Spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	American Radiation Services - Primary
1761S	May 2003	MD21-03-51605 MD21-03-51606 MD21-03-51607 MD21-03-51608	Americium-241 Isotopic plutonium HASL-300 Gamma spectroscopy EPA Method 901.1 Strontium-90 EPA Method 905.0	American Radiation Services - Primary

Summaries of the analytical methods for inorganics, radionuclides, and organic analytes are provided in the following sections. The contract-required detection limit (CRDL) for each analyte listed is provided in Appendix D-1.0. These limits are also detailed in the analytical services SOWs (ER IDs 49738 and 71233).

C-2.0 RADIOCHEMICAL ANALYSES

One hundred thirty-two samples were analyzed for radionuclides by the methods listed in Table C-2.0-1.

Table C-2.0-1
Analytical Methods for Radionuclides

Analytical Method	Analytical Description	Target Compound List
HASL-300	Americium-241	Analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233)
EPA Method 901.1	Gamma spectroscopy	
EPA Method 906.0	Tritium	
HASL-300	Isotopic plutonium	
HASL-300	Isotopic uranium	
HASL-300	Isotopic thorium	
EPA Method 905.0	Strontium-90	

Radionuclides with reported values less than the minimum detectable activity (MDA) were qualified as not detected (U). The radionuclides qualified as not detected (U) based on the MDA are summarized in Table C-3.3-1. Each radionuclide result was also compared with the corresponding 1-sigma total propagated uncertainty (TPU). If the result was not greater than three times the total propagated uncertainty, it was qualified as not detected (U). Radionuclides qualified as not detected (U) based on the 1-sigma TPU are also presented in Table C-3.3-1. Radionuclides qualified as rejected (R) are presented in Table C-3.3-2.

C-2.1 Discussion of Radiochemical Quality Assurance/Quality Control Samples

Precision and bias of radiochemical analyses performed at off-site fixed laboratories were assessed using matrix spike samples, LCSs, method blanks, duplicates, and tracers.

An LCS is a known matrix that has been spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. The LCS serves as a monitor of the overall performance of each step during the analysis, including sample extraction and injection.

The method blank is an analyte-free matrix to which all reagents are added in the same volumes and proportions as those used in the environmental sample processing; it is prepared and analyzed in the same manner as the corresponding environmental samples. The method blanks are used as a measurement of bias and potential cross-contamination during sample preparation and analysis. For analytes detected in the method blank, results are regarded as not detected if the sample results are less than or equal to 5 times the concentration of the analyte in the method blank (EPA 1994, 48639).

Accuracy for radionuclide chemical analyses is also assessed using matrix spike samples. A matrix spike sample is designed to provide information about the effect of each sample matrix on the sample preparation procedures and analytical technique.

Analysis of laboratory duplicate samples allowed assessment of the precision of the radionuclide chemical analyses.

Analysis of laboratory tracers allowed assessment of the accuracy of strontium-90 samples.

C-3.0 DATA VALIDATION

The following tables present the data qualifiers applied to each analyte for a given sample. The data qualifiers are defined in Table C-3.0-1. Table C-3.1-1 (inorganic data quality), Table C-3.2-1 (organic data quality), and Tables C-3.3-1 and C-3.3-2 (radionuclide data quality) summarize the qualifiers for this data set.

Table C-3.0-1
Explanation of Data Qualifiers Used in the Data Validation Procedure

Qualifier	Explanation
U	The analyte was analyzed for but not detected. Reported value is the sample-specific estimated quantitation limit or detection limit.
J	The reported value should be regarded as estimated.
J+	The reported value should be regarded as estimated and biased high.
J-	The reported value should be regarded as estimated and biased low.
UJ	The analyte was analyzed for but not detected. Reported value is an estimate of the sample-specific quantitation limit or detection limit.
UJ+	The analyte was analyzed for but not detected. Reported value is an estimate of the sample-specific quantitation limit or reporting limit with a high bias.
UJ-	The analyte was analyzed for but not detected. Reported value is an estimate of the sample-specific quantitation limit or reporting limit with a low bias.
R	The sample results were rejected because of serious deficiencies in the ability to analyze the sample and meet QC criteria; presence or absence cannot be verified.

C-3.1 Inorganic Data Review

The analytical results for inorganic samples collected at SWMU 21-011(k) are discussed below. See Table C-3.1-1 for more details.

Table C-3.1-1
Inorganic Chemical Data Quality Evaluation for SWMU 21-011(k)

Request No.	Location ID	Sample ID	Analyte	Explanation
8446R	21-11205	MD21-01-0034	Antimony	The reporting limit for this analyte is estimated (UJ) because the analyte was recovered below the lower acceptance level but greater than 30% in the associated spike sample.
8446R	21-11205	MD21-01-0034	Cadmium	The result for this analyte is estimated (J) because the result was less than the PQL but greater than the MDL.

Request 8446R. Paragon Analytics, Inc. analyzed one sample for TAL metals. No target analytes were detected in the method blank. The reporting limit for antimony is estimated (UJ) because the analyte was recovered below the lower acceptance level but greater than 30% in the associated spike sample. The holding times were met. The result for cadmium is estimated (J) because the result was less than the practical quantitation limit (PQL), but greater than the method detection limit (MDL).

Request 8447R. General Engineering analyzed one sample for perchlorate. No target analytes were detected in the method blank. The holding times were met.

C-3.2 Organic Data Review

The analytical results for organic samples collected at SWMU 21-011(k) are discussed below. See Table C-3.2-1 for more details.

Table C-3.2-1
Organic Chemical Data Quality Evaluation for SWMU 21-011(k)

Request No.	Location ID	Sample ID	Analytical Suite	Analyte	Explanation
8445R	21-11205	MD21-01-0034	Pesticides	DDT[4,4'-], endrin aldehyde	The reporting limits for these analytes are estimated (UJ) because the associated percent relative standard deviation or percent difference exceeded criteria in the initial or continuing calibration standards.

Request 8445R. Paragon Analytics, Inc. analyzed one sample for VOCs, PCBs, and pesticides.

- VOCs—No target analytes were detected in the blank. All initial and continuing calibration verifications met acceptance criteria. All surrogate recoveries met acceptance criteria. The holding times were met.
- PCBs—No target analytes were detected in the blank. All initial and continuing calibration verifications met acceptance criteria. All surrogate recoveries met acceptance criteria. The holding times were met.
- Pesticides—No target analytes were detected in the blank. The reporting limits for DDT[4,4'-] and endrin aldehyde are estimated (UJ) because the associated percent relative standard deviation or percent difference exceeded criteria in the initial or continuing calibration standards. All surrogate recoveries met acceptance criteria. The holding times were met.

C-3.3 Radionuclide Data Review

Radionuclides qualified as not detected (U) because the sample concentrations were less than the MDA and those qualified because the associated sample concentration was less than 3 times the 1-sigma TPU are summarized in Table C-3.3-1. These radionuclides are not repeated in the text below. Rejected samples are summarized in Table C-3.3-2.

The analytical results for radionuclide samples collected at SWMU 21-011(k) are discussed below.

Request 8448R. Paragon Analytics, Inc. analyzed one sample for radionuclides. The result for cesium-134 is rejected (R) because the spectral interference prevents positive identification of the analyte; refer to Table C-3.3-2 for details.

Request 1757S. American Radiation Services analyzed 43 samples for radionuclides. The results for europium-152 are not detected (U) because the results were less than 5 times the concentration detected in the method blank.

Table C-3.3-1
Radionuclide Data Quality Evaluation for SWMU 21-011(k)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
8448R	21-11205	MD21-01-0034	Gamma spectroscopy	Cesium-134, Cobalt-60, Europium-152, Ruthenium-106, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
8448R	21-11205	MD21-01-0034	Gamma spectroscopy	Uranium-235	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
15379	21-01591	AAA4009	Isotopic uranium	Uranium-235	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the total propagated uncertainty (TPU).
1699S	21-03-21382	MD21-03-49655	Gamma spectroscopy	Cesium-134, Europium-152	The result for these analytes is not detected (U) because the sample concentration was less than 3 times the TPU.
1699S	21-03-21387 21-03-21387 21-03-21390 21-03-21391 21-03-21392 21-03-21394	MD21-03-49665 MD21-03-49666 MD21-03-49671 MD21-03-49673 MD21-03-49675 MD21-03-49679	Isotopic uranium	Uranium-235	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1699S	21-03-21388	MD21-03-49668	Gamma spectroscopy	Cobalt-60	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1699S	21-03-21390	MD21-03-49671	Gamma spectroscopy	Europium-152, Ruthenium-106	The result for these analytes is not detected (U) because the sample concentration was less than 3 times the TPU.
1699S	21-03-21392	MD21-03-49675	Strontium-90	Strontium-90	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1699S	21-03-21393	MD21-03-49677	Gamma spectroscopy	Europium-152	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1699S	21-03-21395	MD21-03-49681	Gamma spectroscopy	Ruthenium-106	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1699S	21-03-21395	MD21-03-49699	Gamma spectroscopy	Sodium-22	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1699S	21-03-21381 21-03-21382 21-03-21386 21-03-21386 21-03-21387 21-03-21387 21-03-21388 21-03-21389 21-03-21390 21-03-21391 21-03-21392 21-03-21392 21-03-21393 21-03-21393 21-03-21394 21-03-21394 21-03-21396 21-03-21398	MD21-03-49654 MD21-03-49656 MD21-03-49663 MD21-03-49664 MD21-03-49665 MD21-03-49666 MD21-03-49667 MD21-03-49670 MD21-03-49672 MD21-03-49673 MD21-03-49675 MD21-03-49676 MD21-03-49677 MD21-03-49678 MD21-03-49679 MD21-03-49680 MD21-03-49683 MD21-03-49687	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1699S	21-03-21382 21-03-21388 21-03-21389	MD21-03-49655 MD21-03-49668 MD21-03-49669	Gamma spectroscopy	Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1699S	21-03-21390 21-03-21395	MD21-03-49671 MD21-03-49681	Gamma spectroscopy	Cesium-134, Cobalt-60, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1699S	21-03-21395	MD21-03-49699	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1699S	21-03-21381 21-03-21386 21-03-21386 21-03-21387 21-03-21388 21-03-21390 21-03-21390 21-03-21393 21-03-21394 21-03-21395	MD21-03-49654 MD21-03-49663 MD21-03-49664 MD21-03-49665 MD21-03-49668 MD21-03-49671 MD21-03-49672 MD21-03-49678 MD21-03-49679 MD21-03-49699	Isotopic plutonium	Plutonium-238	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.
1699S	21-03-21390 21-03-21390 21-03-21393	MD21-03-49671 MD21-03-49672 MD21-03-49678	Strontium-90	Strontium-90	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.
1699S	21-03-21396	MD21-03-49683	Isotopic uranium	Uranium-235	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1757S	21-22201 21-22204 21-22205 21-22206 21-22207 21-22209 21-22210 21-22211 21-22213	MD21-03-51512 MD21-03-51515 MD21-03-51516 MD21-03-51517 MD21-03-51518 MD21-03-51520 MD21-03-51521 MD21-03-51522 MD21-03-51524	Gamma spectroscopy	Europium-152	The results for this analyte are not detected (U) because the sample concentrations were less than 5 times the concentration detected in the method blank.
1757S	21-22204 21-22205 21-22207 21-22215 21-22217 21-22222 21-22230 21-22201 21-22198	MD21-03-51515 MD21-03-51516 MD21-03-51518 MD21-03-51526 MD21-03-51528 MD21-03-51533 MD21-03-51541 MD21-03-51569 MD21-03-51572	Isotopic uranium	Uranium-235	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1757S	21-22222 21-22225 21-22233 21-22200	MD21-03-51533 MD21-03-51536 MD21-03-51544 MD21-03-51570	Gamma spectroscopy	Sodium-22	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1757S	21-22224 21-22225	MD21-03-51535 MD21-03-51536	Gamma spectroscopy	Europium-152	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1757S	21-22204	MD21-03-51515	Gamma spectroscopy	Cobalt-60	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1757S	21-22207	MD21-03-51518	Gamma spectroscopy	Ruthenium-106	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1757S	21-22200 21-22203 21-22204	MD21-03-51511 MD21-03-51514 MD21-03-51515	Strontium-90	Strontium-90	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1757S	21-22198 21-22199 21-22200 21-22201 21-22202 21-22203 21-22205 21-22206 21-22208 21-22209 21-22210 21-22211 21-22212 21-22213	MD21-03-51509 MD21-03-51510 MD21-03-51511 MD21-03-51512 MD21-03-51513 MD21-03-51514 MD21-03-51516 MD21-03-51517 MD21-03-51519 MD21-03-51520 MD21-03-51521 MD21-03-51522 MD21-03-51523 MD21-03-51524	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1757S	21-22214 21-22215 21-22216 21-22217 21-22218 21-22219 21-22220 21-22221 21-22223 21-22224 21-22226 21-22227 21-22228 21-22229 21-22230 21-22231 21-22232 21-22234 21-22201 21-22199 21-22198 21-22235	MD21-03-51525 MD21-03-51526 MD21-03-51527 MD21-03-51528 MD21-03-51529 MD21-03-51530 MD21-03-51531 MD21-03-51532 MD21-03-51534 MD21-03-51535 MD21-03-51537 MD21-03-51538 MD21-03-51539 MD21-03-51540 MD21-03-51541 MD21-03-51542 MD21-03-51543 MD21-03-51545 MD21-03-51569 MD21-03-51571 MD21-03-51572 MD21-03-51573	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1757S	21-22204	MD21-03-51515	Gamma spectroscopy	Cesium-134, Ruthenium-106, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1757S	21-22207	MD21-03-51518	Gamma spectroscopy	Cesium-134, Cobalt-60, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1757S	21-22222 21-22225 21-22233	MD21-03-51533 MD21-03-51536 MD21-03-51544	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1757S	21-22235	MD21-03-51546	Gamma spectroscopy	Cobalt-60, Ruthenium-106, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1757S	21-22200	MD21-03-51570	Gamma spectroscopy	Cesium-134, Ruthenium-106	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1757S	21-22201 21-22206 21-22200	MD21-03-51512 MD21-03-51517 MD21-03-51570	Strontium-90	Strontium-90	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.
1757S	21-22205 21-22233	MD21-03-51516 MD21-03-51544	Isotopic plutonium	Plutonium-238	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.
1757S	21-22209 21-22227	MD21-03-51520 MD21-03-51538	Isotopic uranium	Uranium-235	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.
1758S	21-22244 21-22246	MD21-03-51555 MD21-03-51557	Gamma spectroscopy	Europium-152	The results for this analyte are not detected (U) because the sample concentrations were less than 5 times the concentration detected in the method blank.
1758S	21-22239 21-22242 21-22245 21-22254	MD21-03-51550 MD21-03-51553 MD21-03-51556 MD21-03-51565	Gamma spectroscopy	Europium-152	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1758S	21-22246 21-22252	MD21-03-51557 MD21-03-51563	Gamma spectroscopy	Cobalt-60	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1758S	21-22252 21-22255	MD21-03-51563 MD21-03-51566	Gamma spectroscopy	Ruthenium-106	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1758S	21-22242 21-22248	MD21-03-51553 MD21-03-51559	Gamma spectroscopy	Sodium-22	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1758S	21-22238 21-22240 21-22244 21-22245 21-22255	MD21-03-51549 MD21-03-51551 MD21-03-51555 MD21-03-51556 MD21-03-51566	Isotopic uranium	Uranium-235	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1758S	21-22236 21-22237 21-22238 21-22239 21-22240 21-22241 21-22243 21-22244 21-22245 21-22247 21-22249 21-22250 21-22251 21-22253 21-22254 21-22256 21-22257	MD21-03-51547 MD21-03-51548 MD21-03-51549 MD21-03-51550 MD21-03-51551 MD21-03-51552 MD21-03-51554 MD21-03-51555 MD21-03-51556 MD21-03-51558 MD21-03-51560 MD21-03-51561 MD21-03-51562 MD21-03-51564 MD21-03-51565 MD21-03-51567 MD21-03-51568	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1758S	21-22242 21-22248	MD21-03-51553 MD21-03-51559	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1758S	21-22246	MD21-03-51557	Gamma spectroscopy	Cesium-134, Ruthenium-106, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1758S	21-22249	MD21-03-51560	Gamma spectroscopy	Europium-152	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
1758S	21-22252	MD21-03-51563	Gamma spectroscopy	Cesium-134, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1758S	21-22255	MD21-03-51566	Gamma spectroscopy	Cesium-134, Cobalt-60, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1758S	21-22242	MD21-03-51553	Isotopic uranium	Uranium-235	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
1758S	21-22255	MD21-03-51566	Isotopic plutonium	Plutonium-238	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
1758S	21-22255	MD21-03-51566	Strontium-90	Strontium-90	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1759S	21-22258 21-22259 21-22260 21-22261 21-22261	MD21-03-51574 MD21-03-51575 MD21-03-51576 MD21-03-51577 MD21-03-51634	Americium-241	Americium-241	The results for this analyte are estimated and biased low (J-) because the laboratory control sample failed low but greater than 10% recovery.
1759S	21-22258 21-22259 21-22261	MD21-03-51574 MD21-03-51575 MD21-03-51634	Isotopic uranium	Uranium-235	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1759S	21-22259	MD21-03-51575	Gamma spectroscopy	Europium-152, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than 3 times the TPU.
1759S	21-22258 21-22260 21-22261 21-22261	MD21-03-51574 MD21-03-51576 MD21-03-51577 MD21-03-51634	Gamma spectroscopy	Cesium-134, Cobalt-60, Sodium-22, Ruthenium-106	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1759S	21-22259	MD21-03-51575	Gamma spectroscopy	Cobalt-60, Ruthenium-106	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1759S	21-22261	MD21-03-51634	Isotopic plutonium	Plutonium-238	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
1760S	21-22263 21-22270	MD21-03-51579 MD21-03-51586	Gamma spectroscopy	Cesium-134	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1760S	21-22264 21-22265 21-22270 21-22272 21-22285 21-22288 21-22287	MD21-03-51580 MD21-03-51581 MD21-03-51586 MD21-03-51588 MD21-03-51601 MD21-03-51604 MD21-03-51638	Gamma spectroscopy	Europium-152	The results for this analyte are not detected (U) because the sample concentrations were less than 3 times the TPU.
1760S	21-22285	MD21-03-51601	Gamma spectroscopy	Ruthenium-106	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1760S	21-22265	MD21-03-51581	Isotopic uranium	Uranium-235	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1760S	21-22262 21-22264 21-22265 21-22266 21-22267 21-22268 21-22269 21-22271 21-22272 21-22273 21-22274 21-22275 21-22276 21-22277 21-22278 21-22279 21-22280 21-22281 21-22282 21-22283 21-22284 21-22286 21-22287 21-22288 21-22281 21-22283 21-22285 21-22287	MD21-03-51578 MD21-03-51580 MD21-03-51581 MD21-03-51582 MD21-03-51583 MD21-03-51584 MD21-03-51585 MD21-03-51587 MD21-03-51588 MD21-03-51589 MD21-03-51590 MD21-03-51591 MD21-03-51592 MD21-03-51593 MD21-03-51594 MD21-03-51595 MD21-03-51596 MD21-03-51597 MD21-03-51598 MD21-03-51599 MD21-03-51600 MD21-03-51602 MD21-03-51603 MD21-03-51604 MD21-03-51635 MD21-03-51636 MD21-03-51637 MD21-03-51638	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1760S	21-22263 21-22270	MD21-03-51579 MD21-03-51586	Gamma spectroscopy	Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1760S	21-22285	MD21-03-51601	Gamma spectroscopy	Cesium-134, Cobalt-60, Sodium-22	The result for these analytes is not detected (U) because the sample concentration was less than the MDA.
1760S	21-22267 21-22285 21-22287	MD21-03-51583 MD21-03-51601 MD21-03-51638	Isotopic uranium	Uranium-235	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.
1760S	21-22283	MD21-03-51599	Isotopic plutonium	Plutonium-238	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
1760S	21-22283	MD21-03-51599	Strontium-90	Strontium-90	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.

Table C-3.3-1 (continued)

Request No.	Location ID	Sample ID	Analyte Suite	Analyte	Explanation
1760S	21-22283	MD21-03-51636	Americium-241	Americium-241	The result for this analyte is not detected (U) because the sample concentration was less than the MDA.
1761S	21-22290	MD21-03-51606	Gamma spectroscopy	Europium-152	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1761S	21-22292	MD21-03-51608	Isotopic uranium	Uranium-235	The result for this analyte is not detected (U) because the sample concentration was less than 3 times the TPU.
1761S	21-22289 21-22290 21-22291 21-22292	MD21-03-51605 MD21-03-51606 MD21-03-51607 MD21-03-51608	Gamma spectroscopy	Cesium-134, Cobalt-60, Ruthenium-106, Sodium-22	The results for these analytes are not detected (U) because the sample concentrations were less than the MDA.
1761S	21-22289 21-22292	MD21-03-51605 MD21-03-51608	Gamma spectroscopy	Europium-152	The results for this analyte are not detected (U) because the sample concentrations were less than the MDA.

Table C-3.3-2
Rejected Radionuclide Data for SWMU 21-011(k)

Request No.	Location ID	Sample ID	Analyte	Explanation
8448R	21-11204	MD21-01-0030	Cesium-134	The result for this analyte is rejected (R) because the spectral interference prevents positive identification of the analyte.

Request 1758S. American Radiation Services and RECRA Labnet analyzed 22 samples for radionuclides. The results for europium-152 are not detected (U) because the results were less than 5 times the concentration detected in the method blank.

Request 1759S. American Radiation Services analyzed five samples for radionuclides. The results for americium-241 are estimated and biased low (J-) because the associated LCS failed low but greater than 10% recovery.

Appendix D

Analytical Suites and Results

APPENDIX D ANALYTICAL SUITES AND RESULTS

D-1.0 TARGET ANALYTES AND DETECTION LIMITS

Tables D-1.0-1 through D-1.0-5 include the minimum required detection limits or quantitation limits, as prescribed in the Environmental Restoration (ER) Project (now the Risk Reduction and Environmental Stewardship Division–Remediation Services [RRES-RS] Project) analytical services statement of work (SOW) for contract laboratories (LANL 1995, 49738; LANL 2000, 71233) and the "Quality Assurance Project Plan Requirements for Sampling and Analysis" (LANL 1996, 54609). In most cases, the reporting limits for the analytes were significantly lower than the detection or quantitation limits in these tables. Summary tables presented in Sections 2.3, 2.4, 3.3, and 3.4 include sample-specific detection or quantitation limits for each analyte.

Table D-1.0-1
Target Analytes and Estimated Detection Limits for Inorganic Chemical Analyses

Analyte	EPA[a] Sample Preparation Method	Analytical Technique	EDL[b] (mg/kg)
Aluminum	3050A	ICPES[c]	40
Antimony	3050A	ICPES	12
Arsenic	7060/3050A	ICPES/GFAA[d]	2
Barium	3050A	ICPES	40
Beryllium	3050A	ICPES	1
Cadmium	3050A	ICPES	1
Calcium	3050A	ICPES	1000
Chromium	3050A	ICPES	0.5
Cobalt	3050A	ICPES	10
Copper	3050A	ICPES	5
Iron	3050A	ICPES	20
Lead	7421/3050A	ICPES/ICPMS[e]	0.6
Magnesium	3050A	ICPES	1000
Manganese	3050A	ICPES	3
Mercury	7471	CVAA[f]	0.1
Nickel	3050A	ICPES	8
Perchlorate	314.0	ICPES	0.1
Potassium	3050A	ICPES	1000
Selenium	7740/3050A	ICPES/GFAA	1
Silver	3050A	ICPES	2
Sodium	3050A	ICPES	1000
Thallium	7841/3050A	ICPES/GFAA/ICPMS	2
Vanadium	3050A	ICPES	10
Zinc	3050A	ICPES	4

[a] EPA = US Environmental Protection Agency.
[b] EDL = Estimated detection limit.
[c] ICPES = Inductively coupled plasma emission spectroscopy by EPA SW-846 Method 6010.
[d] GFAA = Graphite furnace atomic absorption.
[e] ICPMS = Inductively coupled plasma mass spectrometry by EPA SW-846 Method 6020.
[f] CVAA = Cold vapor atomic absorption spectroscopy.

Table D-1.0-2
Target Analytes and Estimated Quantitation Limits for Volatile Organic Compound Analyses

Target Analyte	Soil/Solids EQL* (µg/kg)	Target Analyte	Soil/Solids EQL* (µg/kg)
Acetone	20	1,3-Dichloropropane	5
Benzene	5	2,2-Dichloropropane	5
Bromobenzene	5	1,1-Dichloropropene	5
Bromochloromethane	5	cis-1,3-Dichloropropene	5
Bromodichloromethane	5	trans-1,3-Dichloropropene	5
Bromoform	5	Ethylbenzene	5
Bromomethane	10	Hexachlorobutadiene	10
2-Butanone	20	2-Hexanone	20
n-Butylbenzene	5	Iodomethane	5
sec-Butylbenzene	5	Isopropylbenzene	5
tert-Butylbenzene	5	4-Isopropyltoluene	5
Carbon disulfide	5	4-Methyl-2-pentanone	20
Carbon tetrachloride	5	Methylene chloride	5
Chlorobenzene	5	Naphthalene	10
Chlorodibromomethane	5	1-Propylbenzene	5
Chloroethane	10	Styrene	5
Chloroform	5	1,1,1,2-Tetrachloroethane	5
Chloromethane	10	1,1,2,2-Tetrachloroethane	5
2-Chlorotoluene	5	Tetrachloroethene	5
4-Chlorotoluene	5	Toluene	5
1,2-Dimbromo-3-chloropropane	10	1,1,2-Trichloro-1,2,2-trifluoroethane	5
1,2-Dibromoethane	5	1,2,3-Trichlorobenzene	5
Dibromomethane	5	1,2,4-Trichlorobenzene	10
1,2-Dichlorobenzene	5	1,1,1-Trichloroethane	5
1,3-Dichlorobenzene	5	1,1,2-Trichloroethane	5
1,4-Dichlorobenzene	5	Trichloroethene	5
Dichlorodifluoromethane	10	Trichlorofluoromethane	5
1,1-Dichloroethane	5	1,2,3-Trichloropropane	5
1,2-Dichloroethane	5	1,2,4-Trimethylbenzene	5
1,1-Dichloroethene	5	1,3,5-Trimethylbenzene	5
cis-1,2-Dichloroethene	5	Vinyl chloride	10
trans-1,2-Dichloroethene	5	Xylene (total)	5
1,2-Dichloropropane	5		

Note: All analyses were completed by EPA contract laboratory program Method OLM2.0 or the equivalent EPA Method 8260. These methods are based on purge and trap sample extraction/concentration followed by gas chromatography/mass spectrometry.

*EQL = Estimated quantitation limit.

Table D-1.0-3
Target Analytes and Estimated Quantitation Limits for Pesticide Analyses

Analyte	Soil/Solids EQL (µg/kg)
Aldrin	1.7
BHC [alpha-]	1.7
BHC [beta-]	1.7
BHC [delta-]	1.7
BHC [gamma-]	1.7
Chlordane [alpha-]	1.7
Chlordane [gamma-]	1.7
DDD [4,4'-]	3.3
DDE [4,4'-]	3.3
DDT [4,4'-]	3.3
Dieldrin	3.3
Endosulfan I	1.7
Endosulfan II	3.3
Endosulfan sulfate	3.3*
Endrin	3.3
Endrin aldehyde	3.3
Endrin ketone	3.3*
Heptachlor	1.7
Heptachlor epoxide	1.7
Methoxychlor [4,4'-]	1.7
Toxaphene (technical grade)	170

Note: All analyses were completed by EPA contract laboratory program Method OLM2.0 or the equivalent EPA Method 8260. These methods are based on purge and trap sample extraction/concentration followed by gas chromatography/mass spectrometry.

*Not in table in SW-846.

Table D-1.0-4
Target Analytes and Estimated Quantitation Limits for PCB Analyses

Analyte	Soil/Solids EQL* (µg/kg)
Aroclor-1016	33
Aroclor-1221	67
Aroclor-1232	33
Aroclor-1242	33
Aroclor-1248	33
Aroclor-1254	33
Aroclor-1260	33

Note. All analyses were completed by EPA contract laboratory program Method OLM1.8 or the equivalent EPA Method 8081. These methods are based on solvent extraction, concentration, and gas chromatography/electron capture detection and quantitation.

* EQLs for the samples are based on no gel permeation chromatography (GPC) cleanup being performed. The laboratories' GPC equipment determines the sample-specific EQL based on the volume of extract the GPC equipment uses. However, the laboratories are requested, if possible, to report sample-specific EQLs of no more than twice the value listed in the table.

Table D-1.0-5
Target Analytes and Estimated Quantitation Limits for Radionuclide Analyses

Analyte	Soil/Solids EQL[a] (pCi/g, except as noted)
Americium-241	0.05
Cesium-134	NA[b]
Cesium-137	0.10
Cobalt-60	0.50
Europium-152	NA
Plutonium-238	0.05
Plutonium-239	0.05
Ruthenium-106	NA
Sodium-22	NA
Strontium-90	0.5
Thorium-228	0.1
Thorium-230	0.1
Thorium-232	0.1
Tritium	250 pCi/L
Uranium-234	0.1
Uranium-235	0.1
Uranium-238	0.1

Note: All analyses were completed by EPA contract laboratory program Method OLM1.8 or the equivalent EPA Method 8081. These methods are based on solvent extraction, concentration, and gas chromatography/electron capture detection and quantitation.

[a] EQLs for the samples are based on no gel permeation chromatography (GPC) cleanup being performed. The laboratories' GPC equipment determines the sample-specific EQL based on the volume of extract the GPC equipment uses. However, the laboratories are requested, if possible, to report sample-specific EQLs of no more than twice the value listed in the table.

[b] EQL not applicable.

Efforts were made to ensure that detection limits for inorganic chemicals were below Los Alamos National Laboratory (the Laboratory) background values (BVs) (LANL 1998, 59730). Instances in which the detection limits were greater than BVs are noted and discussed in Section 2.4.3 of this report.

D-2.0 ANALYTE SUITES AND DATA SUMMARY

Table D-2.0-1 presents all analytical results for samples collected from the 1993, 1996, 2001 and 2003 Voluntary Corrective Measures (VCM) Plan for Solid Waste Management Unit (SWMU) 21-011(k) at TA-21. The report qualifier "U" indicates that the analyte was analyzed for but not detected and that the reported value is the sample-specific estimated quantitation limit or detection limit. The report qualifier "J" indicates that the reported value should be regarded as estimated. The report qualifier "J+" indicates that the reported value should be regarded as estimated and biased high. The report qualifier "UJ" indicates that the analyte was analyzed for but not detected and that the reported value is an estimate of the sample-specific quantitation limit or detection limit. The report qualifier "R" indicates that the reported value should be regarded as rejected.

Table D-2.0-1
Analytical Results for SWMU 21-011(k)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-01591	AAA4009	0.0–0.5	ALLH	Americium-241	8.963000298	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Cesium-137	42.63999939	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Plutonium-238	0.859000027	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Plutonium-239	12.77299976	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Strontium-90	8.600000381	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Thorium-228	1.379999995	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Thorium-230	1.419999957	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Thorium-232	1.450000048	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Tritium	0.113315508	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Uranium-234	1.399999976	pCi/g	None
21-01591	AAA4009	0.0–0.5	ALLH	Uranium-235	0.07	pCi/g	U
21-01591	AAA4009	0.0–0.5	ALLH	Uranium-238	1.25999999	pCi/g	None
21-11204	MD21-01-0030	2.0–3.0	ALLH	Cesium-134	0.064	pCi/g	R
21-11205	MD21-01-0034	4.0–5.0	ALLH	Acetone	0.050000001	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aldrin	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aluminum	5000	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Americium-241	6.900000095	pCi/g	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Antimony	0.289999992	mg/kg	UJ
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1016	0.040000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1221	0.081	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1232	0.040000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1242	0.040000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1248	0.040000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1254	0.040000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Aroclor-1260	0.040000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Arsenic	2.099999905	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Barium	43	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Benzene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Beryllium	0.980000019	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	BHC[alpha-]	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	BHC[beta-]	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	BHC[delta-]	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	BHC[gamma-]	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Bromobenzene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Bromochloromethane	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Bromodichloromethane	0.006	mg/kg	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-11205	MD21-01-0034	4.0–5.0	ALLH	Bromoform	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Bromomethane	0.012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Butanone[2-]	0.024	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Butylbenzene[n-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Butylbenzene[sec-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Butylbenzene[tert-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Cadmium	0.109999999	mg/kg	J
21-11205	MD21-01-0034	4.0–5.0	ALLH	Calcium	760	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Carbon disulfide	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Carbon tetrachloride	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Cesium-134	0.028000001	pCi/g	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Cesium-137	3.779999971	pCi/g	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chlordane[alpha-]	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chlordane[gamma-]	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chlorobenzene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chlorodibromomethane	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chloroethane	0.012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chloroform	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chloromethane	0.012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chlorotoluene[2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chlorotoluene[4-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Chromium	6.5	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Cobalt	1.399999976	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Cobalt-60	0.007	pCi/g	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Copper	3.5	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	DDD[4,4'-]	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	DDE[4,4'-]	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	DDT[4,4'-]	0.004	mg/kg	UJ
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dibromo-3-Chloropropane[1,2-]	0.012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dibromoethane[1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dibromomethane	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichlorobenzene[1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichlorobenzene[1,3-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichlorobenzene[1,4-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichlorodifluoromethane	0.012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloroethane[1,1-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloroethane[1,2-]	0.006	mg/kg	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloroethene[1,1-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloroethene[cis-1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloroethene[trans-1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloropropane[1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloropropane[1,3-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloropropane[2,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloropropene[1,1-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloropropene[cis-1,3-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dichloropropene[trans-1,3-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Dieldrin	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Endosulfan I	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Endosulfan II	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Endosulfan sulfate	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Endrin	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Endrin aldehyde	0.004	mg/kg	UJ
21-11205	MD21-01-0034	4.0–5.0	ALLH	Endrin ketone	0.004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Ethylbenzene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Europium-152	-0.2	pCi/g	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Heptachlor	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Heptachlor epoxide	0.002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Hexachlorobutadiene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Hexanone[2-]	0.024	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Iodomethane	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Iron	6500	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Isopropylbenzene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Isopropyltoluene[4-]	0.026000001	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Lead	7.099999905	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Magnesium	710	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Manganese	260	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Mercury	0.0031	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Methoxychlor[4,4'-]	0.020000001	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Methyl-2-pentanone[4-]	0.024	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Methylene chloride	0.072000004	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Naphthalene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Nickel	6.199999809	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Perchlorate	0.028700002	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Plutonium-238	0.209999993	pCi/g	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Plutonium-239	1.00999999	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-11205	MD21-01-0034	4.0–5.0	ALLH	Potassium	1300	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Propylbenzene[1-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Ruthenium-106	0.090000004	pCi/g	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Selenium	0.300000012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Silver	0.057999998	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Sodium	550	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Sodium-22	-0.02	pCi/g	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Strontium-90	1.019999981	pCi/g	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Styrene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Tetrachloroethane[1,1,1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Tetrachloroethane[1,1,2,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Tetrachloroethene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Thallium	0.340000004	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Toluene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Toxaphene (technical grade)	0.200000003	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichloro-1,2,2-trifluoroethane[1,1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichlorobenzene[1,2,3-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichlorobenzene[1,2,4-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichloroethane[1,1,1-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichloroethane[1,1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichloroethene	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichlorofluoromethane	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trichloropropane[1,2,3-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trimethylbenzene[1,2,4-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Trimethylbenzene[1,3,5-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Uranium-235	0.389999986	pCi/g	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Vanadium	7.400000095	mg/kg	None
21-11205	MD21-01-0034	4.0–5.0	ALLH	Vinyl chloride	0.012	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Xylene (total)	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Xylene[1,2-]	0.006	mg/kg	U
21-11205	MD21-01-0034	4.0–5.0	ALLH	Zinc	30	mg/kg	None
21-03-21380	MD21-03-49651	8-9	QBT3	Americium-241	0.135	PCI/G	None
21-03-21380	MD21-03-49652	9-10	QBT3	Americium-241	0.107	PCI/G	None
21-03-21380	MD21-03-49651	8-9	QBT3	Cesium-134	0.064	PCI/G	U
21-03-21380	MD21-03-49652	9-10	QBT3	Cesium-134	0.052	PCI/G	U
21-03-21380	MD21-03-49651	8-9	QBT3	Cesium-137	2.272	PCI/G	
21-03-21380	MD21-03-49652	9-10	QBT3	Cesium-137	1.522	PCI/G	

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21380	MD21-03-49651	8-9	QBT3	Cobalt-60	0.002	PCI/G	U
21-03-21380	MD21-03-49652	9-10	QBT3	Cobalt-60	-0.015	PCI/G	U
21-03-21380	MD21-03-49651	8-9	QBT3	Europium-152	0.186	PCI/G	
21-03-21380	MD21-03-49652	9-10	QBT3	Europium-152	0.276	PCI/G	
21-03-21380	MD21-03-49651	8-9	QBT3	Plutonium-238	0.036	PCI/G	
21-03-21380	MD21-03-49652	9-10	QBT3	Plutonium-238	0.028	PCI/G	U
21-03-21380	MD21-03-49651	8-9	QBT3	Plutonium-239	0.201	PCI/G	
21-03-21380	MD21-03-49652	9-10	QBT3	Plutonium-239	0.154	PCI/G	
21-03-21380	MD21-03-49651	8-9	QBT3	Ruthenium-106	-0.011	PCI/G	U
21-03-21380	MD21-03-49652	9-10	QBT3	Ruthenium-106	0.041	PCI/G	U
21-03-21380	MD21-03-49651	8-9	QBT3	Sodium-22	-0.014	PCI/G	U
21-03-21380	MD21-03-49652	9-10	QBT3	Sodium-22	0.008	PCI/G	U
21-03-21380	MD21-03-49651	8-9	QBT3	Strontium-90	1.827	PCI/G	
21-03-21380	MD21-03-49652	9-10	QBT3	Strontium-90	0.751	PCI/G	
21-03-21380	MD21-03-49651	8-9	QBT3	Uranium-235	0.059	PCI/G	
21-03-21380	MD21-03-49652	9-10	QBT3	Uranium-235	0.211	PCI/G	
21-03-21382	MD21-03-49655	8.0–9.0	Qbt 3	Uranium-235	0.370999992	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Americium-241	0.36500001	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Cesium-134	0.061999999	pCi/g	U
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Cesium-137	1.69599998	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Cobalt-60	-0.005	pCi/g	U
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Europium-152	0.136999995	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Plutonium-238	0.055	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Plutonium-239	0.300999999	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Ruthenium-106	-0.04	pCi/g	U
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Sodium-22	-0.013	pCi/g	U
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Strontium-90	1.569000006	pCi/g	None
21-03-21382	MD21-03-49656	9.0–10.0	Qbt 3	Uranium-235	0.203999996	pCi/g	None
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Americium-241	0.112000003	pCi/g	None
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Cesium-134	-0.198	pCi/g	U
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Cesium-137	1.699000001	pCi/g	None
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Cobalt-60	0.014	pCi/g	U
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Europium-152	0.108999997	pCi/g	None
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Plutonium-238	0.02	pCi/g	U
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Plutonium-239	0.237000003	pCi/g	None
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Ruthenium-106	0.052999999	pCi/g	U
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Sodium-22	0	pCi/g	U
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Strontium-90	2.548000097	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21386	MD21-03-49663	8.0–9.0	Qbt 3	Uranium-235	0.184	pCi/g	None
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Americium-241	0.079000004	pCi/g	None
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Cesium-134	0.067000002	pCi/g	U
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Cesium-137	1.646999955	pCi/g	None
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Cobalt-60	-0.002	pCi/g	U
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Europium-152	0.282000005	pCi/g	None
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Plutonium-238	0.018999999	pCi/g	U
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Plutonium-239	0.081	pCi/g	None
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Ruthenium-106	-0.033	pCi/g	U
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Sodium-22	0	pCi/g	U
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Strontium-90	2.140000105	pCi/g	None
21-03-21386	MD21-03-49664	9.0–10.0	Qbt 3	Uranium-235	0.232999995	pCi/g	None
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Americium-241	0.037	pCi/g	None
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Cesium-134	0.081	pCi/g	U
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Cesium-137	1.873000026	pCi/g	None
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Cobalt-60	-0.009	pCi/g	U
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Europium-152	0.129999995	pCi/g	None
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Plutonium-238	0	pCi/g	U
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Plutonium-239	0.063000001	pCi/g	None
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Ruthenium-106	0.007	pCi/g	U
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Sodium-22	-0.003	pCi/g	U
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Strontium-90	1.95599997	pCi/g	None
21-03-21387	MD21-03-49665	8.0–9.0	Qbt 3	Uranium-235	0.129999995	pCi/g	U
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Americium-241	0.046	pCi/g	None
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Cesium-134	-0.007	pCi/g	U
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Cesium-137	1.338999987	pCi/g	None
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Cobalt-60	0.009	pCi/g	U
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Europium-152	0.172999993	pCi/g	None
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Plutonium-238	0.035	pCi/g	None
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Plutonium-239	0.138999999	pCi/g	None
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Ruthenium-106	0.059999999	pCi/g	U
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Sodium-22	-0.009	pCi/g	U
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Strontium-90	0.915000021	pCi/g	None
21-03-21387	MD21-03-49666	9.0–10.0	Qbt 3	Uranium-235	0.143000007	pCi/g	U
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Americium-241	1.47300005	pCi/g	None
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Cesium-134	0.059999999	pCi/g	U
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Cesium-137	64.60299683	pCi/g	None
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Cobalt-60	0.006	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Europium-152	0.270000011	pCi/g	None
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Plutonium-238	0.186000004	pCi/g	None
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Plutonium-239	7.511000156	pCi/g	None
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Ruthenium-106	-0.191	pCi/g	U
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Sodium-22	0	pCi/g	U
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Strontium-90	23.11100006	pCi/g	None
21-03-21388	MD21-03-49667	8.0–9.0	Qbt 3	Uranium-235	0.203999996	pCi/g	None
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Americium-241	0.072999999	pCi/g	None
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Cesium-134	0.055	pCi/g	U
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Cesium-137	1.078999996	pCi/g	None
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Cobalt-60	0.015	pCi/g	U
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Europium-152	0.224999994	pCi/g	None
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Plutonium-238	0.008	pCi/g	U
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Plutonium-239	0.194000006	pCi/g	None
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Ruthenium-106	0.009	pCi/g	U
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Sodium-22	0	pCi/g	U
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Strontium-90	4.683000088	pCi/g	None
21-03-21388	MD21-03-49668	9.0–10.0	Qbt 3	Uranium-235	0.166999996	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Americium-241	0.368000001	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Cesium-134	0.075999998	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Cesium-137	6.793000221	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Cobalt-60	0.001	pCi/g	U
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Europium-152	0.234999999	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Plutonium-238	0.145999998	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Plutonium-239	0.964999974	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Ruthenium-106	-0.119	pCi/g	U
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Sodium-22	0.009	pCi/g	U
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Strontium-90	6.243000031	pCi/g	None
21-03-21389	MD21-03-49669	8.0–9.0	Qbt 3	Uranium-235	0.188999996	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Americium-241	0.648000002	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Cesium-134	0.059	pCi/g	U
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Cesium-137	7.367000103	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Cobalt-60	-0.001	pCi/g	U
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Europium-152	0.201000005	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Plutonium-238	0.137999997	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Plutonium-239	1.366000056	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Ruthenium-106	-0.05	pCi/g	U
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Sodium-22	0.003	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Strontium-90	4.90899992	pCi/g	None
21-03-21389	MD21-03-49670	9.0–10.0	Qbt 3	Uranium-235	0.214000002	pCi/g	None
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Americium-241	0.101999998	pCi/g	None
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Cesium-134	-0.02	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Cesium-137	1.549000025	pCi/g	None
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Cobalt-60	-0.001	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Europium-152	0.118000001	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Plutonium-238	0.027000001	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Plutonium-239	0.372000009	pCi/g	None
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Ruthenium-106	0.179000005	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Sodium-22	0.008	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Strontium-90	0.112999998	pCi/g	U
21-03-21390	MD21-03-49671	8.0–9.0	Qbt 3	Uranium-235	0.156000003	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Americium-241	0.097999997	pCi/g	None
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Cesium-134	0.083999999	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Cesium-137	0.31099999	pCi/g	None
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Cobalt-60	-0.002	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Europium-152	0.189999998	pCi/g	None
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Plutonium-238	0.011	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Plutonium-239	0.273000002	pCi/g	None
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Ruthenium-106	-0.023	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Sodium-22	0.001	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Strontium-90	-0.095	pCi/g	U
21-03-21390	MD21-03-49672	9.0–10.0	Qbt 3	Uranium-235	0.207000002	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Americium-241	0.913999975	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Cesium-134	0.071000002	pCi/g	U
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Cesium-137	12.6420002	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Europium-152	0.136000007	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Plutonium-238	0.345999986	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Plutonium-239	1.440999985	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Ruthenium-106	-0.037	pCi/g	U
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Sodium-22	-0.018	pCi/g	U
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Strontium-90	3.325000048	pCi/g	None
21-03-21391	MD21-03-49673	8.0–9.0	Qbt 3	Uranium-235	0.186000004	pCi/g	U
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Americium-241	0.328000009	pCi/g	None
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Cesium-134	0.072999999	pCi/g	U
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Cesium-137	2.869999886	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Cobalt-60	0.002	pCi/g	U
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Europium-152	0.206	pCi/g	None
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Plutonium-238	0.029999999	pCi/g	None
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Plutonium-239	1.758999944	pCi/g	None
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Ruthenium-106	0.086999997	pCi/g	U
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Sodium-22	0.002	pCi/g	U
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Strontium-90	0.405999988	pCi/g	U
21-03-21392	MD21-03-49675	5.0–6.0	Qbt 3	Uranium-235	0.195999995	pCi/g	U
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Americium-241	0.437000006	pCi/g	None
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Cesium-134	-0.289	pCi/g	U
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Cesium-137	5.971000195	pCi/g	None
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Cobalt-60	-0.011	pCi/g	U
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Europium-152	0.209999993	pCi/g	None
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Plutonium-238	0.115000002	pCi/g	None
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Plutonium-239	2.667999983	pCi/g	None
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Ruthenium-106	0.107000001	pCi/g	U
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Sodium-22	0.017000001	pCi/g	U
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Strontium-90	1.213000059	pCi/g	None
21-03-21392	MD21-03-49676	6.0–7.0	Qbt 3	Uranium-235	0.216999993	pCi/g	None
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Americium-241	0.81099999	pCi/g	None
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Cesium-134	0.092	pCi/g	U
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Cesium-137	66.34100342	pCi/g	None
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Cobalt-60	-0.005	pCi/g	U
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Europium-152	0.155000001	pCi/g	U
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Plutonium-238	0.114	pCi/g	None
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Plutonium-239	3.594000101	pCi/g	None
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Ruthenium-106	-0.029	pCi/g	U
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Sodium-22	0.011	pCi/g	U
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Strontium-90	12.95199966	pCi/g	None
21-03-21393	MD21-03-49677	5.0–6.0	Qbt 3	Uranium-235	0.202000007	pCi/g	None
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Americium-241	0.094999999	pCi/g	None
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Cesium-134	0.107000001	pCi/g	U
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Cesium-137	1.138000011	pCi/g	None
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Cobalt-60	0.004	pCi/g	U
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Europium-152	0.193000004	pCi/g	None
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Plutonium-238	0.016000001	pCi/g	U
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Plutonium-239	0.256999999	pCi/g	None
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Ruthenium-106	-0.074	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Sodium-22	-0.005	pCi/g	U
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Strontium-90	0.25	pCi/g	U
21-03-21393	MD21-03-49678	6.0–7.0	Qbt 3	Uranium-235	0.217999995	pCi/g	None
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Americium-241	0.196999997	pCi/g	None
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Cesium-134	0.083999999	pCi/g	U
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Cesium-137	9.289999962	pCi/g	None
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Europium-152	0.192000002	pCi/g	None
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Plutonium-238	0.030999999	pCi/g	U
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Plutonium-239	0.640999973	pCi/g	None
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Ruthenium-106	-0.013	pCi/g	U
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Sodium-22	-0.007	pCi/g	U
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Strontium-90	5.850999832	pCi/g	None
21-03-21394	MD21-03-49679	5.0–6.0	Qbt 3	Uranium-235	0.200000003	pCi/g	U
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Americium-241	0.625999987	pCi/g	None
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Cesium-134	0.066	pCi/g	U
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Cesium-137	14.34899998	pCi/g	None
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Cobalt-60	0.005	pCi/g	U
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Europium-152	0.266000003	pCi/g	None
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Plutonium-238	0.148000002	pCi/g	None
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Plutonium-239	6.340000153	pCi/g	None
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Ruthenium-106	0.119000003	pCi/g	U
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Sodium-22	-0.013	pCi/g	U
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Strontium-90	4.322000027	pCi/g	None
21-03-21394	MD21-03-49680	6.0–7.0	Qbt 3	Uranium-235	0.138999999	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Americium-241	0.35800001	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Cesium-134	0.083999999	pCi/g	U
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Cesium-137	3.04399991	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Cobalt-60	-0.002	pCi/g	U
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Europium-152	0.172999993	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Plutonium-238	0.130999997	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Plutonium-239	3.743999958	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Ruthenium-106	0.191	pCi/g	U
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Sodium-22	-0.004	pCi/g	U
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Strontium-90	1.065000057	pCi/g	None
21-03-21395	MD21-03-49681	5.0–6.0	Qbt 3	Uranium-235	0.202000007	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Americium-241	1.22300005	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Cesium-134	-0.018	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Cesium-137	11.72900009	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Cobalt-60	0.002	pCi/g	U
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Europium-152	0.170000002	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Plutonium-238	0.246999994	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Plutonium-239	12.26099968	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Ruthenium-106	-0.025	pCi/g	U
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Sodium-22	-0.001	pCi/g	U
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Strontium-90	5.474999905	pCi/g	None
21-03-21396	MD21-03-49683	3.0–4.0	Qbt 3	Uranium-235	0.075999998	pCi/g	U
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Americium-241	1.047000051	pCi/g	None
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Cesium-134	0.075000003	pCi/g	U
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Cesium-137	4.519999981	pCi/g	None
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Cobalt-60	0.003	pCi/g	U
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Europium-152	0.284000009	pCi/g	None
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Plutonium-238	0.155000001	pCi/g	None
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Plutonium-239	8.215999603	pCi/g	None
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Ruthenium-106	-0.047	pCi/g	U
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Sodium-22	0.002	pCi/g	U
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Strontium-90	2.184000015	pCi/g	None
21-03-21398	MD21-03-49687	1.0–2.0	Qbt 3	Uranium-235	0.157000005	pCi/g	None
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Americium-241	0.122000001	pCi/g	None
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Cesium-134	0.089000002	pCi/g	U
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Cesium-137	3.003999949	pCi/g	None
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Cobalt-60	-0.012	pCi/g	U
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Europium-152	0.155000001	pCi/g	None
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Plutonium-238	0.026000001	pCi/g	U
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Plutonium-239	1.059000015	pCi/g	None
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Ruthenium-106	-0.145	pCi/g	U
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Sodium-22	0.02	pCi/g	U
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Strontium-90	0.768000007	pCi/g	None
21-03-21395	MD21-03-49699	5.0–6.0	Qbt 3	Uranium-235	0.214000002	pCi/g	None
21-22198	MD21-03-51509	0.0–0.5	ALLH	Americium-241	3.484999895	pCi/g	None
21-22198	MD21-03-51509	0.0–0.5	ALLH	Cesium-134	-0.169	pCi/g	U
21-22198	MD21-03-51509	0.0–0.5	ALLH	Cesium-137	39.79000092	pCi/g	None
21-22198	MD21-03-51509	0.0–0.5	ALLH	Cobalt-60	-0.001	pCi/g	U
21-22198	MD21-03-51509	0.0–0.5	ALLH	Europium-152	0.241999999	pCi/g	None
21-22198	MD21-03-51509	0.0–0.5	ALLH	Plutonium-238	0.38499999	pCi/g	None
21-22198	MD21-03-51509	0.0–0.5	ALLH	Plutonium-239	4.097000122	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22198	MD21-03-51509	0.0–0.5	ALLH	Ruthenium-106	-0.17399999	pCi/g	U
21-22198	MD21-03-51509	0.0–0.5	ALLH	Sodium-22	0.005	pCi/g	U
21-22198	MD21-03-51509	0.0–0.5	ALLH	Strontium-90	6.987999916	pCi/g	None
21-22198	MD21-03-51509	0.0–0.5	ALLH	Uranium-235	0.268999994	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Americium-241	0.967999995	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Cesium-134	0.068999998	pCi/g	U
21-22199	MD21-03-51510	0.0–0.5	ALLH	Cesium-137	15.85400009	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Cobalt-60	0.009	pCi/g	U
21-22199	MD21-03-51510	0.0–0.5	ALLH	Europium-152	0.48300001	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Plutonium-238	0.149000004	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Plutonium-239	1.269000053	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Ruthenium-106	0.018999999	pCi/g	U
21-22199	MD21-03-51510	0.0–0.5	ALLH	Sodium-22	-0.018	pCi/g	U
21-22199	MD21-03-51510	0.0–0.5	ALLH	Strontium-90	3.453999996	pCi/g	None
21-22199	MD21-03-51510	0.0–0.5	ALLH	Uranium-235	0.284999996	pCi/g	None
21-22200	MD21-03-51511	0.0–0.5	ALLH	Americium-241	0.423999995	pCi/g	None
21-22200	MD21-03-51511	0.0–0.5	ALLH	Cesium-134	0.07	pCi/g	U
21-22200	MD21-03-51511	0.0–0.5	ALLH	Cesium-137	0.626999974	pCi/g	None
21-22200	MD21-03-51511	0.0–0.5	ALLH	Cobalt-60	-0.001	pCi/g	U
21-22200	MD21-03-51511	0.0–0.5	ALLH	Europium-152	0.446999997	pCi/g	None
21-22200	MD21-03-51511	0.0–0.5	ALLH	Plutonium-238	0.090000004	pCi/g	None
21-22200	MD21-03-51511	0.0–0.5	ALLH	Plutonium-239	1.047000051	pCi/g	None
21-22200	MD21-03-51511	0.0–0.5	ALLH	Ruthenium-106	0.109999999	pCi/g	U
21-22200	MD21-03-51511	0.0–0.5	ALLH	Sodium-22	0.012	pCi/g	U
21-22200	MD21-03-51511	0.0–0.5	ALLH	Strontium-90	0.280000001	pCi/g	U
21-22200	MD21-03-51511	0.0–0.5	ALLH	Uranium-235	0.254000008	pCi/g	None
21-22201	MD21-03-51512	0.0–0.5	ALLH	Americium-241	4.915999889	pCi/g	None
21-22201	MD21-03-51512	0.0–0.5	ALLH	Cesium-134	0.098999999	pCi/g	U
21-22201	MD21-03-51512	0.0–0.5	ALLH	Cesium-137	46.18700027	pCi/g	None
21-22201	MD21-03-51512	0.0–0.5	ALLH	Cobalt-60	0.011	pCi/g	U
21-22201	MD21-03-51512	0.0–0.5	ALLH	Europium-152	0.298999995	pCi/g	U
21-22201	MD21-03-51512	0.0–0.5	ALLH	Plutonium-238	0.319999993	pCi/g	None
21-22201	MD21-03-51512	0.0–0.5	ALLH	Plutonium-239	1.896999955	pCi/g	None
21-22201	MD21-03-51512	0.0–0.5	ALLH	Ruthenium-106	0.128000006	pCi/g	U
21-22201	MD21-03-51512	0.0–0.5	ALLH	Sodium-22	0.002	pCi/g	U
21-22201	MD21-03-51512	0.0–0.5	ALLH	Strontium-90	0.237000003	pCi/g	U
21-22201	MD21-03-51512	0.0–0.5	ALLH	Uranium-235	0.286000013	pCi/g	None
21-22202	MD21-03-51513	0.0–0.5	ALLH	Americium-241	25.16600037	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22202	MD21-03-51513	0.0–0.5	ALLH	Cesium-134	0.079000004	pCi/g	U
21-22202	MD21-03-51513	0.0–0.5	ALLH	Cesium-137	11.19499969	pCi/g	None
21-22202	MD21-03-51513	0.0–0.5	ALLH	Cobalt-60	0	pCi/g	U
21-22202	MD21-03-51513	0.0–0.5	ALLH	Europium-152	0.337000012	pCi/g	None
21-22202	MD21-03-51513	0.0–0.5	ALLH	Plutonium-238	1.187000036	pCi/g	None
21-22202	MD21-03-51513	0.0–0.5	ALLH	Plutonium-239	4.732999802	pCi/g	None
21-22202	MD21-03-51513	0.0–0.5	ALLH	Ruthenium-106	-0.115	pCi/g	U
21-22202	MD21-03-51513	0.0–0.5	ALLH	Sodium-22	0.011	pCi/g	U
21-22202	MD21-03-51513	0.0–0.5	ALLH	Strontium-90	3.835999966	pCi/g	None
21-22202	MD21-03-51513	0.0–0.5	ALLH	Uranium-235	0.277999997	pCi/g	None
21-22203	MD21-03-51514	0.0–0.5	ALLH	Americium-241	0.310000002	pCi/g	None
21-22203	MD21-03-51514	0.0–0.5	ALLH	Cesium-134	0.059999999	pCi/g	U
21-22203	MD21-03-51514	0.0–0.5	ALLH	Cesium-137	1.419999957	pCi/g	None
21-22203	MD21-03-51514	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U
21-22203	MD21-03-51514	0.0–0.5	ALLH	Europium-152	0.246000007	pCi/g	None
21-22203	MD21-03-51514	0.0–0.5	ALLH	Plutonium-238	0.056000002	pCi/g	None
21-22203	MD21-03-51514	0.0–0.5	ALLH	Plutonium-239	0.649999976	pCi/g	None
21-22203	MD21-03-51514	0.0–0.5	ALLH	Ruthenium-106	-0.019	pCi/g	U
21-22203	MD21-03-51514	0.0–0.5	ALLH	Sodium-22	-0.008	pCi/g	U
21-22203	MD21-03-51514	0.0–0.5	ALLH	Strontium-90	0.27700001	pCi/g	U
21-22203	MD21-03-51514	0.0–0.5	ALLH	Uranium-235	0.284999996	pCi/g	None
21-22204	MD21-03-51515	0.0–0.5	ALLH	Americium-241	0.143999994	pCi/g	None
21-22204	MD21-03-51515	0.0–0.5	ALLH	Cesium-134	0.078000002	pCi/g	U
21-22204	MD21-03-51515	0.0–0.5	ALLH	Cesium-137	0.083999999	pCi/g	None
21-22204	MD21-03-51515	0.0–0.5	ALLH	Cobalt-60	0.015	pCi/g	U
21-22204	MD21-03-51515	0.0–0.5	ALLH	Europium-152	0.296999991	pCi/g	U
21-22204	MD21-03-51515	0.0–0.5	ALLH	Plutonium-238	0.033	pCi/g	None
21-22204	MD21-03-51515	0.0–0.5	ALLH	Plutonium-239	8.517000198	pCi/g	None
21-22204	MD21-03-51515	0.0–0.5	ALLH	Ruthenium-106	0.07	pCi/g	U
21-22204	MD21-03-51515	0.0–0.5	ALLH	Sodium-22	0.013	pCi/g	U
21-22204	MD21-03-51515	0.0–0.5	ALLH	Strontium-90	0.395000011	pCi/g	U
21-22204	MD21-03-51515	0.0–0.5	ALLH	Uranium-235	0.156000003	pCi/g	U
21-22205	MD21-03-51516	0.0–0.5	ALLH	Americium-241	0.145999998	pCi/g	None
21-22205	MD21-03-51516	0.0–0.5	ALLH	Cesium-134	0.066	pCi/g	U
21-22205	MD21-03-51516	0.0–0.5	ALLH	Cesium-137	0.911000013	pCi/g	None
21-22205	MD21-03-51516	0.0–0.5	ALLH	Cobalt-60	-0.015	pCi/g	U
21-22205	MD21-03-51516	0.0–0.5	ALLH	Europium-152	0.256999999	pCi/g	U
21-22205	MD21-03-51516	0.0–0.5	ALLH	Plutonium-238	0.014	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22205	MD21-03-51516	0.0–0.5	ALLH	Plutonium-239	1.626999974	pCi/g	None
21-22205	MD21-03-51516	0.0–0.5	ALLH	Ruthenium-106	-0.116	pCi/g	U
21-22205	MD21-03-51516	0.0–0.5	ALLH	Sodium-22	0.008	pCi/g	U
21-22205	MD21-03-51516	0.0–0.5	ALLH	Strontium-90	0.675000012	pCi/g	None
21-22205	MD21-03-51516	0.0–0.5	ALLH	Uranium-235	0.237000003	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Americium-241	0.129999995	pCi/g	None
21-22206	MD21-03-51517	0.0–0.5	ALLH	Cesium-134	0.071999997	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Cesium-137	0.497999996	pCi/g	None
21-22206	MD21-03-51517	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Europium-152	0.317000002	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Plutonium-238	0.022	pCi/g	None
21-22206	MD21-03-51517	0.0–0.5	ALLH	Plutonium-239	0.963	pCi/g	None
21-22206	MD21-03-51517	0.0–0.5	ALLH	Ruthenium-106	-0.002	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Strontium-90	0.209000006	pCi/g	U
21-22206	MD21-03-51517	0.0–0.5	ALLH	Uranium-235	0.268000007	pCi/g	None
21-22207	MD21-03-51518	0.0–0.5	ALLH	Americium-241	0.823000014	pCi/g	None
21-22207	MD21-03-51518	0.0–0.5	ALLH	Cesium-134	0.043000001	pCi/g	U
21-22207	MD21-03-51518	0.0–0.5	ALLH	Cesium-137	15.95699978	pCi/g	None
21-22207	MD21-03-51518	0.0–0.5	ALLH	Cobalt-60	-0.009	pCi/g	U
21-22207	MD21-03-51518	0.0–0.5	ALLH	Europium-152	0.256999999	pCi/g	U
21-22207	MD21-03-51518	0.0–0.5	ALLH	Plutonium-238	0.202999994	pCi/g	None
21-22207	MD21-03-51518	0.0–0.5	ALLH	Plutonium-239	1.625	pCi/g	None
21-22207	MD21-03-51518	0.0–0.5	ALLH	Ruthenium-106	0.252999991	pCi/g	U
21-22207	MD21-03-51518	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22207	MD21-03-51518	0.0–0.5	ALLH	Strontium-90	3.59800005	pCi/g	None
21-22207	MD21-03-51518	0.0–0.5	ALLH	Uranium-235	0.148000002	pCi/g	U
21-22208	MD21-03-51519	0.0–0.5	ALLH	Americium-241	1.055999994	pCi/g	None
21-22208	MD21-03-51519	0.0–0.5	ALLH	Cesium-134	0.086000003	pCi/g	U
21-22208	MD21-03-51519	0.0–0.5	ALLH	Cesium-137	3.750999928	pCi/g	None
21-22208	MD21-03-51519	0.0–0.5	ALLH	Cobalt-60	0.004	pCi/g	U
21-22208	MD21-03-51519	0.0–0.5	ALLH	Europium-152	0.404000014	pCi/g	None
21-22208	MD21-03-51519	0.0–0.5	ALLH	Plutonium-238	0.104999997	pCi/g	None
21-22208	MD21-03-51519	0.0–0.5	ALLH	Plutonium-239	0.481000006	pCi/g	None
21-22208	MD21-03-51519	0.0–0.5	ALLH	Ruthenium-106	0.083999999	pCi/g	U
21-22208	MD21-03-51519	0.0–0.5	ALLH	Sodium-22	-0.001	pCi/g	U
21-22208	MD21-03-51519	0.0–0.5	ALLH	Strontium-90	1.277999997	pCi/g	None
21-22208	MD21-03-51519	0.0–0.5	ALLH	Uranium-235	0.298999995	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22209	MD21-03-51520	0.0–0.5	ALLH	Americium-241	0.35800001	pCi/g	None
21-22209	MD21-03-51520	0.0–0.5	ALLH	Cesium-134	0.056000002	pCi/g	U
21-22209	MD21-03-51520	0.0–0.5	ALLH	Cesium-137	18.23500061	pCi/g	None
21-22209	MD21-03-51520	0.0–0.5	ALLH	Cobalt-60	0.011	pCi/g	U
21-22209	MD21-03-51520	0.0–0.5	ALLH	Europium-152	0.259000003	pCi/g	U
21-22209	MD21-03-51520	0.0–0.5	ALLH	Plutonium-238	0.131999999	pCi/g	None
21-22209	MD21-03-51520	0.0–0.5	ALLH	Plutonium-239	0.782000005	pCi/g	None
21-22209	MD21-03-51520	0.0–0.5	ALLH	Ruthenium-106	-0.164	pCi/g	U
21-22209	MD21-03-51520	0.0–0.5	ALLH	Sodium-22	-0.009	pCi/g	U
21-22209	MD21-03-51520	0.0–0.5	ALLH	Strontium-90	3.257999897	pCi/g	None
21-22209	MD21-03-51520	0.0–0.5	ALLH	Uranium-235	0.081	pCi/g	U
21-22210	MD21-03-51521	0.0–0.5	ALLH	Americium-241	1.238000035	pCi/g	None
21-22210	MD21-03-51521	0.0–0.5	ALLH	Cesium-134	0.068000004	pCi/g	U
21-22210	MD21-03-51521	0.0–0.5	ALLH	Cesium-137	61.40999985	pCi/g	None
21-22210	MD21-03-51521	0.0–0.5	ALLH	Cobalt-60	0.01	pCi/g	U
21-22210	MD21-03-51521	0.0–0.5	ALLH	Europium-152	0.298000008	pCi/g	U
21-22210	MD21-03-51521	0.0–0.5	ALLH	Plutonium-238	0.510999978	pCi/g	None
21-22210	MD21-03-51521	0.0–0.5	ALLH	Plutonium-239	20.40399933	pCi/g	None
21-22210	MD21-03-51521	0.0–0.5	ALLH	Ruthenium-106	-0.053	pCi/g	U
21-22210	MD21-03-51521	0.0–0.5	ALLH	Sodium-22	-0.01	pCi/g	U
21-22210	MD21-03-51521	0.0–0.5	ALLH	Strontium-90	9.498000145	pCi/g	None
21-22210	MD21-03-51521	0.0–0.5	ALLH	Uranium-235	0.270999998	pCi/g	None
21-22211	MD21-03-51522	0.0–0.5	ALLH	Americium-241	1.036000013	pCi/g	None
21-22211	MD21-03-51522	0.0–0.5	ALLH	Cesium-134	0.07	pCi/g	U
21-22211	MD21-03-51522	0.0–0.5	ALLH	Cesium-137	26.94499969	pCi/g	None
21-22211	MD21-03-51522	0.0–0.5	ALLH	Cobalt-60	-0.005	pCi/g	U
21-22211	MD21-03-51522	0.0–0.5	ALLH	Europium-152	0.256999999	pCi/g	U
21-22211	MD21-03-51522	0.0–0.5	ALLH	Plutonium-238	0.199000001	pCi/g	None
21-22211	MD21-03-51522	0.0–0.5	ALLH	Plutonium-239	1.416000009	pCi/g	None
21-22211	MD21-03-51522	0.0–0.5	ALLH	Ruthenium-106	0.197999999	pCi/g	U
21-22211	MD21-03-51522	0.0–0.5	ALLH	Sodium-22	0.002	pCi/g	U
21-22211	MD21-03-51522	0.0–0.5	ALLH	Strontium-90	5.552999973	pCi/g	None
21-22211	MD21-03-51522	0.0–0.5	ALLH	Uranium-235	0.254000008	pCi/g	None
21-22212	MD21-03-51523	0.0–0.5	ALLH	Americium-241	0.991999984	pCi/g	None
21-22212	MD21-03-51523	0.0–0.5	ALLH	Cesium-134	0.075999998	pCi/g	U
21-22212	MD21-03-51523	0.0–0.5	ALLH	Cesium-137	54.8409996	pCi/g	None
21-22212	MD21-03-51523	0.0–0.5	ALLH	Cobalt-60	0.005	pCi/g	U
21-22212	MD21-03-51523	0.0–0.5	ALLH	Europium-152	0.381999999	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22212	MD21-03-51523	0.0–0.5	ALLH	Plutonium-238	0.254999995	pCi/g	None
21-22212	MD21-03-51523	0.0–0.5	ALLH	Plutonium-239	1.572000027	pCi/g	None
21-22212	MD21-03-51523	0.0–0.5	ALLH	Ruthenium-106	0.142000005	pCi/g	U
21-22212	MD21-03-51523	0.0–0.5	ALLH	Sodium-22	-0.001	pCi/g	U
21-22212	MD21-03-51523	0.0–0.5	ALLH	Strontium-90	8.475000381	pCi/g	None
21-22212	MD21-03-51523	0.0–0.5	ALLH	Uranium-235	0.239999995	pCi/g	None
21-22213	MD21-03-51524	0.0–0.5	ALLH	Americium-241	1.123999953	pCi/g	None
21-22213	MD21-03-51524	0.0–0.5	ALLH	Cesium-134	0.057	pCi/g	U
21-22213	MD21-03-51524	0.0–0.5	ALLH	Cesium-137	22.07099915	pCi/g	None
21-22213	MD21-03-51524	0.0–0.5	ALLH	Cobalt-60	0	pCi/g	U
21-22213	MD21-03-51524	0.0–0.5	ALLH	Europium-152	0.331	pCi/g	U
21-22213	MD21-03-51524	0.0–0.5	ALLH	Plutonium-238	0.280999988	pCi/g	None
21-22213	MD21-03-51524	0.0–0.5	ALLH	Plutonium-239	1.49000001	pCi/g	None
21-22213	MD21-03-51524	0.0–0.5	ALLH	Ruthenium-106	0.116999999	pCi/g	U
21-22213	MD21-03-51524	0.0–0.5	ALLH	Sodium-22	0.001	pCi/g	U
21-22213	MD21-03-51524	0.0–0.5	ALLH	Strontium-90	4.991000175	pCi/g	None
21-22213	MD21-03-51524	0.0–0.5	ALLH	Uranium-235	0.263999999	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Americium-241	1.090999961	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Cesium-134	0.057999998	pCi/g	U
21-22214	MD21-03-51525	0.0–0.5	ALLH	Cesium-137	35.59199905	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U
21-22214	MD21-03-51525	0.0–0.5	ALLH	Europium-152	0.254999995	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Plutonium-238	0.206	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Plutonium-239	1.40199995	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Ruthenium-106	-0.057	pCi/g	U
21-22214	MD21-03-51525	0.0–0.5	ALLH	Sodium-22	-0.015	pCi/g	U
21-22214	MD21-03-51525	0.0–0.5	ALLH	Strontium-90	6.518000126	pCi/g	None
21-22214	MD21-03-51525	0.0–0.5	ALLH	Uranium-235	0.209000006	pCi/g	None
21-22215	MD21-03-51526	0.0–0.5	ALLH	Americium-241	13.67099953	pCi/g	None
21-22215	MD21-03-51526	0.0–0.5	ALLH	Cesium-134	0.116999999	pCi/g	U
21-22215	MD21-03-51526	0.0–0.5	ALLH	Cesium-137	43.8730011	pCi/g	None
21-22215	MD21-03-51526	0.0–0.5	ALLH	Cobalt-60	-0.017	pCi/g	U
21-22215	MD21-03-51526	0.0–0.5	ALLH	Europium-152	0.138999999	pCi/g	None
21-22215	MD21-03-51526	0.0–0.5	ALLH	Plutonium-238	2.907000065	pCi/g	None
21-22215	MD21-03-51526	0.0–0.5	ALLH	Plutonium-239	13.32199955	pCi/g	None
21-22215	MD21-03-51526	0.0–0.5	ALLH	Ruthenium-106	-0.086	pCi/g	U
21-22215	MD21-03-51526	0.0–0.5	ALLH	Sodium-22	-0.002	pCi/g	U
21-22215	MD21-03-51526	0.0–0.5	ALLH	Strontium-90	13.60200024	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22215	MD21-03-51526	0.0–0.5	ALLH	Uranium-235	0.42899999	pCi/g	U
21-22216	MD21-03-51527	0.0–0.5	ALLH	Americium-241	5.382999897	pCi/g	None
21-22216	MD21-03-51527	0.0–0.5	ALLH	Cesium-134	0.093999997	pCi/g	U
21-22216	MD21-03-51527	0.0–0.5	ALLH	Cesium-137	4.59800005	pCi/g	None
21-22216	MD21-03-51527	0.0–0.5	ALLH	Cobalt-60	-0.001	pCi/g	U
21-22216	MD21-03-51527	0.0–0.5	ALLH	Europium-152	0.144999996	pCi/g	None
21-22216	MD21-03-51527	0.0–0.5	ALLH	Plutonium-238	0.961000025	pCi/g	None
21-22216	MD21-03-51527	0.0–0.5	ALLH	Plutonium-239	3.229000092	pCi/g	None
21-22216	MD21-03-51527	0.0–0.5	ALLH	Ruthenium-106	0.027000001	pCi/g	U
21-22216	MD21-03-51527	0.0–0.5	ALLH	Sodium-22	0.011	pCi/g	U
21-22216	MD21-03-51527	0.0–0.5	ALLH	Strontium-90	2.243999958	pCi/g	None
21-22216	MD21-03-51527	0.0–0.5	ALLH	Uranium-235	0.243000001	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Americium-241	41.63100052	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Cesium-134	0.097999997	pCi/g	U
21-22217	MD21-03-51528	0.0–0.5	ALLH	Cesium-137	31.61400032	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Cobalt-60	-0.009	pCi/g	U
21-22217	MD21-03-51528	0.0–0.5	ALLH	Europium-152	0.169	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Plutonium-238	4.754000187	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Plutonium-239	29.00600052	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Ruthenium-106	0.236000001	pCi/g	U
21-22217	MD21-03-51528	0.0–0.5	ALLH	Sodium-22	-0.005	pCi/g	U
21-22217	MD21-03-51528	0.0–0.5	ALLH	Strontium-90	18.75399971	pCi/g	None
21-22217	MD21-03-51528	0.0–0.5	ALLH	Uranium-235	0.409999996	pCi/g	U
21-22218	MD21-03-51529	0.0–0.5	ALLH	Americium-241	1.121000051	pCi/g	None
21-22218	MD21-03-51529	0.0–0.5	ALLH	Cesium-134	0.075999998	pCi/g	U
21-22218	MD21-03-51529	0.0–0.5	ALLH	Cesium-137	7.734000206	pCi/g	None
21-22218	MD21-03-51529	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U
21-22218	MD21-03-51529	0.0–0.5	ALLH	Europium-152	0.395999998	pCi/g	None
21-22218	MD21-03-51529	0.0–0.5	ALLH	Plutonium-238	0.059999999	pCi/g	None
21-22218	MD21-03-51529	0.0–0.5	ALLH	Plutonium-239	1.422999978	pCi/g	None
21-22218	MD21-03-51529	0.0–0.5	ALLH	Ruthenium-106	0.104000002	pCi/g	U
21-22218	MD21-03-51529	0.0–0.5	ALLH	Sodium-22	0.005	pCi/g	U
21-22218	MD21-03-51529	0.0–0.5	ALLH	Strontium-90	8.43999958	pCi/g	None
21-22218	MD21-03-51529	0.0–0.5	ALLH	Uranium-235	0.263999999	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Americium-241	3.470999956	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Cesium-134	0.075000003	pCi/g	U
21-22219	MD21-03-51530	0.0–0.5	ALLH	Cesium-137	92.14800262	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Cobalt-60	-0.02	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22219	MD21-03-51530	0.0–0.5	ALLH	Europium-152	0.264999986	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Plutonium-238	0.312000006	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Plutonium-239	6.214000225	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Ruthenium-106	-0.04	pCi/g	U
21-22219	MD21-03-51530	0.0–0.5	ALLH	Sodium-22	-0.009	pCi/g	U
21-22219	MD21-03-51530	0.0–0.5	ALLH	Strontium-90	31.96899986	pCi/g	None
21-22219	MD21-03-51530	0.0–0.5	ALLH	Uranium-235	0.354000002	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Americium-241	3.25	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Cesium-134	-0.15800001	pCi/g	U
21-22220	MD21-03-51531	0.0–0.5	ALLH	Cesium-137	100.3199997	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Cobalt-60	-0.004	pCi/g	U
21-22220	MD21-03-51531	0.0–0.5	ALLH	Europium-152	0.300000012	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Plutonium-238	1.531000018	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Plutonium-239	6.223999977	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Ruthenium-106	-0.046	pCi/g	U
21-22220	MD21-03-51531	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22220	MD21-03-51531	0.0–0.5	ALLH	Strontium-90	16.26399994	pCi/g	None
21-22220	MD21-03-51531	0.0–0.5	ALLH	Uranium-235	0.294999987	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Americium-241	9.548000336	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Cesium-134	-0.21600001	pCi/g	U
21-22221	MD21-03-51532	0.0–0.5	ALLH	Cesium-137	134.1999969	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Cobalt-60	0.01	pCi/g	U
21-22221	MD21-03-51532	0.0–0.5	ALLH	Europium-152	0.312999994	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Plutonium-238	2.493000031	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Plutonium-239	11.30300045	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Ruthenium-106	-0.26199999	pCi/g	U
21-22221	MD21-03-51532	0.0–0.5	ALLH	Sodium-22	-0.007	pCi/g	U
21-22221	MD21-03-51532	0.0–0.5	ALLH	Strontium-90	21.8409996	pCi/g	None
21-22221	MD21-03-51532	0.0–0.5	ALLH	Uranium-235	0.280000001	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Americium-241	9.569999695	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Cesium-134	0.068000004	pCi/g	U
21-22222	MD21-03-51533	0.0–0.5	ALLH	Cesium-137	118.8899994	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Cobalt-60	0.005	pCi/g	U
21-22222	MD21-03-51533	0.0–0.5	ALLH	Europium-152	0.36500001	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Plutonium-238	2.130000114	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Plutonium-239	14.02200031	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Ruthenium-106	-0.043	pCi/g	U
21-22222	MD21-03-51533	0.0–0.5	ALLH	Sodium-22	0.017999999	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22222	MD21-03-51533	0.0–0.5	ALLH	Strontium-90	26.84399986	pCi/g	None
21-22222	MD21-03-51533	0.0–0.5	ALLH	Uranium-235	0.086999997	pCi/g	U
21-22223	MD21-03-51534	0.0–0.5	ALLH	Americium-241	5.089000225	pCi/g	None
21-22223	MD21-03-51534	0.0–0.5	ALLH	Cesium-134	0.046999998	pCi/g	U
21-22223	MD21-03-51534	0.0–0.5	ALLH	Cesium-137	67.68099976	pCi/g	None
21-22223	MD21-03-51534	0.0–0.5	ALLH	Cobalt-60	-0.006	pCi/g	U
21-22223	MD21-03-51534	0.0–0.5	ALLH	Europium-152	0.229000002	pCi/g	None
21-22223	MD21-03-51534	0.0–0.5	ALLH	Plutonium-238	1.062999964	pCi/g	None
21-22223	MD21-03-51534	0.0–0.5	ALLH	Plutonium-239	5.697999954	pCi/g	None
21-22223	MD21-03-51534	0.0–0.5	ALLH	Ruthenium-106	0.066	pCi/g	U
21-22223	MD21-03-51534	0.0–0.5	ALLH	Sodium-22	-0.019	pCi/g	U
21-22223	MD21-03-51534	0.0–0.5	ALLH	Strontium-90	8.295000076	pCi/g	None
21-22223	MD21-03-51534	0.0–0.5	ALLH	Uranium-235	0.268999994	pCi/g	None
21-22224	MD21-03-51535	0.0–0.5	ALLH	Americium-241	4.506000042	pCi/g	None
21-22224	MD21-03-51535	0.0–0.5	ALLH	Cesium-134	0.059	pCi/g	U
21-22224	MD21-03-51535	0.0–0.5	ALLH	Cesium-137	94.1230011	pCi/g	None
21-22224	MD21-03-51535	0.0–0.5	ALLH	Cobalt-60	-0.01	pCi/g	U
21-22224	MD21-03-51535	0.0–0.5	ALLH	Europium-152	0.245000005	pCi/g	U
21-22224	MD21-03-51535	0.0–0.5	ALLH	Plutonium-238	1.932000041	pCi/g	None
21-22224	MD21-03-51535	0.0–0.5	ALLH	Plutonium-239	6.818999767	pCi/g	None
21-22224	MD21-03-51535	0.0–0.5	ALLH	Ruthenium-106	0.158999994	pCi/g	U
21-22224	MD21-03-51535	0.0–0.5	ALLH	Sodium-22	0.004	pCi/g	U
21-22224	MD21-03-51535	0.0–0.5	ALLH	Strontium-90	16.92900085	pCi/g	None
21-22224	MD21-03-51535	0.0–0.5	ALLH	Uranium-235	0.264999986	pCi/g	None
21-22225	MD21-03-51536	0.0–0.5	ALLH	Americium-241	10.63599968	pCi/g	None
21-22225	MD21-03-51536	0.0–0.5	ALLH	Cesium-134	0.145999998	pCi/g	U
21-22225	MD21-03-51536	0.0–0.5	ALLH	Cesium-137	99.52899933	pCi/g	None
21-22225	MD21-03-51536	0.0–0.5	ALLH	Cobalt-60	-0.005	pCi/g	U
21-22225	MD21-03-51536	0.0–0.5	ALLH	Europium-152	0.188999996	pCi/g	U
21-22225	MD21-03-51536	0.0–0.5	ALLH	Plutonium-238	1.55400002	pCi/g	None
21-22225	MD21-03-51536	0.0–0.5	ALLH	Plutonium-239	10.11600018	pCi/g	None
21-22225	MD21-03-51536	0.0–0.5	ALLH	Ruthenium-106	0.195999995	pCi/g	U
21-22225	MD21-03-51536	0.0–0.5	ALLH	Sodium-22	0.022	pCi/g	U
21-22225	MD21-03-51536	0.0–0.5	ALLH	Strontium-90	22.6590004	pCi/g	None
21-22225	MD21-03-51536	0.0–0.5	ALLH	Uranium-235	0.270999998	pCi/g	None
21-22226	MD21-03-51537	0.0–0.5	ALLH	Americium-241	6.869999886	pCi/g	None
21-22226	MD21-03-51537	0.0–0.5	ALLH	Cesium-134	0.050999999	pCi/g	U
21-22226	MD21-03-51537	0.0–0.5	ALLH	Cesium-137	86.03600311	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22226	MD21-03-51537	0.0–0.5	ALLH	Cobalt-60	-0.007	pCi/g	U
21-22226	MD21-03-51537	0.0–0.5	ALLH	Europium-152	0.407999992	pCi/g	None
21-22226	MD21-03-51537	0.0–0.5	ALLH	Plutonium-238	1.5	pCi/g	None
21-22226	MD21-03-51537	0.0–0.5	ALLH	Plutonium-239	9.170000076	pCi/g	None
21-22226	MD21-03-51537	0.0–0.5	ALLH	Ruthenium-106	-0.067	pCi/g	U
21-22226	MD21-03-51537	0.0–0.5	ALLH	Sodium-22	-0.001	pCi/g	U
21-22226	MD21-03-51537	0.0–0.5	ALLH	Strontium-90	16.84600067	pCi/g	None
21-22226	MD21-03-51537	0.0–0.5	ALLH	Uranium-235	0.263999999	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Americium-241	2.016000032	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Cesium-134	0.063000001	pCi/g	U
21-22227	MD21-03-51538	0.0–0.5	ALLH	Cesium-137	32.06200027	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U
21-22227	MD21-03-51538	0.0–0.5	ALLH	Europium-152	0.34799999	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Plutonium-238	0.597000003	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Plutonium-239	3.946000099	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Ruthenium-106	0.048	pCi/g	U
21-22227	MD21-03-51538	0.0–0.5	ALLH	Sodium-22	-0.008	pCi/g	U
21-22227	MD21-03-51538	0.0–0.5	ALLH	Strontium-90	6.210000038	pCi/g	None
21-22227	MD21-03-51538	0.0–0.5	ALLH	Uranium-235	0.103	pCi/g	U
21-22228	MD21-03-51539	0.0–0.5	ALLH	Americium-241	1.830000043	pCi/g	None
21-22228	MD21-03-51539	0.0–0.5	ALLH	Cesium-134	-0.26699999	pCi/g	U
21-22228	MD21-03-51539	0.0–0.5	ALLH	Cesium-137	15.64799976	pCi/g	None
21-22228	MD21-03-51539	0.0–0.5	ALLH	Cobalt-60	-0.006	pCi/g	U
21-22228	MD21-03-51539	0.0–0.5	ALLH	Europium-152	0.310000002	pCi/g	None
21-22228	MD21-03-51539	0.0–0.5	ALLH	Plutonium-238	0.321999997	pCi/g	None
21-22228	MD21-03-51539	0.0–0.5	ALLH	Plutonium-239	2.45600009	pCi/g	None
21-22228	MD21-03-51539	0.0–0.5	ALLH	Ruthenium-106	-0.054	pCi/g	U
21-22228	MD21-03-51539	0.0–0.5	ALLH	Sodium-22	0.014	pCi/g	U
21-22228	MD21-03-51539	0.0–0.5	ALLH	Strontium-90	4.321000099	pCi/g	None
21-22228	MD21-03-51539	0.0–0.5	ALLH	Uranium-235	0.280999988	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Americium-241	2.430000067	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Cesium-134	0.057999998	pCi/g	U
21-22229	MD21-03-51540	0.0–0.5	ALLH	Cesium-137	15.28600025	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Cobalt-60	0.007	pCi/g	U
21-22229	MD21-03-51540	0.0–0.5	ALLH	Europium-152	0.532999992	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Plutonium-238	0.184	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Plutonium-239	1.710999966	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Ruthenium-106	-0.113	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22229	MD21-03-51540	0.0–0.5	ALLH	Sodium-22	0.005	pCi/g	U
21-22229	MD21-03-51540	0.0–0.5	ALLH	Strontium-90	3.118999958	pCi/g	None
21-22229	MD21-03-51540	0.0–0.5	ALLH	Uranium-235	0.245000005	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Americium-241	3.562000036	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Cesium-134	0.078000002	pCi/g	U
21-22230	MD21-03-51541	0.0–0.5	ALLH	Cesium-137	55.49599838	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Cobalt-60	-0.011	pCi/g	U
21-22230	MD21-03-51541	0.0–0.5	ALLH	Europium-152	0.629000008	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Plutonium-238	0.223000005	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Plutonium-239	8.166999817	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Ruthenium-106	-0.206	pCi/g	U
21-22230	MD21-03-51541	0.0–0.5	ALLH	Sodium-22	0.007	pCi/g	U
21-22230	MD21-03-51541	0.0–0.5	ALLH	Strontium-90	20.7310009	pCi/g	None
21-22230	MD21-03-51541	0.0–0.5	ALLH	Uranium-235	0.416000009	pCi/g	U
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Americium-241	5.080999851	pCi/g	None
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Cesium-134	0.104000002	pCi/g	U
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Cesium-137	36.57500076	pCi/g	None
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Europium-152	0.405999988	pCi/g	None
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Plutonium-238	0.377999991	pCi/g	None
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Plutonium-239	7.989999771	pCi/g	None
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Ruthenium-106	0.135000005	pCi/g	U
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Sodium-22	0	pCi/g	U
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Strontium-90	8.751999855	pCi/g	None
21-22231	MD21-03-51542	0.0–0.5	Qbt 3	Uranium-235	0.30399999	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Americium-241	1.26699996	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Cesium-134	-0.067	pCi/g	U
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Cesium-137	24.98900032	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Cobalt-60	-0.005	pCi/g	U
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Europium-152	0.228	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Plutonium-238	0.050000001	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Plutonium-239	1.79400003	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Ruthenium-106	-0.002	pCi/g	U
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Sodium-22	0	pCi/g	U
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Strontium-90	9.114999771	pCi/g	None
21-22232	MD21-03-51543	0.0–0.5	Qbt 3	Uranium-235	0.275999993	pCi/g	None
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Americium-241	0.231999993	pCi/g	None
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Cesium-134	-0.021	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Cesium-137	45.29199982	pCi/g	None
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Cobalt-60	-0.004	pCi/g	U
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Europium-152	0.270999998	pCi/g	None
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Plutonium-238	0.028999999	pCi/g	U
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Plutonium-239	0.666999996	pCi/g	None
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Ruthenium-106	-0.149	pCi/g	U
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Sodium-22	0.018999999	pCi/g	U
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Strontium-90	25.54000092	pCi/g	None
21-22233	MD21-03-51544	0.0–0.5	Qbt 3	Uranium-235	0.223000005	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Americium-241	0.294999987	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Cesium-134	0.068999998	pCi/g	U
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Cesium-137	76.93599701	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Cobalt-60	-0.01	pCi/g	U
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Europium-152	0.312000006	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Plutonium-238	0.030999999	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Plutonium-239	1.162999988	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Ruthenium-106	-0.066	pCi/g	U
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Sodium-22	0.012	pCi/g	U
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Strontium-90	41.11999893	pCi/g	None
21-22234	MD21-03-51545	0.0–0.5	Qbt 3	Uranium-235	0.246000007	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Americium-241	0.467000008	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Cesium-134	0.082999997	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Cesium-137	99.15399933	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Cobalt-60	-0.005	pCi/g	U
21-22235	MD21-03-51546	0.0–0.5	ALLH	Europium-152	0.386999995	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Plutonium-238	0.046	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Plutonium-239	1.458999991	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Ruthenium-106	-0.061	pCi/g	U
21-22235	MD21-03-51546	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22235	MD21-03-51546	0.0–0.5	ALLH	Strontium-90	48.20899963	pCi/g	None
21-22235	MD21-03-51546	0.0–0.5	ALLH	Uranium-235	0.330000013	pCi/g	None
21-22236	MD21-03-51547	0.0–0.5	ALLH	Americium-241	2.217000008	pCi/g	None
21-22236	MD21-03-51547	0.0–0.5	ALLH	Cesium-134	0.075999998	pCi/g	U
21-22236	MD21-03-51547	0.0–0.5	ALLH	Cesium-137	79.60199738	pCi/g	None
21-22236	MD21-03-51547	0.0–0.5	ALLH	Cobalt-60	-0.001	pCi/g	U
21-22236	MD21-03-51547	0.0–0.5	ALLH	Europium-152	0.81400001	pCi/g	None
21-22236	MD21-03-51547	0.0–0.5	ALLH	Plutonium-238	0.123999998	pCi/g	None
21-22236	MD21-03-51547	0.0–0.5	ALLH	Plutonium-239	3.913000107	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22236	MD21-03-51547	0.0–0.5	ALLH	Ruthenium-106	0.120999999	pCi/g	U
21-22236	MD21-03-51547	0.0–0.5	ALLH	Sodium-22	0.014	pCi/g	U
21-22236	MD21-03-51547	0.0–0.5	ALLH	Strontium-90	24.10700035	pCi/g	None
21-22236	MD21-03-51547	0.0–0.5	ALLH	Uranium-235	0.314999998	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Americium-241	1.59800005	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Cesium-134	0.144999996	pCi/g	U
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Cesium-137	84.68299866	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Cobalt-60	-0.007	pCi/g	U
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Europium-152	0.467000008	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Plutonium-238	0.104999997	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Plutonium-239	1.911000013	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Ruthenium-106	0.016000001	pCi/g	U
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Sodium-22	0.002	pCi/g	U
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Strontium-90	29.75499916	pCi/g	None
21-22237	MD21-03-51548	0.0–0.5	Qbt 3	Uranium-235	0.294	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Americium-241	9.654999733	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Cesium-134	0.108000003	pCi/g	U
21-22238	MD21-03-51549	0.0–0.5	ALLH	Cesium-137	16.06900024	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Cobalt-60	-0.01	pCi/g	U
21-22238	MD21-03-51549	0.0–0.5	ALLH	Europium-152	0.379000008	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Plutonium-238	0.363999993	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Plutonium-239	11.89099979	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Ruthenium-106	-0.029	pCi/g	U
21-22238	MD21-03-51549	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22238	MD21-03-51549	0.0–0.5	ALLH	Strontium-90	3.046999931	pCi/g	None
21-22238	MD21-03-51549	0.0–0.5	ALLH	Uranium-235	0.303000003	pCi/g	U
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Americium-241	7.909999847	pCi/g	None
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Cesium-134	-0.32100001	pCi/g	U
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Cesium-137	24.91500092	pCi/g	None
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Cobalt-60	-0.026	pCi/g	U
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Europium-152	0.188999996	pCi/g	U
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Plutonium-238	1.335000038	pCi/g	None
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Plutonium-239	5.644999981	pCi/g	None
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Ruthenium-106	-0.168	pCi/g	U
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Sodium-22	0.003	pCi/g	U
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Strontium-90	12.01200008	pCi/g	None
21-22239	MD21-03-51550	0.0–0.5	Qbt 3	Uranium-235	0.449000001	pCi/g	None
21-22240	MD21-03-51551	0.0–0.5	ALLH	Americium-241	1.485999942	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22240	MD21-03-51551	0.0–0.5	ALLH	Cesium-134	0.104000002	pCi/g	U
21-22240	MD21-03-51551	0.0–0.5	ALLH	Cesium-137	2.855999947	pCi/g	None
21-22240	MD21-03-51551	0.0–0.5	ALLH	Cobalt-60	-0.005	pCi/g	U
21-22240	MD21-03-51551	0.0–0.5	ALLH	Europium-152	0.233999997	pCi/g	None
21-22240	MD21-03-51551	0.0–0.5	ALLH	Plutonium-238	0.150999993	pCi/g	None
21-22240	MD21-03-51551	0.0–0.5	ALLH	Plutonium-239	2.789000034	pCi/g	None
21-22240	MD21-03-51551	0.0–0.5	ALLH	Ruthenium-106	0.024	pCi/g	U
21-22240	MD21-03-51551	0.0–0.5	ALLH	Sodium-22	0.008	pCi/g	U
21-22240	MD21-03-51551	0.0–0.5	ALLH	Strontium-90	1.085000038	pCi/g	None
21-22240	MD21-03-51551	0.0–0.5	ALLH	Uranium-235	0.248999998	pCi/g	U
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Americium-241	28.90099907	pCi/g	None
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Cesium-134	0.086999997	pCi/g	U
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Cesium-137	78.8239975	pCi/g	None
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Cobalt-60	0.001	pCi/g	U
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Europium-152	0.214000002	pCi/g	None
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Plutonium-238	2.960000038	pCi/g	None
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Plutonium-239	11.83899975	pCi/g	None
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Ruthenium-106	0.141000003	pCi/g	U
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Sodium-22	0	pCi/g	U
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Strontium-90	29.35300064	pCi/g	None
21-22241	MD21-03-51552	0.0–0.5	Qbt 3	Uranium-235	0.444000006	pCi/g	None
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Americium-241	7.771999836	pCi/g	None
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Cesium-134	-0.099	pCi/g	U
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Cesium-137	62.94800186	pCi/g	None
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Europium-152	0.244000003	pCi/g	U
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Plutonium-238	0.312000006	pCi/g	None
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Plutonium-239	10.05200005	pCi/g	None
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Ruthenium-106	0.241999999	pCi/g	U
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Sodium-22	0.028000001	pCi/g	U
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Strontium-90	16.94799995	pCi/g	None
21-22242	MD21-03-51553	0.0–0.5	Qbt 3	Uranium-235	0.173999995	pCi/g	U
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Americium-241	1.338999987	pCi/g	None
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Cesium-134	-0.20200001	pCi/g	U
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Cesium-137	26.86899948	pCi/g	None
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Cobalt-60	0.003	pCi/g	U
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Europium-152	0.486000001	pCi/g	None
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Plutonium-238	0.078000002	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Plutonium-239	1.66900003	pCi/g	None
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Ruthenium-106	-0.028	pCi/g	U
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Sodium-22	-0.01	pCi/g	U
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Strontium-90	9.711000443	pCi/g	None
21-22243	MD21-03-51554	0.0–0.5	Qbt 3	Uranium-235	0.32100001	pCi/g	None
21-22244	MD21-03-51555	0.0–0.5	ALLH	Americium-241	2.227999926	pCi/g	None
21-22244	MD21-03-51555	0.0–0.5	ALLH	Cesium-134	0.172000006	pCi/g	U
21-22244	MD21-03-51555	0.0–0.5	ALLH	Cesium-137	12.41899967	pCi/g	None
21-22244	MD21-03-51555	0.0–0.5	ALLH	Cobalt-60	0.012	pCi/g	U
21-22244	MD21-03-51555	0.0–0.5	ALLH	Europium-152	0.386999995	pCi/g	U
21-22244	MD21-03-51555	0.0–0.5	ALLH	Plutonium-238	0.166999996	pCi/g	None
21-22244	MD21-03-51555	0.0–0.5	ALLH	Plutonium-239	2.227999926	pCi/g	None
21-22244	MD21-03-51555	0.0–0.5	ALLH	Ruthenium-106	-0.126	pCi/g	U
21-22244	MD21-03-51555	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22244	MD21-03-51555	0.0–0.5	ALLH	Strontium-90	5.518000126	pCi/g	None
21-22244	MD21-03-51555	0.0–0.5	ALLH	Uranium-235	0.388999999	pCi/g	U
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Americium-241	99.8239975	pCi/g	None
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Cesium-134	-0.359	pCi/g	U
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Cesium-137	75.47699738	pCi/g	None
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Cobalt-60	0.017999999	pCi/g	U
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Europium-152	0.123999998	pCi/g	U
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Plutonium-238	7.337999821	pCi/g	None
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Plutonium-239	27.60199928	pCi/g	None
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Ruthenium-106	0.414000005	pCi/g	U
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Sodium-22	-0.005	pCi/g	U
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Strontium-90	41.67300034	pCi/g	None
21-22245	MD21-03-51556	0.0–0.5	Qbt 3	Uranium-235	0.537	pCi/g	U
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Americium-241	2.740999937	pCi/g	None
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Cesium-134	-0.19599999	pCi/g	U
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Cesium-137	17.30200005	pCi/g	None
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Cobalt-60	0.032000002	pCi/g	U
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Europium-152	0.307000011	pCi/g	U
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Plutonium-238	0.405999988	pCi/g	None
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Plutonium-239	1.809000015	pCi/g	None
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Ruthenium-106	-0.05	pCi/g	U
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Sodium-22	-0.007	pCi/g	U
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Strontium-90	6.129000187	pCi/g	None
21-22246	MD21-03-51557	0.0–0.5	Qbt 3	Uranium-235	0.316000015	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Americium-241	5.040999889	pCi/g	None
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Cesium-134	0.07	pCi/g	U
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Cesium-137	69.28500366	pCi/g	None
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Cobalt-60	-0.005	pCi/g	U
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Europium-152	0.247999996	pCi/g	None
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Plutonium-238	0.270999998	pCi/g	None
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Plutonium-239	6.644000053	pCi/g	None
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Ruthenium-106	-0.185	pCi/g	U
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Sodium-22	0	pCi/g	U
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Strontium-90	20.00699997	pCi/g	None
21-22247	MD21-03-51558	0.0–0.5	Qbt 3	Uranium-235	0.307000011	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Americium-241	1.756999969	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Cesium-134	0.068999998	pCi/g	U
21-22248	MD21-03-51559	0.0–0.5	ALLH	Cesium-137	16.94000053	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Cobalt-60	-0.023	pCi/g	U
21-22248	MD21-03-51559	0.0–0.5	ALLH	Europium-152	0.294	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Plutonium-238	0.166999996	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Plutonium-239	2.062999964	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Ruthenium-106	-0.015	pCi/g	U
21-22248	MD21-03-51559	0.0–0.5	ALLH	Sodium-22	0.025	pCi/g	U
21-22248	MD21-03-51559	0.0–0.5	ALLH	Strontium-90	13.74199963	pCi/g	None
21-22248	MD21-03-51559	0.0–0.5	ALLH	Uranium-235	0.363999993	pCi/g	None
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Americium-241	15.55099964	pCi/g	None
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Cesium-134	-0.032	pCi/g	U
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Cesium-137	52.07899857	pCi/g	None
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Cobalt-60	0	pCi/g	U
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Europium-152	0.067000002	pCi/g	U
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Plutonium-238	2.39199996	pCi/g	None
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Plutonium-239	16.81500053	pCi/g	None
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Ruthenium-106	-0.021	pCi/g	U
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Sodium-22	0.013	pCi/g	U
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Strontium-90	18.52899933	pCi/g	None
21-22249	MD21-03-51560	0.0–0.5	Qbt 3	Uranium-235	0.38499999	pCi/g	None
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Americium-241	2.86500001	pCi/g	None
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Cesium-134	0.158999994	pCi/g	U
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Cesium-137	20.16200066	pCi/g	None
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Europium-152	0.405000001	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Plutonium-238	0.307000011	pCi/g	None
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Plutonium-239	1.644000053	pCi/g	None
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Ruthenium-106	0.054000001	pCi/g	U
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Sodium-22	0.013	pCi/g	U
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Strontium-90	6.585000038	pCi/g	None
21-22250	MD21-03-51561	0.0–0.5	Qbt 3	Uranium-235	0.337000012	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Americium-241	3.306999922	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Cesium-134	0.093999997	pCi/g	U
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Cesium-137	20.1760006	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Cobalt-60	-0.016	pCi/g	U
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Europium-152	0.541999996	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Plutonium-238	0.136999995	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Plutonium-239	3.53399992	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Ruthenium-106	0.120999999	pCi/g	U
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Sodium-22	-0.007	pCi/g	U
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Strontium-90	8.647000313	pCi/g	None
21-22251	MD21-03-51562	0.0–0.5	Qbt 3	Uranium-235	0.27700001	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Americium-241	0.56099999	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Cesium-134	0.092	pCi/g	U
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Cesium-137	53.70500183	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Cobalt-60	0.017000001	pCi/g	U
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Europium-152	0.35800001	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Plutonium-238	0.039999999	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Plutonium-239	1.182000041	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Ruthenium-106	0.238999993	pCi/g	U
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Sodium-22	0.002	pCi/g	U
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Strontium-90	27.34600067	pCi/g	None
21-22252	MD21-03-51563	0.0–0.5	Qbt 3	Uranium-235	0.356999993	pCi/g	None
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Americium-241	37.42900085	pCi/g	None
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Cesium-134	0.100000001	pCi/g	U
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Cesium-137	158.4600067	pCi/g	None
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Cobalt-60	-0.009	pCi/g	U
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Europium-152	0.246999994	pCi/g	None
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Plutonium-238	3.119999886	pCi/g	None
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Plutonium-239	35.70700073	pCi/g	None
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Ruthenium-106	-0.24699999	pCi/g	U
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Sodium-22	0.016000001	pCi/g	U
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Strontium-90	43.70600128	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22253	MD21-03-51564	0.0–0.5	Qbt 3	Uranium-235	0.460999995	pCi/g	None
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Americium-241	9.265999794	pCi/g	None
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Cesium-134	0.109999999	pCi/g	U
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Cesium-137	168.0899963	pCi/g	None
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Europium-152	0.150999993	pCi/g	U
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Plutonium-238	2.263000011	pCi/g	None
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Plutonium-239	11.8380003	pCi/g	None
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Ruthenium-106	-0.33399999	pCi/g	U
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Sodium-22	-0.022	pCi/g	U
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Strontium-90	35.24399948	pCi/g	None
21-22254	MD21-03-51565	0.0–0.5	Qbt 3	Uranium-235	0.560000002	pCi/g	None
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Americium-241	0.108999997	pCi/g	None
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Cesium-134	0.114	pCi/g	U
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Cesium-137	0.324999988	pCi/g	None
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Cobalt-60	-0.02	pCi/g	U
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Europium-152	0.216999993	pCi/g	None
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Plutonium-238	0.009	pCi/g	U
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Plutonium-239	0.163000003	pCi/g	None
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Ruthenium-106	0.268999994	pCi/g	U
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Sodium-22	-0.01	pCi/g	U
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Strontium-90	-0.008	pCi/g	U
21-22255	MD21-03-51566	0.0–0.5	Qbt 3	Uranium-235	0.152999997	pCi/g	U
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Americium-241	0.307999998	pCi/g	None
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Cesium-134	-0.27200001	pCi/g	U
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Cesium-137	12.01399994	pCi/g	None
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Cobalt-60	-0.01	pCi/g	U
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Europium-152	0.231999993	pCi/g	None
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Plutonium-238	0.136999995	pCi/g	None
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Plutonium-239	3.53399992	pCi/g	None
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Ruthenium-106	0.093999997	pCi/g	U
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Sodium-22	0	pCi/g	U
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Strontium-90	1.968999982	pCi/g	None
21-22256	MD21-03-51567	0.0–0.5	Qbt 3	Uranium-235	0.266000003	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Americium-241	1.223999977	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Cesium-134	0.085000001	pCi/g	U
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Cesium-137	10.88199997	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Cobalt-60	-0.005	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Europium-152	0.354000002	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Plutonium-238	0.039999999	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Plutonium-239	1.182000041	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Ruthenium-106	-0.126	pCi/g	U
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Sodium-22	0.003	pCi/g	U
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Strontium-90	1.33099997	pCi/g	None
21-22257	MD21-03-51568	0.0–0.5	Qbt 3	Uranium-235	0.342000008	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Americium-241	4.528999805	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Cesium-134	0.096000001	pCi/g	U
21-22201	MD21-03-51569	0.0–0.5	ALLH	Cesium-137	40.07699966	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Cobalt-60	-0.009	pCi/g	U
21-22201	MD21-03-51569	0.0–0.5	ALLH	Europium-152	0.261000007	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Plutonium-238	0.414000005	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Plutonium-239	2.413000107	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Ruthenium-106	0.179000005	pCi/g	U
21-22201	MD21-03-51569	0.0–0.5	ALLH	Sodium-22	-0.007	pCi/g	U
21-22201	MD21-03-51569	0.0–0.5	ALLH	Strontium-90	8.616000175	pCi/g	None
21-22201	MD21-03-51569	0.0–0.5	ALLH	Uranium-235	0.39199999	pCi/g	U
21-22200	MD21-03-51570	0.0–0.5	ALLH	Americium-241	0.238000005	pCi/g	None
21-22200	MD21-03-51570	0.0–0.5	ALLH	Cesium-134	0.041000001	pCi/g	U
21-22200	MD21-03-51570	0.0–0.5	ALLH	Cesium-137	0.595000029	pCi/g	None
21-22200	MD21-03-51570	0.0–0.5	ALLH	Cobalt-60	0.037999999	pCi/g	None
21-22200	MD21-03-51570	0.0–0.5	ALLH	Europium-152	0.241999999	pCi/g	None
21-22200	MD21-03-51570	0.0–0.5	ALLH	Plutonium-238	0.052999999	pCi/g	None
21-22200	MD21-03-51570	0.0–0.5	ALLH	Plutonium-239	1.40199995	pCi/g	None
21-22200	MD21-03-51570	0.0–0.5	ALLH	Ruthenium-106	-0.052	pCi/g	U
21-22200	MD21-03-51570	0.0–0.5	ALLH	Sodium-22	0.026000001	pCi/g	U
21-22200	MD21-03-51570	0.0–0.5	ALLH	Strontium-90	0.275999993	pCi/g	U
21-22200	MD21-03-51570	0.0–0.5	ALLH	Uranium-235	0.316000015	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Americium-241	1.059999943	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Cesium-134	0.078000002	pCi/g	U
21-22199	MD21-03-51571	0.0–0.5	ALLH	Cesium-137	14.83399963	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Cobalt-60	-0.007	pCi/g	U
21-22199	MD21-03-51571	0.0–0.5	ALLH	Europium-152	0.268000007	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Plutonium-238	0.164000005	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Plutonium-239	1.414000034	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Ruthenium-106	0.104000002	pCi/g	U
21-22199	MD21-03-51571	0.0–0.5	ALLH	Sodium-22	-0.002	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22199	MD21-03-51571	0.0–0.5	ALLH	Strontium-90	2.482000113	pCi/g	None
21-22199	MD21-03-51571	0.0–0.5	ALLH	Uranium-235	0.289000005	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Americium-241	2.720000029	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Cesium-134	-0.064	pCi/g	U
21-22198	MD21-03-51572	0.0–0.5	ALLH	Cesium-137	38.96300125	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Cobalt-60	-0.018	pCi/g	U
21-22198	MD21-03-51572	0.0–0.5	ALLH	Europium-152	0.209999993	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Plutonium-238	0.321999997	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Plutonium-239	3.375	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Ruthenium-106	-0.131	pCi/g	U
21-22198	MD21-03-51572	0.0–0.5	ALLH	Sodium-22	0.001	pCi/g	U
21-22198	MD21-03-51572	0.0–0.5	ALLH	Strontium-90	4.448999882	pCi/g	None
21-22198	MD21-03-51572	0.0–0.5	ALLH	Uranium-235	0.312000006	pCi/g	U
21-22235	MD21-03-51573	0.0–0.5	ALLH	Americium-241	0.43900001	pCi/g	None
21-22235	MD21-03-51573	0.0–0.5	ALLH	Cesium-134	-0.168	pCi/g	U
21-22235	MD21-03-51573	0.0–0.5	ALLH	Cesium-137	89.11699677	pCi/g	None
21-22235	MD21-03-51573	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U
21-22235	MD21-03-51573	0.0–0.5	ALLH	Europium-152	0.370999992	pCi/g	None
21-22235	MD21-03-51573	0.0–0.5	ALLH	Plutonium-238	0.079999998	pCi/g	None
21-22235	MD21-03-51573	0.0–0.5	ALLH	Plutonium-239	1.842000008	pCi/g	None
21-22235	MD21-03-51573	0.0–0.5	ALLH	Ruthenium-106	-0.27500001	pCi/g	U
21-22235	MD21-03-51573	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22235	MD21-03-51573	0.0–0.5	ALLH	Strontium-90	44.04700089	pCi/g	None
21-22235	MD21-03-51573	0.0–0.5	ALLH	Uranium-235	0.282999992	pCi/g	None
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Americium-241	0.314999998	pCi/g	J-
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Cesium-134	0.115999997	pCi/g	U
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Cesium-137	3.838999987	pCi/g	None
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Cobalt-60	0.012	pCi/g	U
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Europium-152	0.266000003	pCi/g	None
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Plutonium-238	0.043000001	pCi/g	None
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Plutonium-239	0.229000002	pCi/g	None
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Ruthenium-106	-0.131	pCi/g	U
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Sodium-22	-0.018	pCi/g	U
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Strontium-90	1.886999965	pCi/g	None
21-22258	MD21-03-51574	0.0–0.5	Qbt 3	Uranium-235	0.307999998	pCi/g	U
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Americium-241	3.25999999	pCi/g	J-
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Cesium-134	0.505999982	pCi/g	None
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Cesium-137	29.69599915	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Cobalt-60	-0.002	pCi/g	U
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Europium-152	0.187000006	pCi/g	U
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Plutonium-238	0.104000002	pCi/g	None
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Plutonium-239	0.727999985	pCi/g	None
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Ruthenium-106	0.048	pCi/g	U
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Sodium-22	0.02	pCi/g	U
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Strontium-90	5.306000233	pCi/g	None
21-22259	MD21-03-51575	0.0–0.5	Qbt 3	Uranium-235	0.345999986	pCi/g	U
21-22260	MD21-03-51576	0.0–0.5	ALLH	Americium-241	3.461999893	pCi/g	J-
21-22260	MD21-03-51576	0.0–0.5	ALLH	Cesium-134	0.077	pCi/g	U
21-22260	MD21-03-51576	0.0–0.5	ALLH	Cesium-137	25.79999924	pCi/g	None
21-22260	MD21-03-51576	0.0–0.5	ALLH	Cobalt-60	-0.003	pCi/g	U
21-22260	MD21-03-51576	0.0–0.5	ALLH	Europium-152	0.547999978	pCi/g	None
21-22260	MD21-03-51576	0.0–0.5	ALLH	Plutonium-238	0.167999998	pCi/g	None
21-22260	MD21-03-51576	0.0–0.5	ALLH	Plutonium-239	3.969000101	pCi/g	None
21-22260	MD21-03-51576	0.0–0.5	ALLH	Ruthenium-106	0.199000001	pCi/g	U
21-22260	MD21-03-51576	0.0–0.5	ALLH	Sodium-22	0.006	pCi/g	U
21-22260	MD21-03-51576	0.0–0.5	ALLH	Strontium-90	3.822000027	pCi/g	None
21-22260	MD21-03-51576	0.0–0.5	ALLH	Uranium-235	0.361999989	pCi/g	None
21-22261	MD21-03-51577	0.0–0.5	ALLH	Americium-241	0.508000016	pCi/g	J-
21-22261	MD21-03-51577	0.0–0.5	ALLH	Cesium-134	0.082000002	pCi/g	U
21-22261	MD21-03-51577	0.0–0.5	ALLH	Cesium-137	13.1420002	pCi/g	None
21-22261	MD21-03-51577	0.0–0.5	ALLH	Cobalt-60	0.008	pCi/g	U
21-22261	MD21-03-51577	0.0–0.5	ALLH	Europium-152	0.317999989	pCi/g	None
21-22261	MD21-03-51577	0.0–0.5	ALLH	Plutonium-238	0.086000003	pCi/g	None
21-22261	MD21-03-51577	0.0–0.5	ALLH	Plutonium-239	0.853999972	pCi/g	None
21-22261	MD21-03-51577	0.0–0.5	ALLH	Ruthenium-106	0.090999998	pCi/g	U
21-22261	MD21-03-51577	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22261	MD21-03-51577	0.0–0.5	ALLH	Strontium-90	2.102999926	pCi/g	None
21-22261	MD21-03-51577	0.0–0.5	ALLH	Uranium-235	0.202000007	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Americium-241	9.821000099	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Cesium-134	0.081	pCi/g	U
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Cesium-137	69.03199768	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Cobalt-60	0.005	pCi/g	U
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Europium-152	0.323000014	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Plutonium-238	0.51700002	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Plutonium-239	9.138999939	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Ruthenium-106	-0.145	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Sodium-22	0.006	pCi/g	U
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Strontium-90	24.42700005	pCi/g	None
21-22262	MD21-03-51578	0.0–0.5	Qbt 3	Uranium-235	0.264999986	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Americium-241	0.944000006	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Cesium-134	0.270000011	pCi/g	U
21-22263	MD21-03-51579	0.0–0.5	ALLH	Cesium-137	43.30599976	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Cobalt-60	-0.008	pCi/g	U
21-22263	MD21-03-51579	0.0–0.5	ALLH	Europium-152	0.287999988	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Plutonium-238	0.178000003	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Plutonium-239	4.171000004	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Ruthenium-106	-0.329	pCi/g	U
21-22263	MD21-03-51579	0.0–0.5	ALLH	Sodium-22	0.014	pCi/g	U
21-22263	MD21-03-51579	0.0–0.5	ALLH	Strontium-90	12.84899998	pCi/g	None
21-22263	MD21-03-51579	0.0–0.5	ALLH	Uranium-235	0.393000007	pCi/g	None
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Americium-241	44.92900085	pCi/g	None
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Cesium-134	-0.025	pCi/g	U
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Cesium-137	157.3399963	pCi/g	None
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Cobalt-60	0.011	pCi/g	U
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Europium-152	0.108000003	pCi/g	U
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Plutonium-238	2.924000025	pCi/g	None
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Plutonium-239	18.52300072	pCi/g	None
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Ruthenium-106	0.303000003	pCi/g	U
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Sodium-22	-0.019	pCi/g	U
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Strontium-90	35.31499863	pCi/g	None
21-22264	MD21-03-51580	0.0–0.5	Qbt 3	Uranium-235	0.453999996	pCi/g	None
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Americium-241	20.68000031	pCi/g	None
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Cesium-134	0.077	pCi/g	U
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Cesium-137	36.20199966	pCi/g	None
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Cobalt-60	-0.015	pCi/g	U
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Europium-152	0.223000005	pCi/g	U
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Plutonium-238	0.670000017	pCi/g	None
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Plutonium-239	9.295999527	pCi/g	None
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Ruthenium-106	0.007	pCi/g	U
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Sodium-22	-0.004	pCi/g	U
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Strontium-90	11.44400024	pCi/g	None
21-22265	MD21-03-51581	0.0–0.5	Qbt 3	Uranium-235	0.180999994	pCi/g	U
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Americium-241	56.32899857	pCi/g	None
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Cesium-134	0.068000004	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Cesium-137	68.16699982	pCi/g	None
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Cobalt-60	-0.001	pCi/g	U
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Europium-152	0.122000001	pCi/g	None
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Plutonium-238	5.749000072	pCi/g	None
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Plutonium-239	59.36899948	pCi/g	None
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Ruthenium-106	-0.17200001	pCi/g	U
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Sodium-22	0.007	pCi/g	U
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Strontium-90	26.29500008	pCi/g	None
21-22266	MD21-03-51582	0.0–0.5	Qbt 3	Uranium-235	0.338	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Americium-241	1.774000049	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Cesium-134	0.057	pCi/g	U
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Cesium-137	63.89899826	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Cobalt-60	-0.019	pCi/g	U
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Europium-152	0.342000008	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Plutonium-238	0.246000007	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Plutonium-239	3.509000063	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Ruthenium-106	0	pCi/g	U
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Sodium-22	-0.025	pCi/g	U
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Strontium-90	25.24900055	pCi/g	None
21-22267	MD21-03-51583	0.0–0.5	Qbt 3	Uranium-235	0.162	pCi/g	U
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Americium-241	5.493999958	pCi/g	None
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Cesium-134	0.082000002	pCi/g	U
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Cesium-137	34.65399933	pCi/g	None
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Cobalt-60	0.001	pCi/g	U
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Europium-152	0.291999996	pCi/g	None
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Plutonium-238	0.349000007	pCi/g	None
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Plutonium-239	14.69400024	pCi/g	None
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Ruthenium-106	0.136999995	pCi/g	U
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Sodium-22	-0.001	pCi/g	U
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Strontium-90	6.112999916	pCi/g	None
21-22268	MD21-03-51584	0.0–0.5	Qbt 3	Uranium-235	0.252999991	pCi/g	None
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Americium-241	23.24799919	pCi/g	None
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Cesium-134	0.075000003	pCi/g	U
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Cesium-137	37.04499817	pCi/g	None
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Cobalt-60	0.009	pCi/g	U
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Europium-152	0.101999998	pCi/g	None
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Plutonium-238	2.721999884	pCi/g	None
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Plutonium-239	25.44300079	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Ruthenium-106	0.025	pCi/g	U
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Sodium-22	0.003	pCi/g	U
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Strontium-90	20.8010006	pCi/g	None
21-22269	MD21-03-51585	0.0–0.5	Qbt 3	Uranium-235	0.257999986	pCi/g	None
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Americium-241	33.1570015	pCi/g	None
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Cesium-134	0.409000009	pCi/g	U
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Cesium-137	76.03900146	pCi/g	None
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Cobalt-60	0.007	pCi/g	U
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Europium-152	0.133000001	pCi/g	U
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Plutonium-238	4.758999825	pCi/g	None
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Plutonium-239	37.68299866	pCi/g	None
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Ruthenium-106	0.218999997	pCi/g	U
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Sodium-22	-0.006	pCi/g	U
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Strontium-90	26.95599937	pCi/g	None
21-22270	MD21-03-51586	0.0–0.5	Qbt 3	Uranium-235	0.312000006	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Americium-241	3.065000057	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Cesium-134	-0.146	pCi/g	U
21-22271	MD21-03-51587	0.0–0.5	ALLH	Cesium-137	7.428999901	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Cobalt-60	-0.001	pCi/g	U
21-22271	MD21-03-51587	0.0–0.5	ALLH	Europium-152	0.521000028	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Plutonium-238	0.263999999	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Plutonium-239	8.824999809	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Ruthenium-106	0.056000002	pCi/g	U
21-22271	MD21-03-51587	0.0–0.5	ALLH	Sodium-22	-0.006	pCi/g	U
21-22271	MD21-03-51587	0.0–0.5	ALLH	Strontium-90	1.172999978	pCi/g	None
21-22271	MD21-03-51587	0.0–0.5	ALLH	Uranium-235	0.270000011	pCi/g	None
21-22272	MD21-03-51588	0.0–0.5	ALLH	Americium-241	8.99600029	pCi/g	None
21-22272	MD21-03-51588	0.0–0.5	ALLH	Cesium-134	0.064999998	pCi/g	U
21-22272	MD21-03-51588	0.0–0.5	ALLH	Cesium-137	93.16899872	pCi/g	None
21-22272	MD21-03-51588	0.0–0.5	ALLH	Cobalt-60	0.016000001	pCi/g	U
21-22272	MD21-03-51588	0.0–0.5	ALLH	Europium-152	0.237000003	pCi/g	U
21-22272	MD21-03-51588	0.0–0.5	ALLH	Plutonium-238	0.864000022	pCi/g	None
21-22272	MD21-03-51588	0.0–0.5	ALLH	Plutonium-239	23.50900078	pCi/g	None
21-22272	MD21-03-51588	0.0–0.5	ALLH	Ruthenium-106	0.012	pCi/g	U
21-22272	MD21-03-51588	0.0–0.5	ALLH	Sodium-22	0.015	pCi/g	U
21-22272	MD21-03-51588	0.0–0.5	ALLH	Strontium-90	21.39100075	pCi/g	None
21-22272	MD21-03-51588	0.0–0.5	ALLH	Uranium-235	0.282999992	pCi/g	None
21-22273	MD21-03-51589	0.0–0.5	ALLH	Americium-241	2.242000103	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22273	MD21-03-51589	0.0–0.5	ALLH	Cesium-134	0.083999999	pCi/g	U
21-22273	MD21-03-51589	0.0–0.5	ALLH	Cesium-137	38.04199982	pCi/g	None
21-22273	MD21-03-51589	0.0–0.5	ALLH	Cobalt-60	0.006	pCi/g	U
21-22273	MD21-03-51589	0.0–0.5	ALLH	Europium-152	0.245000005	pCi/g	None
21-22273	MD21-03-51589	0.0–0.5	ALLH	Plutonium-238	0.345999986	pCi/g	None
21-22273	MD21-03-51589	0.0–0.5	ALLH	Plutonium-239	4.822999954	pCi/g	None
21-22273	MD21-03-51589	0.0–0.5	ALLH	Ruthenium-106	-0.116	pCi/g	U
21-22273	MD21-03-51589	0.0–0.5	ALLH	Sodium-22	0.016000001	pCi/g	U
21-22273	MD21-03-51589	0.0–0.5	ALLH	Strontium-90	7.668000221	pCi/g	None
21-22273	MD21-03-51589	0.0–0.5	ALLH	Uranium-235	0.246999994	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Americium-241	4.337999821	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Cesium-134	0.143000007	pCi/g	U
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Cesium-137	180.2100067	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Cobalt-60	-0.008	pCi/g	U
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Europium-152	0.30399999	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Plutonium-238	0.39199999	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Plutonium-239	15.32299995	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Ruthenium-106	0.008	pCi/g	U
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Sodium-22	0.003	pCi/g	U
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Strontium-90	36.9129982	pCi/g	None
21-22274	MD21-03-51590	0.0–0.5	Qbt 3	Uranium-235	0.268999994	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Americium-241	0.048999999	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Cesium-134	0.075000003	pCi/g	U
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Cesium-137	83.21800232	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Cobalt-60	-0.009	pCi/g	U
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Europium-152	0.354000002	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Plutonium-238	0.026000001	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Plutonium-239	0.996999979	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Ruthenium-106	0.048999999	pCi/g	U
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Sodium-22	-0.002	pCi/g	U
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Strontium-90	18.30200005	pCi/g	None
21-22275	MD21-03-51591	0.0–0.5	Qbt 3	Uranium-235	0.282999992	pCi/g	None
21-22276	MD21-03-51592	0.0–0.5	ALLH	Americium-241	1.404999971	pCi/g	None
21-22276	MD21-03-51592	0.0–0.5	ALLH	Cesium-134	0.050000001	pCi/g	U
21-22276	MD21-03-51592	0.0–0.5	ALLH	Cesium-137	91.21499634	pCi/g	None
21-22276	MD21-03-51592	0.0–0.5	ALLH	Cobalt-60	-0.012	pCi/g	U
21-22276	MD21-03-51592	0.0–0.5	ALLH	Europium-152	0.349000007	pCi/g	None
21-22276	MD21-03-51592	0.0–0.5	ALLH	Plutonium-238	0.545000017	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22276	MD21-03-51592	0.0–0.5	ALLH	Plutonium-239	5.250999928	pCi/g	None
21-22276	MD21-03-51592	0.0–0.5	ALLH	Ruthenium-106	0.022	pCi/g	U
21-22276	MD21-03-51592	0.0–0.5	ALLH	Sodium-22	-0.007	pCi/g	U
21-22276	MD21-03-51592	0.0–0.5	ALLH	Strontium-90	8.706000328	pCi/g	None
21-22276	MD21-03-51592	0.0–0.5	ALLH	Uranium-235	0.264999986	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Americium-241	1.582000017	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Cesium-134	0.083999999	pCi/g	U
21-22277	MD21-03-51593	0.0–0.5	ALLH	Cesium-137	51.33599854	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Cobalt-60	0.001	pCi/g	U
21-22277	MD21-03-51593	0.0–0.5	ALLH	Europium-152	0.254999995	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Plutonium-238	0.568000019	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Plutonium-239	4.235000134	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Ruthenium-106	-0.167	pCi/g	U
21-22277	MD21-03-51593	0.0–0.5	ALLH	Sodium-22	0.009	pCi/g	U
21-22277	MD21-03-51593	0.0–0.5	ALLH	Strontium-90	7.269999981	pCi/g	None
21-22277	MD21-03-51593	0.0–0.5	ALLH	Uranium-235	0.206	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Americium-241	0.685000002	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Cesium-134	0.109999999	pCi/g	U
21-22278	MD21-03-51594	0.0–0.5	ALLH	Cesium-137	30.66200066	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Cobalt-60	0.013	pCi/g	U
21-22278	MD21-03-51594	0.0–0.5	ALLH	Europium-152	0.229000002	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Plutonium-238	0.203999996	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Plutonium-239	1.799000025	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Ruthenium-106	0.111000001	pCi/g	U
21-22278	MD21-03-51594	0.0–0.5	ALLH	Sodium-22	0.001	pCi/g	U
21-22278	MD21-03-51594	0.0–0.5	ALLH	Strontium-90	4.703999996	pCi/g	None
21-22278	MD21-03-51594	0.0–0.5	ALLH	Uranium-235	0.287	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Americium-241	1	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Cesium-134	0.068999998	pCi/g	U
21-22279	MD21-03-51595	0.0–0.5	ALLH	Cesium-137	66.17700195	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Cobalt-60	-0.004	pCi/g	U
21-22279	MD21-03-51595	0.0–0.5	ALLH	Europium-152	0.374000013	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Plutonium-238	0.388000011	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Plutonium-239	3.24000001	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Ruthenium-106	0.210999995	pCi/g	U
21-22279	MD21-03-51595	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22279	MD21-03-51595	0.0–0.5	ALLH	Strontium-90	8.527000427	pCi/g	None
21-22279	MD21-03-51595	0.0–0.5	ALLH	Uranium-235	0.199000001	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22280	MD21-03-51596	0.0–0.5	ALLH	Americium-241	0.578000009	pCi/g	None
21-22280	MD21-03-51596	0.0–0.5	ALLH	Cesium-134	-0.009	pCi/g	U
21-22280	MD21-03-51596	0.0–0.5	ALLH	Cesium-137	21.66900063	pCi/g	None
21-22280	MD21-03-51596	0.0–0.5	ALLH	Cobalt-60	0.006	pCi/g	U
21-22280	MD21-03-51596	0.0–0.5	ALLH	Europium-152	0.191	pCi/g	None
21-22280	MD21-03-51596	0.0–0.5	ALLH	Plutonium-238	0.216999993	pCi/g	None
21-22280	MD21-03-51596	0.0–0.5	ALLH	Plutonium-239	2.051000118	pCi/g	None
21-22280	MD21-03-51596	0.0–0.5	ALLH	Ruthenium-106	-0.088	pCi/g	U
21-22280	MD21-03-51596	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22280	MD21-03-51596	0.0–0.5	ALLH	Strontium-90	3.351999998	pCi/g	None
21-22280	MD21-03-51596	0.0–0.5	ALLH	Uranium-235	0.266000003	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Americium-241	2.052999973	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Cesium-134	0.083999999	pCi/g	U
21-22281	MD21-03-51597	0.0–0.5	ALLH	Cesium-137	62.68600082	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Cobalt-60	-0.008	pCi/g	U
21-22281	MD21-03-51597	0.0–0.5	ALLH	Europium-152	0.279000014	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Plutonium-238	0.522000015	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Plutonium-239	7.052999973	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Ruthenium-106	-0.15000001	pCi/g	U
21-22281	MD21-03-51597	0.0–0.5	ALLH	Sodium-22	0.002	pCi/g	U
21-22281	MD21-03-51597	0.0–0.5	ALLH	Strontium-90	11.39400005	pCi/g	None
21-22281	MD21-03-51597	0.0–0.5	ALLH	Uranium-235	0.286000013	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Americium-241	1.430999994	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Cesium-134	0.054000001	pCi/g	U
21-22282	MD21-03-51598	0.0–0.5	ALLH	Cesium-137	25.63699913	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Cobalt-60	-0.004	pCi/g	U
21-22282	MD21-03-51598	0.0–0.5	ALLH	Europium-152	0.349000007	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Plutonium-238	0.361999989	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Plutonium-239	2.726999998	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Ruthenium-106	-0.106	pCi/g	U
21-22282	MD21-03-51598	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22282	MD21-03-51598	0.0–0.5	ALLH	Strontium-90	3.622999907	pCi/g	None
21-22282	MD21-03-51598	0.0–0.5	ALLH	Uranium-235	0.261999995	pCi/g	None
21-22283	MD21-03-51599	0.0–0.5	ALLH	Americium-241	0.181999996	pCi/g	None
21-22283	MD21-03-51599	0.0–0.5	ALLH	Cesium-134	0.052000001	pCi/g	U
21-22283	MD21-03-51599	0.0–0.5	ALLH	Cesium-137	1.786000013	pCi/g	None
21-22283	MD21-03-51599	0.0–0.5	ALLH	Cobalt-60	-0.024	pCi/g	U
21-22283	MD21-03-51599	0.0–0.5	ALLH	Europium-152	0.203999996	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22283	MD21-03-51599	0.0–0.5	ALLH	Plutonium-238	0.014	pCi/g	U
21-22283	MD21-03-51599	0.0–0.5	ALLH	Plutonium-239	0.165000007	pCi/g	None
21-22283	MD21-03-51599	0.0–0.5	ALLH	Ruthenium-106	0.107000001	pCi/g	U
21-22283	MD21-03-51599	0.0–0.5	ALLH	Sodium-22	-0.011	pCi/g	U
21-22283	MD21-03-51599	0.0–0.5	ALLH	Strontium-90	0.261000007	pCi/g	U
21-22283	MD21-03-51599	0.0–0.5	ALLH	Uranium-235	0.25	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Americium-241	1.644999981	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Cesium-134	0.071000002	pCi/g	U
21-22284	MD21-03-51600	0.0–0.5	ALLH	Cesium-137	113.9499969	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Cobalt-60	0.001	pCi/g	U
21-22284	MD21-03-51600	0.0–0.5	ALLH	Europium-152	0.273000002	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Plutonium-238	0.828000009	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Plutonium-239	6.991000175	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Ruthenium-106	-0.271	pCi/g	U
21-22284	MD21-03-51600	0.0–0.5	ALLH	Sodium-22	0.012	pCi/g	U
21-22284	MD21-03-51600	0.0–0.5	ALLH	Strontium-90	10.99199963	pCi/g	None
21-22284	MD21-03-51600	0.0–0.5	ALLH	Uranium-235	0.294999987	pCi/g	None
21-22285	MD21-03-51601	0.0–0.5	ALLH	Americium-241	1.236999989	pCi/g	None
21-22285	MD21-03-51601	0.0–0.5	ALLH	Cesium-134	-0.198	pCi/g	U
21-22285	MD21-03-51601	0.0–0.5	ALLH	Cesium-137	44.58800125	pCi/g	None
21-22285	MD21-03-51601	0.0–0.5	ALLH	Cobalt-60	0.005	pCi/g	U
21-22285	MD21-03-51601	0.0–0.5	ALLH	Europium-152	0.153999999	pCi/g	U
21-22285	MD21-03-51601	0.0–0.5	ALLH	Plutonium-238	0.305999994	pCi/g	None
21-22285	MD21-03-51601	0.0–0.5	ALLH	Plutonium-239	2.947999954	pCi/g	None
21-22285	MD21-03-51601	0.0–0.5	ALLH	Ruthenium-106	0.300000012	pCi/g	U
21-22285	MD21-03-51601	0.0–0.5	ALLH	Sodium-22	0	pCi/g	U
21-22285	MD21-03-51601	0.0–0.5	ALLH	Strontium-90	7.388999939	pCi/g	None
21-22285	MD21-03-51601	0.0–0.5	ALLH	Uranium-235	0.035999998	pCi/g	U
21-22286	MD21-03-51602	0.0–0.5	ALLH	Americium-241	1.921000004	pCi/g	None
21-22286	MD21-03-51602	0.0–0.5	ALLH	Cesium-134	0.068999998	pCi/g	U
21-22286	MD21-03-51602	0.0–0.5	ALLH	Cesium-137	76.2460022	pCi/g	None
21-22286	MD21-03-51602	0.0–0.5	ALLH	Cobalt-60	-0.005	pCi/g	U
21-22286	MD21-03-51602	0.0–0.5	ALLH	Europium-152	0.31099999	pCi/g	None
21-22286	MD21-03-51602	0.0–0.5	ALLH	Plutonium-238	0.460000008	pCi/g	None
21-22286	MD21-03-51602	0.0–0.5	ALLH	Plutonium-239	5.022999763	pCi/g	None
21-22286	MD21-03-51602	0.0–0.5	ALLH	Ruthenium-106	-0.245	pCi/g	U
21-22286	MD21-03-51602	0.0–0.5	ALLH	Sodium-22	0.003	pCi/g	U
21-22286	MD21-03-51602	0.0–0.5	ALLH	Strontium-90	8.397999763	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22286	MD21-03-51602	0.0–0.5	ALLH	Uranium-235	0.303000003	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Americium-241	1.644000053	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Cesium-134	0.100000001	pCi/g	U
21-22287	MD21-03-51603	0.0–0.5	ALLH	Cesium-137	69.22299957	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Cobalt-60	0	pCi/g	U
21-22287	MD21-03-51603	0.0–0.5	ALLH	Europium-152	0.26699999	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Plutonium-238	0.194999993	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Plutonium-239	2.875999928	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Ruthenium-106	0.165000007	pCi/g	U
21-22287	MD21-03-51603	0.0–0.5	ALLH	Sodium-22	0.006	pCi/g	U
21-22287	MD21-03-51603	0.0–0.5	ALLH	Strontium-90	15.78600025	pCi/g	None
21-22287	MD21-03-51603	0.0–0.5	ALLH	Uranium-235	0.231000006	pCi/g	None
21-22288	MD21-03-51604	0.0–0.5	ALLH	Americium-241	4.282000065	pCi/g	None
21-22288	MD21-03-51604	0.0–0.5	ALLH	Cesium-134	0.090000004	pCi/g	U
21-22288	MD21-03-51604	0.0–0.5	ALLH	Cesium-137	70.14800262	pCi/g	None
21-22288	MD21-03-51604	0.0–0.5	ALLH	Cobalt-60	0	pCi/g	U
21-22288	MD21-03-51604	0.0–0.5	ALLH	Europium-152	0.247999996	pCi/g	U
21-22288	MD21-03-51604	0.0–0.5	ALLH	Plutonium-238	0.644999981	pCi/g	None
21-22288	MD21-03-51604	0.0–0.5	ALLH	Plutonium-239	4.348999977	pCi/g	None
21-22288	MD21-03-51604	0.0–0.5	ALLH	Ruthenium-106	0.216999993	pCi/g	U
21-22288	MD21-03-51604	0.0–0.5	ALLH	Sodium-22	-0.009	pCi/g	U
21-22288	MD21-03-51604	0.0–0.5	ALLH	Strontium-90	18.97999954	pCi/g	None
21-22288	MD21-03-51604	0.0–0.5	ALLH	Uranium-235	0.340999991	pCi/g	None
21-22289	MD21-03-51605	0.0–0.5	ALLH	Americium-241	24.12899971	pCi/g	None
21-22289	MD21-03-51605	0.0–0.5	ALLH	Cesium-134	0.189999998	pCi/g	U
21-22289	MD21-03-51605	0.0–0.5	ALLH	Cesium-137	114.4400024	pCi/g	None
21-22289	MD21-03-51605	0.0–0.5	ALLH	Cobalt-60	-0.016	pCi/g	U
21-22289	MD21-03-51605	0.0–0.5	ALLH	Europium-152	0.085000001	pCi/g	U
21-22289	MD21-03-51605	0.0–0.5	ALLH	Plutonium-238	2.085999966	pCi/g	None
21-22289	MD21-03-51605	0.0–0.5	ALLH	Plutonium-239	8.642000198	pCi/g	None
21-22289	MD21-03-51605	0.0–0.5	ALLH	Ruthenium-106	0.143999994	pCi/g	U
21-22289	MD21-03-51605	0.0–0.5	ALLH	Sodium-22	-0.015	pCi/g	U
21-22289	MD21-03-51605	0.0–0.5	ALLH	Strontium-90	25.95400047	pCi/g	None
21-22289	MD21-03-51605	0.0–0.5	ALLH	Uranium-235	0.414000005	pCi/g	None
21-22290	MD21-03-51606	0.0–0.5	ALLH	Americium-241	6.607999802	pCi/g	None
21-22290	MD21-03-51606	0.0–0.5	ALLH	Cesium-134	0.017000001	pCi/g	U
21-22290	MD21-03-51606	0.0–0.5	ALLH	Cesium-137	78.39099884	pCi/g	None
21-22290	MD21-03-51606	0.0–0.5	ALLH	Cobalt-60	-0.002	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22290	MD21-03-51606	0.0–0.5	ALLH	Europium-152	0.170000002	pCi/g	U
21-22290	MD21-03-51606	0.0–0.5	ALLH	Plutonium-238	0.555999994	pCi/g	None
21-22290	MD21-03-51606	0.0–0.5	ALLH	Plutonium-239	15.63500023	pCi/g	None
21-22290	MD21-03-51606	0.0–0.5	ALLH	Ruthenium-106	-0.19	pCi/g	U
21-22290	MD21-03-51606	0.0–0.5	ALLH	Sodium-22	0.021	pCi/g	U
21-22290	MD21-03-51606	0.0–0.5	ALLH	Strontium-90	30.43199921	pCi/g	None
21-22290	MD21-03-51606	0.0–0.5	ALLH	Uranium-235	0.335000008	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Americium-241	2.084000111	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Cesium-134	0.07	pCi/g	U
21-22291	MD21-03-51607	0.0–0.5	ALLH	Cesium-137	88.19499969	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Cobalt-60	0.014	pCi/g	U
21-22291	MD21-03-51607	0.0–0.5	ALLH	Europium-152	0.289000005	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Plutonium-238	0.195999995	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Plutonium-239	8.241999626	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Ruthenium-106	0.104999997	pCi/g	U
21-22291	MD21-03-51607	0.0–0.5	ALLH	Sodium-22	-0.007	pCi/g	U
21-22291	MD21-03-51607	0.0–0.5	ALLH	Strontium-90	17.77599907	pCi/g	None
21-22291	MD21-03-51607	0.0–0.5	ALLH	Uranium-235	0.30399999	pCi/g	None
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Americium-241	40.86600113	pCi/g	None
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Cesium-134	0.123999998	pCi/g	U
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Cesium-137	105.3799973	pCi/g	None
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Cobalt-60	0.003	pCi/g	U
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Europium-152	0.028000001	pCi/g	U
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Plutonium-238	4.931000233	pCi/g	None
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Plutonium-239	20.64299965	pCi/g	None
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Ruthenium-106	-0.124	pCi/g	U
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Sodium-22	-0.027	pCi/g	U
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Strontium-90	38.01300049	pCi/g	None
21-22292	MD21-03-51608	0.0–0.5	Qbt 3	Uranium-235	0.259000003	pCi/g	U
21-22261	MD21-03-51634	0.0–0.5	ALLH	Americium-241	0.296000004	pCi/g	J-
21-22261	MD21-03-51634	0.0–0.5	ALLH	Cesium-134	0.075999998	pCi/g	U
21-22261	MD21-03-51634	0.0–0.5	ALLH	Cesium-137	12.52000046	pCi/g	None
21-22261	MD21-03-51634	0.0–0.5	ALLH	Cobalt-60	0.011	pCi/g	U
21-22261	MD21-03-51634	0.0–0.5	ALLH	Europium-152	0.244000003	pCi/g	None
21-22261	MD21-03-51634	0.0–0.5	ALLH	Plutonium-238	0.017000001	pCi/g	U
21-22261	MD21-03-51634	0.0–0.5	ALLH	Plutonium-239	0.782999992	pCi/g	None
21-22261	MD21-03-51634	0.0–0.5	ALLH	Ruthenium-106	-0.022	pCi/g	U
21-22261	MD21-03-51634	0.0–0.5	ALLH	Sodium-22	0.003	pCi/g	U

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22261	MD21-03-51634	0.0–0.5	ALLH	Strontium-90	3.39199996	pCi/g	None
21-22261	MD21-03-51634	0.0–0.5	ALLH	Uranium-235	0.164000005	pCi/g	U
21-22281	MD21-03-51635	0.0–0.5	ALLH	Americium-241	1.338999987	pCi/g	None
21-22281	MD21-03-51635	0.0–0.5	ALLH	Cesium-134	-0.17200001	pCi/g	U
21-22281	MD21-03-51635	0.0–0.5	ALLH	Cesium-137	57.37200165	pCi/g	None
21-22281	MD21-03-51635	0.0–0.5	ALLH	Cobalt-60	0.003	pCi/g	U
21-22281	MD21-03-51635	0.0–0.5	ALLH	Europium-152	0.263000011	pCi/g	None
21-22281	MD21-03-51635	0.0–0.5	ALLH	Plutonium-238	0.751999974	pCi/g	None
21-22281	MD21-03-51635	0.0–0.5	ALLH	Plutonium-239	5.190999985	pCi/g	None
21-22281	MD21-03-51635	0.0–0.5	ALLH	Ruthenium-106	-0.086	pCi/g	U
21-22281	MD21-03-51635	0.0–0.5	ALLH	Sodium-22	-0.007	pCi/g	U
21-22281	MD21-03-51635	0.0–0.5	ALLH	Strontium-90	13.76900005	pCi/g	None
21-22281	MD21-03-51635	0.0–0.5	ALLH	Uranium-235	0.238000005	pCi/g	None
21-22283	MD21-03-51636	0.0–0.5	ALLH	Americium-241	0.041999999	pCi/g	U
21-22283	MD21-03-51636	0.0–0.5	ALLH	Cesium-134	0.096000001	pCi/g	U
21-22283	MD21-03-51636	0.0–0.5	ALLH	Cesium-137	1.930999994	pCi/g	None
21-22283	MD21-03-51636	0.0–0.5	ALLH	Cobalt-60	0	pCi/g	U
21-22283	MD21-03-51636	0.0–0.5	ALLH	Europium-152	0.340000004	pCi/g	None
21-22283	MD21-03-51636	0.0–0.5	ALLH	Plutonium-238	0.035999998	pCi/g	None
21-22283	MD21-03-51636	0.0–0.5	ALLH	Plutonium-239	0.107000001	pCi/g	None
21-22283	MD21-03-51636	0.0–0.5	ALLH	Ruthenium-106	0	pCi/g	U
21-22283	MD21-03-51636	0.0–0.5	ALLH	Sodium-22	-0.017	pCi/g	U
21-22283	MD21-03-51636	0.0–0.5	ALLH	Strontium-90	0.688000023	pCi/g	None
21-22283	MD21-03-51636	0.0–0.5	ALLH	Uranium-235	0.261000007	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Americium-241	1.149000049	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Cesium-134	0.085000001	pCi/g	U
21-22285	MD21-03-51637	0.0–0.5	ALLH	Cesium-137	38.59000015	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Cobalt-60	-0.009	pCi/g	U
21-22285	MD21-03-51637	0.0–0.5	ALLH	Europium-152	0.233999997	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Plutonium-238	0.43900001	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Plutonium-239	9.131999969	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Ruthenium-106	0.150000006	pCi/g	U
21-22285	MD21-03-51637	0.0–0.5	ALLH	Sodium-22	0.002	pCi/g	U
21-22285	MD21-03-51637	0.0–0.5	ALLH	Strontium-90	5.697999954	pCi/g	None
21-22285	MD21-03-51637	0.0–0.5	ALLH	Uranium-235	0.234999999	pCi/g	None
21-22287	MD21-03-51638	0.0–0.5	ALLH	Americium-241	1.838000059	pCi/g	None
21-22287	MD21-03-51638	0.0–0.5	ALLH	Cesium-134	0.090999998	pCi/g	U
21-22287	MD21-03-51638	0.0–0.5	ALLH	Cesium-137	64.72299957	pCi/g	None

Table D-2.0-1 (continued)

Location ID	Sample ID	Depth (ft)	Media Code	Analyte	Result	Unit	Report Qualifier
21-22287	MD21-03-51638	0.0–0.5	ALLH	Cobalt-60	-0.006	pCi/g	U
21-22287	MD21-03-51638	0.0–0.5	ALLH	Europium-152	0.237000003	pCi/g	U
21-22287	MD21-03-51638	0.0–0.5	ALLH	Plutonium-238	0.213	pCi/g	None
21-22287	MD21-03-51638	0.0–0.5	ALLH	Plutonium-239	3.733999968	pCi/g	None
21-22287	MD21-03-51638	0.0–0.5	ALLH	Ruthenium-106	0.005	pCi/g	U
21-22287	MD21-03-51638	0.0–0.5	ALLH	Sodium-22	0.01	pCi/g	U
21-22287	MD21-03-51638	0.0–0.5	ALLH	Strontium-90	21.03100014	pCi/g	None
21-22287	MD21-03-51638	0.0–0.5	ALLH	Uranium-235	0.033	pCi/g	U

D-3.0 REFERENCES

The following list includes all references cited in this appendix. Parenthetical information following each reference provides the author, publication date, and the ER record identification (ER ID) number. This information also is included in the citations in the text. ER ID numbers are assigned by the Laboratory's RRES-RS Records Processing Facility (RPF) are used to locate copies of the actual documents at the RPF and, where applicable, with the ER Project reference library titled "Reference Set for Material Disposal Areas, Technical Area 21".

Copies of the reference library are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Area Office; United States EPA, Region VI; and RRES-RS. This library is a living collection of documents that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this document. However, documents previously submitted to the administrative authority are not included.

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

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory report LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, 54609)

Appendix E

Statistical Analyses

APPENDIX E STATISTICAL ANALYSES

E-1.0 INTRODUCTION

This section details the statistical analysis performed on the data for SWMU 21-011(k) for radionuclide compounds from the samples collected from 0.0 to 0.5 below ground surface (bgs). The analysis included the calculation of upper confidence limits (UCLs) at a five percent significance level (95 percent confidence). UCLs were calculated using three different methods including Bootstrapping (nonparametric distribution), Student's *t* (normal distribution assumption), and Land's *H* (lognormal distribution).

The UCL calculation is the second step in a process for screening COPCs. The screening process consists of the following steps:

- Step #1: The maximum concentration observed at the site for each analyte in a specific medium (soil, Qbt 3) is compared to the background upper tolerance limit (UTL), also known as the BV or FV. Those analytes having a maximum concentration below the BV/FV are eliminated as COPCs. Other analytes proceed to step #2.
- Step #2: Assuming sufficient data are available to calculate a valid statistical confidence interval, UCLs are calculated for the depth interval(s) of interest. Data from these depth intervals are used in site assessments to evaluate potential effects on ecological and human receptors. In this assessment the depth interval of interest is 0 to 0.5 ft.

E-2.0 COPC DETERMINATION

The Laboratory compared sample concentrations for 10 potential COPCs to the sample data in the background database. The analytes compared to BV/FV were americium-241, cesium-134, cesium-137, cobalt-60, europium-152, plutonium-238, plutonium-239, strontium-90, tritium, and uranium-235. LANL compared these analytes to the appropriate background data set, soil or Qbt 3. Table 2.5-2 shows the analytes and the lithologic units to which LANL compared them. Many of these radionuclides do not have BV/FV for comparison because they are fallout radionuclides for which there is no real background. These radionuclides were retained as COPCs.

E-3.0 STATISTICAL ANALYSIS

The UCLs represent three different approaches to calculation depending upon the statistical distribution assumption. These include the Bootstrap method, which assumes a nonparametric distribution, the Student's t statistic, which assumes a normal distribution of the data, and the Land's *H* statistic, which assumes a lognormal distribution.

The Laboratory calculated UCLs for ten radionuclides: americium-241, cesium-134, cesium-137, cobalt-60, europium-152, plutonium-238, plutonium-239, strontium-90, tritium, and uranium-235. UCLs were calculated for sample data falling in the 0 to 0.5 ft interval using the Bootstrap method, the Student's t statistic, and the Land's *H* statistic. Results of the statistical analyses are summarized in Tables E-3.0-1. LANL chose to use the UCLs based on the Student's t approach in the Site Assessments.

Table E-3.0-1
Upper Confidence Limits (UCLs) for Radionuclides at SWMU 21-011(k)

COPC	0.0 to 0.5 ft		
	UCL based on Student's t (pCi/g)	UCL based on Land H (pCi/g)	UCL based on Bootstrap (pCi/g)
Americium-241	11.0	13.1	8.48
Cesium-134	0.0652	0.105	0.0478
Cesium-137	60.1	123	53.2
Cobalt-60	0.0000175	Reject[a]	Reject
Europium-152	0.304	0.336	0.286
Plutonium-238	1.10	1.44	0.891
Plutonium-239	8.69	10.6	7.39
Strontium-90	15.5	25.3	13.8
Tritium	NA[b]	NA	NA
Uranium-235	0.295	0.311	0.282

[a] "Reject" indicates UCL exceeded maximum value and was, therefore, rejected.
[b] NA indicates data set was too small to allow calculation of UCL.

E-3.1 Calculation of the Student's *t* Statistic

The Student's *t* statistic is a parametric approach to calculating confidence intervals around the population. Because the true mean is not known, a confidence interval can be constructed that is designed to capture the true mean a specified percentage of the time, say 95 percent of the time. An upper confidence limit denotes the concentration value below which the true mean is expected to fall 95 percent of the time. The calculation uses the mean and standard deviation of the sample data, a statistical *t* value (derived from standard tables), and the number of samples in the data set. The equation to calculate the UCL of a population at a 100(1-α)% level of confidence using the Student's t statistic appears below.

$$UCL_{1-\alpha} = \left(\bar{x} + t_{1-\alpha,df=n-1}\right)\left(s_x / \sqrt{n}\right)$$

where $t_{1-\alpha,df=n-1}$ is the 100(1-α)th percentile of the *t* distribution with n-1 degrees of freedom. The value $t_{1-\alpha,df=n-1}$ is obtained from Table 6-2, p. 146 of Myers (1997, 59388).

For a set of *n* sample values, $x_1, x_2, \ldots x_n$, the mean estimate is

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

which represents the summation of all the sample values divided by the number of samples.

Calculation of the 95% UCL uses the standard deviation of the sample data, calculated by

$$s_x = \left(\sum_{i=1}^{n} \frac{(x_i - \bar{x})^2}{n-1} \right)^{1/2}$$

The use of the Student's *t* assumes that the data are normally distributed. If statistical tests for normality indicate that the data are not normal, then the value of the UCL calculated using the Student's *t* statistic is questionable.

E-3.2 Calculation of the Land *H* Statistic

The Land *H* statistic is a parametric approach that can be used to calculate a UCL if the data are lognormally distributed. The equation to calculate the UCL of a lognormal population is using the Land *H* statistic (Gilbert 1987, 55619.1, p. 169–171):

$$UCL_{1-\alpha} = \exp\left(\bar{y} + \frac{1}{2} s_y^2 + \frac{s_y H_{1-\alpha}}{\sqrt{n-1}} \right)$$

where *y* and s_y are the mean and standard deviation of the log-transformed data, respectively. The significance level, α, is set at 0.05. The *H* value is a function of the standard deviation s_y and is obtained from Table A-12, p. 285 of Gilbert, for $H_{1-\alpha}$.

Use of the Land *H* statistic is predicated that the data are truly lognormal, not just skewed. If the data are not lognormal, unacceptable values of the UCL may result, such as the UCL being lower than the UCL calculated using the same data but using the Student's t statistic. In other cases, the Land *H* UCL results in a value greater than any observed sample, sometimes more than an order of magnitude more. Either of these results indicates a problem in the use of the Land *H* statistic. Due to these problems, EPA recommends highly that alternative methods be used to calculate the UCL of skewed data.

E-3.3 Calculation of the Bootstrap Statistic

The bootstrap procedure is a nonparametric method to calculate UCLs. Starting with a sample data set of size *n*, the method randomly selects a value. This value is kept as a realization, but is also put back into the data set for potential selection again. The process continues (sampling "with replacement") until *n* samples have been selected. Selection of *n* samples is called a *trial*. The arithmetic average of the trial (*n* samples) is then calculated. A large number of trials, say 2000, is run, which produces a mean value and a variability of the mean. Using these values, a UCL can be calculated.

Because it is a nonparametric technique, the bootstrap approach does not assume any particular distribution. This eliminates the questionable distribution assumption required for the Student's *t* and the Land *H* statistics. However, the bootstrap approach consistently produces the lowest UCL value of the three methods used, making it the least conservative.

E-4.0 REFERENCES

The following list includes all references cited in this appendix. Parenthetical information following each reference provides the author, publication date, and the ER record identification (ER ID) number. This information also is included in the citations in the text. ER ID numbers are assigned by the Laboratory's

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Gilbert, R. O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, ISBN 0-442-23050-8, Van Nostrand Reinhold, New York. (Gilbert 1987, 55619)

Myers, J. C. 1997. *Geostatistical Error Management: Quantifying Uncertainty for Environmental Sampling and Mapping,* Van Nostrand Reinhold, New York. (Myers 1997, 59388)

Appendix F

Risk Calculations

APPENDIX F RISK CALCULATIONS

F-1.0 MIXTURE SUM OF RATIOS

Table F-1.0-1
Mixture Sum of Ratios for COPCs at 21-011(k) Based on the Trail-User Scenario

Sample ID	Location ID	Depth (ft)	Medium	Am-241 (pCi/g)	Cs-137 (pCi/g)	Pu-238 (pCi/g)	Pu-239 (pCi/g)	Sr-90 pCi/g)	Sum of Ratios*
SRSG				**424**	**294**	**496**	**447**	**8288**	
AAA4009	21-01591	0.00–0.50	Soil	8.963	42.64	0.859	12.773	8.6	0.20
MD21-03-49654	21-03-21381	9.00–10.00	Qbt 3	0.126	1.666	0	0.127	1.96	0.01
MD21-03-49655	21-03-21382	8.00–9.00	Qbt 3	2.348	57.882	0.178	6.877	23.039	0.22
MD21-03-49656	21-03-21382	9.00–10.00	Qbt 3	0.365	1.696	0.055	0.301	1.569	0.01
MD21-03-49663	21-03-21386	8.00–9.00	Qbt 3	0.112	1.699	0	0.237	2.548	0.01
MD21-03-49664	21-03-21386	9.00–10.00	Qbt 3	0.079	1.647	0	0.081	2.14	0.01
MD21-03-49665	21-03-21387	8.00–9.00	Qbt 3	0.037	1.873	0	0.063	1.956	0.01
MD21-03-49666	21-03-21387	9.00–10.00	Qbt 3	0.046	1.339	0.035	0.139	0.915	0.01
MD21-03-49667	21-03-21388	8.00–9.00	Qbt 3	1.473	64.603	0.186	7.511	23.111	0.24
MD21-03-49668	21-03-21388	9.00–10.00	Qbt 3	0.073	1.079	0	0.194	4.683	0.00
MD21-03-49669	21-03-21389	8.00–9.00	Qbt 3	0.368	6.793	0.146	0.965	6.243	0.03
MD21-03-49670	21-03-21389	9.00–10.00	Qbt 3	0.648	7.367	0.138	1.366	4.909	0.03
MD21-03-49671	21-03-21390	8.00–9.00	Qbt 3	0.102	1.549	0	0.372	0	0.01
MD21-03-49672	21-03-21390	9.00–10.00	Qbt 3	0.098	0.311	0	0.273	0	0.00
MD21-03-49673	21-03-21391	8.00–9.00	Qbt 3	0.914	12.642	0.346	1.441	3.325	0.05
MD21-03-49675	21-03-21392	5.00–6.00	Qbt 3	0.328	2.87	0.03	1.759	0	0.01
MD21-03-49676	21-03-21392	6.00–7.00	Qbt 3	0.437	5.971	0.115	2.668	1.213	0.03
MD21-03-49677	21-03-21393	5.00–6.00	Qbt 3	0.811	66.341	0.114	3.594	12.952	0.24
MD21-03-49678	21-03-21393	6.00–7.00	Qbt 3	0.095	1.138	0	0.257	0	0.00
MD21-03-49679	21-03-21394	5.00–6.00	Qbt 3	0.197	9.29	0	0.641	5.851	0.03
MD21-03-49680	21-03-21394	6.00–7.00	Qbt 3	0.626	14.349	0.148	6.34	4.322	0.07
MD21-03-49681	21-03-21395	5.00–6.00	Qbt 3	0.358	3.044	0.131	3.744	1.065	0.02
MD21-03-49699	**21-03-21395**	**5.00–6.00**	**Qbt 3**	**0.122**	**3.004**	**0**	**1.059**	**0.768**	0.01
MD21-03-49683	21-03-21396	3.00–4.00	Qbt 3	1.223	11.729	0.247	12.261	5.475	0.07
MD21-03-49687	21-03-21398	1.00–2.00	Qbt 3	1.047	4.52	0.155	8.216	2.184	0.04
MD21-01-0034	21-11205	4.00–5.00	Soil	6.9	3.78	0.21	1.01	1.02	0.03
MD21-03-51509	21-22198	0.00–0.50	Soil	3.485	39.79	0.385	4.097	6.988	0.15
MD21-03-51572	**21-22198**	**0.00–0.50**	**Soil**	**2.72**	**38.963**	**0.322**	**3.375**	**4.449**	0.15
MD21-03-51510	21-22199	0.00–0.50	Soil	0.968	15.854	0.149	1.269	3.454	0.06
MD21-03-51571	**21-22199**	**0.00–0.50**	**Soil**	**1.06**	**14.834**	**0.164**	**1.414**	**2.482**	0.06
MD21-03-51511	21-22200	0.00–0.50	Soil	0.424	0	0.09	1.047	0	0.00
MD21-03-51570	**21-22200**	**0.00–0.50**	**Soil**	**0.238**	**0**	**0.053**	**1.402**	**0**	0.00

Table F-1.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Am-241 (pCi/g)	Cs-137 (pCi/g)	Pu-238 (pCi/g)	Pu-239 (pCi/g)	Sr-90 pCi/g)	Sum of Ratios*
MD21-03-51512	21-22201	0.00–0.50	Soil	4.916	46.187	0.32	1.897	0	0.17
MD21-03-51569	**21-22201**	**0.00–0.50**	**Soil**	**4.529**	**40.077**	**0.414**	**2.413**	**8.616**	0.15
MD21-03-51513	21-22202	0.00–0.50	Soil	25.166	11.195	1.187	4.733	3.836	0.11
MD21-03-51514	21-22203	0.00–0.50	Soil	0.31	0	0.056	0.65	0	0.00
MD21-03-51515	21-22204	0.00–0.50	Soil	0.144	0	0.033	8.517	0	0.02
MD21-03-51516	21-22205	0.00–0.50	Soil	0.146	0	0	1.627	0	0.00
MD21-03-51517	21-22206	0.00–0.50	Soil	0.13	0	0	0.963	0	0.00
MD21-03-51518	21-22207	0.00–0.50	Soil	0.823	15.957	0.203	1.625	3.598	0.06
MD21-03-51519	21-22208	0.00–0.50	Soil	1.056	3.751	0.105	0.481	0	0.02
MD21-03-51520	21-22209	0.00–0.50	Soil	0.358	18.235	0.132	0.782	3.258	0.07
MD21-03-51521	21-22210	0.00–0.50	Soil	1.238	61.41	0.511	20.404	9.498	0.26
MD21-03-51522	21-22211	0.00–0.50	Soil	1.036	26.945	0.199	1.416	5.553	0.10
MD21-03-51523	21-22212	0.00–0.50	Soil	0.992	54.841	0.255	1.572	8.475	0.19
MD21-03-51524	21-22213	0.00–0.50	Soil	1.124	22.071	0.281	1.49	4.991	0.08
MD21-03-51525	21-22214	0.00–0.50	Soil	1.091	35.592	0.206	1.402	6.518	0.13
MD21-03-51526	21-22215	0.00–0.50	Soil	13.671	43.873	2.907	13.322	13.602	0.22
MD21-03-51527	21-22216	0.00–0.50	Soil	5.383	4.598	0.961	3.229	2.244	0.04
MD21-03-51528	21-22217	0.00–0.50	Soil	41.631	31.614	4.754	29.006	18.754	0.28
MD21-03-51529	21-22218	0.00–0.50	Soil	1.121	7.734	0.06	1.423	8.44	0.03
MD21-03-51530	21-22219	0.00–0.50	Soil	3.471	92.148	0.312	6.214	31.969	0.34
MD21-03-51531	21-22220	0.00–0.50	Soil	3.25	100.32	1.531	6.224	16.264	0.37
MD21-03-51532	21-22221	0.00–0.50	Soil	9.548	134.2	2.493	11.303	21.841	0.51
MD21-03-51533	21-22222	0.00–0.50	Soil	9.57	118.89	2.13	14.022	26.844	0.47
MD21-03-51534	21-22223	0.00–0.50	Soil	5.089	67.681	1.063	5.698	8.295	0.26
MD21-03-51535	21-22224	0.00–0.50	Soil	4.506	94.123	1.932	6.819	16.929	0.35
MD21-03-51536	21-22225	0.00–0.50	Soil	10.636	99.529	1.554	10.116	22.659	0.39
MD21-03-51537	21-22226	0.00–0.50	Soil	6.87	86.036	1.5	9.17	16.846	0.33
MD21-03-51538	21-22227	0.00–0.50	Soil	2.016	32.062	0.597	3.946	6.21	0.12
MD21-03-51539	21-22228	0.00–0.50	Soil	1.83	15.648	0.322	2.456	4.321	0.06
MD21-03-51540	21-22229	0.00–0.50	Soil	2.43	15.286	0.184	1.711	3.119	0.06
MD21-03-51541	21-22230	0.00–0.50	Soil	3.562	55.496	0.223	8.167	20.731	0.22
MD21-03-51542	21-22231	0.00–0.50	Qbt 3	5.081	36.575	0.378	7.99	8.752	0.16
MD21-03-51543	21-22232	0.00–0.50	Qbt 3	1.267	24.989	0.05	1.794	9.115	0.09
MD21-03-51544	21-22233	0.00–0.50	Qbt 3	0.232	45.292	0	0.667	25.54	0.16
MD21-03-51545	21-22234	0.00–0.50	Qbt 3	0.295	76.936	0.031	1.163	41.12	0.27
MD21-03-51546	21-22235	0.00–0.50	Soil	0.467	99.154	0.046	1.459	48.209	0.35
MD21-03-51573	**21-22235**	**0.00–0.50**	**Soil**	**0.439**	**89.117**	**0.08**	**1.842**	**44.047**	0.31
MD21-03-51547	21-22236	0.00–0.50	Soil	2.217	79.602	0.124	3.913	24.107	0.29

Table F-1.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Am-241 (pCi/g)	Cs-137 (pCi/g)	Pu-238 (pCi/g)	Pu-239 (pCi/g)	Sr-90 pCi/g)	Sum of Ratios*
MD21-03-51548	21-22237	0.00–0.50	Qbt 3	1.598	84.683	0.105	1.911	29.755	0.30
MD21-03-51549	21-22238	0.00–0.50	Soil	9.655	16.069	0.364	11.891	3.047	0.11
MD21-03-51550	21-22239	0.00–0.50	Qbt 3	7.91	24.915	1.335	5.645	12.012	0.12
MD21-03-51551	21-22240	0.00–0.50	Soil	1.486	2.856	0.151	2.789	0	0.02
MD21-03-51552	21-22241	0.00–0.50	Qbt 3	28.901	78.824	2.96	11.839	29.353	0.37
MD21-03-51553	21-22242	0.00–0.50	Qbt 3	7.772	62.948	0.312	10.052	16.948	0.26
MD21-03-51554	21-22243	0.00–0.50	Qbt 3	1.339	26.869	0.078	1.669	9.711	0.10
MD21-03-51555	21-22244	0.00–0.50	Soil	2.228	12.419	0.167	2.228	5.518	0.05
MD21-03-51556	21-22245	0.00–0.50	Qbt 3	99.824	75.477	7.338	27.602	41.673	0.57
MD21-03-51557	21-22246	0.00–0.50	Qbt 3	2.741	17.302	0.406	1.809	6.129	0.07
MD21-03-51558	21-22247	0.00–0.50	Qbt 3	5.041	69.285	0.271	6.644	20.007	0.27
MD21-03-51559	21-22248	0.00–0.50	Soil	1.757	16.94	0.167	2.063	13.742	0.07
MD21-03-51560	21-22249	0.00–0.50	Qbt 3	15.551	52.079	2.392	16.815	18.529	0.26
MD21-03-51561	21-22250	0.00–0.50	Qbt 3	2.865	20.162	0.307	1.644	6.585	0.08
MD21-03-51562	21-22251	0.00–0.50	Qbt 3	3.307	20.176	0.137	3.534	8.647	0.09
MD21-03-51563	21-22252	0.00–0.50	Qbt 3	0.561	53.705	0.04	1.182	27.346	0.19
MD21-03-51564	21-22253	0.00–0.50	Qbt 3	37.429	158.46	3.12	35.707	43.706	0.72
MD21-03-51565	21-22254	0.00–0.50	Qbt 3	9.266	168.09	2.263	11.838	35.244	0.63
MD21-03-51566	21-22255	0.00–0.50	Qbt 3	0.109	0.325	0	0.163	0	0.00
MD21-03-51567	21-22256	0.00–0.50	Qbt 3	0.308	12.014	0.137	3.534	1.969	0.05
MD21-03-51568	21-22257	0.00–0.50	Qbt 3	1.224	10.882	0.04	1.182	1.331	0.04
MD21-03-51574	21-22258	0.00–0.50	Qbt 3	0.315	3.839	0.043	0.229	1.887	0.01
MD21-03-51575	21-22259	0.00–0.50	Qbt 3	3.26	29.696	0.104	0.728	5.306	0.11
MD21-03-51576	21-22260	0.00–0.50	Soil	3.462	25.8	0.168	3.969	3.822	0.11
MD21-03-51577	21-22261	0.00–0.50	Soil	0.508	13.142	0.086	0.854	2.103	0.05
MD21-03-51634	**21-22261**	**0.00–0.50**	**Soil**	**0.296**	**12.52**	**0**	**0.783**	**3.392**	**0.05**
MD21-03-51578	21-22262	0.00–0.50	Qbt 3	9.821	69.032	0.517	9.139	24.427	0.28
MD21-03-51579	21-22263	0.00–0.50	Soil	0.944	43.306	0.178	4.171	12.849	0.16
MD21-03-51580	21-22264	0.00–0.50	Qbt 3	44.929	157.34	2.924	18.523	35.315	0.69
MD21-03-51581	21-22265	0.00–0.50	Qbt 3	20.68	36.202	0.67	9.296	11.444	0.20
MD21-03-51582	21-22266	0.00–0.50	Qbt 3	56.329	68.167	5.749	59.369	26.295	0.51
MD21-03-51583	21-22267	0.00–0.50	Qbt 3	1.774	63.899	0.246	3.509	25.249	0.23
MD21-03-51584	21-22268	0.00–0.50	Qbt 3	5.494	34.654	0.349	14.694	6.113	0.17
MD21-03-51585	21-22269	0.00–0.50	Qbt 3	23.248	37.045	2.722	25.443	20.801	0.25
MD21-03-51586	21-22270	0.00–0.50	Qbt 3	33.157	76.039	4.759	37.683	26.956	0.43
MD21-03-51587	21-22271	0.00–0.50	Soil	3.065	7.429	0.264	8.825	0	0.05
MD21-03-51588	21-22272	0.00–0.50	Soil	8.996	93.169	0.864	23.509	21.391	0.40
MD21-03-51589	21-22273	0.00–0.50	Soil	2.242	38.042	0.346	4.823	7.668	0.15

Table F-1.0-1 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Am-241 (pCi/g)	Cs-137 (pCi/g)	Pu-238 (pCi/g)	Pu-239 (pCi/g)	Sr-90 pCi/g)	Sum of Ratios*
MD21-03-51590	21-22274	0.00–0.50	Qbt 3	4.338	180.21	0.392	15.323	36.913	0.66
MD21-03-51591	21-22275	0.00–0.50	Qbt 3	0.049	83.218	0.026	0.997	18.302	0.29
MD21-03-51592	21-22276	0.00–0.50	Soil	1.405	91.215	0.545	5.251	8.706	0.33
MD21-03-51593	21-22277	0.00–0.50	Soil	1.582	51.336	0.568	4.235	7.27	0.19
MD21-03-51594	21-22278	0.00–0.50	Soil	0.685	30.662	0.204	1.799	4.704	0.11
MD21-03-51595	21-22279	0.00–0.50	Soil	1	66.177	0.388	3.24	8.527	0.24
MD21-03-51596	21-22280	0.00–0.50	Soil	0.578	21.669	0.217	2.051	3.352	0.08
MD21-03-51597	21-22281	0.00–0.50	Soil	2.053	62.686	0.522	7.053	11.394	0.24
MD21-03-51635	21-22281	0.00–0.50	Soil	1.339	57.372	0.752	5.191	13.769	0.21
MD21-03-51598	21-22282	0.00–0.50	Soil	1.431	25.637	0.362	2.727	3.623	0.10
MD21-03-51599	21-22283	0.00–0.50	Soil	0.182	1.786	0	0.165	0	0.01
MD21-03-51636	**21-22283**	**0.00–0.50**	**Soil**	**0**	**1.931**	**0.036**	**0.107**	**0**	**0.01**
MD21-03-51600	21-22284	0.00–0.50	Soil	1.645	113.95	0.828	6.991	10.992	0.41
MD21-03-51601	21-22285	0.00–0.50	Soil	1.237	44.588	0.306	2.948	7.389	0.16
MD21-03-51637	**21-22285**	**0.00–0.50**	**Soil**	**1.149**	**38.59**	**0.439**	**9.132**	**5.698**	**0.16**
MD21-03-51602	21-22286	0.00–0.50	Soil	1.921	76.246	0.46	5.023	8.398	0.28
MD21-03-51603	21-22287	0.00–0.50	Soil	1.644	69.223	0.195	2.876	15.786	0.25
MD21-03-51638	**21-22287**	**0.00–0.50**	**Soil**	**1.838**	**64.723**	**0.213**	**3.734**	**21.031**	**0.24**
MD21-03-51604	21-22288	0.00–0.50	Soil	4.282	70.148	0.645	4.349	18.98	0.26
MD21-03-51605	21-22289	0.00–0.50	Soil	24.129	114.44	2.086	8.642	25.954	0.47
MD21-03-51606	21-22290	0.00–0.50	Soil	6.608	78.391	0.556	15.635	30.432	0.32
MD21-03-51607	21-22291	0.00–0.50	Soil	2.084	88.195	0.196	8.242	17.776	0.33
MD21-03-51608	21-22292	0.00–0.50	Qbt 3	40.866	105.38	4.931	20.643	38.013	0.52

Note: Sample IDs in bold are field duplicates.

*Sum of ratios = Σ(measured concentration of each radionuclide/SRSG for each radionuclide).

F-2.0 RESRAD OUTPUT FORMS

RESRAD output forms are provided below. There are two forms in which mean input concentrations are used and two in which 95% UCL inputs are used.

Site-specific RESRAD input parameters:

Area of contaminated zone—7412 m^2.

Fraction of time spent outdoors (onsite)—0.016 y/yr for recreational trail user (140 hrs out of 8760 in a year); 0.028 yr/yr for extended backyard (200 hrs out of 8760 in a year). From "Interim Acid Canyon Report" (LANL 2000, 66867).

Soil ingestion rate—587 g/yr for recreational trail user (From "Interim Acid Canyon Report"); 626 g/yr for extended backyard (from "Interim Acid Canyon Report"(LANL 2000, 66867).

Inhalation rate – 14,000 m^3/yr for recreational trail user (assumes adult respiration rate for moderate activity of 1.6 m^3/hr); 10,500 m^3/yr for extended backyard (assumes child respiration rate for moderate activity of 1.2 m^3/hr).

Mass loading for inhalation—2.0E-5 g/m^3 for both scenarios. From "Interim Acid Canyon Report" (LANL 2000, 66867)

Humidity in air—5.55 g/m^3 for both scenarios. From "Interim Acid Canyon Report" (LANL 2000, 66867)

Annual average wind speed – 3 m/s for both scenarios. From "Interim Acid Canyon Report" (LANL 2000, 66867)

Evapotranspiration coefficient – 0.999 (unitless) for both scenarios. From "Interim Acid Canyon Report" (LANL 2000, 66867)

Precipitation – 0.35 m/yr for both scenarios. From "Interim Acid Canyon Report" (LANL 2000, 66867)

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Summary : 21_011K UCL Recreational 7K area   File: 21011K01.RAD

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Summary : 21_011K UCL Recreational 74K area   File: 21011K01.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-134	4.630E-05	4.630E-05	DCF2(3)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(4)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(5)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(7)
B-1	H-3	6.400E-08	6.400E-08	DCF2(8)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(9)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(10)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(11)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(12)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(13)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(14)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(15)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(16)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(17)
B-1	U-233	1.350E-01	1.350E-01	DCF2(18)

B-1	U-234	1.320E-01	1.320E-01	DCF2(19)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(20)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Cs-134	7.330E-05	7.330E-05	DCF3(3)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(4)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(5)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(7)
D-1	H-3	6.400E-08	6.400E-08	DCF3(8)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(9)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(10)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(11)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(12)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(13)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(14)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(15)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(16)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(17)
D-1	U-233	2.890E-04	2.890E-04	DCF3(18)
D-1	U-234	2.830E-04	2.830E-04	DCF3(19)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(20)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				

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Dose Conversion Factor (and Related) Parameter Summary (continued)
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0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Cs-134 , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Cs-134 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(3,2)
D-34	Cs-134 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(3,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(4,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(4,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,2)

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D-34 ³ Eu-152    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 2.000E-05 ³ 2.000E-05 ³ RTF( 5,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Gd-152    , plant/soil concentration ratio, dimensionless     ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 7,1)
D-34 ³ Gd-152    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 2.000E-03 ³ 2.000E-03 ³ RTF( 7,2)
D-34 ³ Gd-152    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 2.000E-05 ³ 2.000E-05 ³ RTF( 7,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ H-3       , plant/soil concentration ratio, dimensionless     ³ 4.800E+00 ³ 4.800E+00 ³ RTF( 8,1)
D-34 ³ H-3       , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.200E-02 ³ 1.200E-02 ³ RTF( 8,2)
D-34 ³ H-3       , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 1.000E-02 ³ 1.000E-02 ³ RTF( 8,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Np-237+D  , plant/soil concentration ratio, dimensionless     ³ 2.000E-02 ³ 2.000E-02 ³ RTF( 9,1)
D-34 ³ Np-237+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 9,2)
D-34 ³ Np-237+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 9,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Pa-231    , plant/soil concentration ratio, dimensionless     ³ 1.000E-02 ³ 1.000E-02 ³ RTF(10,1)
D-34 ³ Pa-231    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 5.000E-03 ³ 5.000E-03 ³ RTF(10,2)
D-34 ³ Pa-231    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 5.000E-06 ³ 5.000E-06 ³ RTF(10,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Pb-210+D  , plant/soil concentration ratio, dimensionless     ³ 1.000E-02 ³ 1.000E-02 ³ RTF(11,1)
D-34 ³ Pb-210+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 8.000E-04 ³ 8.000E-04 ³ RTF(11,2)
D-34 ³ Pb-210+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 3.000E-04 ³ 3.000E-04 ³ RTF(11,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Pu-238    , plant/soil concentration ratio, dimensionless     ³ 1.000E-03 ³ 1.000E-03 ³ RTF(12,1)
D-34 ³ Pu-238    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.000E-04 ³ 1.000E-04 ³ RTF(12,2)
D-34 ³ Pu-238    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 1.000E-06 ³ 1.000E-06 ³ RTF(12,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Pu-239    , plant/soil concentration ratio, dimensionless     ³ 1.000E-03 ³ 1.000E-03 ³ RTF(13,1)
D-34 ³ Pu-239    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.000E-04 ³ 1.000E-04 ³ RTF(13,2)
D-34 ³ Pu-239    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 1.000E-06 ³ 1.000E-06 ³ RTF(13,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Ra-226+D  , plant/soil concentration ratio, dimensionless     ³ 4.000E-02 ³ 4.000E-02 ³ RTF(14,1)
D-34 ³ Ra-226+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.000E-03 ³ 1.000E-03 ³ RTF(14,2)
D-34 ³ Ra-226+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 1.000E-03 ³ 1.000E-03 ³ RTF(14,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Sr-90+D   , plant/soil concentration ratio, dimensionless     ³ 3.000E-01 ³ 3.000E-01 ³ RTF(15,1)
D-34 ³ Sr-90+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 8.000E-03 ³ 8.000E-03 ³ RTF(15,2)
D-34 ³ Sr-90+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 2.000E-03 ³ 2.000E-03 ³ RTF(15,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ Th-229+D  , plant/soil concentration ratio, dimensionless     ³ 1.000E-03 ³ 1.000E-03 ³ RTF(16,1)
D-34 ³ Th-229+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.000E-04 ³ 1.000E-04 ³ RTF(16,2)
D-34 ³ Th-229+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 5.000E-06 ³ 5.000E-06 ³ RTF(16,3)
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                       Dose Conversion Factor (and Related) Parameter Summary (continued)
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0      ³                                                               ³  Current  ³           ³ Parameter
 Menu  ³                       Parameter                               ³   Value   ³  Default  ³   Name

 D-34 ³ Th-230    , plant/soil concentration ratio, dimensionless      ³ 1.000E-03 ³ 1.000E-03 ³ RTF(17,1)
 D-34 ³ Th-230    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)      ³ 1.000E-04 ³ 1.000E-04 ³ RTF(17,2)
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D-34 ³ Th-230    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF(17,3)
D-34 ³                                                             ³           ³           ³
D-34 ³ U-233     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF(18,1)
D-34 ³ U-233     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF(18,2)
D-34 ³ U-233     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF(18,3)
D-34 ³                                                             ³           ³           ³
D-34 ³ U-234     , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF(19,1)
D-34 ³ U-234     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF(19,2)
D-34 ³ U-234     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF(19,3)
D-34 ³                                                             ³           ³           ³
D-34 ³ U-235+D   , plant/soil concentration ratio, dimensionless   ³ 2.500E-03 ³ 2.500E-03 ³ RTF(20,1)
D-34 ³ U-235+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 3.400E-04 ³ 3.400E-04 ³ RTF(20,2)
D-34 ³ U-235+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 6.000E-04 ³ 6.000E-04 ³ RTF(20,3)
     ³                                                             ³           ³           ³
D-5  ³ Bioaccumulation factors, fresh water, L/kg:                 ³           ³           ³
D-5  ³ Ac-227+D  , fish                                            ³ 1.500E+01 ³ 1.500E+01 ³ BIOFAC( 1,1)
D-5  ³ Ac-227+D  , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 1,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Am-241    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC( 2,1)
D-5  ³ Am-241    , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 2,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Cs-134    , fish                                            ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC( 3,1)
D-5  ³ Cs-134    , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 3,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Cs-137+D  , fish                                            ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC( 4,1)
D-5  ³ Cs-137+D  , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 4,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Eu-152    , fish                                            ³ 5.000E+01 ³ 5.000E+01 ³ BIOFAC( 5,1)
D-5  ³ Eu-152    , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 5,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Gd-152    , fish                                            ³ 2.500E+01 ³ 2.500E+01 ³ BIOFAC( 7,1)
D-5  ³ Gd-152    , crustacea and mollusks                          ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 7,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ H-3       , fish                                            ³ 1.000E+00 ³ 1.000E+00 ³ BIOFAC( 8,1)
D-5  ³ H-3       , crustacea and mollusks                          ³ 1.000E+00 ³ 1.000E+00 ³ BIOFAC( 8,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Np-237+D  , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC( 9,1)
D-5  ³ Np-237+D  , crustacea and mollusks                          ³ 4.000E+02 ³ 4.000E+02 ³ BIOFAC( 9,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Pa-231    , fish                                            ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(10,1)
D-5  ³ Pa-231    , crustacea and mollusks                          ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC(10,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Pb-210+D  , fish                                            ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(11,1)
D-5  ³ Pb-210+D  , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(11,2)
D-5  ³                                                             ³           ³           ³
D-5  ³ Pu-238    , fish                                            ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(12,1)
D-5  ³ Pu-238    , crustacea and mollusks                          ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(12,2)
D-5  ³                                                             ³           ³           ³
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Dose Conversion Factor (and Related) Parameter Summary (continued)
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Menu	Parameter	Current Value	Default	Parameter Name
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(13,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(13,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(14,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(14,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(15,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(17,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(17,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	7.412E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)

R012	Initial principal radionuclide (pCi/g): Am-241	1.100E+01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-134	7.000E-02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	6.010E+01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-152	3.000E-01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): H-3	1.000E-01	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.100E+00	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Pu-239	8.700E+00	0.000E+00	---	S1(13)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.550E+01	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g): U-235	3.000E-01	0.000E+00	---	S1(20)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Cs-134	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(15)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(20)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	4.400E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	5.500E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	3.500E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	not used	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	not used	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	not used	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	not used	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	not used	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.636E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Cs-134				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.332E-08	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	1.000E+03	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.332E-08	ALEACH(4)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.131E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	0.000E+00	---	DCNUCU(8,2)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.000E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(12,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+03	---	DCNUCU(12,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.666E-08	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(13,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+03	---	DCNUCU(13,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.666E-08	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	not used	3.000E+01	---	DCNUCU(15,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	3.000E+01	---	DCNUCU(15,2)
R016	Saturated zone (cm**3/g)	not used	3.000E+01	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.097E-06	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,1)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.636E-06	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(7,2)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.131E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(9,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(9,2)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.624E-07	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(11,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	1.000E+02	---	DCNUCU(11,2)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.321E-07	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name

R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(14,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	7.000E+01	---	DCNUCU(14,2)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.331E-06	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(16,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	6.000E+04	---	DCNUCU(16,2)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.556E-09	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(17,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	6.000E+04	---	DCNUCU(17,2)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.556E-09	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(18,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(18,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(19,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(19,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R017	Inhalation rate (m**3/yr)	1.400E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.600E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	5.870E+02	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD

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0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed

```
Find peak pathway doses   ³   active
ƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒƒ
1RESRAD, Version 6.21     T« Limit = 0.5 year       10/07/2003  16:51  Page  14
 Summary : 21_011K UCL Recreational 74K area                 File: 21011K01.RAD

     Contaminated Zone Dimensions          Initial Soil Concentrations, pCi/g

       Area:   7412.00 square meters            Am-241     1.100E+01
   Thickness:     2.00 meters                   Cs-134     7.000E-02
 Cover Depth:     0.00 meters                   Cs-137     6.010E+01
                                                Eu-152     3.000E-01
                                                H-3        1.000E-01
                                                Pu-238     1.100E+00
                                                Pu-239     8.700E+00
                                                Sr-90      1.550E+01
                                                U-235      3.000E-01
0
                         Total Dose TDOSE(t), mrem/yr
                 Basic Radiation Dose Limit = 1.500E+01 mrem/yr
        Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)
        Ä
   t (years):  0.000E+00  1.000E+00  3.000E+00  1.000E+01  3.000E+01  1.000E+02  3.000E+02  1.000E+03
   TDOSE(t):   3.821E+00  3.746E+00  3.603E+00  3.159E+00  2.229E+00  9.434E-01  5.384E-01  3.667E-01
      M(t):    2.547E-01  2.497E-01  2.402E-01  2.106E-01  1.486E-01  6.289E-02  3.590E-02  2.445E-02
0Maximum TDOSE(t):  3.821E+00 mrem/yr   at t = 0.000E+00 years
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 Summary : 21_011K UCL Recreational 74K area                 File: 21011K01.RAD

        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
0                         Water Independent Pathways (Inhalation excludes radon)
```

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	7.404E-03	0.0019	3.121E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.758E-01	0.0983
Cs-134	8.367E-03	0.0022	1.761E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.093E-05	0.0000
Cs-137	3.011E+00	0.7880	1.212E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.790E-02	0.0073
Eu-152	3.060E-02	0.0080	4.132E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.779E-05	0.0000
H-3	0.000E+00	0.0000	7.194E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.215E-08	0.0000
Pu-238	2.615E-06	0.0000	2.747E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.293E-02	0.0086
Pu-239	3.923E-05	0.0000	2.387E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.893E-01	0.0757
Sr-90	5.626E-03	0.0015	1.283E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.201E-02	0.0058
U-235	3.439E-03	0.0009	2.361E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.526E-04	0.0002
Total	3.066E+00	0.8025	5.822E-03	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.487E-01	0.1959

```
0
        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
0                                Water Dependent Pathways
0           Water          Fish          Radon          Plant          Meat          Milk          All Pathways*
```

Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.863E-01	0.1011
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.408E-03	0.0022
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.039E+00	0.7953
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.061E-02	0.0080
H-3	0.000E+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	7.616E-07	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.321E-02	0.0087
Pu-239	0.000E+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	2.917E-01	0.0763
Sr-90	0.000E+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	2.765E-02	0.0072
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.215E-03	0.0011
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.821E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	7.392E-03	0.0020	3.116E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.751E-01	0.1001
Cs-134	5.978E-03	0.0016	1.258E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.924E-05	0.0000
Cs-137	2.942E+00	0.7854	1.185E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.726E-02	0.0073
Eu-152	2.905E-02	0.0078	3.923E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.689E-05	0.0000
H-3	0.000E+00	0.0000	3.371E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.975E-08	0.0000
Pu-238	2.595E-06	0.0000	2.726E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.267E-02	0.0087
Pu-239	3.923E-05	0.0000	2.387E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.892E-01	0.0772
Sr-90	5.494E-03	0.0015	1.253E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.149E-02	0.0057
U-235	3.439E-03	0.0009	2.361E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.533E-04	0.0002
Total	2.994E+00	0.7991	5.814E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.466E-01	0.1993

0

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

0 Water Dependent Pathways

0 Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.857E-01	0.1030
Cs-134	0.000E+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	6.008E-03	0.0016
Cs-137	0.000E+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	2.969E+00	0.7927
Eu-152	0.000E+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	2.906E-02	0.0078
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.569E-07	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.295E-02	0.0088
Pu-239	0.000E+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	2.917E-01	0.0779

Sr-90	0.000E+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	2.700E-02	0.0072
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.216E-03	0.0011
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.746E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

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

0

Water Independent Pathways (Inhalation excludes radon)

0

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	7.368E-03	0.0020	3.106E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.739E-01	0.1038
Cs-134	3.052E-03	0.0008	6.422E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.493E-05	0.0000
Cs-137	2.809E+00	0.7797	1.131E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.603E-02	0.0072
Eu-152	2.618E-02	0.0073	3.536E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.522E-05	0.0000
H-3	0.000E+00	0.0000	7.388E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.328E-09	0.0000
Pu-238	2.554E-06	0.0000	2.683E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.216E-02	0.0089
Pu-239	3.923E-05	0.0000	2.387E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.892E-01	0.0803
Sr-90	5.239E-03	0.0015	1.195E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.049E-02	0.0057
U-235	3.439E-03	0.0010	2.363E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.547E-04	0.0002
Total	2.855E+00	0.7923	5.799E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.426E-01	0.2061

0

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

0

Water Dependent Pathways

0

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.844E-01	0.1067
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.067E-03	0.0009
Cs-137	0.000E+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	2.835E+00	0.7869
Eu-152	0.000E+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	2.619E-02	0.0073
H-3	0.000E+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	7.820E-08	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.243E-02	0.0090
Pu-239	0.000E+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	2.917E-01	0.0809
Sr-90	0.000E+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	2.574E-02	0.0071
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.217E-03	0.0012
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.603E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

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

0
Water Independent Pathways (Inhalation excludes radon)
0

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	7.286E-03	0.0023	3.072E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.698E-01	0.1171
Cs-134	2.902E-04	0.0001	6.106E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.419E-06	0.0000
Cs-137	2.390E+00	0.7565	9.622E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.214E-02	0.0070
Eu-152	1.819E-02	0.0058	2.457E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.058E-05	0.0000
H-3	0.000E+00	0.0000	3.559E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.085E-11	0.0000
Pu-238	2.417E-06	0.0000	2.539E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.043E-02	0.0096
Pu-239	3.922E-05	0.0000	2.387E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.892E-01	0.0915
Sr-90	4.434E-03	0.0014	1.012E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.735E-02	0.0055
U-235	3.439E-03	0.0011	2.370E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.603E-04	0.0002
Total	2.423E+00	0.7672	5.747E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.296E-01	0.2310

0
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
0
Water Dependent Pathways
0

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.801E-01	0.1203
Cs-134	0.000E+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	2.916E-04	0.0001
Cs-137	0.000E+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	2.412E+00	0.7636
Eu-152	0.000E+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	1.820E-02	0.0058
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.767E-10	0.0000
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.068E-02	0.0097
Pu-239	0.000E+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	2.916E-01	0.0923
Sr-90	0.000E+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	2.179E-02	0.0069
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.223E-03	0.0013
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.159E+00	1.0000

0*Sum of all water independent and dependent pathways.
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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

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
0
Water Independent Pathways (Inhalation excludes radon)
0

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	7.057E-03	0.0032	2.974E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.581E-01	0.1606
Cs-134	3.491E-07	0.0000	7.345E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.707E-09	0.0000
Cs-137	1.505E+00	0.6753	6.061E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.395E-02	0.0063
Eu-152	6.430E-03	0.0029	8.684E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.739E-06	0.0000
H-3	0.000E+00	0.0000	7.028E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.117E-18	0.0000

Pu-238	2.064E-06	0.0000	2.168E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.598E-02	0.0117
Pu-239	3.920E-05	0.0000	2.385E-03	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.890E-01	0.1296
Sr-90	2.755E-03	0.0012	6.284E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.078E-02	0.0048
U-235	3.441E-03	0.0015	2.406E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.812E-04	0.0004
Total	1.525E+00	0.6841	5.607E-03	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.985E-01	0.3133

0

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

0 Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	fract.	Fish mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	All Pathways* mrem/yr	fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.681E-01	0.1651
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.508E-07	0.0000
Cs-137	0.000E+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	1.519E+00	0.6816
Eu-152	0.000E+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	6.433E-03	0.0029
H-3	0.000E+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	7.440E-17	0.0000
Pu-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	2.620E-02	0.0118
Pu-239	0.000E+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	2.914E-01	0.1307
Sr-90	0.000E+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	1.354E-02	0.0061
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.246E-03	0.0019
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.229E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	Soil mrem/yr	fract.
Am-241	6.309E-03	0.0067	2.658E-03	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.199E-01	0.3391
Cs-134	2.107E-17	0.0000	4.433E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.031E-19	0.0000
Cs-137	2.987E-01	0.3166	1.203E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.768E-03	0.0029
Eu-152	1.688E-04	0.0002	2.280E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.816E-08	0.0000
H-3	0.000E+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
Pu-238	1.189E-06	0.0000	1.247E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.495E-02	0.0158
Pu-239	3.913E-05	0.0000	2.380E-03	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.884E-01	0.3057
Sr-90	5.204E-04	0.0006	1.187E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.036E-03	0.0022
U-235	3.453E-03	0.0037	2.604E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.776E-04	0.0009
Total	3.092E-01	0.3278	5.190E-03	0.0055	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.290E-01	0.6667

0

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

0 Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.289E-01	0.3486
Cs-134	0.000E+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	2.117E-17	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.015E-01	0.3196
Eu-152	0.000E+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	1.689E-04	0.0002
H-3	0.000E+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
Pu-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	1.507E-02	0.0160
Pu-239	0.000E+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	2.908E-01	0.3083
Sr-90	0.000E+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	2.557E-03	0.0027
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.357E-03	0.0046
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.434E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	4.584E-03	0.0085	1.927E-03	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.320E-01	0.4308
Cs-134	0.000E+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
Cs-137	2.940E-03	0.0055	1.184E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.724E-05	0.0001
Eu-152	5.138E-09	0.0000	6.941E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.988E-12	0.0000
H-3	0.000E+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
Pu-238	2.521E-07	0.0000	2.571E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.079E-03	0.0057
Pu-239	3.892E-05	0.0001	2.367E-03	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.868E-01	0.5326
Sr-90	4.452E-06	0.0000	1.016E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.742E-05	0.0000
U-235	3.494E-03	0.0065	3.246E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.178E-03	0.0022
Total	1.106E-02	0.0205	4.352E-03	0.0081	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.230E-01	0.9714

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	2.385E-01	0.4429
Cs-134	0.000E+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
Cs-137	0.000E+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	2.968E-03	0.0055
Eu-152	0.000E+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	5.141E-09	0.0000
H-3	0.000E+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
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.105E-03	0.0058

Pu-239	0.000E+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	2.892E-01	0.5370
Sr-90	0.000E+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	2.188E-05	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.704E-03	0.0087
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.384E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.512E-03	0.0041	6.256E-04	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.530E-02	0.2053
Cs-134	0.000E+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
Cs-137	2.782E-10	0.0000	1.120E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.578E-12	0.0000
Eu-152	7.993E-25	0.0000	1.607E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.563E-17	0.0000
H-3	0.000E+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
Pu-238	9.176E-08	0.0000	1.357E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.331E-05	0.0000
Pu-239	3.821E-05	0.0001	2.319E-03	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.810E-01	0.7663
Sr-90	2.578E-13	0.0000	5.881E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.009E-12	0.0000
U-235	3.634E-03	0.0099	5.481E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.220E-03	0.0061
Total	5.184E-03	0.0141	3.000E-03	0.0082	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.586E-01	0.9777

0

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

0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	7.744E-02	0.2112
Cs-134	0.000E+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
Cs-137	0.000E+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	2.808E-10	0.0000
Eu-152	0.000E+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	1.724E-17	0.0000
H-3	0.000E+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
Pu-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	1.354E-05	0.0000
Pu-239	0.000E+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	2.834E-01	0.7727
Sr-90	0.000E+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	1.267E-12	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.909E-03	0.0161
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.667E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

Dose/Source Ratios Summed Over All Pathways

Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch 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
			DSR(j,t) (mrem/yr)/(pCi/g)							
Am-241	Am-241	1.000E+00	3.512E-02	3.506E-02	3.495E-02	3.456E-02	3.346E-02	2.990E-02	2.167E-02	7.031E-03
Am-241	Np-237	1.000E+00	9.487E-09	2.844E-08	6.626E-08	1.977E-07	5.650E-07	1.762E-06	4.523E-06	9.438E-06
Am-241	U-233	1.000E+00	6.659E-16	4.659E-15	2.460E-14	2.193E-13	1.829E-12	1.914E-11	1.545E-10	1.247E-09
Am-241	Th-229	1.000E+00	3.526E-19	5.288E-18	6.164E-17	1.630E-15	3.953E-14	1.373E-12	3.381E-11	9.616E-10
Am-241	äDSR(j)		3.512E-02	3.506E-02	3.495E-02	3.456E-02	3.346E-02	2.990E-02	2.168E-02	7.040E-03
0Cs-134	Cs-134	1.000E+00	1.201E-01	8.582E-02	4.382E-02	4.166E-03	5.011E-06	3.025E-16	1.401E-45	0.000E+00
0Cs-137	Cs-137	1.000E+00	5.056E-02	4.941E-02	4.718E-02	4.013E-02	2.528E-02	5.016E-03	4.938E-05	4.672E-12
0Eu-152	Eu-152	7.208E-01	7.356E-02	6.983E-02	6.293E-02	4.373E-02	1.546E-02	4.058E-04	1.235E-08	1.922E-24
0Eu-152	Eu-152	2.792E-01	2.849E-02	2.705E-02	2.438E-02	1.694E-02	5.987E-03	1.572E-04	4.785E-09	7.444E-25
Eu-152	Gd-152	2.792E-01	1.468E-18	4.306E-18	9.556E-18	2.417E-17	4.570E-17	5.715E-17	5.746E-17	5.746E-17
Eu-152	äDSR(j)		2.849E-02	2.705E-02	2.438E-02	1.694E-02	5.987E-03	1.572E-04	4.785E-09	5.746E-17
0H-3	H-3	1.000E+00	7.616E-06	3.569E-06	7.820E-07	3.767E-09	7.440E-16	2.376E-40	0.000E+00	0.000E+00
0Pu-238	Pu-238	1.000E+00	3.019E-02	2.995E-02	2.948E-02	2.790E-02	2.382E-02	1.370E-02	2.822E-03	1.119E-05
Pu-238	U-234	1.000E+00	3.886E-09	1.162E-08	2.690E-08	7.851E-08	2.112E-07	5.403E-07	8.936E-07	9.819E-07
Pu-238	Th-230	1.000E+00	2.281E-14	1.593E-13	8.378E-13	7.360E-12	5.895E-11	5.403E-10	3.219E-09	1.508E-08
Pu-238	Ra-226	1.000E+00	8.284E-17	1.240E-15	1.441E-14	3.768E-13	8.847E-12	2.762E-10	5.260E-09	8.621E-08
Pu-238	Pb-210	1.000E+00	1.946E-19	5.991E-18	1.487E-16	1.102E-14	6.737E-13	5.020E-11	1.534E-09	3.058E-08
Pu-238	äDSR(j)		3.019E-02	2.995E-02	2.948E-02	2.790E-02	2.382E-02	1.370E-02	2.823E-03	1.231E-05
0Pu-239	Pu-239	1.000E+00	3.353E-02	3.353E-02	3.352E-02	3.352E-02	3.350E-02	3.343E-02	3.324E-02	3.257E-02
Pu-239	U-235	1.000E+00	6.918E-12	2.075E-11	4.842E-11	1.453E-10	4.218E-10	1.388E-09	4.139E-09	1.363E-08
Pu-239	Pa-231	1.000E+00	3.586E-16	2.510E-15	1.327E-14	1.187E-13	1.000E-12	1.085E-11	9.663E-11	1.058E-09
Pu-239	Ac-227	1.000E+00	4.767E-18	7.102E-17	8.162E-16	2.051E-14	4.342E-13	1.025E-11	1.321E-10	1.670E-09
Pu-239	äDSR(j)		3.353E-02	3.353E-02	3.352E-02	3.352E-02	3.350E-02	3.343E-02	3.324E-02	3.257E-02
0Sr-90	Sr-90	1.000E+00	1.784E-03	1.742E-03	1.661E-03	1.406E-03	8.733E-04	1.650E-04	1.411E-06	8.174E-14
0U-235	U-235	1.000E+00	1.405E-02	1.405E-02	1.405E-02	1.405E-02	1.405E-02	1.405E-02	1.404E-02	1.402E-02
U-235	Pa-231	1.000E+00	1.092E-06	3.277E-06	7.647E-06	2.294E-05	6.661E-05	2.193E-04	6.541E-04	2.159E-03
U-235	Ac-227	1.000E+00	1.933E-08	1.341E-07	6.945E-07	5.785E-06	4.033E-05	2.581E-04	9.847E-04	3.516E-03
U-235	äDSR(j)		1.405E-02	1.405E-02	1.406E-02	1.408E-02	1.415E-02	1.452E-02	1.568E-02	1.970E-02

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide (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
Am-241	4.272E+02	4.278E+02	4.292E+02	4.341E+02	4.483E+02	5.017E+02	6.919E+02	2.131E+03
Cs-134	1.249E+02	1.748E+02	3.423E+02	3.601E+03	2.993E+06	*1.294E+15	*1.294E+15	*1.294E+15
Cs-137	2.967E+02	3.036E+02	3.179E+02	3.738E+02	5.933E+02	2.990E+03	3.038E+05	3.211E+12
Eu-152	1.470E+02	1.548E+02	1.718E+02	2.472E+02	6.995E+02	2.664E+04	8.753E+08	*1.765E+14
H-3	1.970E+06	4.203E+06	1.918E+07	3.981E+09	*9.594E+15	*9.594E+15	*9.594E+15	*9.594E+15
Pu-238	4.969E+02	5.008E+02	5.088E+02	5.377E+02	6.298E+02	1.095E+03	5.314E+03	1.219E+06
Pu-239	4.474E+02	4.474E+02	4.475E+02	4.475E+02	4.478E+02	4.487E+02	4.513E+02	4.605E+02
Sr-90	8.409E+03	8.611E+03	9.031E+03	1.067E+04	1.718E+04	9.091E+04	1.063E+07	*1.365E+14

U-235	1.068E+03	1.067E+03	1.067E+03	1.066E+03	1.060E+03	1.033E+03	9.567E+02	7.615E+02

*At specific activity limit
0

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 = 0.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.100E+01	0.000E+00	3.512E-02	4.272E+02	3.512E-02	4.272E+02
Cs-134	7.000E-02	0.000E+00	1.201E-01	1.249E+02	1.201E-01	1.249E+02
Cs-137	6.010E+01	0.000E+00	5.056E-02	2.967E+02	5.056E-02	2.967E+02
Eu-152	3.000E-01	0.000E+00	1.020E-01	1.470E+02	1.020E-01	1.470E+02
H-3	1.000E-01	0.000E+00	7.616E-06	1.970E+06	7.616E-06	1.970E+06
Pu-238	1.100E+00	0.000E+00	3.019E-02	4.969E+02	3.019E-02	4.969E+02
Pu-239	8.700E+00	0.000E+00	3.353E-02	4.474E+02	3.353E-02	4.474E+02
Sr-90	1.550E+01	0.000E+00	1.784E-03	8.409E+03	1.784E-03	8.409E+03
U-235	3.000E-01	1.000E+03	1.970E-02	7.615E+02	1.405E-02	1.068E+03

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Summary : 21_011K UCL Recreational 74K area   File: 21011K01.RAD

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

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	3.863E-01	3.857E-01	3.844E-01	3.801E-01	3.681E-01	3.289E-01	2.384E-01	7.734E-02
0Np-237	Am-241	1.000E+00	1.044E-07	3.128E-07	7.288E-07	2.174E-06	6.215E-06	1.938E-05	4.976E-05	1.038E-04
0U-233	Am-241	1.000E+00	7.325E-15	5.125E-14	2.706E-13	2.412E-12	2.012E-11	2.105E-10	1.699E-09	1.372E-08
0Th-229	Am-241	1.000E+00	3.879E-18	5.816E-17	6.780E-16	1.793E-14	4.348E-13	1.510E-11	3.719E-10	1.058E-08
0Cs-134	Cs-134	1.000E+00	8.408E-03	6.008E-03	3.067E-03	2.916E-04	3.508E-07	2.117E-17	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00	3.039E+00	2.969E+00	2.835E+00	2.412E+00	1.519E+00	3.015E-01	2.968E-03	2.808E-10
0Eu-152	Eu-152	7.208E-01	2.207E-02	2.095E-02	1.888E-02	1.312E-02	4.637E-03	1.217E-04	3.706E-09	5.765E-25
Eu-152	Eu-152	2.792E-01	8.548E-03	8.115E-03	7.313E-03	5.082E-03	1.796E-03	4.716E-05	1.435E-09	2.233E-25
Eu-152	äDOSE(j)		3.061E-02	2.906E-02	2.619E-02	1.820E-02	6.433E-03	1.689E-04	5.141E-09	7.998E-25
0Gd-152	Eu-152	2.792E-01	4.405E-19	1.292E-18	2.867E-18	7.252E-18	1.371E-17	1.715E-17	1.724E-17	1.724E-17
0H-3	H-3	1.000E+00	7.616E-07	3.569E-07	7.820E-08	3.767E-10	7.440E-17	0.000E+00	0.000E+00	0.000E+00
0Pu-238	Pu-238	1.000E+00	3.321E-02	3.295E-02	3.243E-02	3.068E-02	2.620E-02	1.507E-02	3.104E-03	1.231E-05
0U-234	Pu-238	1.000E+00	4.274E-09	1.278E-08	2.959E-08	8.636E-08	2.323E-07	5.943E-07	9.830E-07	1.080E-06
0Th-230	Pu-238	1.000E+00	2.509E-14	1.753E-13	9.216E-13	8.096E-12	6.485E-11	5.943E-10	3.540E-09	1.659E-08
0Ra-226	Pu-238	1.000E+00	9.112E-17	1.364E-15	1.585E-14	4.144E-13	9.732E-12	3.038E-10	5.786E-09	9.483E-08
0Pb-210	Pu-238	1.000E+00	2.141E-19	6.591E-18	1.636E-16	1.212E-14	7.410E-13	5.522E-11	1.687E-09	3.364E-08
0Pu-239	Pu-239	1.000E+00	2.917E-01	2.917E-01	2.917E-01	2.916E-01	2.914E-01	2.908E-01	2.892E-01	2.834E-01
0U-235	Pu-239	1.000E+00	6.019E-11	1.806E-10	4.213E-10	1.264E-09	3.670E-09	1.208E-08	3.601E-08	1.186E-07
U-235	U-235	1.000E+00	4.215E-03	4.215E-03	4.215E-03	4.214E-03	4.214E-03	4.214E-03	4.212E-03	4.207E-03
U-235	äDOSE(j)		4.215E-03	4.215E-03	4.215E-03	4.214E-03	4.214E-03	4.214E-03	4.212E-03	4.207E-03
0Pa-231	Pu-239	1.000E+00	3.120E-15	2.184E-14	1.154E-13	1.033E-12	8.703E-12	9.437E-11	8.407E-10	9.203E-09

Pa-231	U-235	1.000E+00	3.277E-07	9.831E-07	2.294E-06	6.881E-06	1.998E-05	6.579E-05	1.962E-04	6.477E-04
Pa-231	äDOSE(j)		3.277E-07	9.831E-07	2.294E-06	6.881E-06	1.998E-05	6.579E-05	1.962E-04	6.477E-04
0Ac-227	Pu-239	1.000E+00	4.147E-17	6.179E-16	7.101E-15	1.785E-13	3.778E-12	8.921E-11	1.149E-09	1.453E-08
Ac-227	U-235	1.000E+00	5.799E-09	4.023E-08	2.083E-07	1.736E-06	1.210E-05	7.744E-05	2.954E-04	1.055E-03
Ac-227	äDOSE(j)		5.799E-09	4.023E-08	2.083E-07	1.736E-06	1.210E-05	7.744E-05	2.954E-04	1.055E-03
0Sr-90	Sr-90	1.000E+00	2.765E-02	2.700E-02	2.574E-02	2.179E-02	1.354E-02	2.557E-03	2.188E-05	1.267E-12

BRF(i) is the branch fraction of the parent nuclide.

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Summary : 21_011K UCL Recreational 74K area File: 21011K01.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.100E+01	1.098E+01	1.095E+01	1.082E+01	1.048E+01	9.366E+00	6.789E+00	2.202E+00
0Np-237	Am-241	1.000E+00	0.000E+00	3.560E-06	1.066E-05	3.534E-05	1.043E-04	3.291E-04	8.478E-04	1.771E-03
0U-233	Am-241	1.000E+00	0.000E+00	7.786E-12	7.000E-11	7.749E-10	6.900E-09	7.387E-08	6.003E-07	4.858E-06
0Th-229	Am-241	1.000E+00	0.000E+00	2.451E-16	6.613E-15	2.442E-13	6.537E-12	2.351E-10	5.848E-09	1.669E-07
0Cs-134	Cs-134	1.000E+00	7.000E-02	5.002E-02	2.553E-02	2.428E-03	2.920E-06	1.763E-16	1.401E-45	0.000E+00
0Cs-137	Cs-137	1.000E+00	6.010E+01	5.873E+01	5.608E+01	4.770E+01	3.005E+01	5.963E+00	5.869E-02	5.553E-09
0Eu-152	Eu-152	7.208E-01	2.162E-01	2.053E-01	1.850E-01	1.286E-01	4.544E-02	1.193E-03	3.631E-08	5.649E-24
Eu-152	Eu-152	2.792E-01	8.376E-02	7.952E-02	7.166E-02	4.980E-02	1.760E-02	4.621E-04	1.407E-08	2.188E-24
Eu-152	äS(j):		3.000E-01	2.848E-01	2.567E-01	1.784E-01	6.304E-02	1.655E-03	5.038E-08	7.837E-24
0Gd-152	Eu-152	2.792E-01	0.000E+00	5.238E-16	1.493E-15	4.192E-15	8.166E-15	1.028E-14	1.034E-14	1.034E-14
0H-3	H-3	1.000E+00	1.000E-01	4.688E-02	1.028E-02	4.962E-05	9.861E-12	3.225E-36	0.000E+00	0.000E+00
0Pu-238	Pu-238	1.000E+00	1.100E+00	1.091E+00	1.074E+00	1.016E+00	8.679E-01	4.992E-01	1.028E-01	4.078E-04
0U-234	Pu-238	1.000E+00	0.000E+00	3.106E-06	9.245E-06	2.998E-05	8.329E-05	2.155E-04	3.575E-04	3.930E-04
0Th-230	Pu-238	1.000E+00	0.000E+00	1.400E-11	1.253E-10	1.367E-09	1.169E-08	1.096E-07	6.572E-07	3.085E-06
0Ra-226	Pu-238	1.000E+00	0.000E+00	2.023E-15	5.438E-14	1.985E-12	5.146E-11	1.663E-09	3.199E-08	5.259E-07
0Pb-210	Pu-238	1.000E+00	0.000E+00	1.563E-17	1.246E-15	1.457E-13	1.017E-11	7.938E-10	2.456E-08	4.914E-07
0Pu-239	Pu-239	1.000E+00	8.700E+00	8.700E+00	8.699E+00	8.697E+00	8.692E+00	8.675E+00	8.625E+00	8.453E+00
0U-235	Pu-239	1.000E+00	0.000E+00	8.568E-09	2.570E-08	8.567E-08	2.569E-07	8.555E-07	2.559E-06	8.438E-06
U-235	U-235	1.000E+00	3.000E-01	3.000E-01	3.000E-01	3.000E-01	3.000E-01	2.999E-01	2.998E-01	2.994E-01
U-235	äS(j):		3.000E-01	3.000E-01	3.000E-01	3.000E-01	3.000E-01	2.999E-01	2.998E-01	2.995E-01
0Pa-231	Pu-239	1.000E+00	0.000E+00	9.064E-14	8.158E-13	9.063E-12	8.154E-11	9.048E-10	8.114E-09	8.904E-08
Pa-231	U-235	1.000E+00	0.000E+00	6.347E-06	1.904E-05	6.347E-05	1.904E-04	6.340E-04	1.897E-03	6.269E-03
Pa-231	äS(j):		0.000E+00	6.347E-06	1.904E-05	6.347E-05	1.904E-04	6.340E-04	1.897E-03	6.269E-03
0Ac-227	Pu-239	1.000E+00	0.000E+00	9.543E-16	2.536E-14	8.898E-13	2.078E-11	5.077E-10	6.595E-09	8.365E-08
Ac-227	U-235	1.000E+00	0.000E+00	9.997E-08	8.810E-07	9.111E-06	6.774E-05	4.431E-04	1.699E-03	6.074E-03
Ac-227	äS(j):		0.000E+00	9.997E-08	8.810E-07	9.111E-06	6.774E-05	4.431E-04	1.699E-03	6.074E-03
0Sr-90	Sr-90	1.000E+00	1.550E+01	1.514E+01	1.443E+01	1.222E+01	7.589E+00	1.434E+00	1.226E-02	7.103E-10

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 5.84 seconds

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Part I: Mixture Sums and Single Radionuclide Guidelines
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Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-134	4.630E-05	4.630E-05	DCF2(3)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(4)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(5)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(7)
B-1	H-3	6.400E-08	6.400E-08	DCF2(8)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(9)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(10)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(11)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(12)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(13)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(14)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(15)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(16)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(17)

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B-1   ³ U-233                                                  ³ 1.350E-01 ³ 1.350E-01 ³ DCF2(18)
B-1   ³ U-234                                                  ³ 1.320E-01 ³ 1.320E-01 ³ DCF2(19)
B-1   ³ U-235+D                                                ³ 1.230E-01 ³ 1.230E-01 ³ DCF2(20)
      ³                                                        ³           ³           ³
D-1   ³ Dose conversion factors for ingestion, mrem/pCi:       ³           ³           ³
D-1   ³ Ac-227+D                                               ³ 1.480E-02 ³ 1.480E-02 ³ DCF3( 1)
D-1   ³ Am-241                                                 ³ 3.640E-03 ³ 3.640E-03 ³ DCF3( 2)
D-1   ³ Cs-134                                                 ³ 7.330E-05 ³ 7.330E-05 ³ DCF3( 3)
D-1   ³ Cs-137+D                                               ³ 5.000E-05 ³ 5.000E-05 ³ DCF3( 4)
D-1   ³ Eu-152                                                 ³ 6.480E-06 ³ 6.480E-06 ³ DCF3( 5)
D-1   ³ Gd-152                                                 ³ 1.610E-04 ³ 1.610E-04 ³ DCF3( 7)
D-1   ³ H-3                                                    ³ 6.400E-08 ³ 6.400E-08 ³ DCF3( 8)
D-1   ³ Np-237+D                                               ³ 4.440E-03 ³ 4.440E-03 ³ DCF3( 9)
D-1   ³ Pa-231                                                 ³ 1.060E-02 ³ 1.060E-02 ³ DCF3(10)
D-1   ³ Pb-210+D                                               ³ 7.270E-03 ³ 7.270E-03 ³ DCF3(11)
D-1   ³ Pu-238                                                 ³ 3.200E-03 ³ 3.200E-03 ³ DCF3(12)
D-1   ³ Pu-239                                                 ³ 3.540E-03 ³ 3.540E-03 ³ DCF3(13)
D-1   ³ Ra-226+D                                               ³ 1.330E-03 ³ 1.330E-03 ³ DCF3(14)
D-1   ³ Sr-90+D                                                ³ 1.530E-04 ³ 1.530E-04 ³ DCF3(15)
D-1   ³ Th-229+D                                               ³ 4.030E-03 ³ 4.030E-03 ³ DCF3(16)
D-1   ³ Th-230                                                 ³ 5.480E-04 ³ 5.480E-04 ³ DCF3(17)
D-1   ³ U-233                                                  ³ 2.890E-04 ³ 2.890E-04 ³ DCF3(18)
D-1   ³ U-234                                                  ³ 2.830E-04 ³ 2.830E-04 ³ DCF3(19)
D-1   ³ U-235+D                                                ³ 2.670E-04 ³ 2.670E-04 ³ DCF3(20)
      ³                                                        ³           ³           ³
D-34  ³ Food transfer factors:                                 ³           ³           ³
D-34  ³ Ac-227+D , plant/soil concentration ratio, dimensionless ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 1,1)
D-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)
D-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)
D-34  ³                                                        ³           ³           ³
D-34  ³ Am-241   , plant/soil concentration ratio, dimensionless ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 2,1)
D-34  ³ Am-241   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 5.000E-05 ³ 5.000E-05 ³ RTF( 2,2)
D-34  ³ Am-241   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)  ³ 2.000E-06 ³ 2.000E-06 ³ RTF( 2,3)
D-34  ³                                                        ³           ³           ³
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                    Dose Conversion Factor (and Related) Parameter Summary (continued)
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0     ³                                                        ³  Current  ³           ³ Parameter
Menu  ³                      Parameter                         ³   Value   ³  Default  ³   Name

D-34  ³ Cs-134   , plant/soil concentration ratio, dimensionless ³ 4.000E-02 ³ 4.000E-02 ³ RTF( 3,1)
D-34  ³ Cs-134   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 3.000E-02 ³ 3.000E-02 ³ RTF( 3,2)
D-34  ³ Cs-134   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)  ³ 8.000E-03 ³ 8.000E-03 ³ RTF( 3,3)
D-34  ³                                                        ³           ³           ³
D-34  ³ Cs-137+D , plant/soil concentration ratio, dimensionless ³ 4.000E-02 ³ 4.000E-02 ³ RTF( 4,1)
D-34  ³ Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 3.000E-02 ³ 3.000E-02 ³ RTF( 4,2)
D-34  ³ Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)  ³ 8.000E-03 ³ 8.000E-03 ³ RTF( 4,3)
D-34  ³                                                        ³           ³           ³
D-34  ³ Eu-152   , plant/soil concentration ratio, dimensionless ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 5,1)
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D-34 ³ Eu-152    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 2.000E-03 ³ 2.000E-03 ³ RTF( 5,2)
D-34 ³ Eu-152    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-05 ³ 2.000E-05 ³ RTF( 5,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Gd-152    , plant/soil concentration ratio, dimensionless    ³ 2.500E-03 ³ 2.500E-03 ³ RTF( 7,1)
D-34 ³ Gd-152    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 2.000E-03 ³ 2.000E-03 ³ RTF( 7,2)
D-34 ³ Gd-152    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-05 ³ 2.000E-05 ³ RTF( 7,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ H-3       , plant/soil concentration ratio, dimensionless    ³ 4.800E+00 ³ 4.800E+00 ³ RTF( 8,1)
D-34 ³ H-3       , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 1.200E-02 ³ 1.200E-02 ³ RTF( 8,2)
D-34 ³ H-3       , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 1.000E-02 ³ 1.000E-02 ³ RTF( 8,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Np-237+D  , plant/soil concentration ratio, dimensionless    ³ 2.000E-02 ³ 2.000E-02 ³ RTF( 9,1)
D-34 ³ Np-237+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 9,2)
D-34 ³ Np-237+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 9,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Pa-231    , plant/soil concentration ratio, dimensionless    ³ 1.000E-02 ³ 1.000E-02 ³ RTF(10,1)
D-34 ³ Pa-231    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 5.000E-03 ³ 5.000E-03 ³ RTF(10,2)
D-34 ³ Pa-231    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 5.000E-06 ³ 5.000E-06 ³ RTF(10,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Pb-210+D  , plant/soil concentration ratio, dimensionless    ³ 1.000E-02 ³ 1.000E-02 ³ RTF(11,1)
D-34 ³ Pb-210+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 8.000E-04 ³ 8.000E-04 ³ RTF(11,2)
D-34 ³ Pb-210+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 3.000E-04 ³ 3.000E-04 ³ RTF(11,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Pu-238    , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(12,1)
D-34 ³ Pu-238    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 1.000E-04 ³ 1.000E-04 ³ RTF(12,2)
D-34 ³ Pu-238    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 1.000E-06 ³ 1.000E-06 ³ RTF(12,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Pu-239    , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(13,1)
D-34 ³ Pu-239    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 1.000E-04 ³ 1.000E-04 ³ RTF(13,2)
D-34 ³ Pu-239    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 1.000E-06 ³ 1.000E-06 ³ RTF(13,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Ra-226+D  , plant/soil concentration ratio, dimensionless    ³ 4.000E-02 ³ 4.000E-02 ³ RTF(14,1)
D-34 ³ Ra-226+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(14,2)
D-34 ³ Ra-226+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 1.000E-03 ³ 1.000E-03 ³ RTF(14,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Sr-90+D   , plant/soil concentration ratio, dimensionless    ³ 3.000E-01 ³ 3.000E-01 ³ RTF(15,1)
D-34 ³ Sr-90+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 8.000E-03 ³ 8.000E-03 ³ RTF(15,2)
D-34 ³ Sr-90+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-03 ³ 2.000E-03 ³ RTF(15,3)
D-34 ³                                                              ³           ³           ³
D-34 ³ Th-229+D  , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(16,1)
D-34 ³ Th-229+D  , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 1.000E-04 ³ 1.000E-04 ³ RTF(16,2)
D-34 ³ Th-229+D  , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 5.000E-06 ³ 5.000E-06 ³ RTF(16,3)
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0      ³                                                        ³  Current  ³           ³  Parameter
 Menu  ³                        Parameter                       ³   Value   ³  Default  ³    Name

D-34 ³ Th-230    , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF(17,1)
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D-34 ³ Th-230    , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 1.000E-04 ³ 1.000E-04 ³ RTF(17,2)
D-34 ³ Th-230    , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 5.000E-06 ³ 5.000E-06 ³ RTF(17,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ U-233     , plant/soil concentration ratio, dimensionless     ³ 2.500E-03 ³ 2.500E-03 ³ RTF(18,1)
D-34 ³ U-233     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 3.400E-04 ³ 3.400E-04 ³ RTF(18,2)
D-34 ³ U-233     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 6.000E-04 ³ 6.000E-04 ³ RTF(18,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ U-234     , plant/soil concentration ratio, dimensionless     ³ 2.500E-03 ³ 2.500E-03 ³ RTF(19,1)
D-34 ³ U-234     , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 3.400E-04 ³ 3.400E-04 ³ RTF(19,2)
D-34 ³ U-234     , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 6.000E-04 ³ 6.000E-04 ³ RTF(19,3)
D-34 ³                                                               ³           ³           ³
D-34 ³ U-235+D   , plant/soil concentration ratio, dimensionless     ³ 2.500E-03 ³ 2.500E-03 ³ RTF(20,1)
D-34 ³ U-235+D   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)     ³ 3.400E-04 ³ 3.400E-04 ³ RTF(20,2)
D-34 ³ U-235+D   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)      ³ 6.000E-04 ³ 6.000E-04 ³ RTF(20,3)
     ³                                                               ³           ³           ³
D-5  ³ Bioaccumulation factors, fresh water, L/kg:                   ³           ³           ³
D-5  ³ Ac-227+D , fish                                               ³ 1.500E+01 ³ 1.500E+01 ³ BIOFAC( 1,1)
D-5  ³ Ac-227+D , crustacea and mollusks                             ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 1,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Am-241   , fish                                               ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC( 2,1)
D-5  ³ Am-241   , crustacea and mollusks                             ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 2,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Cs-134   , fish                                               ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC( 3,1)
D-5  ³ Cs-134   , crustacea and mollusks                             ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 3,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Cs-137+D , fish                                               ³ 2.000E+03 ³ 2.000E+03 ³ BIOFAC( 4,1)
D-5  ³ Cs-137+D , crustacea and mollusks                             ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC( 4,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Eu-152   , fish                                               ³ 5.000E+01 ³ 5.000E+01 ³ BIOFAC( 5,1)
D-5  ³ Eu-152   , crustacea and mollusks                             ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 5,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Gd-152   , fish                                               ³ 2.500E+01 ³ 2.500E+01 ³ BIOFAC( 7,1)
D-5  ³ Gd-152   , crustacea and mollusks                             ³ 1.000E+03 ³ 1.000E+03 ³ BIOFAC( 7,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ H-3      , fish                                               ³ 1.000E+00 ³ 1.000E+00 ³ BIOFAC( 8,1)
D-5  ³ H-3      , crustacea and mollusks                             ³ 1.000E+00 ³ 1.000E+00 ³ BIOFAC( 8,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Np-237+D , fish                                               ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC( 9,1)
D-5  ³ Np-237+D , crustacea and mollusks                             ³ 4.000E+02 ³ 4.000E+02 ³ BIOFAC( 9,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Pa-231   , fish                                               ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(10,1)
D-5  ³ Pa-231   , crustacea and mollusks                             ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC(10,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Pb-210+D , fish                                               ³ 3.000E+02 ³ 3.000E+02 ³ BIOFAC(11,1)
D-5  ³ Pb-210+D , crustacea and mollusks                             ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(11,2)
D-5  ³                                                               ³           ³           ³
D-5  ³ Pu-238   , fish                                               ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(12,1)
D-5  ³ Pu-238   , crustacea and mollusks                             ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(12,2)
D-5  ³                                                               ³           ³           ³
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D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(13,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(13,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(14,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(14,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(15,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(16,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(16,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(17,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(17,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(18,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(18,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(19,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(19,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(20,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(20,2)

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	7.412E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)

R012	Initial principal radionuclide (pCi/g): Am-241	1.100E+01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-134	7.000E-02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Cs-137	6.010E+01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Eu-152	3.000E-01	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): H-3	1.000E-01	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-238	1.100E+00	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Pu-239	8.700E+00	0.000E+00	---	S1(13)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.550E+01	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g): U-235	3.000E-01	0.000E+00	---	S1(20)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Cs-134	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(15)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(20)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	4.400E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	5.500E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	3.500E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ

R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	not used	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	not used	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	not used	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	not used	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	not used	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.947E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Cs-134				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.600E-07	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	1.000E+03	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(4)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.600E-07	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.939E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	0.000E+00	---	DCNUCU(8,2)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.200E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(12,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+03	---	DCNUCU(12,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.999E-08	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03	---	DCNUCU(13,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+03	---	DCNUCU(13,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+03	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.999E-08	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	not used	3.000E+01	---	DCNUCU(15,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	3.000E+01	---	DCNUCU(15,2)
R016	Saturated zone (cm**3/g)	not used	3.000E+01	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.310E-06	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(20)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(20,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.191E-06	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.947E-06	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	8.249E+02	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(7,2)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.939E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(9,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	-1.000E+00	---	DCNUCU(9,2)
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.212E-07	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.191E-06	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(11,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	1.000E+02	---	DCNUCU(11,2)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.598E-06	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(14,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	7.000E+01	---	DCNUCU(14,2)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.281E-06	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(16,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	6.000E+04	---	DCNUCU(16,2)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.667E-09	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(17,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	6.000E+04	---	DCNUCU(17,2)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.667E-09	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(18,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(18,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.191E-06	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(19,1)
R016	Unsaturated zone 2 (cm**3/g)	not used	5.000E+01	---	DCNUCU(19,2)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.191E-06	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R017	Inhalation rate (m**3/yr)	1.050E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	6.000E+00	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.280E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	6.260E+02	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)

STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active

9 -- radon ³ suppressed
Find peak pathway doses ³ active

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

Contaminated Zone Dimensions	
Area:	7412.00 square meters
Thickness:	2.00 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Am-241	1.100E+01
Cs-134	7.000E-02
Cs-137	6.010E+01
Eu-152	3.000E-01
H-3	1.000E-01
Pu-238	1.100E+00
Pu-239	8.700E+00
Sr-90	1.550E+01
U-235	3.000E-01

0
Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	5.570E+00	5.463E+00	5.258E+00	4.624E+00	3.295E+00	1.452E+00	8.567E-01	5.839E-01
M(t):	3.713E-01	3.642E-01	3.506E-01	3.082E-01	2.197E-01	9.678E-02	5.711E-02	3.893E-02

0Maximum TDOSE(t): 5.570E+00 mrem/yr at t = 0.000E+00 years

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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
0
Water Independent Pathways (Inhalation excludes radon)
0

Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.055E-02	0.0019	3.336E-02	0.0060	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.710E-01	0.1025
Cs-134	1.192E-02	0.0021	1.882E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.220E-05	0.0000
Cs-137	4.291E+00	0.7704	1.296E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.240E-02	0.0076
Eu-152	4.360E-02	0.0078	4.416E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.704E-05	0.0000
H-3	0.000E+00	0.0000	1.069E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.196E-08	0.0000
Pu-238	3.727E-06	0.0000	2.936E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.004E-02	0.0090
Pu-239	5.590E-05	0.0000	2.551E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.396E-01	0.0789
Sr-90	8.018E-03	0.0014	1.372E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.345E-02	0.0060
U-235	4.900E-03	0.0009	2.523E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.144E-03	0.0002
Total	4.370E+00	0.7846	6.221E-02	0.0112	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.138E+00	0.2043

0
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
0
Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	fract.	Fish mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	All Pathways* mrem/yr	fract.
Am-241	0.000E+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	6.149E-01	0.1104
Cs-134	0.000E+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	1.199E-02	0.0022
Cs-137	0.000E+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	4.333E+00	0.7780
Eu-152	0.000E+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	4.363E-02	0.0078
H-3	0.000E+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	1.121E-06	0.0000
Pu-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	5.298E-02	0.0095
Pu-239	0.000E+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	4.651E-01	0.0835
Sr-90	0.000E+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	4.160E-02	0.0075
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.296E-03	0.0011
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.570E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground Ä mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	Soil mrem/yr	fract.
Am-241	1.053E-02	0.0019	3.331E-02	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.701E-01	0.1044
Cs-134	8.519E-03	0.0016	1.344E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.444E-05	0.0000
Cs-137	4.193E+00	0.7675	1.266E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.143E-02	0.0076
Eu-152	4.139E-02	0.0076	4.193E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.567E-05	0.0000
H-3	0.000E+00	0.0000	3.036E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.475E-08	0.0000
Pu-238	3.698E-06	0.0000	2.913E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.965E-02	0.0091
Pu-239	5.590E-05	0.0000	2.551E-02	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.396E-01	0.0805
Sr-90	7.829E-03	0.0014	1.339E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.266E-02	0.0060
U-235	4.900E-03	0.0009	2.523E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.145E-03	0.0002
Total	4.266E+00	0.7809	6.213E-02	0.0114	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.135E+00	0.2077

0

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

0 Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	fract.	Fish mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	All Pathways* mrem/yr	fract.
Am-241	0.000E+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	6.139E-01	0.1124
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.564E-03	0.0016
Cs-137	0.000E+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	4.234E+00	0.7751
Eu-152	0.000E+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	4.142E-02	0.0076
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.183E-07	0.0000
Pu-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	5.257E-02	0.0096

Pu-239	0.000E+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	4.651E-01	0.0851
Sr-90	0.000E+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	4.062E-02	0.0074
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.297E-03	0.0012
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.463E+00	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T" Limit = 0.5 year 10/07/2003 17:19 Page 17
Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.050E-02	0.0020	3.320E-02	0.0063	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.683E-01	0.1081
Cs-134	4.349E-03	0.0008	6.864E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.269E-05	0.0000
Cs-137	4.003E+00	0.7613	1.209E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.956E-02	0.0075
Eu-152	3.730E-02	0.0071	3.779E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.313E-05	0.0000
H-3	0.000E+00	0.0000	2.437E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.184E-09	0.0000
Pu-238	3.640E-06	0.0000	2.867E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.887E-02	0.0093
Pu-239	5.590E-05	0.0000	2.551E-02	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.395E-01	0.0836
Sr-90	7.465E-03	0.0014	1.277E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.114E-02	0.0059
U-235	4.900E-03	0.0009	2.525E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.147E-03	0.0002
Total	4.068E+00	0.7736	6.197E-02	0.0118	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.129E+00	0.2146

0

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

0 Water Dependent Pathways

0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	6.120E-01	0.1164
Cs-134	0.000E+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	4.372E-03	0.0008
Cs-137	0.000E+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	4.043E+00	0.7688
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.733E-02	0.0071
H-3	0.000E+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	2.556E-08	0.0000
Pu-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	5.174E-02	0.0098
Pu-239	0.000E+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	4.651E-01	0.0884
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.874E-02	0.0074
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.300E-03	0.0012
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.258E+00	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T" Limit = 0.5 year 10/07/2003 17:19 Page 18
Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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
0
Water Independent Pathways (Inhalation excludes radon)
0

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.038E-02	0.0022	3.283E-02	0.0071	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.619E-01	0.1215
Cs-134	4.135E-04	0.0001	6.526E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.157E-06	0.0000
Cs-137	3.405E+00	0.7365	1.028E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.365E-02	0.0073
Eu-152	2.592E-02	0.0056	2.626E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.607E-05	0.0000
H-3	0.000E+00	0.0000	3.440E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.672E-13	0.0000
Pu-238	3.444E-06	0.0000	2.713E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.624E-02	0.0100
Pu-239	5.589E-05	0.0000	2.551E-02	0.0055	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.394E-01	0.0950
Sr-90	6.319E-03	0.0014	1.081E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.636E-02	0.0057
U-235	4.901E-03	0.0011	2.533E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.155E-03	0.0002
Total	3.453E+00	0.7469	6.142E-02	0.0133	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.109E+00	0.2398

0

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
0
Water Dependent Pathways
0

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	6.051E-01	0.1309
Cs-134	0.000E+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	4.157E-04	0.0001
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.439E+00	0.7438
Eu-152	0.000E+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	2.594E-02	0.0056
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.608E-12	0.0000
Pu-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	4.896E-02	0.0106
Pu-239	0.000E+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	4.650E-01	0.1006
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.279E-02	0.0071
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.309E-03	0.0014
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.624E+00	1.0000

0*Sum of all water independent and dependent pathways.
1RESRAD, Version 6.21   T" Limit = 0.5 year   10/07/2003 17:19 Page 19
Summary : 21-011(k) UCL extended bkyrd 7K area   File: 21011K02.RAD

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
0
Water Independent Pathways (Inhalation excludes radon)
0

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.005E-02	0.0031	3.179E-02	0.0096	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.441E-01	0.1651
Cs-134	4.974E-07	0.0000	7.850E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.595E-09	0.0000
Cs-137	2.145E+00	0.6511	6.478E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.120E-02	0.0064
Eu-152	9.162E-03	0.0028	9.281E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.682E-06	0.0000

H-3	0.000E+00	0.0000	2.465E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.198E-24	0.0000
Pu-238	2.941E-06	0.0000	2.317E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.948E-02	0.0120
Pu-239	5.586E-05	0.0000	2.549E-02	0.0077	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.392E-01	0.1333
Sr-90	3.925E-03	0.0012	6.715E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.637E-02	0.0050
U-235	4.903E-03	0.0015	2.571E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.187E-03	0.0004
Total	2.173E+00	0.6596	5.993E-02	0.0182	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.062E+00	0.3222

0

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

0 Water Dependent Pathways

0

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	5.859E-01	0.1778
Cs-134	0.000E+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	5.000E-07	0.0000
Cs-137	0.000E+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	2.167E+00	0.6575
Eu-152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.168E-03	0.0028
H-3	0.000E+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	2.585E-23	0.0000
Pu-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	4.180E-02	0.0127
Pu-239	0.000E+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	4.647E-01	0.1410
Sr-90	0.000E+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	2.037E-02	0.0062
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.348E-03	0.0019
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.295E+00	1.0000

0*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T" Limit = 0.5 year 10/07/2003 17:19 Page 20
Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	8.988E-03	0.0062	2.840E-02	0.0196	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.860E-01	0.3348
Cs-134	3.002E-17	0.0000	4.738E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.566E-19	0.0000
Cs-137	4.257E-01	0.2932	1.285E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.206E-03	0.0029
Eu-152	2.405E-04	0.0002	2.437E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.492E-07	0.0000
H-3	0.000E+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
Pu-238	1.694E-06	0.0000	1.333E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.271E-02	0.0156
Pu-239	5.575E-05	0.0000	2.544E-02	0.0175	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.383E-01	0.3019
Sr-90	7.414E-04	0.0005	1.268E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.093E-03	0.0021
U-235	4.920E-03	0.0034	2.782E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.333E-03	0.0009
Total	4.406E-01	0.3035	5.546E-02	0.0382	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.557E-01	0.6583

0

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

0 Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	5.234E-01	0.3605
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.018E-17	0.0000
Cs-137	0.000E+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	4.299E-01	0.2961
Eu-152	0.000E+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	2.407E-04	0.0002
H-3	0.000E+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
Pu-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	2.405E-02	0.0166
Pu-239	0.000E+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	4.638E-01	0.3195
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.847E-03	0.0026
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.532E-03	0.0045
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.452E+00	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	6.526E-03	0.0076	2.057E-02	0.0240	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.522E-01	0.4111
Cs-134	0.000E+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
Cs-137	4.190E-03	0.0049	1.265E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.140E-05	0.0000
Eu-152	7.322E-09	0.0000	7.418E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.540E-12	0.0000
H-3	0.000E+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
Pu-238	3.592E-07	0.0000	2.748E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.679E-03	0.0055
Pu-239	5.546E-05	0.0001	2.529E-02	0.0295	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.358E-01	0.5087
Sr-90	6.340E-06	0.0000	1.085E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.645E-05	0.0000
U-235	4.977E-03	0.0058	3.468E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.789E-03	0.0021
Total	1.575E-02	0.0184	4.649E-02	0.0543	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.945E-01	0.9273

0

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

0 Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.793E-01	0.4427
Cs-134	0.000E+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
Cs-137	0.000E+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	4.231E-03	0.0049
Eu-152	0.000E+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	7.326E-09	0.0000
H-3	0.000E+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

Pu-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	4.954E-03	0.0058
Pu-239	0.000E+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	4.611E-01	0.5383
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.290E-05	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.112E-03	0.0083
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.567E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	Soil mrem/yr	fract.
Am-241	2.147E-03	0.0037	6.663E-03	0.0114	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.141E-01	0.1953
Cs-134	0.000E+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
Cs-137	3.964E-10	0.0000	1.197E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.917E-12	0.0000
Eu-152	1.139E-24	0.0000	1.717E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.375E-17	0.0000
H-3	0.000E+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
Pu-238	1.307E-07	0.0000	1.450E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.022E-05	0.0000
Pu-239	5.445E-05	0.0001	2.479E-02	0.0425	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.271E-01	0.7314
Sr-90	3.666E-13	0.0000	6.272E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.529E-12	0.0000
U-235	5.172E-03	0.0089	5.850E-04	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.369E-03	0.0058
Total	7.374E-03	0.0126	3.204E-02	0.0549	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.445E-01	0.9325

0

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

0 Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	fract.	Fish mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	All Pathways* mrem/yr	fract.
Am-241	0.000E+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	1.229E-01	0.2104
Cs-134	0.000E+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
Cs-137	0.000E+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	4.003E-10	0.0000
Eu-152	0.000E+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	4.092E-17	0.0000
H-3	0.000E+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
Pu-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	2.180E-05	0.0000
Pu-239	0.000E+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	4.519E-01	0.7739
Sr-90	0.000E+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	1.902E-12	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.126E-03	0.0156
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.839E-01	1.0000

0*Sum of all water independent and dependent pathways.

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch 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
			DSR(j,t) (mrem/yr)/(pCi/g)							
Am-241	Am-241	1.000E+00	5.590E-02	5.581E-02	5.563E-02	5.501E-02	5.326E-02	4.758E-02	3.447E-02	1.116E-02
Am-241	Np-237	1.000E+00	1.468E-08	4.400E-08	1.025E-07	3.058E-07	8.740E-07	2.725E-06	6.994E-06	1.458E-05
Am-241	U-233	1.000E+00	1.198E-15	8.384E-15	4.427E-14	3.946E-13	3.291E-12	3.443E-11	2.779E-10	2.241E-09
Am-241	Th-229	1.000E+00	5.938E-19	8.903E-18	1.038E-16	2.744E-15	6.656E-14	2.311E-12	5.691E-11	1.617E-09
Am-241	äDSR(j)		5.590E-02	5.581E-02	5.563E-02	5.501E-02	5.327E-02	4.758E-02	3.448E-02	1.117E-02
0Cs-134	Cs-134	1.000E+00	1.712E-01	1.223E-01	6.246E-02	5.938E-03	7.143E-06	4.311E-16	2.803E-45	0.000E+00
0Cs-137	Cs-137	1.000E+00	7.210E-02	7.045E-02	6.727E-02	5.722E-02	3.605E-02	7.153E-03	7.040E-05	6.661E-12
0Eu-152	Eu-152	7.208E-01	1.048E-01	9.951E-02	8.968E-02	6.232E-02	2.203E-02	5.783E-04	1.760E-08	2.738E-24
0Eu-152	Eu-152	2.792E-01	4.060E-02	3.855E-02	3.474E-02	2.414E-02	8.532E-03	2.240E-04	6.818E-09	1.061E-24
Eu-152	Gd-152	2.792E-01	3.486E-18	1.022E-17	2.269E-17	5.739E-17	1.085E-16	1.357E-16	1.364E-16	1.364E-16
Eu-152	äDSR(j)		4.060E-02	3.855E-02	3.474E-02	2.414E-02	8.532E-03	2.240E-04	6.818E-09	1.364E-16
0H-3	H-3	1.000E+00	1.121E-05	3.183E-06	2.556E-07	3.608E-11	2.585E-22	0.000E+00	0.000E+00	0.000E+00
0Pu-238	Pu-238	1.000E+00	4.817E-02	4.779E-02	4.704E-02	4.451E-02	3.800E-02	2.186E-02	4.502E-03	1.786E-05
Pu-238	U-234	1.000E+00	6.999E-09	2.092E-08	4.844E-08	1.414E-07	3.803E-07	9.731E-07	1.609E-06	1.766E-06
Pu-238	Th-230	1.000E+00	4.277E-14	2.987E-13	1.571E-12	1.380E-11	1.105E-10	1.013E-09	6.034E-09	2.826E-08
Pu-238	Ra-226	1.000E+00	1.186E-16	1.776E-15	2.064E-14	5.395E-13	1.267E-11	3.954E-10	7.530E-09	1.234E-07
Pu-238	Pb-210	1.000E+00	2.961E-19	9.116E-18	2.263E-16	1.676E-14	1.025E-12	7.637E-11	2.334E-09	4.650E-08
Pu-238	äDSR(j)		4.817E-02	4.779E-02	4.704E-02	4.451E-02	3.800E-02	2.186E-02	4.504E-03	1.982E-05
0Pu-239	Pu-239	1.000E+00	5.346E-02	5.346E-02	5.346E-02	5.345E-02	5.342E-02	5.331E-02	5.300E-02	5.194E-02
Pu-239	U-235	1.000E+00	1.033E-11	3.100E-11	7.233E-11	2.170E-10	6.301E-10	2.074E-09	6.181E-09	2.035E-08
Pu-239	Pa-231	1.000E+00	5.701E-16	3.991E-15	2.109E-14	1.887E-13	1.590E-12	1.724E-11	1.536E-10	1.680E-09
Pu-239	Ac-227	1.000E+00	8.248E-18	1.229E-16	1.412E-15	3.549E-14	7.512E-13	1.774E-11	2.284E-10	2.888E-09
Pu-239	äDSR(j)		5.346E-02	5.346E-02	5.346E-02	5.345E-02	5.342E-02	5.331E-02	5.300E-02	5.194E-02
0Sr-90	Sr-90	1.000E+00	2.684E-03	2.621E-03	2.499E-03	2.115E-03	1.314E-03	2.482E-04	2.122E-06	1.227E-13
0U-235	U-235	1.000E+00	2.099E-02	2.099E-02	2.099E-02	2.098E-02	2.098E-02	2.098E-02	2.097E-02	2.092E-02
U-235	Pa-231	1.000E+00	1.737E-06	5.210E-06	1.216E-05	3.646E-05	1.059E-04	3.486E-04	1.039E-03	3.427E-03
U-235	Ac-227	1.000E+00	3.344E-08	2.320E-07	1.202E-06	1.001E-05	6.977E-05	4.465E-04	1.703E-03	6.074E-03
U-235	äDSR(j)		2.099E-02	2.099E-02	2.100E-02	2.103E-02	2.116E-02	2.177E-02	2.371E-02	3.042E-02

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide (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
Am-241	2.683E+02	2.688E+02	2.696E+02	2.727E+02	2.816E+02	3.152E+02	4.351E+02	1.343E+03
Cs-134	8.761E+01	1.226E+02	2.402E+02	2.526E+03	2.100E+06	*1.294E+15	*1.294E+15	*1.294E+15
Cs-137	2.081E+02	2.129E+02	2.230E+02	2.621E+02	4.161E+02	2.097E+03	2.131E+05	2.252E+12
Eu-152	1.031E+02	1.086E+02	1.206E+02	1.735E+02	4.908E+02	1.870E+04	6.142E+08	*1.765E+14
H-3	1.338E+06	4.712E+06	5.869E+07	4.158E+11	*9.594E+15	*9.594E+15	*9.594E+15	*9.594E+15
Pu-238	3.114E+02	3.139E+02	3.189E+02	3.370E+02	3.947E+02	6.862E+02	3.330E+03	7.568E+05
Pu-239	2.806E+02	2.806E+02	2.806E+02	2.806E+02	2.808E+02	2.814E+02	2.830E+02	2.888E+02

Sr-90	5.589E+03	5.723E+03	6.002E+03	7.091E+03	1.142E+04	6.043E+04	7.067E+06	1.222E+14
U-235	7.147E+02	7.146E+02	7.143E+02	7.132E+02	7.089E+02	6.889E+02	6.327E+02	4.931E+02

*At specific activity limit

0

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 = 0.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.100E+01	0.000E+00	5.590E-02	2.683E+02	5.590E-02	2.683E+02
Cs-134	7.000E-02	0.000E+00	1.712E-01	8.761E+01	1.712E-01	8.761E+01
Cs-137	6.010E+01	0.000E+00	7.210E-02	2.081E+02	7.210E-02	2.081E+02
Eu-152	3.000E-01	0.000E+00	1.454E-01	1.031E+02	1.454E-01	1.031E+02
H-3	1.000E-01	0.000E+00	1.121E-05	1.338E+06	1.121E-05	1.338E+06
Pu-238	1.100E+00	0.000E+00	4.817E-02	3.114E+02	4.817E-02	3.114E+02
Pu-239	8.700E+00	0.000E+00	5.346E-02	2.806E+02	5.346E-02	2.806E+02
Sr-90	1.550E+01	0.000E+00	2.684E-03	5.589E+03	2.684E-03	5.589E+03
U-235	3.000E-01	1.000E+03	3.042E-02	4.931E+02	2.099E-02	7.147E+02

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

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

DOSE(j,t), mrem/yr

0Nuclide (j)	Parent (i)	BRF(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
Am-241	Am-241	1.000E+00	6.149E-01	6.139E-01	6.120E-01	6.051E-01	5.859E-01	5.234E-01	3.792E-01	1.227E-01
0Np-237	Am-241	1.000E+00	1.614E-07	4.840E-07	1.127E-06	3.363E-06	9.614E-06	2.997E-05	7.693E-05	1.604E-04
0U-233	Am-241	1.000E+00	1.318E-14	9.223E-14	4.870E-13	4.340E-12	3.621E-11	3.787E-10	3.056E-09	2.465E-08
0Th-229	Am-241	1.000E+00	6.531E-18	9.794E-17	1.142E-15	3.019E-14	7.321E-13	2.542E-11	6.260E-10	1.779E-08
0Cs-134	Cs-134	1.000E+00	1.199E-02	8.564E-03	4.372E-03	4.157E-04	5.000E-07	3.018E-17	0.000E+00	0.000E+00
0Cs-137	Cs-137	1.000E+00	4.333E+00	4.234E+00	4.043E+00	3.439E+00	2.167E+00	4.299E-01	4.231E-03	4.003E-10
0Eu-152	Eu-152	7.208E-01	3.145E-02	2.985E-02	2.691E-02	1.870E-02	6.608E-03	1.735E-04	5.281E-09	8.215E-25
Eu-152	Eu-152	2.792E-01	1.218E-02	1.156E-02	1.042E-02	7.242E-03	2.560E-03	6.720E-05	2.045E-09	3.182E-25
Eu-152	äDOSE(j)		4.363E-02	4.142E-02	3.733E-02	2.594E-02	9.168E-03	2.407E-04	7.326E-09	1.140E-24
0Gd-152	Eu-152	2.792E-01	1.046E-18	3.067E-18	6.807E-18	1.722E-17	3.255E-17	4.071E-17	4.093E-17	4.092E-17
0H-3	H-3	1.000E+00	1.121E-06	3.183E-07	2.556E-08	3.608E-12	2.585E-23	0.000E+00	0.000E+00	0.000E+00
0Pu-238	Pu-238	1.000E+00	5.298E-02	5.257E-02	5.174E-02	4.896E-02	4.180E-02	2.405E-02	4.953E-03	1.964E-05
0U-234	Pu-238	1.000E+00	7.698E-09	2.301E-08	5.329E-08	1.555E-07	4.184E-07	1.070E-06	1.770E-06	1.943E-06
0Th-230	Pu-238	1.000E+00	4.705E-14	3.286E-13	1.728E-12	1.518E-11	1.216E-10	1.114E-09	6.638E-09	3.108E-08
0Ra-226	Pu-238	1.000E+00	1.305E-16	1.954E-15	2.270E-14	5.934E-13	1.393E-11	4.349E-10	8.283E-09	1.357E-07
0Pb-210	Pu-238	1.000E+00	3.257E-19	1.003E-17	2.489E-16	1.844E-14	1.127E-12	8.401E-11	2.567E-09	5.115E-08
0Pu-239	Pu-239	1.000E+00	4.651E-01	4.651E-01	4.651E-01	4.650E-01	4.647E-01	4.638E-01	4.611E-01	4.519E-01
0U-235	Pu-239	1.000E+00	8.990E-11	2.697E-10	6.293E-10	1.888E-09	5.481E-09	1.804E-08	5.377E-08	1.770E-07
U-235	U-235	1.000E+00	6.296E-03	6.296E-03	6.296E-03	6.295E-03	6.295E-03	6.294E-03	6.290E-03	6.276E-03
U-235	äDOSE(j)		6.296E-03	6.296E-03	6.296E-03	6.295E-03	6.295E-03	6.294E-03	6.290E-03	6.276E-03

0Pa-231	Pu-239	1.000E+00	4.960E-15	3.472E-14	1.835E-13	1.641E-12	1.384E-11	1.500E-10	1.336E-09	1.462E-08
Pa-231	U-235	1.000E+00	5.210E-07	1.563E-06	3.647E-06	1.094E-05	3.177E-05	1.046E-04	3.118E-04	1.028E-03
Pa-231	äDOSE(j)		5.210E-07	1.563E-06	3.647E-06	1.094E-05	3.177E-05	1.046E-04	3.118E-04	1.028E-03
0Ac-227	Pu-239	1.000E+00	7.175E-17	1.069E-15	1.229E-14	3.088E-13	6.536E-12	1.543E-10	1.987E-09	2.512E-08
Ac-227	U-235	1.000E+00	1.003E-08	6.960E-08	3.605E-07	3.003E-06	2.093E-05	1.340E-04	5.109E-04	1.822E-03
Ac-227	äDOSE(j)		1.003E-08	6.960E-08	3.605E-07	3.003E-06	2.093E-05	1.340E-04	5.109E-04	1.822E-03
0Sr-90	Sr-90	1.000E+00	4.160E-02	4.062E-02	3.874E-02	3.279E-02	2.037E-02	3.847E-03	3.290E-05	1.902E-12

BRF(i) is the branch fraction of the parent nuclide.

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Summary : 21-011(k) UCL extended bkyrd 7K area File: 21011K02.RAD

Individual Nuclide Soil Concentration

Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.100E+01	1.098E+01	1.095E+01	1.082E+01	1.048E+01	9.363E+00	6.783E+00	2.195E+00
0Np-237	Am-241	1.000E+00	0.000E+00	3.560E-06	1.066E-05	3.534E-05	1.043E-04	3.290E-04	8.474E-04	1.768E-03
0U-233	Am-241	1.000E+00	0.000E+00	7.786E-12	7.000E-11	7.749E-10	6.899E-09	7.386E-08	6.001E-07	4.851E-06
0Th-229	Am-241	1.000E+00	0.000E+00	2.451E-16	6.613E-15	2.442E-13	6.537E-12	2.351E-10	5.846E-09	1.667E-07
0Cs-134	Cs-134	1.000E+00	7.000E-02	5.002E-02	2.553E-02	2.428E-03	2.920E-06	1.763E-16	1.401E-45	0.000E+00
0Cs-137	Cs-137	1.000E+00	6.010E+01	5.873E+01	5.608E+01	4.770E+01	3.005E+01	5.963E+00	5.869E-02	5.552E-09
0Eu-152	Eu-152	7.208E-01	2.162E-01	2.053E-01	1.850E-01	1.286E-01	4.544E-02	1.193E-03	3.631E-08	5.649E-24
Eu-152	Eu-152	2.792E-01	8.376E-02	7.952E-02	7.166E-02	4.980E-02	1.760E-02	4.621E-04	1.407E-08	2.188E-24
Eu-152	äS(j):		3.000E-01	2.848E-01	2.567E-01	1.784E-01	6.304E-02	1.655E-03	5.038E-08	7.837E-24
0Gd-152	Eu-152	2.792E-01	0.000E+00	5.238E-16	1.493E-15	4.192E-15	8.166E-15	1.028E-14	1.034E-14	1.034E-14
0H-3	H-3	1.000E+00	1.000E-01	2.840E-02	2.282E-03	3.233E-07	2.339E-18	0.000E+00	0.000E+00	0.000E+00
0Pu-238	Pu-238	1.000E+00	1.100E+00	1.091E+00	1.074E+00	1.016E+00	8.679E-01	4.992E-01	1.028E-01	4.078E-04
0U-234	Pu-238	1.000E+00	0.000E+00	3.106E-06	9.245E-06	2.998E-05	8.329E-05	2.155E-04	3.574E-04	3.925E-04
0Th-230	Pu-238	1.000E+00	0.000E+00	1.400E-11	1.253E-10	1.367E-09	1.169E-08	1.096E-07	6.571E-07	3.083E-06
0Ra-226	Pu-238	1.000E+00	0.000E+00	2.023E-15	5.438E-14	1.985E-12	5.146E-11	1.663E-09	3.198E-08	5.256E-07
0Pb-210	Pu-238	1.000E+00	0.000E+00	1.563E-17	1.246E-15	1.457E-13	1.017E-11	7.937E-10	2.455E-08	4.910E-07
0Pu-239	Pu-239	1.000E+00	8.700E+00	8.700E+00	8.699E+00	8.697E+00	8.692E+00	8.675E+00	8.625E+00	8.452E+00
0U-235	Pu-239	1.000E+00	0.000E+00	8.568E-09	2.570E-08	8.567E-08	2.569E-07	8.555E-07	2.558E-06	8.432E-06
U-235	U-235	1.000E+00	3.000E-01	3.000E-01	3.000E-01	3.000E-01	3.000E-01	2.999E-01	2.997E-01	2.990E-01
U-235	äS(j):		3.000E-01	3.000E-01	3.000E-01	3.000E-01	3.000E-01	2.999E-01	2.997E-01	2.991E-01
0Pa-231	Pu-239	1.000E+00	0.000E+00	9.064E-14	8.158E-13	9.063E-12	8.154E-11	9.048E-10	8.112E-09	8.896E-08
Pa-231	U-235	1.000E+00	0.000E+00	6.347E-06	1.904E-05	6.347E-05	1.903E-04	6.339E-04	1.896E-03	6.261E-03
Pa-231	äS(j):		0.000E+00	6.347E-06	1.904E-05	6.347E-05	1.903E-04	6.339E-04	1.896E-03	6.261E-03
0Ac-227	Pu-239	1.000E+00	0.000E+00	9.543E-16	2.536E-14	8.898E-13	2.078E-11	5.076E-10	6.593E-09	8.357E-08
Ac-227	U-235	1.000E+00	0.000E+00	9.997E-08	8.810E-07	9.111E-06	6.774E-05	4.431E-04	1.698E-03	6.065E-03
Ac-227	äS(j):		0.000E+00	9.997E-08	8.810E-07	9.111E-06	6.774E-05	4.431E-04	1.698E-03	6.065E-03
0Sr-90	Sr-90	1.000E+00	1.550E+01	1.514E+01	1.443E+01	1.222E+01	7.588E+00	1.433E+00	1.226E-02	7.087E-10

BRF(i) is the branch fraction of the parent nuclide.

0RESCALC.EXE execution time = 2.94 seconds

F-3.0 Ecological Scoping Checklist

The Ecological Scoping Checklist for SWMU 21-011(k) is provided below.

Part A—Scoping Meeting Documentation

Site ID	**SWMU 21-011(k)**
Form of site releases (solid, liquid, vapor): Describe all relevant known or suspected mechanisms of release (e.g., spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	Site was a former outfall associated with two 12,700-gal. effluent holding tanks (TA-21-112 and TA-21-113) that discharged treated effluent from an industrial liquid waste treatment facility into DP Canyon via 21-011(k) outfall. Releases at the outfall were to the surface. The discharge flowed down the slope and eventually into the DP Canyon drainage.
List of primary impacted media **(Indicate all that apply.)**	**Surface soil – XX** – impacted by discharges at the outfall. **Surface water/sediment – X** –impacted from the discharge into the canyon; sediment in bottom of canyon and surface water including ephemeral stream channel in bottom of canyon. **Subsurface –** **Groundwater –** **Other, explain –**
FIMAD vegetation class based on Arcview vegetation coverage **(Indicate all that apply.)**	**Water – XX** An ephemeral stream channel exists at the bottom of DP Canyon and flows eastward. It is located approximately 100–200 yards from the former outfall. **Bare ground/unvegetated – XX** There were few areas of bare ground between vegetated areas prior to remediation. These areas were either exposed tuff or dirt, often covered with pine needles and other plant litter. Nearly all vegetation was removed during remediation. The goal of post-remediation revegetation was to recreate the pre-existing site vegetation. The area has been hydro-seeded with a native seed mix and ponderosa and gamble oak have been planted. **Spruce/fir/aspen/mixed conifer –** **Ponderosa pine – XX-** Primary vegetation community; also ground cover of grasses and shrubs. **Piñon juniper/juniper savannah –** **Grassland/shrubland – XX** in the bottom of DP Canyon, with small patches of bare ground. **Developed –**
Is T&E habitat present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	The site is on the border of the core habitat for the Mexican spotted owl. This site is within an area in which the owl may be assumed to forage with a moderate to low frequency.
Provide list of neighboring/ contiguous/ upgradient sites. Include a brief summary of COPCs and form of releases for relevant sites and reference map as appropriate. **(Use information to evaluate need to aggregate sites for screening.)**	Neighboring/contiguous/upgradient from SWMU 21-011(k) are: 21-001, 21-011(a), 21-019(g), 21-011(h), 21-011(j), 21-011(i), 21-011(e), 21-011(d), 21-011(g), 21-010(e), 21-011(f), 21-016(a), 21-010(f), 21-010(a), 21-010(c), 21-011(c), 21-028(a), 21-016(b), 21-010(b), 21-016(c), 21-010(h), and 21-010(g). The majority of the contamination contributing to SWMU 21-011(k) would have come from SWMUs 21-011(g) and (f), two 12,700 gal. effluent-holding tanks (TA-21-112 and TA-21-113) that discharged treated effluent from an industrial liquid waste treatment facility into DP Canyon. Additionally, SWMUs 21-016(a-c) (MDA T) where liquid radioactive waste was disposed is upgradient from SWMU 21-011(k).

Surface water erosion potential information: **Summarize information from SOP 2.01, including the runoff subscore (maximum of 46), terminal point of surface water transport, slope, and surface water runon sources.**	The Erosion Matrix score for this SWMU is 52.2, with a score of 26.2 for runoff (visible evidence of runoff discharging [5.0], runoff terminates in a drainage/wetland [19.0], and runoff in a gully [2.2]) and a score of 0.0 for runon (natural drainages onto site). The score also reflects that it is within the canyon floodplain, but not watercourse (13.0), ground cover is 25-75% (6.5), and slope is >10-30%. (6.5). Potential exists for soil erosion at this site. The runoff terminates in DP Canyon.

Part B—Site Visit Documentation

Site ID	**SWMU 21-011(k)**
Date of Site Visit	**10/26/2000**
Site Visit Conducted by	**Rich Mirenda, Linda Causey, Jayne Jones**

Receptor Information:

Estimate cover	**Relative vegetative cover (high, medium, low, none)** = low **Relative wetland cover (high, medium, low, none)** = none **Relative structures/asphalt, etc. cover (high, medium, low, none)** = none
Field notes on the FIMAD vegetation class to assist in ground-truthing the Arcview information	Site visit in October 2000 confirmed that this SWMU was a combination of open areas and ponderosa pine. In some places the tuff is exposed at the surface; in others it is several inches below the surface. Post-remediation ground cover consists of grasses and young trees. As of September 2003, ~170 trees and shrubs (ponderosa and gamble oak) were planted on-site. Native grass has also been applied to the site and germination has begun.
Field notes on T&E habitat, if applicable: Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	Site provides good to excellent habitat for foraging. There is no on-site nesting habitat of T&E species. The Mexican spotted owl may forage in DP Canyon (Koch 1999, 63599).
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. Terrestrial receptors are present in and around the SWMU. Various songbirds were observed in the trees and raptors were observed circling. There was some evidence of burrowing observed in this area. Bear tracks were observed in the dry stream bed. Other large mammals such as deer, elk, coyotes and raccoons would be in the area. Plant life is currently being reestablished following remediation. No aquatic receptors are present in the canyon reach below the SWMU.

Contaminant Transport Information:

Surface water transport: **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Previously, the runoff flowed into a deeply incised (3–4 ft deep) gully and into DP Canyon. Runoff flow to this gully has been diverted to prevent contaminants from being moved via water. The surface water runoff has now been diverted into DP Canyon via a drainage to the east and another to the far west of the site. Rain water that falls directly onto the outfall portion of the SWMU would flow into DP Canyon via sheet flow. The terminal point of surface water transport is the intermittent stream channel at the bottom of DP Canyon. There is evidence of erosion into the canyon.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation.**	Surface water transport is the primary off-site transport pathway. Air transport via particulates or fugitive dust would be a possibility due to surface contamination; however, there are no barren patches of ground that would be subjected to wind, there is ground cover, plant litter, and organic matter covering the dirt, and the area is protected from wind by trees. Groundwater is a viable pathway because the alluvial aquifer is less than 5 ft from the ground surface and is suspected to be the source for DP Spring.

Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	An interim action was conducted at this SWMU in 1996. Contaminated soil was removed and runoff was diverted from the contaminated west drainage. The current VCM removed a large quantity of contaminated material from the site. No other action is required to meet the requirements of DOE 5400.5 under the "trail user" or extended backyard scenarios.

Ecological Effects Information:

Physical disturbance: **Provide list of major types of disturbances, including erosion and construction activities. Review historical aerial photos where appropriate.**	The current VCM involved major physical disturbance, including excavation of approximately 25% of the site and heavy equipment operations over the rest of the site. Following the recent VCM, clean fill was imported and the site regraded and revegetated.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	Yes. Physical disturbance and removal of existing vegetation undoubtedly caused short-term ecological effects.
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No. Current data do not support the implementation of an interim action to address ecological effects.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport. Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate, and extent of contamination? **(yes/no/uncertain)** **Provide explanation.** **(Consider whether the maximum value was captured by existing sample data.)**	**Nature -** Yes. Full suite samples from past sampling adequately define the nature of contamination. Confirmation samples following the VCM adequately define nature of radiological contamination. **Rate -** Yes. Aerial photographs show that gamma shine starts in DP Canyon at SWMU 21-011(k) and continues down-canyon, and sampling downstream of SWMU 21-011(k) in the canyon has been conducted by the Canyons Focus Area. **Extent -** Yes. Sampling has been conducted laterally, vertically, and downstream.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)**	Yes. The sampling conducted during the VCM addresses the major potential transport pathway (i.e., surface water runoff down the drainage and into DP Canyon).

Provide explanation. (Consider whether other sites should be aggregated to characterize potential ecological risk.)	

Part C—Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10-5 atm-me/mol and molecular weight <200 g/mol).**
- **Answer (likely/unlikely/uncertain): unlikely**

Provide explanation: One VOC (methylene chloride) was detected in the samples previously collected. Waste samples collected during the current VCM confirmed the extremely low levels of VOCs and the waste was disposed of under a contained in ruling. In the absence of a source with significant concentration, exposure is unlikely.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): likely

Provide explanation: Much of the on-site soil contamination is on the surface of the soil and is available to become dust where there are bare areas. Vegetation (grasses) cover most of the ground, however, so fugitive dust would be unlikely to occur. There is evidence, however, of burrowing animals; they would have to burrow through the contamination at the surface. Additionally, all remediated areas contain a minimum of 6 in. of clean fill, with topsoil and organic mulch added as part of site regrading and revegetation activities.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each SWMU included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* Note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**

- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The major off-site transport pathway is surface water runoff into DP Canyon. However, there are no aquatic ecosystems in this reach of the canyon that would receive this runoff.

<u>**Question D:**</u>

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Likely

Provide explanation: Alluvial water is close to the surface in the canyon portion of the SWMU. Strontium-90 has been detected in water samples collected from alluvial wells LAUZ-1 [located on the eastern edge of SWMU 21-011(k) next to the stream bed] and LAUZ-2 (located approximately 250 ft downgradient from LAUZ-1). These wells encountered alluvial water at approximately 4.5 ft below the surface. The saturated zone at the time was approximately 3.5 ft thick. This alluvial water is thought to be a source for DP Spring. The spring flows from the south-facing slope of DP Canyon, approximately 3,000 ft downstream to the east from SWMU 21-011(k). The shallow alluvial water on-site can discharge into the ephemeral stream at the canyon bottom. Contaminants are available for root uptake by terrestrial plants with roots in contact with the alluvial water. Terrestrial wildlife receptors can contact this alluvial water when it surfaces into the ephemeral stream at the bottom of DP Canyon. There are no seeps or springs upcanyon from the SWMU.

<u>**Question E:**</u>

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Likely

- **Provide explanation:** Americium-241, cesium-134, cesium-137, plutonium-239/240, strontium-90, tritium, and uranium -235 are still present in SWMU 21-011(k) soil in concentrations higher than FV. Plutonium-239/240, strontium-90, and uranium-234 have been observed in alluvial groundwater from LAUZ-1 and LAUZ-2 to DP Spring. Tritium and uranium-235 were detected in the alluvial groundwater from LAUZ-1 and LAUZ-2 (LANL 1999, 63915).

<u>Question F:</u>

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodability of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: While the slope is relatively unvegetated, the slope is stable . All soil has been stripped from the slope leaving only exposed tuff. Mass wasting of tuff would is a potential release mechanism, but one with low probability of occurrence.

<u>Question G:</u>

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: Volatile organics are not COPCs at the SWMU.

<u>Question H:</u>

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 2

Provide explanation: Although there is residual contamination at the surface, the remediated areas have been backfilled and revegetated. Areas that are not backfilled are either the tuff bedrock of the steep slope. There is only limited evidence of burrowing animals.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Root uptake is a complete pathway. The shallow nature of the contamination makes it available to roots. Ground cover rain splash is a potentially complete pathway; however, due to the clean backfill and mulch used for restoration, contamination of plants via this pathway is unlikely.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: The radionuclides remaining in place are present in relatively low concentrations; however, all of them except tritium are taken up by mammals and sequestered in tissue or bone.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

- **Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):**

Terrestrial Animals: 2

Provide explanation: Incidental ingestion is a minor pathway because portions of the site have not been covered with clean fill and surficial residual contamination is present in these areas.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: The COPCs are all radionuclides and do not have a true dermal component. See Question K. No organic chemicals were detected.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 3

Terrestrial Animals: 3

Provide explanation: Most all of the radionuclide COPCs at this site, with the exception of tritium, have an external irradiation component.

Stream Channel

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**

- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Some of the residual contamination is surficial in nature and the alluvial ground water is close to the surface. Therefore, roots could directly take up contaminants from alluvial groundwater or sediment. Rain splash is, however, a very minor consideration because of the ground cover and plant litter on the ground surface.

<u>Question O:</u>

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Terrestrial animals could ingest the cesium-137 or strontium-90 (which are preferentially taken up by plants), and isotopic uranium (a bioaccumulator).

<u>Question P:</u>

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Although there are no aquatic systems present on the site or in the canyon below the SWMU, there is evidence that the contaminants have moved downslope and, once in the stream bed, downstream from the SWMU. This movement is due to water transporting contaminants either in a soluble form or on particulates. Terrestrial animals could have access to this water for drinking, if only for the period of rainwater or snowmelt flow.

<u>Question Q:</u>

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: All COPCs are radionuclides and do not have a true dermal component for exposure.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Most all of the COPCs, with the exception of tritium, have an external irradiation component.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: There are no aquatic systems present on-site or in the canyon below the SWMU.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**

- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There are no aquatic systems present on-site or in the canyon below the SWMU.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophilic organic contaminants and some metals may concentrate in an organism's tissues.**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There are no aquatic systems present on-site or in the canyon below the SWMU.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants: 0

Aquatic Animals: 0

Provide explanation: There are no aquatic systems present on-site or in the canyon below the SWMU.

REFERENCES

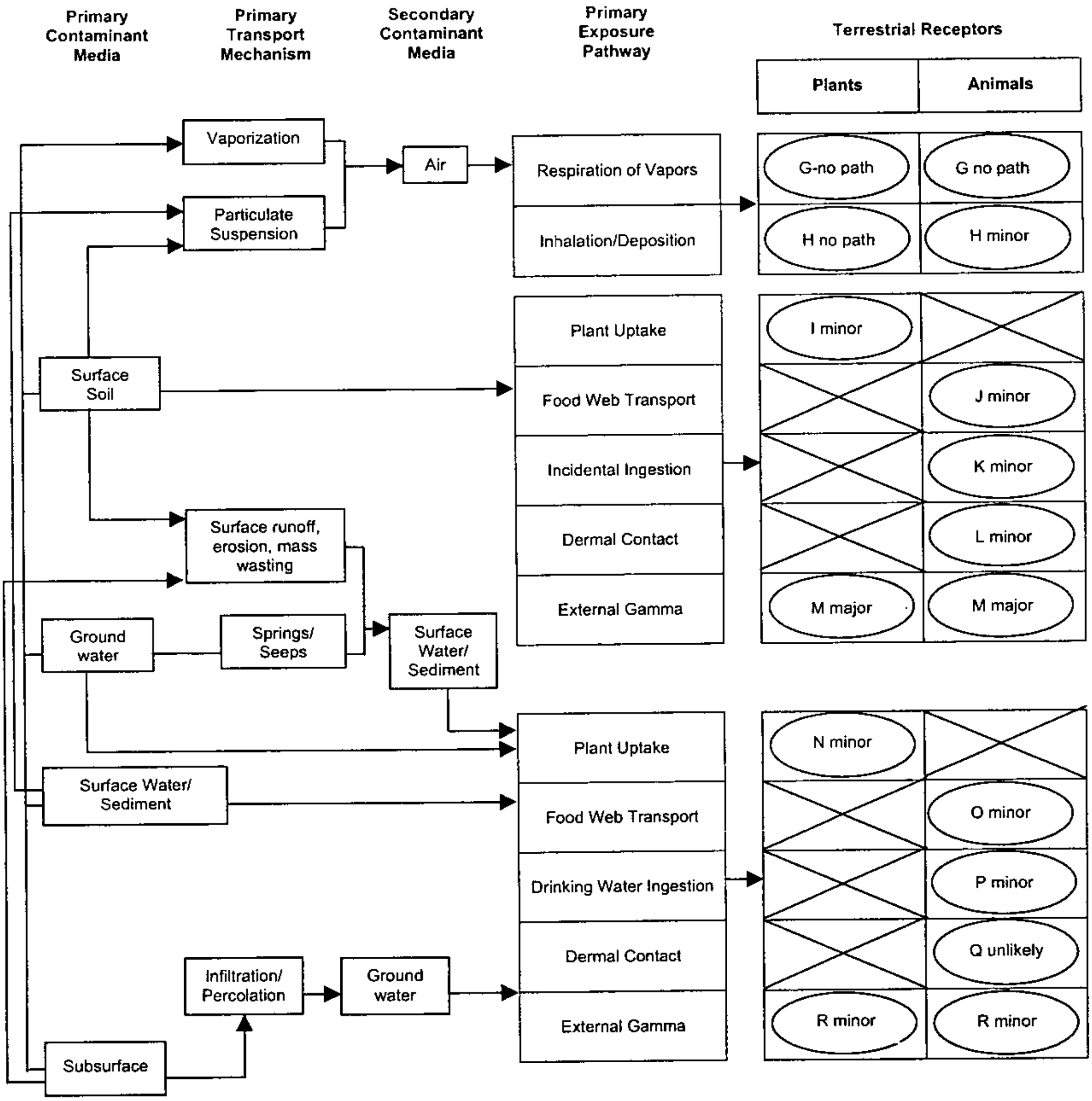
Koch, S., July 15, 1999. "Memorandum to Greg McDermott: Review of Potential Release Sites for Threatened and Endangered Species Habitat for the Purpose of Ecological Screening/Risk Assessment," Los Alamos National Laboratory Memorandum ESH-20/Ecol-98-0732, Los Alamos, New Mexico. (Koch 1999, 63599)

LANL (Los Alamos National Laboratory), August 26, 1999. "Evaluation of Sediment and Alluvial Groundwater in DP Canyon, Reaches DP-1, DP-2, DP-3, and DP-4," Los Alamos National Laboratory document LA-UR-99-4238, Los Alamos, New Mexico. (LANL 1999, 63915)

LANL (Los Alamos National Laboratory), April 2000. "Interim Report on Sediment Contamination in the South Fork of Acid Canyon," Los Alamos National Laboratory document LA-UR-00-1903, Los Alamos, New Mexico. (LANL 2000, 66867)

NOTE:
Letters in circles refer to questions on the Scoping Checklist

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model



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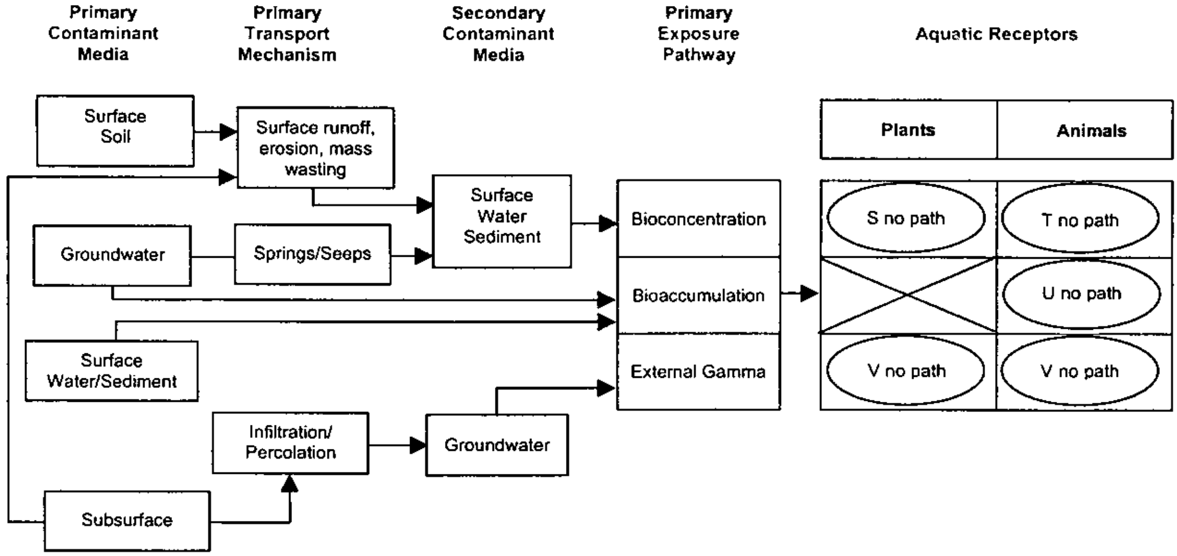
Ecological Pathways Conceptual Exposure Model



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Linda Causey
Name (signature): Linda Causey
Organization: PMC Environmental
Phone number: 662-1365
Date Completed: 4/17/02

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Richard Mirenda
Name (signature): Richard Mirenda
Organization: RRES
Phone number: 665-6953
Date Completed: 4/17/02

Appendix G

Comparison of Anticipated and Actual Costs

APPENDIX G COMPARISON OF ANTICIPATED AND ACTUAL COSTS

The baseline costs for the voluntary corrective measure (VCM) activities at Solid Waste Management Unit (SWMU) 21-011(k) were initially estimated at $468,679 for FY02, $2,060,836 for FY 03, and $149,891 for FY 04 (total cost to complete of $2,679,406). Due to the change in the remedial approach (from excavation, stabilization, and onsite disposal to excavation and off-site disposal), required revisions to the VCM plan, a significant increase in the volume of radiologically contaminated material removed (original estimate of 560 cubic yards versus actual removal of 1845 cubic yards), and the associated increase in project duration and confirmatory sampling the actual cost for the VCM through FY03 is approximately $3.2 million.

Appendix H

VCM Plan

RRES Remediation Program

LA-UR-03-3026
May 2003
ER2003-0326

Voluntary Corrective Measures Plan for Solid Waste Management Unit 21-011(k) at Technical Area 21

Revision 3

Los Alamos NATIONAL LABORATORY
Los Alamos NM 87545

Prepared by Risk Reduction and Environmental Stewardship—Remediation

EXECUTIVE SUMMARY

This Voluntary Corrective Measure (VCM) plan presents the approach for remediation of Solid Waste Management Unit (SWMU) 21-011(k) located within Technical Area (TA) 21 at Los Alamos National Laboratory (LANL or the Laboratory).

SWMU 21-011(k) consists of an inactive National Pollutant Discharge Elimination System (NPDES)-permitted outfall (NPDES outfall no. EPA 050050) for treated industrial wastewater from the former wastewater treatment plants (WWTPs) (Buildings 21-35 and -157) at TA-21. Components of the SWMU include a 4-in. cast iron drainline and outfall area on the north-facing slope of DP Canyon. The initial drainline from holding tanks 21-112 and -113 consisted of a 4-in. vitrified-clay pipe (VCP) that reportedly discharged to an "outfall ditch" excavated into soil and tuff (LANL 1991, 07528). The VCP was replaced in 1976 with a 4-in. cast iron drainline that was installed within the VCP drainline excavation and outfall ditch. The discharge end of the 4-in. cast iron drainline is located approximately 80 ft north of the TA-21 perimeter road where the outfall ditch previously ended. A gently sloping, rocky surface extends from the end of the outfall drainline approximately 30 ft to the south rim of DP Canyon. The effluent discharged at SWMU 21-011(k) was comprised of process wastewater generated from the purification of plutonium and contained a variety of radioactive and chemical constituents. SWMU 21-011(k) received industrial effluent from the WWTP in Building 21-35 from 1952 until 1967 and from the WWTP in Building 21-257 (that replaced the treatment plant at Building 21-35) from 1967 to July 1986 (LANL 2002, 73115). The inactive outfall was not included in the subsequent LANL NPDES permit renewal, which took effect in 1994. The drainline was not plugged until January 2001 (LANL 2001, 72667).

SWMU 21-011(k) was investigated in 1988 by the Department of Energy (DOE) and by the Laboratory's Environmental Restoration (ER) Project in 1992 and 1993 after use of the outfall had been discontinued. Previous investigation results indicated the presence of radionuclide contamination. An interim action (IA) was performed in 1996 to 1) divert storm water away from the outfall area, and 2) remove a portion of the radionuclide source term from the hillside by excavating and removing the most highly contaminated soil with activity exceeding the gross gamma level of approximately 100,000 counts per minute (cpm). Approximately 390 yd^3 of radioactively contaminated soil was removed from the site and disposed of at the Laboratory's low-level radioactive waste landfill, Area G at TA-54. Post-excavation radiation survey and soil sampling showed a reduction in gross gamma count levels from greater than 500,000 cpm to 100,000 cpm. The IA Report recommended the development of a VCM to effect a final remedy at the site (LANL 1997, 55648.2).

In November 2000, an extensive in situ gamma spectrometry survey was conducted over the entire site. In March 2001, 48 surface and subsurface soil, tuff, and/or sediment samples were collected from eleven of the in situ gamma survey locations. Twenty-six of the samples were analyzed specifically for waste characterization purposes. The other 22 samples were used to characterize contaminant distribution with depth. The data from the in situ gamma survey and characterization samples was used to confirm the location of remaining areas within the boundary of SWMU 21-011(k) with concentrations above the VCM target cleanup level of 150 picocuries per gram (pCi/g) of cesium-137 (Cs-137), and establish a correlation between Cs-137 concentrations, the primary radionuclide at the site, and the concentrations of other radionuclides present at the site. Review of the data from the November 2000 and March 2001 sampling events indicate the following:

- Based on the average concentration of radionuclides present, the site meets dose criterion protective of an individual using the area for recreational trail use. However, there are areas where the target cleanup levels described in this plan of 150 pCi/g Cs-137 and 170 pCi/g americium-241 (Am-241) in the western drainage are exceeded.

- The chemicals of potential concern (COPCs) are radionuclides including primarily Cs-137 (half-life 30 yrs.) and americium-241 (Am-241) (half-life 432 yrs).
- Contaminated material at the site would not be considered hazardous waste upon generation.
- Several inorganic chemicals were detected just above background values and will be included in human health and ecological screening assessments to be performed as part of the VCM Completion Report.
- Completion of the VCM will result in a dose lower than the dose below that required to satisfy DOE's as low as reasonable achievable (ALARA) requirement for corrective measures.

The objectives of this VCM are to

- remove the radionuclide contamination remaining at the site above target cleanup levels;
- reduce the potential dose associated with the remaining contaminated material; and
- prevent future contaminant migration from the source.

To meet these objectives, the Laboratory's Risk Reduction and Environmental Stewardship (RRES) Project will conduct the following activities:

- excavate and dispose of the outfall drainline;
- excavate and dispose of contaminated soil, tuff and sediment from areas at the site with Cs-137 concentrations above 150 pCi/g in addition to sediment in the western drainage that is contaminated with Am-241 above 170 pCi/g;
- restore the site by installing an engineered cover over areas where soil, tuff, and sediment with Cs-137 concentrations above 150 pCi/g was removed, restore the area in the western drainage where sediment with Am-241 concentrations above 170 /Ci/g was removed, and place a vegetative cover over the entire site; and
- install stormwater run-on and runoff controls.

As the details of this VCM plan are presented in the body of this document, the following should be taken into account:

- The site is located on the hillside above DP Canyon where the average slope is 21%, which is toc steep for a building site.
- The planned land use for this site is industrial, with the site remaining under DOE control for at least the next 100 years; however, access by TA-21 workers for recreational use makes the trail-user land use scenario more practical.
- The principle radionuclides contributing to trail-user exposure are Cs-137 (~78% of the dose, half life 30 yr) and Am-241 (~13% of the dose, half-life 432 yr). Over the next 100 years, radioactive decay alone will cause dose rates to decline to 26% of current levels under the recreational trail-user scenario assuming pre-remediation average site concentrations.

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APPENDICES

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1.0 INTRODUCTION

This VCM plan presents the approach for remediating SWMU 21-011(k) located at TA-21, at Los Alamos National Laboratory (Figures 1.0-1 and 1.0-2). SWMU 21-011(k) is an inactive drainline and outfall listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, 01585.2, EPA 1994, 44146).

1.1 Purpose and Scope

The objectives of this VCM are source reduction, dose reduction, and prevention of contaminant migration. To meet these objectives, the Laboratory's Risk Reduction and Environmental Stewardship (RRES) Project will conduct the following activities:

- supplemental sampling;
- excavate and dispose of approximately 500 yd^3 of contaminated soil, tuff, and sediment, and approximately 60 yd^3 of contaminated sediment in the western drainage;
- confirmation sampling;
- engineered site restoration;
- post-VCM radiation survey and/or sampling;
- removal of the inactive and plugged drainline extending from the wastewater treatment tanks to the outfall area and confirmation sampling beneath the line; and
- installation of stormwater run-on and runoff controls.

The DOE requires that corrective measures implemented at sites with radionuclide contamination strive to reduce radiation levels to "As Low As Reasonably Achievable" (ALARA). This VCM plan incorporates the principle of ALARA (DOE 1990, 58980.1). ALARA features include isolating radioactive materials from the environment and removal of areas with elevated radioactivity (above 150 pCi/g of Cs-137 and 170 pCi/g Am-241). The COPCs at SWMU 21-011(k) are cesium-137 (Cs-137), strontium-90 (Sr-90), americium-241 (Am-241), and plutonium-239 (Pu-239). While the site, on average, meets the 15 mrem/yr dose limit for a recreational trail-user scenario (Appendix F), this dose limit is exceeded within some areas of the site. Soil from these areas will be removed and disposed of at Area G at Technical Area 54 (TA-54) (see Figure 3.0-2). Implementation of the VCM will reduce exposure to a trail-user below the 15 mrem/yr dose limit over the entire site consistent with ALARA. Long-term stewardship of the site will be discussed in the VCM completion report for SWMU 21-011(k).

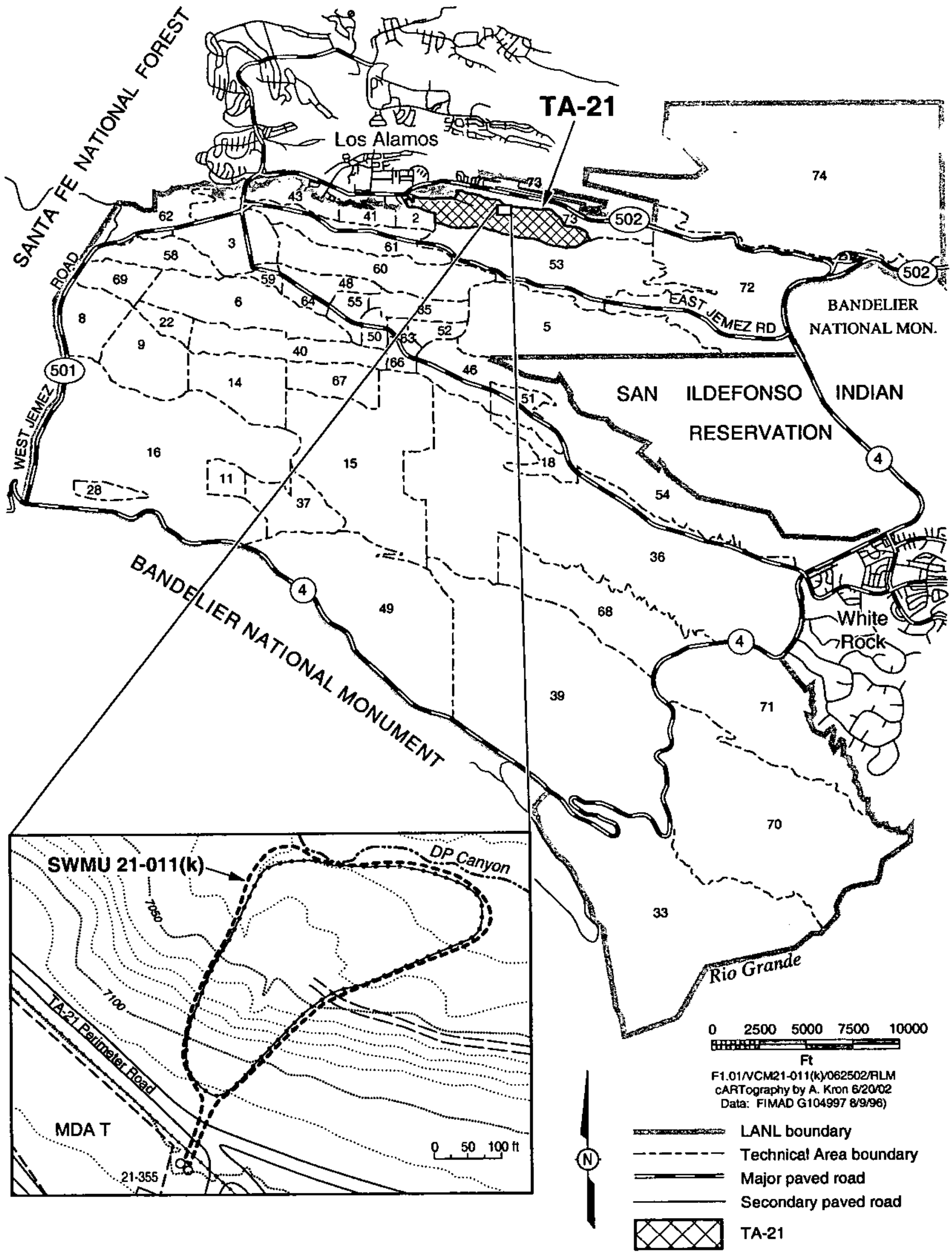


Figure 1.0-1. Location of TA-21 with respect to Laboratory TAs and surrounding land holdings

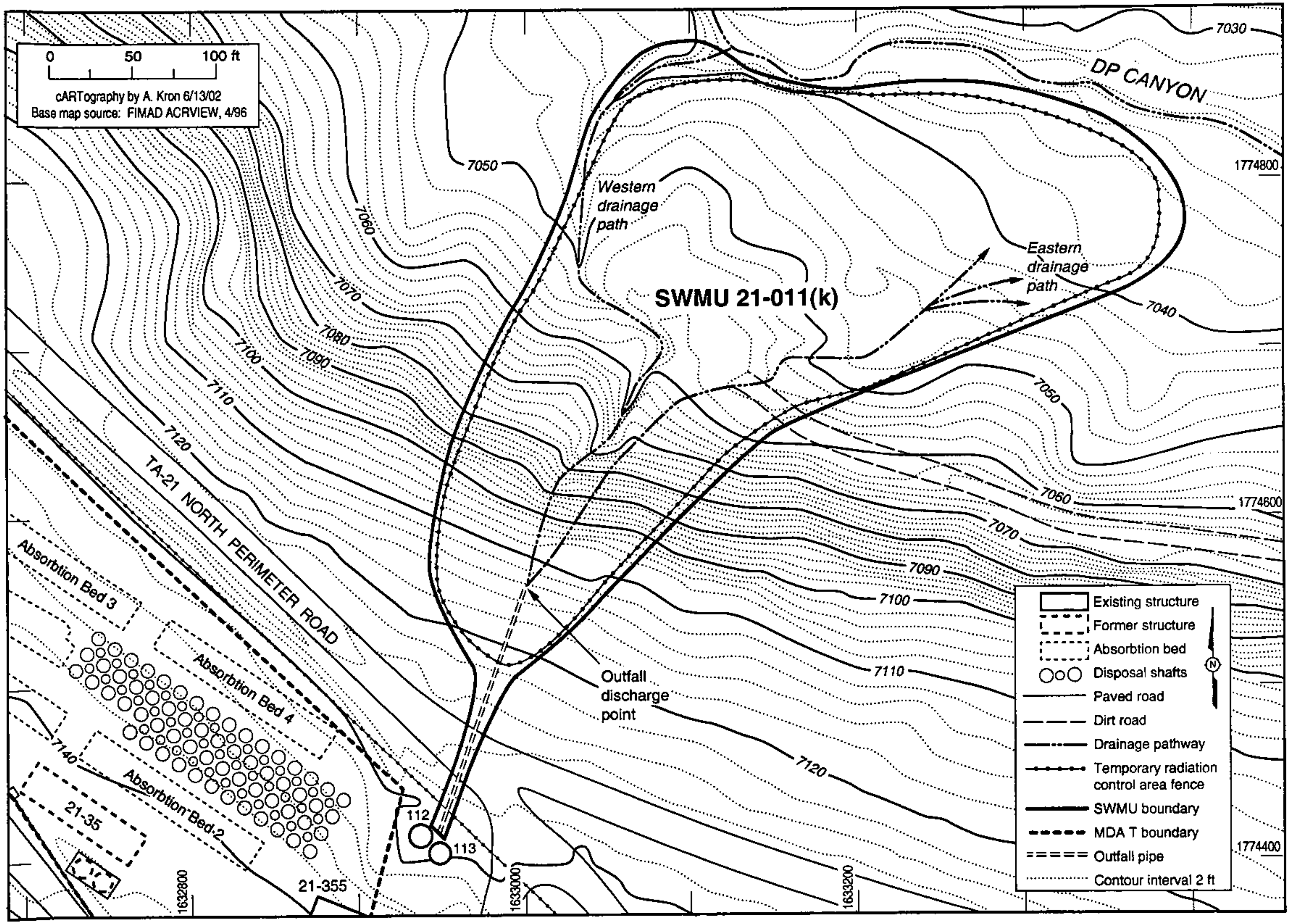


Figure 1.0-2. Location of SWMU 21-011(k) within Laboratory TA-21

1.2 Regulatory History

The regulatory activities conducted at SWMU 21-011(k) are summarized in Table 1.2-1.

Table 1.2-1
Regulatory Activity for SWMU 21-011(k)

Date	Activity	Document
1988	Sampling	1994 TA-21 OU RFI Phase Report 1C (LANL 1994, 31591)
1991	LANL TA-21 RFI Work Plan	1991 TA-21 Operable Unit RFI Work Plan for Environmental Restoration (LANL 1991, 07528.1)
1992-93	RFI Site Characterization	1994 Addendum to TA-21 Phase Reports 1B and 1C (LANL 1994, 52350.1)
1996/1997	Interim Action	1996 Interim Action Plan for PRS 21-011(k) (LANL 1996, 54790.2); 1997 Interim Action Report for PRS 21-011(k) (LAN 1997, 55648.2)
2001	VCM Implementation Approach for SWMU 21-011(k)	Communication Record (LANL 2002, 70217)
2002	Submittal of VCM Plan for SWMU 21-011(k) at TA-21	"Voluntary Corrective Measures Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21," LA-UR-02-2218, (LANL 2002, 73085.2)
2002	NMED Issues Comments on SWMU 21-011(k) VCM Plan	Notice of Technical Incompleteness, VCM Plan for SWMU 21-011(k), (NMED 2002, 73201)
2002	Submittal of Revision 1 of the VCM Plan for SWMU 21-011(k) at TA-21	"Voluntary Corrective Measures Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21, Revision 1" LA-UR-02-3807, (LANL 2002, 73654.2)
2002	Withdrawal of Revision 1 of the VCM Plan for SWMU 21-011(k) at TA-21	Withdrawal Letter (LANL 2002, 73605)
2002	Submittal of Revision 2 of the VCM Plan for SWMU 21-011(k) at TA-21	"Voluntary Corrective Measures Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21, Revision 2" LA-UR-02-6797, (LANL 2002, 73722)
2002	Submittal of Request for "No Longer Contained In" determination for soil, tuff, and sediment at SWMU 21-011(k), at TA-21	Letter Requesting No Longer Contained in Determination, (LANL 2002, 73721)
2002	NMED Issues No Longer Contained-In Determination for material to be excavated from SWMU 21-011(k), TA-21	Approval letter from NMED, (NMED 2002, 73720)
2002	Submittal of VCM Confirmation Sampling Notification	Sampling Notification Letter, ER2002-0797, (LANL 2002, 73723)
2002	Submittal of offsite analytical laboratory data to validate the proposed screening method to be used during the VCM at SWMU 21-011(k)	Communication Record, ER2002-0800, (LANL 2002, 73725)
2002	NMED issues Notice of Deficiency on SWMU 21-011(k) VCM Plan	Notice of Deficiency, VCM Plan for SWMU 21-011(k), (NMED 2002, 73724)
2003	Submittal of Response to NOD on SWMU 21-011(k) VCM Plan	Response to NOD on VCM Plan for SWMU 21-011(k) at TA-2 Rev. 2 (LANL 2003, 75936)
2003	NMED issues Comments and Conditions for NOD Response.	Comments and conditions for NOD response, SWMU 21-011(k) VCM Plan (NMED 2003, 75935)

1.3 Rationale for Proposed Corrective Measure

SWMU 21-011(k) is located on the north side of DP Mesa on a hillside that leads to DP Canyon. The northern SWMU boundary is within the high-water table of the DP Canyon streambed. SWMU 21-011(k) has been identified as the primary source of radionuclide contamination in sediments in the Los Alamos (LA) Canyon watershed (LANL 1999, 63915). Approximately one-third of a curie of Cs-137 has been identified in the LA Canyon watershed inventory and exists within DP Canyon and LA Canyon exclusive of SWMU 21-011(k). The existing radionuclide inventory in surface soil, tuff, and sediment at SWMU 21-011(k) is estimated at one-fourth of a curie of Cs-137 (LANL 2002, 73392). Because of the site's high potential for erosion (erosion matrix score of 72 out of 100, Appendix C), there is the potential for radionuclides from the site to increase the radionuclide inventory in the LA Canyon watershed. Therefore, remediation of the site is considered a priority by the Laboratory, DOE, and the New Mexico Environment Department (NMED).

SWMU 21-011(k) is located on DOE property and will remain under DOE control for at least the next 100 years. Land use for TA-21 is, and will continue to be, industrial under DOE ownership and control. However, SWMU 21-011(k) is not a typical industrial site as it is located on a steep hillside that slopes to the bottom of DP Canyon. Although there are no plans by Los Alamos County to develop any hiking trails in the canyon, the area is accessible to LANL employees and potentially to the public. Consequently, the trail-user land use scenario is proposed for this VCM (LANL 2001, 70217) and used to screen soil and sediment areas with potentially elevated radionuclide concentration exceeding the acceptable human health dose level (15 mrem/yr).

The intent of the proposed VCM is to remove localized areas of elevated contamination (greater than 150 pCi/g of Cs-137 and greater than 170 pCi/g of Am-241 in the western drainage) and dispose of the contaminated material at Area G at TA-54 (Section 4.5). The present day (other than the western drainage) calculated dose rate of 7 mrem/yr is primarily (78%) due to Cs-137, which has a half-life of about 30 years. The dose rate is projected to decline to less than 2 mrem/yr within 100 years due solely to decay of Cs-137 (Figure 1.3-1).

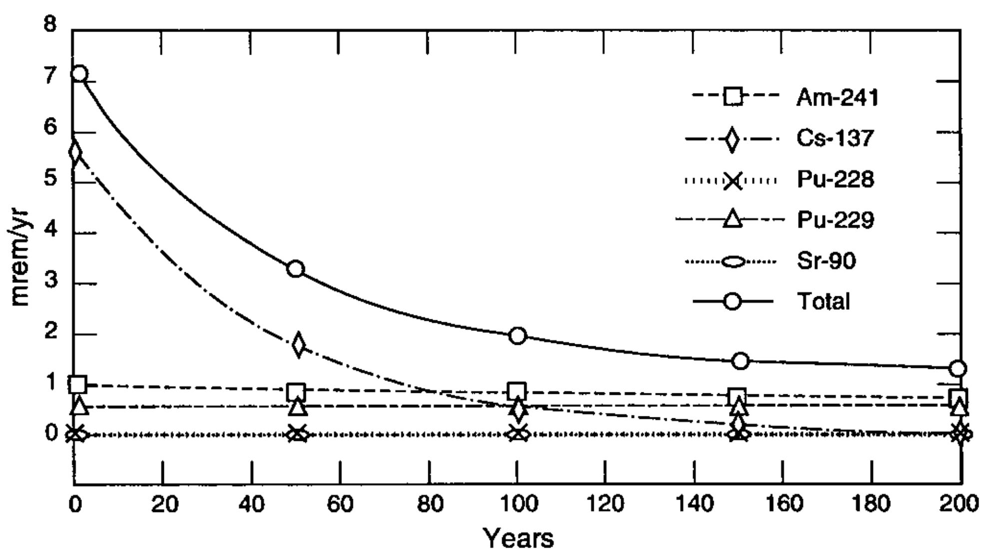


Figure 1.3-1 Present-day dose vs. time for trail-user scenario at SWMU 21-011(k)

Site restoration will include placement of clean backfill in disturbed areas, followed by the recontouring and revegetation of the site. This remediation approach is a cost-effective and proactive remedial alternative, and is preferred over no action, fencing of the site, and/or stabilization and placement in an on-site containment cell.

2.0 PREVIOUS SITE CHARACTERIZATION AT SWMU 21-011(K)

2.1 Site Description and Operational History

SWMU 21-011(k) was the NPDES-permitted outfall (NPDES outfall no. EPA 050050) for treated industrial wastewater from the former waste water treatment plants (WWTPs) (Buildings 21-35 and -157) at TA-21. The SWMU consists of a drainline from two treated wastewater holding tanks (structures 21-112 and -113) and an outfall area on the north-facing slope of DP Canyon. The initial drainline from tanks 21-112 and -113 consisted of a 4-in. VCP that reportedly discharged to an "outfall ditch" excavated into soil and tuff (LANL 1991, 07528.1). The VCP was replaced in 1976 with a 4-in. cast iron drainline that was installed within the VCP drainline excavation and outfall ditch. The discharge end of the 4-in. cast iron drainline is located approximately 80 ft north of the TA-21 perimeter road where the outfall ditch previously ended. A gently sloping, rocky surface extends from the end of the outfall drainline approximately 30 ft to the south rim of DP Canyon.

TA-21 is the former plutonium processing facility at the Laboratory. The first WWTP (Building 21-35) was activated in 1952 and operated until 1967 when the new industrial WWTP (Building 21-257) came on line. Both facilities treated wastes from DP West and DP East consisting of liquids remaining after plutonium extraction and processing of radioactive materials for nuclear weapons and aeronautical research projects. The treatment process mixed the raw waste with lime, ferric sulfate, and coagulant aids. The waste was then pumped to a flocculator and on to a settling tank. Settled effluent was pumped through a pressure filter and sampled to verify adequate treatment. When the effluent was determined to be adequately treated, it was pumped to two final holding tanks (structures 21-112 and -113). From the tanks, the effluent was piped northeast toward DP Canyon and discharged on the north side of DP Mesa to what is now SWMU 21-011(k). This effluent contained a variety of radioactive and chemical constituents. Discharges of treated industrial wastewater to the outfall were discontinued in July 1986 (LANL 2002, 73115). Building 21-257 has been used since 1986 for the treatment of tritiated wastewater from the Tritium Systems Test Assembly (TSTA) facility (Building 21-155). The wastewater is stored in holding tanks 21-112 and -113 and is routinely transported by tanker truck to the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50.

Approximately 55 gal. of partially treated tritiated wastewater was released from holding tank 21-113 through the SWMU 21-011(k) drainline in January 2001 when a faulty gauge caused the tank to over fill. The wastewater in the tank originated from the TSTA facility (LANL 2002, 73116). The released wastewater was absorbed into the ground within 50 ft of the end of the 4-in. cast iron drainline within the outfall area of SWMU 21-011(k). The Release/Discharge Notification (Attachment 1) submitted to NMED and EPA Region 6, indicates that the wastewater did not reach a watercourse. The area impacted was approximately 2 ft x 50 ft and was covered with snow. After the discharge was stopped, a sample of wastewater from the tank was immediately collected and screened for tritium and for gross alpha and beta concentration. The results were reported as tritium = 630 nCi/L, gross alpha = 0.14 nCi/L, gross beta = 2.2 nCi/L (LANL 2001, 72667). Tritium is exclusively a beta emitting radionuclide (with a half-life of approximately 12 yr), which accounts for the elevated gross beta concentration result. These results are from the liquid wastewater that remained in the tank and are not indicative of the residual concentrations in the soil. Residual tritium concentrations in the area of the spill were initially diluted with the snow pack and then reduced through sublimation from the snow surface. Tritium concentrations were further reduced by evapotranspiration during the spring and summer. Subsequent drought conditions have resulted in the evaporation of most of the available near-surface moisture along with the residual tritium. Therefore, this release will have no impact on the proposed corrective measure for this SWMU. The outfall line from holding tanks 21-112 and -113 was permanently plugged as part of the release response in January 2001 (LANL 2001, 72667).

2.2 Previous Field Investigations

SWMU 21-011(k) was sampled during a 1988 DOE Headquarters Environmental Survey of the Laboratory (DOE 1988, 15363). In 1992, SWMU 21-011(k) was characterized in accordance with the TA-21 Operable Unit (OU) RFI Work Plan, which involved a radiological field survey and collection of soil samples (LANL 1991, 07528.1). Additional site characterization consisting of a second radiological survey and collection of additional soil samples was conducted in 1993 to confirm the elevated radioactivity levels measured in 1992 and because holding times were missed for samples submitted for analysis of volatile organic compounds (VOCs) from the 1992 sampling effort (Figure 2.2-1) (LANL 1994, 52350.1). All of the above efforts post-date inactivation of the outfall in July 1986 (LANL 2002, 73115). Data from the previous field investigations is summarized in Appendix G.

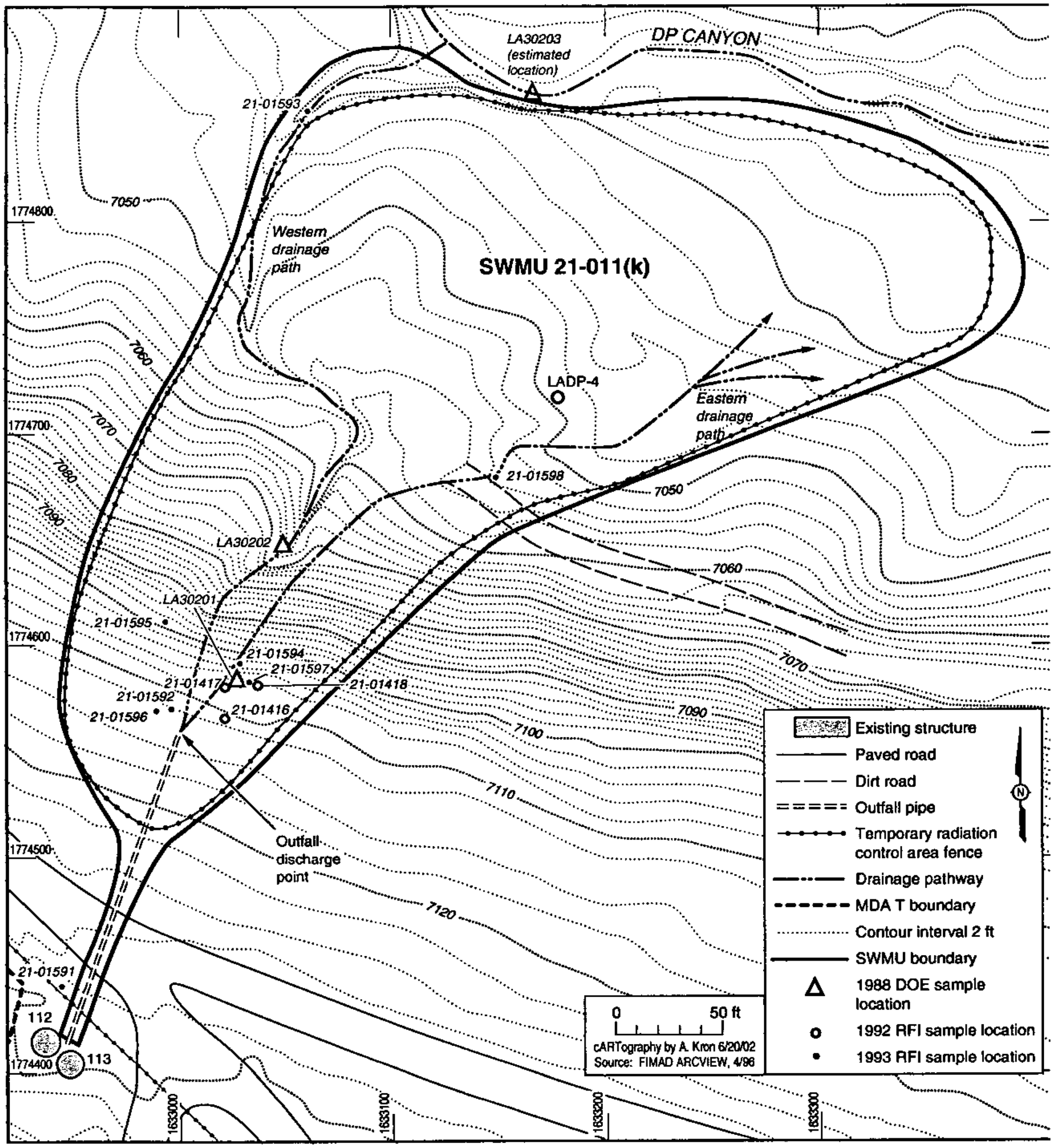


Figure 2.2-1. 1988, 1992, and 1993 sampling locations at SWMU 21-011(k)

2.2.1 1996 Interim Action Soil Removal

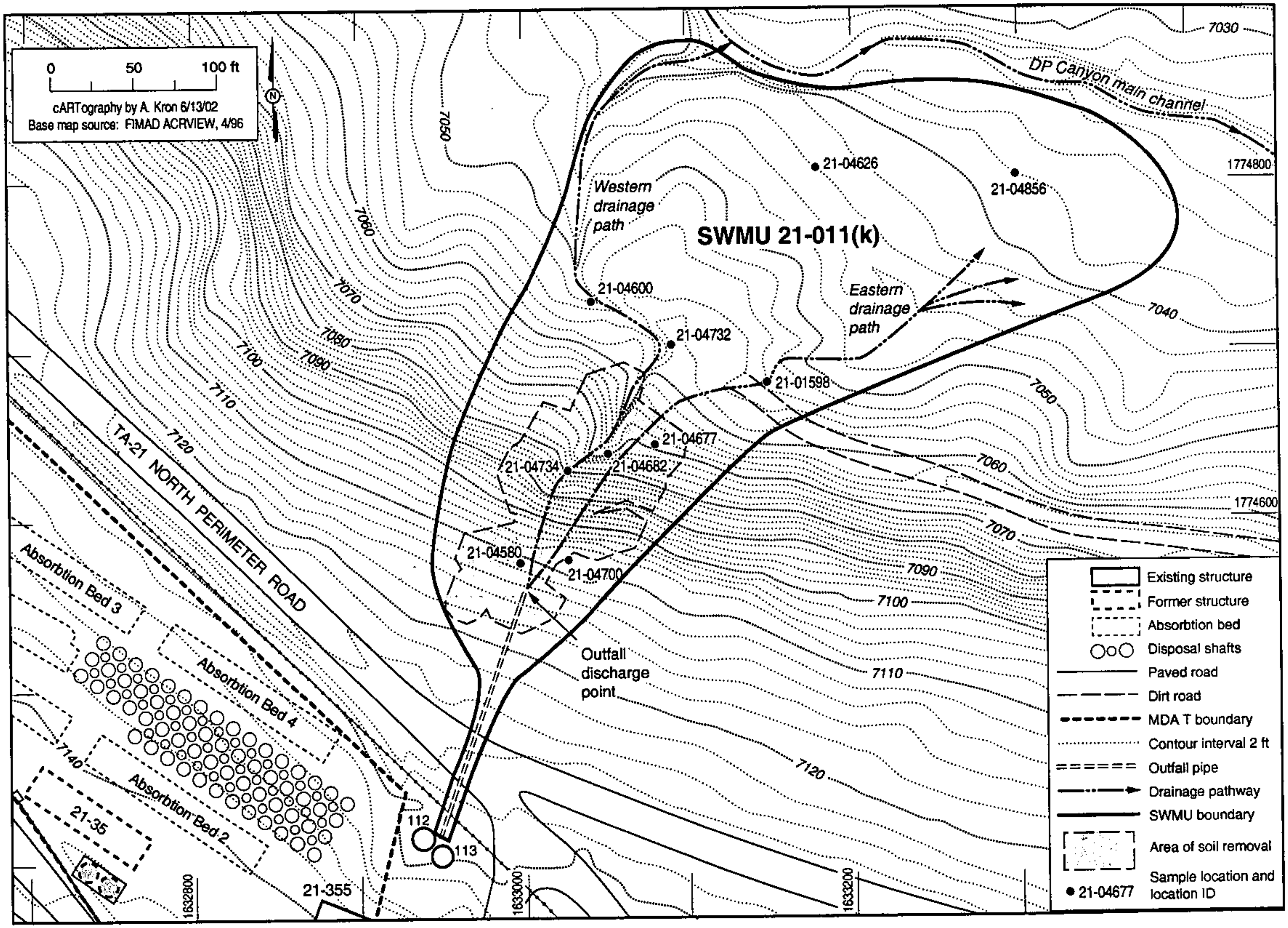
In 1996, an IA plan was prepared (LANL 1996, 54790.2). The IA was conducted in 1996 and reported in the Interim Action Report for Potential Release Site 21-011(k) (LANL 1997, 55648.2).

The IA had two objectives:

- remove a significant portion of the source term from the areas of the outfall exhibiting the greatest levels of radioactivity.
- install storm water control measures as a best management practice (BMP) to mitigate the migration of contaminated soil and sediment into the main channel of DP Canyon by preventing stormwater run-on and runoff.

During the 1996 IA, approximately 390 yd^3 of soil over an area of approximately 11,600 ft^2 were removed from the upper drainage/outfall area of SWMU 21-011(k) (Figure 2.2-2). Results of a post-excavation radiological survey indicated that the gross gamma concentration in soil, sediment, and tuff was reduced from greater than 500,000 cpm to less than 100,000 cpm over the entire upper drainage area.

Upon completion of the soil removal in November 1996, ten surface confirmation samples (from 0 to 6 in.) were collected from throughout the SWMU, five from within the excavation area (Figure 2.2-2). The samples were analyzed for isotopic Pu, Sr-90, Cs-137 and Am-241. Analytical results for the ten surface confirmation samples are presented in Table 2.2-1 (LANL 1997, 55648.2). Analytical results in the table are compared to background or fallout values as presented in "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments and Bandelier Tuff at Los Alamos National Laboratory," (Ryti et al. 1998, 59730.2). Results are also compared to risk-based screening action levels (SAL) that are protective of human health. The SALs used in these comparisons are based on a residential land use scenario presented in "Derivation and Use of Radionuclide Screening Action Levels," (LANL 2001, 69683.1). Americium -241, Cs-137, Pu-239, and Sr-90 exceeded their respective soil fallout values and SALs, as shown in Table 2.2-1.


0 50 100 ft
cARTography by A. Kron 6/13/02
Base map source: FIMAD ACRVIEW, 4/96
SWMU 21-011(k)
DP Canyon main channel
Western drainage path
Eastern drainage path
Outfall discharge point
TA-21 NORTH PERIMETER ROAD
Absorbtion Bed 3
Absorbtion Bed 4
Absorbtion Bed 2
21-35
21-355
112
113
21-04626
21-04856
21-04600
21-04732
21-01598
21-04677
21-04734
21-04682
21-04580
21-04700
7030
7040
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7090
7100
7110
7120
7140
1774800
1774600
1632800
1633000
1633200
Existing structure
Former structure
Absorbtion bed
Disposal shafts
Paved road
Dirt road
MDA T boundary
Contour interval 2 ft
Outfall pipe
Drainage pathway
SWMU boundary
Area of soil removal
Sample location and location ID
21-04677

Table 2.2-1
1996 Interim Action Confirmation Sample Results

Sample ID	Location ID	Depth (ft)	Media	Am-241 (pCi/g)	Cs-137 (pCi/g)	Pu-238 (pCi/g)	Pu-239 (pCi/g)	Sr-90 (pCi/g)
Soil Fallout Value[a]				0.013	1.65	0.023	0.054	1.31
SAL[b]				39	5.3	49	44	5.7
0121-96-0801	21-04734	0-0.5	Soil	10.6	**351**	0.78	20.29	**74**
0121-96-0802	21-04682	0-0.5	Soil	32.3	**621**	5.30	**45.96**	**240**
0121-96-0803	21-04600	0-0.5	Soil	**125**	**72.1**	7.10	25.14	**30.7**
0121-96-0804	21-04677	0-0.5	Soil	10.5	**85.3**	1.22	8.73	**33.8**
0121-96-0805	21-01598	0-0.5	Soil	0.28	**7.05**	0.10	0.79	1.4
0121-96-0806	21-04732	0-0.5	Soil	2.06	**19.7**	0.24	1.83	**7.1**
0121-96-0807	21-04700	0-0.5	Soil	**601**	**66.5**	27.89	**75.15**	**63**
0121-96-0808	21-04580	0-0.5	Soil	20.2	**877**	1.01	**50.95**	**219**
0121-96-0809	21-04856	0-0.5	Soil	2.9	**327**	0.96	6.23	**24.9**
0121-96-0810	21-04626	0-0.5	Soil	14.3	**222**	4.87	23.76	**60**

Note: Results in bold face indicate concentrations above SALs.
[a]Fallout values for soil (Ryti and Longmire 1998, 59730.2)
[b]SALs (LANL 2001, 69683.1)

2.2.2 2000 Chemrad and In Situ Gross Gamma Surveys and 2001 Pre-VCM Characterization Sampling

A walkover gross gamma survey of SWMU 21-011(k) was performed by Chemrad in July 2000. Review of the data (Figure 2.2-3) indicated that the nature and extent of radionuclide contamination at the site had been defined and areas with gross gamma concentration above 105,000 cpm had been clearly identified. An in situ gamma survey and screening of grab samples (Figure 2.2-4) was conducted at the site in November 2000 to gather more detailed information about the nature and extent (including depth profiles) of the radionuclide contamination at the site.

During the November 2000 in situ gamma surface radiation survey, 650 locations were measured for gross gamma radiation. Approximately 77% of these values were below 50,000 cpm. Approximately 91% of the measurements taken were below 100,000 cpm and 100% of the measurements were below 400,000 cpm (Figure 2.2-4). In March 2001, 11 of the November 2000 in situ gamma survey locations were selected with concurrence from NMED (LANL 2001, 70217) to conduct depth profiling of the primary radionuclides at the site and to complete waste and site characterization activities prior to the proposed VCM (Figure 2.2-4 and Table H-1 in Appendix H). Two locations with in situ gamma survey results in the low range (less than or equal to 50,000 cpm), four locations exhibiting mid-range survey results (greater than 50,000 cpm but less than 100,000 cpm), and five locations exhibiting high-range survey results (greater than 100,000 cpm) were chosen for sample collection. The following guidance established by the Laboratory ER Project with input from NMED was followed for the pre-VCM sample collection: a minimum of one discrete grab sample was collected from each auger hole location; if no elevated radioactivity was detected at the time of sample collection; the discrete sample was then collected from the bottom of the auger hole (5 ft or refusal); two discrete samples were collected from any auger hole advanced to a depth of 5 ft or deeper with sample collection intervals based on field screening results and/or the bottom of the hole (see Appendix H).

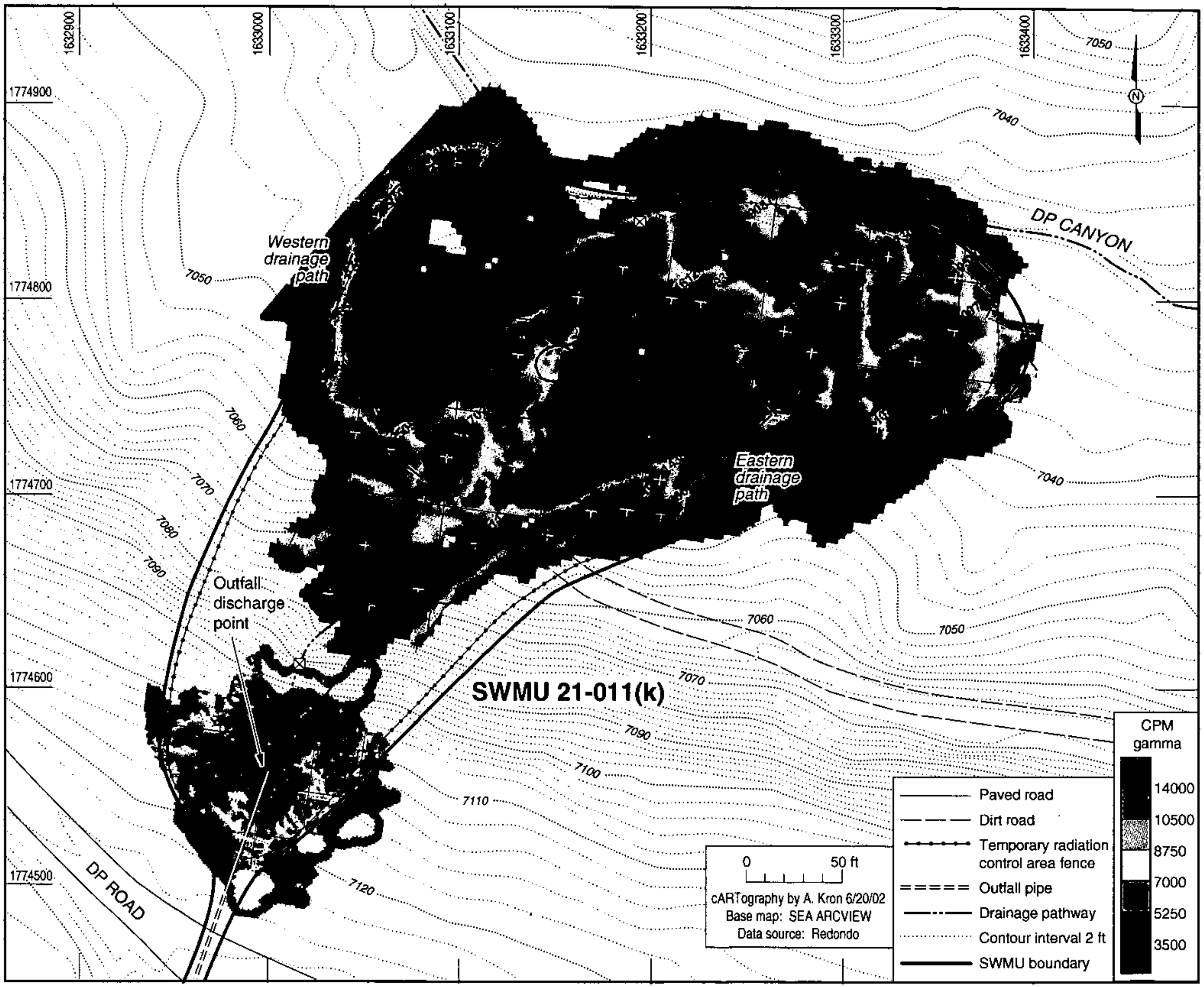

Figure 2.2-3 July 2000 Chemrad gross gamma survey results at SWMU 21-011(k)

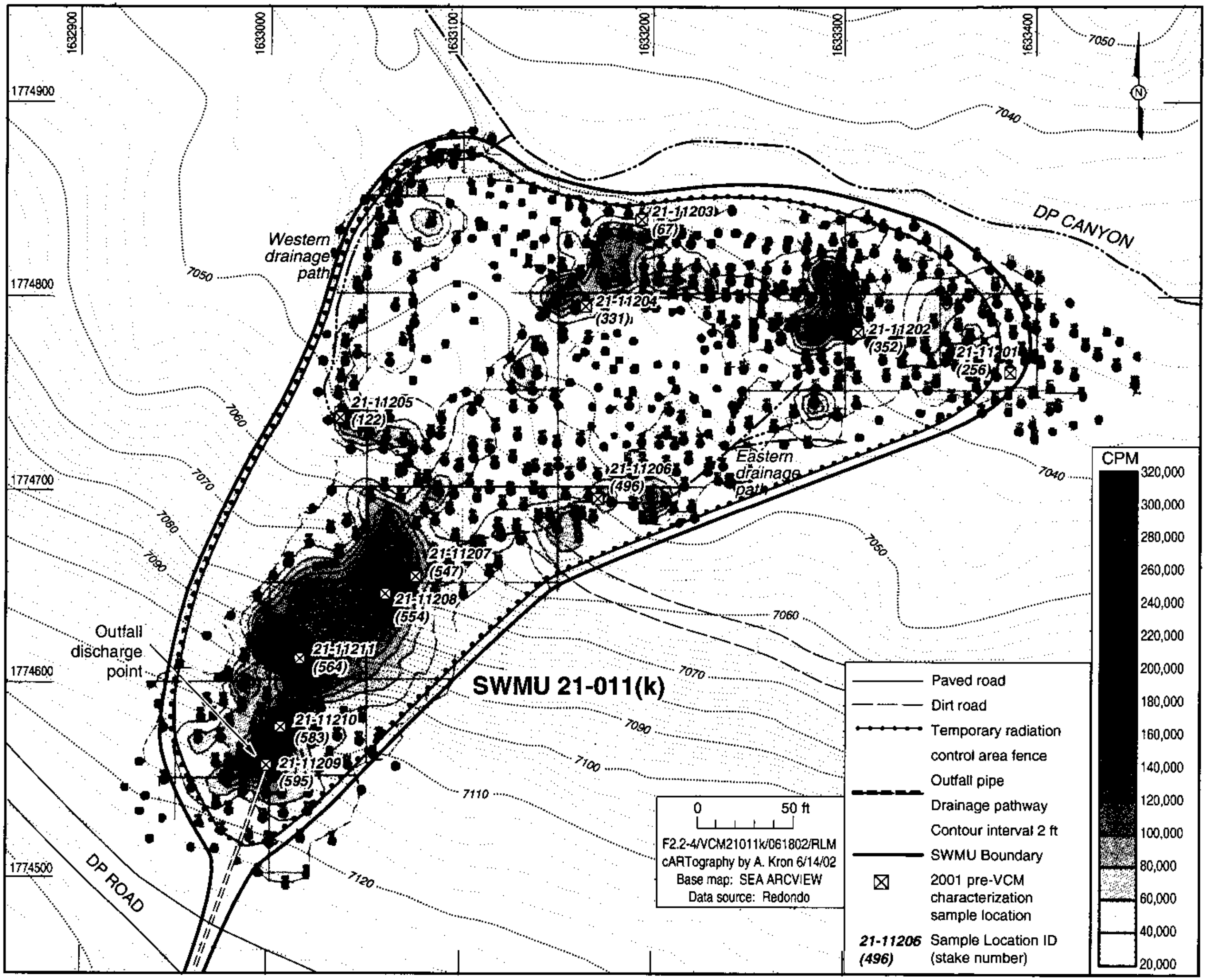

Figure 2.2-4 November 2000 in situ gamma survey results and March 2001 pre-VCM characterization sample locations at SWMU 21-011(k)

Samples submitted for VOC analysis were collected from the depth intervals with the highest radioactivity screening results and/or the bottom of the auger hole and not from the top six-in. sample interval. A composite sample, made up of aliquots from each depth profile sample collected from each sample location for waste characterization purposes, was collected from the remaining material at each of the 11 sample locations. A sample from each location was screened for gross alpha, beta and gamma radiation and Cs-137. The analytical suites for discrete samples collected at each location to confirm nature and extent and for site and waste characterization purposes included the following: perchlorate, gamma spectroscopy, isotopic Pu, Sr-90, Am-241, Cs-137, target analyte list (TAL) metals, toxicity characteristic leaching procedures (TCLP) metals, TCLP VOCs, TCLP semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), VOCs via Encore samplers, and screening for gross alpha beta and gamma radiation. The analytical suites for composite waste characterization samples collected at each location included all of the same analytes as the discrete samples except TAL metals.

Pre-VCM characterization sample summaries including the in situ gamma survey ID, sample location ID, sample depth, sample ID, date and time of sample collection, sample type, and the analytical suite specific to each type of sample, are shown in Table H-1 in Appendix H. The samples were collected between March 6 and 9, 2001. Field screening data were used to develop an instrument correlation curve (correlating cpm with Cs-137 concentration levels), which was presented to NMED in May 2001 and is presented in Appendix F. The November 2000 in situ gross gamma survey map and March 2001 pre-VCM characterization sample locations are shown in Figure 2.2-4.

Sample results for discrete 2001 pre-VCM characterization samples are compared to SALs and to Ecological Screening Levels (ESLs) as presented in the Laboratory's ECORISK database, version 1.4 (LANL 2002, 72802).

Mercury was the single inorganic chemical detected in discrete pre-VCM characterization samples. Mercury was detected at three sample locations (21-11209, -11210, and -11211) at concentrations of 0.14, 0.16, and 1.8 mg/kg respectively (the background value for mercury is 0.1 mg/kg). Mercury was not detected above the SAL (23 mg/kg) but was detected above the minimum ESL (earthworm) at sample locations 21-11209, -11210, and -11211. However, the concentration of mercury was less than the ESL for all other receptors; therefore, mercury does not pose a potential unacceptable risk to human or ecological receptors. The SALs used in these comparisons are derived according to the approach in the human health screening methodology document (LANL 2002, 72639), which is based on guidance in NMED (2000, 68554.1) and EPA (2001, 71466). The ESLs are derived based on the screening level ecological risk assessment approach document (LANL1999, 64783.1) and the ECORISK database, version 1.4 (LANL 2002, 72802).

Table 2.2-2 presents sample results for organic chemicals detected in discrete pre-VCM characterization samples. The analytical results for sample location MD21-0034 were suspect because no organics were detected in the samples collected directly above and below this sample. Therefore, three additional discrete samples (MD21-01-0519, -0520, and -0521) were collected from three depths at the same location in October 2001. The organic chemicals detected were at concentrations below their respective SALs except for trichloroethylene (TCE), which was detected at a concentration approximately equivalent to its SAL in one sample (Table 2.2-2). However, the total cancer risk and noncarcinogenic hazard is less than NMED's target level of 10^{-5} cancer and a hazard index of 1.0 (NMED 2000, 68554.1). The organic chemical concentrations were also less than the minimum ESLs (Table 2.2-2). The TCE concentration of 1.8 mg/kg is just below the minimum ESL of 1.9 mg/kg and less than the ESLs for the other receptors. Therefore, the organic chemicals do not pose a potential unacceptable risk to human or ecological receptors.

Table 2.2-2
2001 Pre-VCM Characterization Sample Organic Chemical Concentrations

Sample ID	Location Id	Date collected	Depth Interval	4,4'-DDT (mg/kg)	Acetone (mg/kg)	Methylene chloride (mg/kg)	4-Isopropyltoluene (mg/kg)	2-Hexanone (mg/kg)	Trichloroethylene (mg/kg)	Toluene (mg/kg)
SAL				**1.7**	**1600**	**65**	**160[a]**	**7300[b]**	**1.6**	**180**
Minimum ESL				**0.0026**	**3.8**	**7.1**	**NA[c]**	**NA**	**1.9**	**70**
MD21-01-0025	21-11202	3/01	0-1 ft	0.00044 (J)[d]	—[e]	—	—	—	—	—
MD21-01-0022	21-11202	3/01	4–5 ft	—	0.013 (J)	—	0.0073	—	—	—
MD21-01-0033	21-11205	3/01	1–2 ft	0.00057 (J)	—	—	—	—	—	—
MD21-01-0034	21-11205	3/01	4–5 ft	—	0.050	0.072	0.026	—	—	—
MD21-01-0036	21-11206	3/01	0–1 ft	0.00039 (J)	—	—	—	—	—	—
MD21-01-0039	21-11207	3/01	0–1 ft	—	—	0.0076	—	—	—	—
MD21-01-0041	21-11208	3/01	1–2 ft	—	—	0.0082	—	—	—	—
MD21-01-0042	21-11208	3/01	4–5 ft	—	—	0.0092	—	—	—	—
MD21-01-0519	21-11205	10/01	0–1 ft	—	—	—	—	—	—	—
MD21-01-0520	21-11205	10/01	4–5 ft	—	—	—	—	—	—	—
MD21-01-0521	21-11205	10/01	1–2 ft	—	—	—	—	—	**1.8(J)**	1.0(J)

Note: Results in bold face indicate concentrations above SALs.
[a] isopropylbenzene was used as a surrogate for isopropyltoluene (EPA 2001, 71466)
[b] methyl ethyl ketone used as a surrogate for 2-hexanone (EPA 2001, 71466)
[c] "NA" denotes not available
[d] "J" denotes estimated value between the MDL and PQL
[e] "-" denotes not detected.

Table 2.2-3 presents the radionuclide values detected in discrete pre-VCM characterization samples at concentrations greater than fallout values for Am-241, Cs-137, Pu-238, Pu-239, and Sr-90. Of these radionuclides, Cs-137 and Sr-90 were detected at concentrations greater than their respective SALs. Cesium-137 was detected above its SAL in seven discrete samples and Sr-90 was detected above its SAL in five discrete samples. When compared to ESLs, Sr-90, Am-241, Pu-238, and Pu-239 were detected at concentrations less than their respective minimum ESL. Cs-137 was detected at a maximum concentration of 445 pCi/g, below the minimum ESL of 680 pCi/g. These results indicate that current radionuclide concentrations at SWMU 21-011(k) do not pose potential adverse ecological effects.

Table 2.2-3
2001 Pre-VCM Characterization Sample
Radionuclide Concentrations above Background/Fallout

Sample ID	Location ID	Depth (ft)	Cs-137 (pCi/g)	Sr-90 (pCi/g)	Pu-239 (pCi/g)	Am-241 (pCi/g)	Pu-238 (pCi/g)
Fallout Soil Value[a]			**1.65**	**1.31**	**0.054**	**0.013**	**0.023**
SAL			**5.3**	**5.7**	**44**	**39**	**49**
Minimum ESL			680	560	47	44	44
MD21-01-0021	21-11201	1-2	1.43	1.7	0.12	—[b]	0.044
MD21-01-0022	21-11202	4-5	1.67	—	0.09	—	—
MD21-01-0025	21-11202	0-1	**40.5**	**7.1**	1.93	2.2	0.29
MD21-01-0027	21-11203	1-2	**8.7**	2.56	0.37	—	0.31
MD21-01-0029	21-11203	4-5	1.03	—	0.04	—	0.05
MD21-01-0030	21-11204	2-3	2.6	0.9	0.11	—	0.07
MD21-01-0033	21-11205	1-2	**150**	**26.1**	13.2	13.7	0.63
MD21-01-0034	21-11205	4-5	3.78	1.02	1.01	6.9	0.21
MD21-01-0036	21-11206	0-1	**29**	3.75	1.18	—	0.12
MD21-01-0037	21-11206	4-5	1.52	0.51	0.12	—	—
MD21-01-0039	21-11207	0-1	**109**	**30.8**	11.3	7.9	0.74
MD21-01-0041	21-11208	1-2	**445**	**132**	20.5	19	1.64
MD21-01-0042	21-11208	4-5	**56.7**	**15.8**	4.33	21	1.2

Note: Results in bold face indicate concentrations above SALs.
[a] (Ryti et al. 1998, 59730.2)
[b] "—" denotes not detected

Summary

The 1996 post-IA confirmation sample data, July 2000 Chemrad and November 2000 in situ gamma survey data, and March 2001 pre-VCM characterization data confirm that radionuclides are the primary COPCs at the site, and identified areas with elevated concentrations that will be addressed during this VCM. The July 2000 Chemrad and November 2000 in situ gamma survey results show a clear boundary between the northern edge of SWMU 21-011(k) and the DP Canyon stream channel and indicate that radionuclides have not migrated to the channel since the completion of the 1996 IA. The proposed VCM will address source removal and dose reduction of the radionuclide contamination at SWMU 21-011(k). Assessment of the contamination in the canyon floor will be conducted as part of the Los Alamos/Pueblo Canyon Surface Aggregate Report to be prepared by the Canyons Focus Area.

3.0 BASIS FOR CLEANUP LEVELS

The land-use scenario considered most appropriate for derivation of cleanup levels is a recreational trail use for TA-21 employees. The recreational trail-user scenario represents an individual working at TA-21 who regularly walks on the site, as it currently exists, prior to implementation of the VCM. The recreationa user is assumed to visit the site 140 times per year for 30 yrs and stay for one hour per visit. Over thirty years, this results in a total annual dose to this user of approximately 7 mrem/yr as shown in Figure 1.3-1 and is projected to decline to less than 2 mrem/yr within 100 years due to decay of Cs-137. This is compared to the acceptable annual radiation dose limit of 15 mrem/yr. (DOE 2000, 67489 and EPA 1997, 58693). The dose-based radiological cleanup levels for the trail-user scenario are derived using RESRAD 6.1, as shown in Appendix F, Exhibit F.2, and are presented in Table 3.0-1 as the single radionuclide soil guidelines (SRSGs). The SRSG for each radionuclide is based on a target dose limit of 15 mrem/yr.

Table 3.0-1
SRSGs Derived for the Recreational Trail-User Scenario

Radionuclide	SRSG (pCi/g)
Am-241	427
Cs-137	294
Pu-238	496
Pu-239	447
Sr-90	8,288

By comparison, the calculated dose to a hypothetical recreational trail user following implementation of the proposed excavation and disposal of 500 yd^3 of contaminated material with concentrations of Cs-137 greater than 150 pCi/g and approximately 60 yd^3 of contaminated sediment in the western drainage with Am-241 concentration greater than 170 pCi/g is between 3 and 4 mrem/yr or about 1/4 the criterion of 15 mrem/yr for the free-release of real property (DOE 2000, 67489). The estimated dose rate is still primarily due to Cs-137, which has a half-life of approximately 30 years. The total dose rate is projected to decline to less than 2 mrem/yr within approximately 30 years after excavation due solely to the decay of Cs-137. This is approximately 1/3 the time that would be required to reach 2 mrem/yr without the source reduction achieved through implementation of the VCM. Figure 3.0-1 is a dose versus time plot produced by RESRAD 6.1 (Appendix F, Exhibit F.C) for the recreational trail user following implementation of the proposed excavation and disposal of 500 yd^3 of contaminated material with concentrations of Cs-137 greater than 150 pCi/g and approximately 60 yd^3 of Am-241 contaminated sediment in the western drainage with Am-241 concentrations greater than 170 pCi/g.

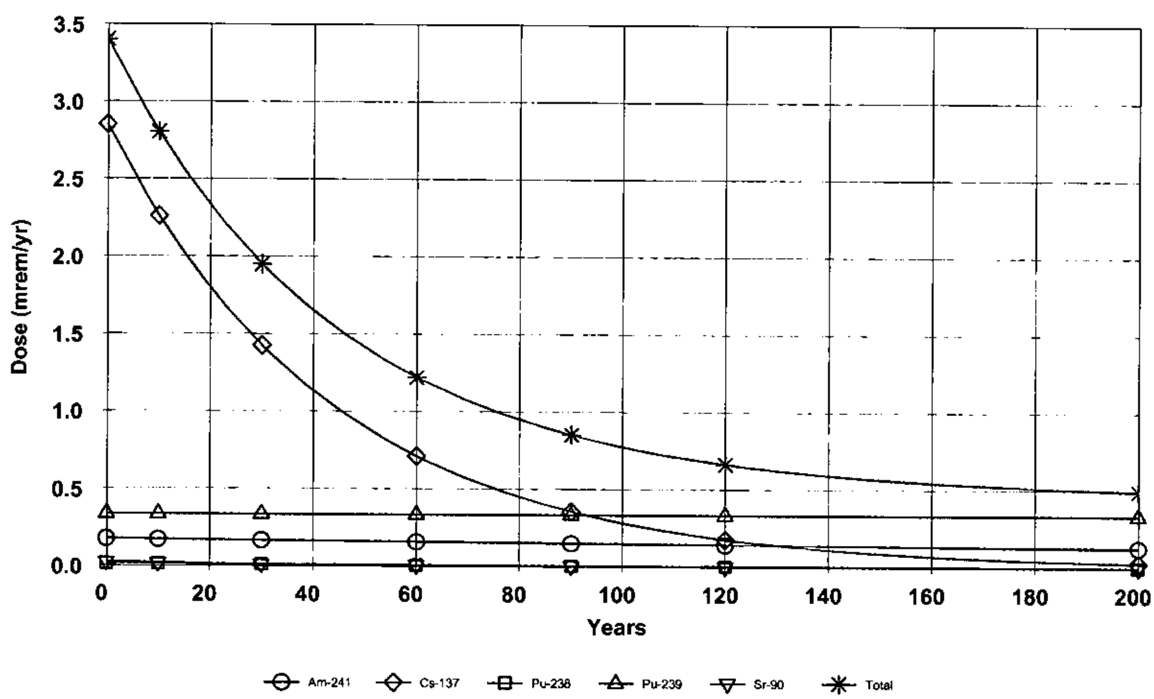

Figure 3.0-1. Dose vs. time for trail-user scenario at SWMU 21-011(k) after excavation and removal and prior to installation of engineered cover

Because SWMU 21-011(k) has a mixture of radionuclides present at the site, the SRSGs do not apply independently. A sum of ratios rule applies instead, and the sum of ratios is calculated as:

$$\text{Sum of ratios} = \sum \text{Concentration of isotope i / SRSG of isotope i.}$$

The mixture derived concentration guideline (DCGL) (Appendix F) for soil is satisfied when the sum of ratios or the radionuclides present is less than or equal to 1. Based on site average concentrations, the current dose at SWMU 21-011(k) is 7.3 mrem/yr for a recreational trail-user scenario, well below the 15 mrem/yr dose-based criteria.

However, areas of elevated concentration are present on site where the sum of ratios may approach or exceed unity. These areas are the focus of the VCM. Soil will be removed from these locations with the goal of meeting the mixture DCGL (Appendix F). In addition, an elevated concentration criterion in DOE Order 5400.5 (Chapter 4, section 4.A.1) must be satisfied once these areas have been remediated (DOE 1990, 58980.1). The DOE Order 5400.5 criterion is listed in the Appendix A definitions section and is further discussed in Appendix F.

The areas of elevated concentrations were identified based on analytical data and November 2000 gamma surveys (Figure 3.0-2). These results were used to generate volume estimates that are presented in Appendix F. Based on a preliminary assessment of potential impacts to site ecology, corrective measures for protection of human health will also be protective of ecological receptors. A complete Ecological Screening Assessment will be presented in the VCM completion report.

4.0 PROPOSED VOLUNTARY CORRECTIVE MEASURE

4.1 Conceptual Model

SWMU 21-011(k) is an outfall where treated industrial wastewater was discharged onto the north side of DP Mesa. The wastewater remaining after the plutonium extraction contained a variety of radioactive and chemical constituents. The COPCs in the effluent would have been largely in solution, but because of their geochemical characteristics, most would have adsorbed onto sediment particles or organic colloids (Langmuir 1997, 56037).

COPCs in effluent that were deposited onto the colluvial slope would have preferentially adsorbed to organic matter in the soil and finer-grained particles because of their greater surface area and, in the case of clay minerals and solid organic matter, their high-cation exchange capacity. COPCs in effluent that were deposited onto the toe of the slope would have encountered mainly coarse-grained sediment. Adsorption of the radionuclides would likely have been onto small amounts of other components within the coarse-grained sediment (e.g., organic matter, iron oxide coatings on larger grains, or clay particles adhered to larger grains).

During the period of effluent releases, contaminant inventories would have built up incrementally. Later development of a gully on the slope below SWMU 21-011(k) allowed erosion of some of the contaminated sediments into the DP Canyon channel (LANL 1999, 63915).

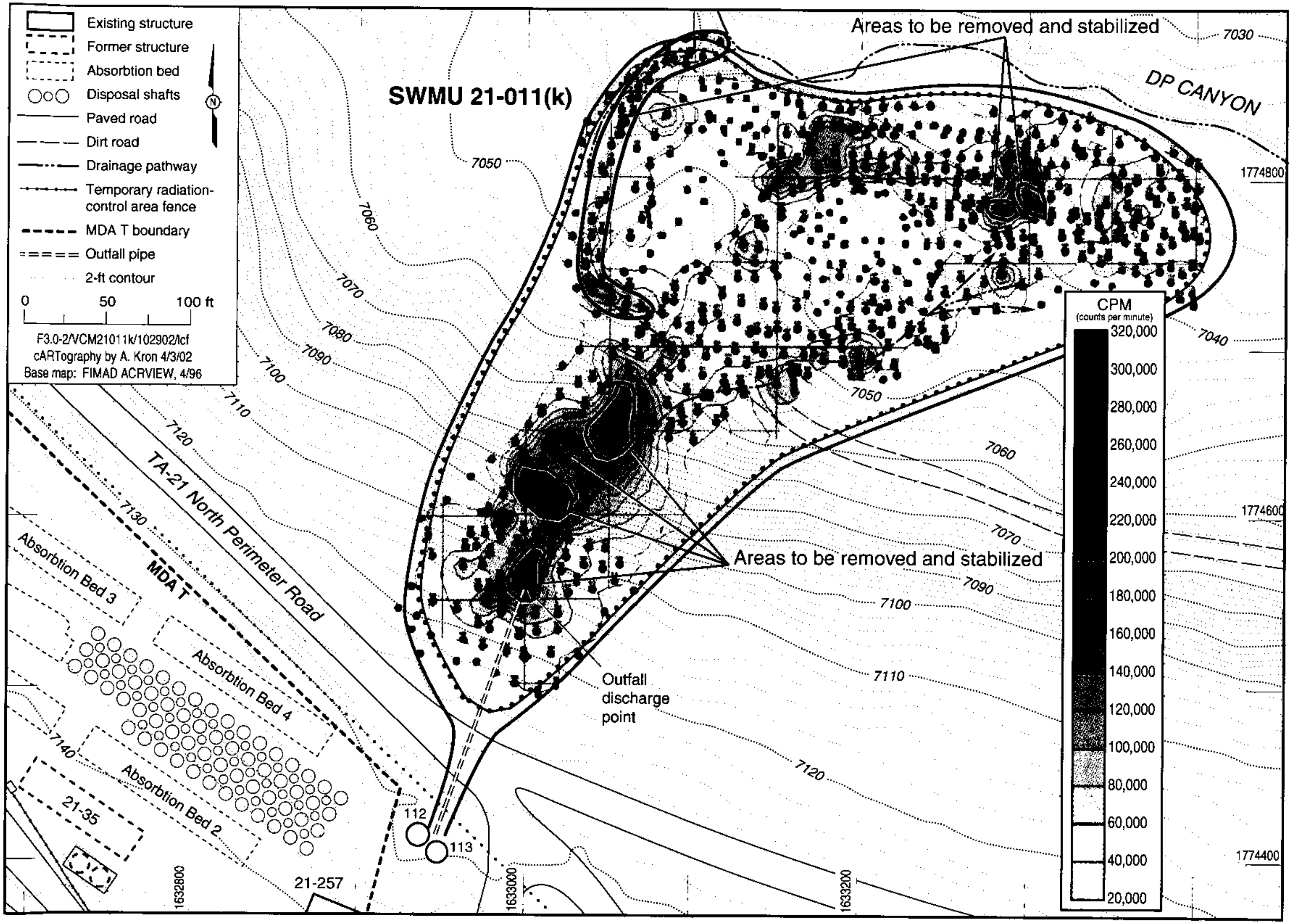

Figure 3.0-2 November 2000 in situ gross gamma survey results at SWMU 21-011(k) with circled areas planned for removal

The surface water, air, and mass wasting transport pathways do not contribute significantly to current contaminant transport. The site is currently protected by stormwater run-on and runoff controls so the only water contacting the contaminated soil is rain or snow falling directly on the SWMU. Therefore, contaminant transport via stormwater or snowmelt run-on and runoff has been controlled and on-site infiltration reduced to the absolute minimum by the BMPs. During the summer of 2002 the woody vegetation from the SWMU was removed in anticipation of VCM activities. Grasses and plant litter remain over much of the site which help minimize contaminant transport via wind and fugitive dust. Contaminant transport via mass wasting is unlikely because the slope is quite stable with no new evidence of erosion since the stormwater run-on and runoff controls were installed in 1996 and upgraded in 1999.

There are three complete pathways for potential human contact. The first is direct radiation from gamma emitting COPCs such as Cs-137 and Am-241, the second is ingestion of contaminated soil, and the third is inhalation of particulates, which is considered of low potential for any substantial exposure.

The ecological conceptual site model and rationale are presented in Part C of the ecological scoping checklist in Appendix D. The ecological model depicts the potential transport and exposure pathways of significance to terrestrial receptors. Major and minor exposure pathways for plants include uptake and external gamma (Appendix D). Major exposure pathways for animals include food web transport, incidental soil ingestion, and external gamma, while minor exposure pathways include inhalation/deposition, and dermal contact. There are no aquatic receptors.

The Canyons Focus Area has completed the characterization of reaches in DP Canyon, including Reach DP-2, which straddles the contaminated hillside portion of SWMU 21-011(k). Sediment and water data from the DP Canyon investigation is being incorporated into ecological and human health risk assessments that address the entire Los Alamos and Pueblo Canyon watershed. The assessment will be included in the Los Alamos/Pueblo Canyon Surface Aggregate Report, which is currently scheduled for completion in late fiscal year 2003.

4.2 Supplemental Sampling

The discussions that follow in Sections 4.2.1, Surveys and Sampling, and 4.2.2, Radiological Sampling, describe supplemental screening and sampling performed in August and September, 2002 to ensure field instrument accuracy and for determining areas requiring excavation in the western drainage.

4.2.1 Surveys and Sampling

Gross gamma surveys will be performed in the field to guide the excavation of materials with elevated concentrations at the site. In the western drainage, an Eberline PG-2 sodium iodide analyzer will be used to screen and guide excavation, as described in Section 4.2.3. This data will be supplemented by screening for Cs-137 in an on-site trailer using single-channel or multi-channel analysis with a sodium iodide scintillation detector. Due to the variation of instrument efficiencies, samples were collected in August and September 2002 for fixed laboratory analysis to validate the screening measurements for Cs-137 and Am-241. Results are discussed in the following sections.

4.2.2 Radiological Sampling

Gross gamma survey and Cs-137 measurements performed with instrumentation in the on-site trailer during the VCM will guide excavation in all areas to be remediated, except for the drainage in the western portion of the site. A total of 8 surface soil grab samples were collected from six locations from the upper slope area where Cs-137 screening will guide the remediation (Table 4.2-1). Grab samples were collected per ER SOP 6.09, R1. All samples were screened for Am-241 using a single channel analyzer equipped with a PG-2 detector, and also for Cs-137 using a single channel analyzer equipped with a 2 x 2 in. sodium iodide (NaI) detector using Washington Group International Inc. (WGII) Standard Operating Procedure (SOP) 10.15, R0. Following screening, the eight samples were sent to ARS for gross alpha, beta and gamma analysis and analysis for Am-241 and Cs-137 by gamma spectroscopy. The ARS screening data was used to select two samples for fixed laboratory analysis for gamma spectroscopy, isotopic plutonium, and Sr-90. These analytical data, along with the results from the samples collected from the western drainage (Section 4.2.3) will be used for final validation of the screening approach. Samples submitted to ARS for analysis will be returned to the site and used as benchmarks throughout the remediation effort for validation of on-site measurements.

Table 4.2-1 Samples collected for validation of field screening approach.

Location ID	Sample ID	Date Collected	Depth (ft)	Sample Location	ARS Analytical[1]	Fixed Lab[2]
21-02-19953	MD21-02-49367	8/15/02	0-0.5	Slope	X	
21-02-19954	MD21-02-49368	8/15/02	0-0.5	Slope	X	
21-02-19955	MD21-02-49369	8/15/02	0-0.5	Slope	X	
21-02-19956	MD21-02-49370	8/15/02	0-0.5	Slope	X	
21-02-19957	MD21-02-49371	8/15/02	0-0.5	Slope	X	
21-02-19958	MD21-02-49372	8/15/02	0-0.5	Slope	X	
21-02-19961	MD21-02-49373	8/15/02	0-1	Western Drainage	X	X
21-02-19962	MD21-02-49374	8/15/02	3-4	Western Drainage	X	X
21-02-19963	MD21-02-49375	8/14/02	0-1	Western Drainage	X	X
21-02-19964	MD21-02-49376	8/14/02	0-1	Western Drainage	X	X
21-02-19967	MD21-02-49377	8/14/02	0-1	Western Drainage	X	X
21-02-19967	MD21-02-49378	8/14/02	1-2	Western Drainage	X	X
21-02-19969	MD21-02-49380	9/6/02	0-0.5	Slope	X	X
21-02-19970	MD21-02-49381	9/6/02	0-0.5	Slope	X	X

[1]-ARS analytical suite: gross alpha, beta and gamma radiation, and gamma spectroscopy for Am-241 and Cs-137.
[2]-Fixed laboratory analytical suite: gamma spectroscopy, isotopic Pu, and Sr-90.

Cs-137 field screening estimates were compared to the ARS Cs-137 analytical results and showed a corrected correlation coefficient of greater than 99.5%. The anticipated detection limit for the field estimates of Cs-137 is approximately 20 pCi/g using a two-minute count. The good correlation to ARS analytical results and the low detection limit relative to the cleanup target of 150 pCi/g for Cs-137 shows that the screening approach is capable of guiding the soil removal activity.

4.2.3 Western Drainage Pre-Excavation Screening

To supplement the lack of data points within the western drainage, additional samples have been collected for screening in an on-site trailer and for analysis at an off-site fixed analytical laboratory. Screening for Am-241 in an on-site trailer on soil grab samples collected from the western drainage was performed using a single channel analyzer equipped with a PG-2 detector.

A total of 31 grab samples were collected from nine locations distributed along the length of the western drainage and six of these samples were submitted to ARS and the fixed laboratory for analysis (Table 4.2-1). The ARS screening data was used to select six samples for fixed laboratory analysis for gamma spectroscopy, isotopic plutonium, and Sr-90. These analytical data, along with the results from the samples collected from the main body of the site will be used for final validation of the screening approach. Grab samples were collected at each location at one foot intervals from the surface to auger refusal per ER SOP 6.10, R2. Samples were collected from depths as great as 3 to 4 ft below ground surface. All of the initial grab samples were screened for Am-241 using a single channel analyzer equipped with a PG-2 detector, and also for Cs-137 using a single channel analyzer equipped with a 2x2 in. NaI detector using WGII SOP 10.15, R0. The fixed Laboratory data will be shared with NMED as soon as it's received and prior to beginning any excavation activities and will be included in the VCM report for SWMU 21-011(k).

Review of the ARS screening data and the field screening estimates for Am-241 showed a correlation coefficient of 94%. The screening method provides a detection limit of about 10 pCi/g for a two-minute count. The good correlation to ARS analytical results, and the low detection limit relative to the cleanup target of 170 pCi/g for Am-241 in the western drainage shows that the screening approach is capable of guiding the soil removal activity.

Based on the field screening for Am-241, five areas within the western drainage were identified as having concentrations greater than or equal to 170 pCi/g (maximum contamination of 380 pCi/g). All of the samples with concentrations greater than 170 pCi/g were found from 0 to 2.0 ft bgs. Assuming an average of 150 ft^2 for each anomaly and a 2–ft depth of excavation, the estimated volume of contaminated material to be removed from the western drainage is 56 yd^3 (conservatively 60 yd^3). This value serves as a conservative upper limit for the total western drainage remediation and is used in the total volume estimates for the entire VCM.

4.3 Remedial Approach

Following the readiness review, mobilization and site preparation for remedial activities commenced. Mobilization activities included the delivery of site trailers, materials, and heavy equipment. Site preparation activities included clearing and grubbing of vegetation in areas to be excavated; set-up of site trailers; survey and staking of areas to be excavated; construction of site support zones; installation of sanitary facilities; tree removal and chipping; improvement and extension of the existing haul road; fence removal; installation of temporary fencing; and installation of stormwater BMPs.

Tree trunks over 8 in. in diameter were cut into nominal 15-ft lengths for subsequent use as stormwater run-on and runoff control diversion barriers. Prior to clearing and grubbing, on-site vegetation was sampled for waste characterization purposes as described in detail in Section 6.0. The material was cleared and stored in rolloff containers. After receipt and review of waste characterization results the material will be disposed of at Area G at TA-54. The drainline from the northern fence line of the two holding tanks (structures 21-112 and -113) to the outfall at the southern end of the SWMU has been removed. This 4-in. diameter, cast iron drainline extended 80 ft from the south side of the North Perimeter Road to a discharge point just below the canyon rim. The soil above the cast iron drainline was excavated and the drainline removed. The drainline excavation trench was field screened using a gamma instrument and PG-2 detector in the same manner being followed for guiding the soil removal. Samples were collected immediately below the removed line and following collection of confirmation samples, the trench was backfilled. Based on soil screening results some soil removal and additional sampling will be required along the section of the drainline that formerly ran under the road. Once that work is accomplished the road will be repaired as described in Section 5.

During field activities, the Laboratory is monitoring worker exposure to radionuclide-contaminated soil at SWMU 21-011(k) based on the requirements of the site-specific health and safety plan (SSHASP). The two high-volume air samplers proposed in the previous version of this VCM plan are not being used. Upon further review of the project, Laboratory Air Quality Group personnel determined that high-volume air samples located in close proximity to the site, (i.e., across the DP Canyon drainage channel to the north) would not detect contamination present in suspended particulates from the VCM, because 1) once suspended, the particulates travel a much further distance before being deposited on the ground, and 2) the high-volume samplers will not collect an aliquot of sample sufficient for analysis in a short time period. In lieu of the high-volume samplers, the Laboratory is monitoring exposure to members of the public during remediation of 21-011(k) by use of existing airnet stations. The Laboratory operates four airnet stations near the Los Alamos Airport and DP Road (Airnet stations: 9 - Los Alamos Airport, 68 - Airport Road, 62 - Crossroads Bible Church, and 69 - DP Road West Entrance). Airnet station 72 is just south of the site and is also being operated during the VCM. Airnet station 69 was shut down at the end of December 2002. These stations are downwind of SWMU 21-011(k) and in the predominant wind direction and will be used to monitor potential exposure to the public from field activities at 21-011k. The data collected from these stations during the implementation of the VCM will be reported in the VCM Completion Report for SWMU 21-011(k).

The Air Quality Group personnel conducted a new source review for the SWMU 21-011(k) VCM to determine if a new air sampling station is required by National Emissions Standards for Hazardous Air Pollutants (NESHAPs) as adopted by 20.2.78 of the New Mexico Administrative Code (NMAC), and LANL Air Quality Group criteria. The soil characterization data for radionuclides was used with the appropriate release factors, as described in Appendix D of 40 CFR Part 61, to calculate an emissions estimate for excavating, transporting and treating the contaminated material onsite (1500 yd^3). This calculation was conducted prior to the decision to excavate the material and transport it to Area G at TA-54 for disposal and before the total volume estimate had been refined. Therefore, with the change in the remediation approach, the current volume estimate is lowered to 560 yd^3. The calculated emission estimate represents a conservative estimate of the potential effective dose equivalent. Dose assessments from the emissions estimates were calculated using CAP88, an EPA-approved dispersion-modeling program. Based on the previous modeling results, the potential effective dose equivalent from excavation and transport of the material to Area G at TA-54 (560 yd^3 of contaminated soil) to the nearest receptor along State Road 502 (based on predominant wind direction) would conservatively be 0.07 mrem/yr (based on the original 1500 yds^3), which is below the monitoring threshold of 0.1 mrem/yr specified in Title 40 of the Code of Federal Regulations (40 CFR) Part 61, Subpart H (Radionuclide-NESHAPs).

Areas of the site with concentrations above 150 pCi/g Cs-137 and 170 pCi/g Am-241 have been surveyed and staked for excavation based on an initial walkover radiation survey conducted prior to the start of excavation. These areas showed excellent correlation to those shown in Figure 3.0-2. As these areas are excavated, real-time radiological screening combined with real-time mapping of gross gamma radiation is being used to determine whether enough media has been removed to achieve the established clean-up level. Excavated soil, sediment, and tuff are being staged on site within the bermed stockpile areas and covered with plastic sheeting. Silt fences, silt dikes, and/or straw wattles are being used to control run-on and runoff as described in the Storm Water Pollution Prevention Plan for 21-011(k) (LANL 2002, 73189). As a BMP, soil/sediment currently located near the northern SWMU boundary and along the western and eastern edges of SWMU 21-011(k) with Cs-137 concentrations just below the target clean-up level is being excavated first and staged on site. Confirmation sampling and a radiological survey of the entire site will be conducted prior to recontouring and placement of the vegetative cover over the site in accordance with Section 5.0, Confirmation Surveys and Sampling.

As the excavation process proceeds, the contaminated material is being placed in individual stockpiles from the various excavation areas until all of the material with Cs-137 concentrations greater than 150 pCi/g and material in the western drainage with Am-241 concentrations greater than 170 pCi/g have been excavated. All stockpile areas are in level easily-accessible portions of the site. In accordance with the No Longer Contained-In determination received from NMED on November 25, 2002, each 100 yd^3 of excavated material will be sampled for Appendix VIII volatile organic compounds (VOCs), the results reviewed with NMED prior to disposal of the soil at Area G at TA-54, and the results included in the VCM Completion Report for SWMU 21-011(k). After receipt and review of the VOC results with NMED, rolloff containers will be brought on site and the excavated material will be placed into the containers using a front-end loader. Trucks will then be used to transport the full rolloff containers to Area G at TA-54. The trucks and rolloff containers will be surveyed by Health, Safety, and Radiation Protection (HSR-1) Radiological Control Technicians (RCTs) prior to being released from the site. To ensure efficient disposa at Area G, all waste shipping paperwork will be compiled in advance of transport.

Following excavation and transportation activities, project personnel will decontaminate all earth-moving equipment. Residual media adhering to equipment will be removed using dry decontamination methods including the use of wire brushes and scrapers (WGII SOP 1.08 Rev 1). If necessary, final equipment decontamination will be performed on a temporary wash pad with a high-density polyethylene (HDPE) liner. Cleaning solutions and wash water will be collected for proper disposal (Section 6.0). All parts of the equipment, including the undercarriage, wheels, tracks, chassis, and cab will be thoroughly cleaned. Air filters on equipment operating in the exclusion zone will be considered contaminated and will be removed and replaced before equipment leaves the site. A high-pressure sprayer along with long handled brushes and rods will be used to effectively remove contaminated material from equipment. Decontamination solutions will be containerized and sampled to determine final disposition (Section 6). Equipment will be surveyed by an HSR-1 RCT prior to being released from the site.

4.3.1 Site Restoration

Upon completion of excavation and removal, removal of the equipment, satisfactory completion of the site radiation survey and confirmation sample collection (described in Section 5.0), site restoration activities will be implemented. Restoration activities will involve recontouring the excavated areas, including placement of at least 560 yd^3 of clean fill material in the excavated areas, and revegetation of the entire site.

At least 560 yd^3 of clean borrow material will be used as restoration materials for the areas excavated during the VCM. Borrow material will be hauled to the site. Material brought in from off site will be taken from a borrow source from an undisturbed face within the vendors pit with no history of industrial activity.

Areas excavated during the VCM will be restored. Due to the fact that the ground slopes at the site vary from steep to nearly flat, three different restoration approaches have been prepared to cover the various conditions. Diagrams of the three engineered restoration approaches can be found in drawing 02-030, Restoration Cover sections and details (Attachment 2). Specifications for fill placement in the restoration areas are detailed in Attachment 2.

Restoration of the disturbed areas will be performed from the top of the slope downward (south to north). On steeply sloping excavated areas (greater than 2:1), benches will be cut into the tuff bedrock and a boulder retaining wall set in place at the toe of the restoration to eliminate creep of the placed materials. Compacted lifts will be placed until a minimum 2 ft of fill has been placed. Compaction will be achieved using a small remotely operated trench compactor or hand operated vibrating plate compactor as approved by the geotechnical engineer. The final slope of the restoration will be 2:1 or less. Following placement of the fill material, erosion matting will be placed over the restored area and secured per the manufacturer's instructions.

Restoration of the areas sloping approximately 2:1 will be the same as for the steeper sloped areas discussed above except that a boulder retaining wall at the toe of the restoration fill is not required. Areas with slopes flatter than 2:1 will be backfilled with a minimum 2 ft of backfill placed in compacted lifts. The up-slope edge of the backfill will be feathered into the hillside. The toe of the restoration will be sloped at a 2:1 slope. Erosion matting will be placed over the restoration materials and secured to the ground per the manufacturer's requirements to minimize stormwater runoff.

Borrow material will be placed in lifts and compacted. All grades will be finished in conformance with the lines and grade on the plans. Run-on controls will be installed at the south end of the site to limit erosion. The run-on controls will consist of a water diversion ditch located at the top of the slope of the southern boundary of SWMU 21-011(k) to prevent stormwater from running onto the slope. The BMPs will remain at the south and north ends of the site until vegetation is well established.

Once grading is complete, revegetation activities will commence in the spring of 2003. Revegetation activities will conform to project specifications prepared by a landscape architect licensed in the State of New Mexico. Seeded areas will be maintained in accordance with the vegetation specification (Attachment 2) until a well developed vegetative cover is established. Monthly inspections of the BMPs and cover will be performed as part of the site-specific LANL Surface Water Pollution Prevention Plan (SWPPP) for the Project.

5.0 CONFIRMATION SURVEYS AND SAMPLING

5.1 Confirmation Sampling beneath the Outfall Drainline at SWMU 21-011(k)

At a minimum, five locations will be sampled below the removed outfall drainline leading to SWMU 21-011(k) (Figure 5.1-1). Samples will be collected from two depths (0 to 12 in. and 24 to 36 in. below the bottom of the removed pipe). Samples will be analyzed by gamma spectroscopy for Cs-137, by alpha spectroscopy for Am-241 and isotopic Pu, and by gas proportional counting for Sr-90 at an off-site fixed laboratory and screened for gross alpha, beta, and gamma radiation for DOT shipping purposes. A sample point will be located at the joint nearest the north and south ends of the removed drainline. The remaining three sample locations will be distributed along the length of the removed drainline. Gamma screening will be conducted along the length of the line using the same radiological detection instrumentation used for the excavation activities to identify potential release locations. Sample locations will be biased to areas of elevated gamma radiation identified during the screening as well as locations of fractures or staining. Additional sample locations will be added as appropriate. In the event that elevated radiological screening indicates a possible release, deeper samples will be collected until site background levels are reached or a clear decreasing trend is observed to ensure the determination of the nature and extent of any potential contamination. Step-out samples to define nature and extent laterally will be collected approximately 5 ft in each direction until contamination has been bounded (Figure 5.1-1).

Much of the line to be removed is beneath the roadbed leading to the TSTA facility. Since this is the sole access road to this operating nuclear facility, the above samples will be collected in stages. The line will be removed and samples collected so as not to completely block access to TSTA. Road repairs will be made to one side of the road prior to removal of the line and sampling the other side. The final details of the removal and sampling will be provided in the VCM Completion Report for SWMU 21-011(k).

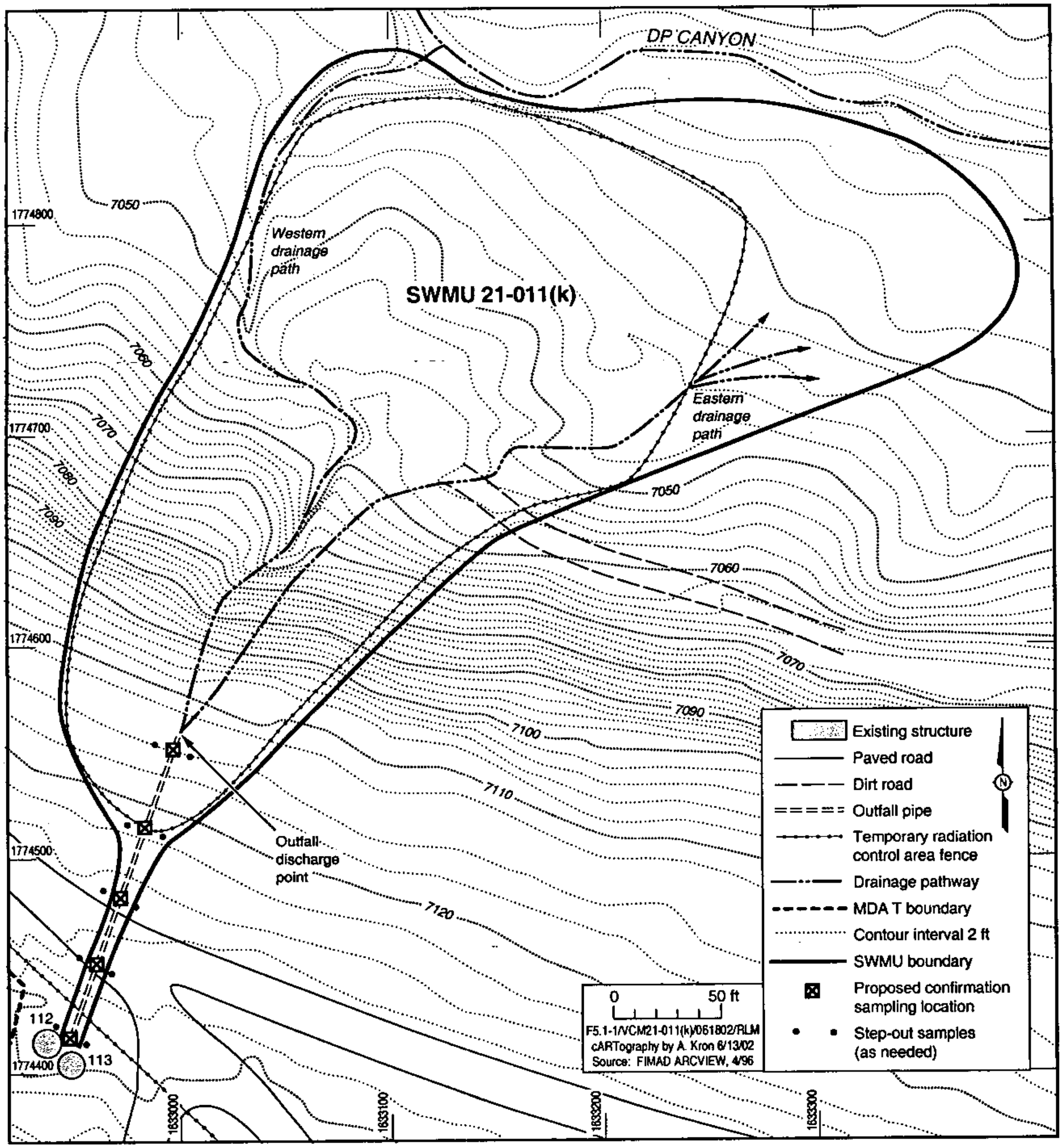

Figure 5.1-1. Outfall pipe to be removed and proposed confirmation sample locations at SWMU 21-011(k)

5.2 Confirmation Surveys and Sampling of Soil Removal Areas

Confirmation that cleanup goals have been met will be made through collection of samples from both remediated (soil removal) areas and site-wide unremediated areas. Sampling frequencies are different for each type of excavated area. In each discrete remediated area, a minimum of one surface (0 to 12 in.) confirmation sample will be collected regardless of the area's size. For remediated areas larger than 25

m^2, samples will be collected at a rate of one per every 25 m^2. Unremediated areas will be sampled at a rate of one surface sample per every 500 m^2. Samples will be analyzed by gamma spectroscopy for Cs-137 and by alpha spectroscopy for Am-241, isotopic Pu, and Sr-90 to confirm the excavated areas meet the requirements of DOE order 5400.5.

A walkover gross gamma survey of the entire SWMU will be performed to obtain count rates across the site and will include at least one reading per yd^2 of affected area. This survey will include all affected areas as well as the particular locations where confirmation samples were collected. The standard deviation of the data set generated in the confirmation surveys should not exceed 2% of the count rate for the cleanup goals of 150 pCi/g for Cs-137 and 170 pCi/g for Am-241.

After restoration of the excavated areas of the site and revegetation of the site have been completed, a confirmation survey will be conducted to confirm that the goals of the VCM have been achieved. The confirmation screening survey will consist of a walkover gross gamma survey of the entire site.

Data from both surveys will be used to derive radionuclide concentrations to demonstrate that the site meets mixture DCGL values (Appendix F) and that the DOE 5400.5 elevated concentration criterion is satisfied. Attainment of these objectives will be documented in the VCM completion report for SWMU 21-011(k).

5.3 Short-Term Maintenance and Monitoring

Stormwater run-on and runoff controls will be inspected weekly during implementation of the VCM and on a monthly basis as part of the RRES Project BMP inspection program. Any erosion features noted during these inspections will be brought to the attention of the design engineer for evaluation. Repairs will be made at the direction of the design engineer as needed. These inspections will continue for a period of two years. After two years, a review of the necessary frequency of inspections will be made and a new frequency may be proposed based on the performance of the restoration materials. Details of the BMP inspections and long-term stewardship will be included in the VCM completion report for SWMU 21-011(k).

6.0 WASTE MANAGEMENT

6.1 Estimated Types and Volumes of Waste

Five separate waste streams are anticipated from this VCM. The waste streams, expected waste types, and volumes are summarized in Table 6.1-1. Waste stream descriptions, including the principal components of the waste and any uncertainties in volume calculations, are described in the paragraphs that follow.

Table 6.1-1
Waste Streams, Types, and Volumes at SWMU 21-011(k)

Waste Stream	Waste Type/Form	Anticipated Volume
Contact waste (PPE, plastic sheeting, disposable sampling supplies, dry decontamination waste, etc.)	Low-level radioactive waste; solid, compactable	30 yd^3 (precompacted)
Decontamination solutions	Low-level radioactive waste; liquid	1,000 gallons
Vegetation (brush, small-diameter trees, scrub oak)	Low-level radioactive waste; solid	40 yd^3
Metal pipe	Low-level radioactive waste; solid, noncompactable	5 yd^3

Table 6.1-1 (continued)		
Waste Stream	**Waste Type/Form**	**Anticipated Volume**
Municipal refuse, uncontaminated trash and debris (cardboard, paper, plastic, etc.)	Municipal solid waste (MSW); solid	25 yd^3
Soil, tuff, and sediment	Low-level radioactive waste; solid, noncompactable	560 yd^3

Contact waste. This waste stream will include various types of disposable debris including personal protective equipment (gloves, booties, filter cartridges); plastic sheeting (e.g., liners, tarps and contamination control covers); sampling supplies such as plastic scoops, plastic bags, jars, and filters; and dry decontamination waste. These wastes have the potential to be become contaminated through direct contact with contaminated environmental media. Characterization of this waste will be determined through soil contaminant concentrations and from direct radiological surveys. The volume of contact waste will be kept to a minimum by decontaminating any reusable items that come into contact with the contaminated environmental media.

Decontamination solutions. This waste stream will consist of liquids generated from on-site decontamination of tools; excavation equipment, vehicles; sampling equipment; and personnel. The volume of decontamination solutions will be minimized using "dry" techniques.

Decontamination solutions will be containerized and characterized through direct sampling in order to demonstrate compliance with Waste Acceptance Criteria (WAC) at the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF).

Vegetation. Brush, small trees, and scrub oak were cleared from the site during site preparation activities. Large ponderosa pines were felled, their branches cut off, and the trunks cut into nominal 15 ft lengths. These tree trunks are being used as BMPs. Disposition of the remaining vegetation will be determined by results from the waste characterization samples described in the following paragraph.

A total of three composite samples of the vegetation removed from the site were collected during the week of June 3, 2002; two one-gallon samples were collected for waste characterization purposes to determine if the vegetation complies with waste acceptance criteria for either disposal at Area G at TA-54 or at the TA-16 incinerator, and a third sample was collected for screening by the ARS Laboratory to ensure compliance with the 2000 pCi/g total activity limit for transporting radioactively contaminated materials.

Each of the two characterization samples consisted of three plant species. One sample consisted of trees and bushes growing near the region with the highest levels of radioactivity within the Radiation Control Area (RCA); the second sample was collected from plants growing within the RCA. These two samples were analyzed by gamma spectroscopy, for Sr-90 by test method 905.0. and Cs-137 by test method 901.1. In addition, they were analyzed for Am-241, Pu-238, and Pu-239 by alpha spectroscopy following test method 300 in DOE's Environmental Measurements Laboratory Procedures Manual.

Metal pipe. A 4-in.-diameter, cast iron drainline from the two-wastewater treatment tanks will be removed and packaged as low-level radioactive waste. This waste stream will be characterized by survey of direct and removable contamination on the drainline. All surveys will be performed by a qualified RCT.

Municipal refuse. This waste stream will include miscellaneous uncontaminated cardboard, plastic, and paper generated during the project. Administrative controls will be established to minimize the introduction of items (e.g., packaging materials) into the exclusion zone and/or radiological control areas.

As much as practicable, plastic sheeting (e.g., tarps, liners, and contamination control covers) and reusable supplies will be decontaminated, surveyed, and released by a qualified RCT. All recyclable materials will be segregated from this waste stream prior to disposal.

Soil, tuff, and sediment. This waste stream will include the 500 yd^3 of excavated soil, tuff, and sediment contaminated above the cleanup goal of 150 pCi/g Cs-137 and 60 yd^3 Am-241 contaminated sediment above the cleanup goal of 170 pCi/g from the western drainage.

6.2 Method of Management and Disposal

This section describes the planned methods of managing the waste from the time of generation to final disposal.

Contact waste. This waste will be collected in 55-gallon plastic bags and deposited into metal collection boxes (approx. 90 cu ft capacity) for interim storage. The metal boxes will remain in an on-site radioactive waste staging area located until filled and prepared for transport. The contact waste will then be shipped to the low-level waste (LLW) Compaction Facility at Area G at TA-54 for disposal.

Decontamination solutions. Wastewater from the on-site decontamination pad will be pumped into plastic tuff tanks (330-gal capacity) and stored in secondary containment within a liquid radioactive waste staging area. Liquid waste samples will be collected for characterization purposes. Radioactively contaminated liquids will be transported in the tuff tanks to the TA-50 RLWTF for disposal.

Vegetation. Two vegetation samples were collected from SWMU 21-011(k) prior to clearing activities conducted in July 2002. Samples were analyzed for gamma spectroscopy, isotopic plutonium, Sr-90 and, Am-241 by alpha spectroscopy. Of the radionuclide COPCs present at the site, only Cs-137 and Sr-90 were detected in the samples. Cs-137 ranged from 1.81 pCi/g to 2.45 pCi/g. Sr-90 ranged from 114 pCi/g to 283 pCi/g. Since the Sr- 90 values are higher than the anticipated residual levels remaining in the site soils after the VCM, all of the vegetation materials will be disposed of as LLW at Area G at TA-54.

Metal pipe. The cast iron drainline will be placed into a lined rolloff container and staged in an on-site radioactive waste storage area. This waste stream will be disposed at Area G at TA-54.

Municipal refuse. Uncontaminated trash will be collected daily in plastic drum liners and staged on site in a solid waste storage area. This waste will be disposed at the Los Alamos County Landfill.

Soil, tuff, and sediment. Contaminated soil, tuff, and sediment will be excavated and staged on-site in a level easily accessible area. Once all excavation activities are complete the material will be loaded into lined rolloff containers and transported to Area G at TA-54.

7.0 PROPOSED SCHEDULE AND UNCERTAINTIES

The fieldwork portion for this VCM began when the vegetation was removed and pre-excavation screening and sampling was conducted in July and August 2002. The excavation, transport, and disposal for this VCM is anticipated to be completed by the end of May 2003 (Table 7.0-1). Fifteen working days have been allotted for a site readiness review, training, and mobilization. Six working days have been allotted for site preparation activities. One hundred five working days have been scheduled for excavation of contaminated material, transportation of contaminated material to Area G of TA-54 and confirmation surveys and sample collection. Ten working days have been allotted for site restoration activities. Demobilization activities are schedule to take fifteen working days. Seventy-five working days have been allotted for waste disposal activities. The VCM Completion Report will be prepared and submitted to the NMED Hazardous Waste Bureau (HWB) by October 31, 2003.

Table 7.0-1
VCM Field Work Schedule

Activity	Workday Duration	Start	Finish
Submit VCM plan to NMED	N/A	N/A	TBD[a]
Readiness review/mobilization/pre-excavation radiological survey	15 days	November 14, 2002	November 29, 2002
Site preparation	6 days	November 14, 2002	November 20, 2002
Excavation, confirmation sampling, and post-excavation radiological survey	105 days	November 21, 2002	May 31, 2003
Review/Transmit VOC results	60 days	February 17, 2003	April 15, 2003
Waste management/disposal	75 days	February 17, 2003	May 31, 2003
Site restoration and final radiological survey	30 days	June 1, 2003	July 11, 2003
Demobilization	15 days	July 14, 2003	July 31, 2003
Approximate VCM working days	175 days	November 11, 2002	July, 2003
VCM Completion Report Submittal	N/A	N/A	October 31, 2003

[a]TBD – to be determined

8.0 REFERENCES

The following list includes all references cited in this document. Parenthetical information following each reference provides the author, publication date, and the ER identification (ID) number. This information also is included in the citations in the text. ER ID numbers are assigned by the Laboratory's RRES Project to track records associated with the Project. These numbers can be used to locate copies of the actual documents at the RRES Project's Records Processing Facility and, where applicable, with the RRES Project reference library titled "Reference Set for Material Disposal Areas, Technical Area 54."

Copies of the reference library are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Area Office; United States Environmental Protection Agency, Region 6; and the RRES Project Material Disposal Areas Focus Area. This library is a living collection of documents that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this document. However, documents previously submitted to the administrative authority are not included.

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Appendix A

Acronyms, Glossary, and Metric Conversion Tables

APPENDIX A ACRONYMS, GLOSSARY, AND METRIC CONVERSION TABLES

A-1.0 ACRONYMS

ALARA as low as reasonably achievable

AOC area of concern

BGS below ground surface

BMP best management practice

COPC chemical of potential concern

CST Chemical Science and Technology (Laboratory Division)

CVAA cold vapor atomic absorption

DCGL derived concentration guideline

DOE US Department of Energy

DNA delayed neutron assay

EPA US Environmental Protection Agency

EQL estimated quantitation limit

ER environmental restoration

ESL ecological screening level

FIMAD Facility for Information Management, Analysis, and Display

HSR Health Safety and Radiation Protection

HSWA Hazardous and Solid Waste Amendments of 1984

HWB Hazardous Waste Bureau

IA interim action

Laboratory Los Alamos National Laboratory

LLW low-level waste

MDA material disposal area

MDL method detection limit

NMED New Mexico Environment Department (New Mexico Environmental Improvement Division before 1991)

PRS potential release site

QA quality assurance

RCA radiation control area

RCT radiological control technician

RLWTF radioactive liquid waste treatment facility

RRES Risk Reduction and Environmental Stewardship

SAL screening action level

SOP standard operating procedure

SRSG single radionuclide soil guidelines

SSHASP site-specific health and safety plan

SVOC semivolatile organic compound

SWMU solid waste management unit

SWPPP surface water pollution prevention plan

TA technical area

TAL target analyte list

TCLP toxicity characteristic leaching procedures

TSTA tritium systems test assembly

VCP vitrified-clay pipe

VOC volatile organic compound

WAC waste acceptance criteria

WWTP waste water treatment plant

A-2.0 GLOSSARY

Administrative authority (AA). The Director of the New Mexico Environment Department, or his/her designee, or the U.S. Environmental Protection Agency.

Alluvium. Clay, silt, sand, and gravel transported by water and deposited on streambeds, flood plains, and alluvial fans.

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

Background value (BV). The upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. When a UTL cannot be calculated, either the detection limit or the maximum reported value is used as a BV; BVs are used as simple threshold numbers to identify potentially contaminated site sample results that are greater than background levels in that geological sample medium (or group of media). All inorganic chemicals and radionuclides have BVs.

Baseline risk assessment (also known as risk assessment). A site-specific analysis of the potential adverse effects of hazardous substances that are released from a site in the absence of any control or mitigation actions. A baseline risk assessment consists of four steps: data collection and analysis, exposure assessment, toxicity assessment, and risk characterization.

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

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

Cold vapor atomic absorption (CVAA). An analytical technique used for measuring mercury; it is described in EPA Methods 7470A (Mercury in Liquid Waste) and 7471A (Mercury in Solid or Semisolid Waste). The technique is based on the absorption of radiation at 253.7-nm by mercury vapor. The mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance (peak height) is measured as a function of mercury concentration.

Data validation. Systematic process that applies a defined set of performance-based criteria to a body of data; may result in qualification of the data. The data validation process is performed independently of the analytical laboratory that generates the data set and occurs before conclusions are drawn from the data. The process may comprise a standardized data review (routine data validation) and/or a problem-specific data review (focused data validation).

Department of Energy (DOE). Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

Detection limit. Minimum concentration that can be determined by a single measurement by an instrument; implies a specified statistical confidence that the analytical concentration is greater than zero.

DOE Order 5400.5, Elevated Activity Criterion. "If the average concentration in any surface or below-surface area less than or equal to 25 m^2 exceeds the limit or guideline by a factor of $(100/A)^{0.5}$ [where A is the area of the region in which concentrations are elevated]. Limits for "hot-spots" shall also be developed and applied. Procedures for calculating these hot-spot limits, which depend on the extent of the elevated local concentrations, are given in DOE/CH-8901. In addition, reasonable efforts shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit for soil, irrespective of the average concentration in the soil."

Dose. Quantity of radiation that is absorbed, per unit of mass, by the body or by any portion of the body.

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

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

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

Estimated detection limit (EDL). The detection limit required by the Laboratory statement of work (SOW) for analytical services (RFP No. 9-XS1-Q4257). The Laboratory value reflect the contract-required detection limits (CRDLs) of the Contract Laboratory Program (CLP) methods.

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

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

Exposure pathway. Mode by which a receptor may be exposed to contaminants in environmental media (e.g., drinking water, ingesting food, or inhaling dust).

External standard. External standard calibration involves comparison of instrument responses from the sample to the responses from the target compounds in the calibration standards. Sample peak areas (or peak heights) are compared to peak areas (or heights) of the standards.

Fallout radionuclides. Radionuclides that are present at globally elevated levels in the environment as a result of the fallout from atomic weapons tests. The Laboratory background data sets consist of Environmental Surveillance samples taken from marginal and regional locations for the following radionuclides associated with fallout: tritium, Cs-137, americium-241, plutonium-238, plutonium-239/240, and strontium-90. Samples were collected from regional and marginal locations in the vicinity of the Laboratory that are (1) representative of geological media found within Laboratory boundaries and (2) were not impacted by Laboratory operations.

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

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

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

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

Groundwater. Water in a subsurface saturated zone; water beneath the regional water table.

Hazard quotient (HQ). The ratio of a calculated exposure (E) to or dose (D) from a given contaminant (I) to a given receptor (j) over a reference value (TRV) for contaminant (I) determined to be protective of receptor (j), i.e., $HQ_{ij} = E_{ij}$ [or D_{ij}]TRV_{ij}.

Hazardous and Solid Waste Amendments (HSWA). The Hazardous and Solid Waste Amendments of 1984 (Public Law No. 98-616, 98 Stat. 3221), which amended the Resource Conservation and Recovery Act of 1976, 42 U.S.C. § 6901 et seq.

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

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

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

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

Inductively coupled plasma emission spectroscopy (ICPES). ICPES determines trace elements, including metals, in solutions. The instrument measures characteristic emission spectra by optical spectrometry. Samples are nebulized, and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a grating spectrometer, and photosensitive devices are used to monitor the intensities of the emission lines.

Inductively coupled plasma mass spectroscopy (ICPMS). ICPMS is applicable to the determination of sub-mg/l concentrations of a large number of elements in water samples and in waste extracts or digests. When dissolved constituents are required, samples must be filtered and acid preserved before analysis. No digestion is required before analysis for dissolved elements in water samples. The method measures ions produced by a radio-frequency inductively coupled plasma. Analyte species originating in a liquid are nebulized, and the resulting aerosol transported by argon gas into the plasma torch. The ions produced are entrained in the plasma gas and introduced, by means of an interface, into a mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-change ratios and quantified with a channel electron multiplier.

Internal standards. Compounds added to the sample after sample preparation for qualitative and quantitative instrument analysis—the compounds serve as a standard of retention time and response, which is invariant from run to run with the instruments. (Handbook of Environmental Analysis, by Roy-Keith Smith, 3rd ed.)

Laboratory control sample (LCS). A known matrix that has been spiked with compound(s) representative of the target analytes. The LCS is used to document laboratory performance. The acceptance criteria for LCSs are method specific.

Laboratory qualifier (or laboratory flag). Codes applied to the data by the contract analytical laboratory to indicate, on a gross scale, a verifiable or potential data deficiency. These flags are applied using the Environmental protection Agency (EPA) contract laboratory program (CLP) guidelines.

Matrix spike. An aliquot of sample spiked with a known concentration of target analyte(s). Matrix spike samples are used to measure the ability to recover prescribed analytes from a native sample matrix. The spiking typically occurs before sample preparation and analysis.

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

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

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

Minimum detectable activity. For the *analysis* of *radionuclides*, the minimum detectable activity is the lowest detectable radioactivity for a given analytical technique. The following equation shall be used to calculate the MDA unless otherwise noted or approved by the Laboratory:

$$\mathrm{MDA} = \frac{4.65(\mathrm{BKG})^{0.5} + 2.71}{2.22 \times \mathrm{EFF} \times \mathrm{V} \times \mathrm{T_S} \times \mathrm{Y}}$$

where BKG = the total background counts,
EFF = the fraction detector efficiency,
V = the volume or unit weight,
T = the *sample* count duration, and
Y = the fractional *chemical* recovery obtained from the *tracer* recovery.

Depending on the type of *analysis*, other terms may also be required in the denominator (e.g., gamma abundance).

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

No further action (NFA). A recommendation that not further investigation or remediation is warranted based on specific criteria.

Nondetect. Sample result that is less than the MDL. The laboratory reports nondetects as undetected at the EQL.

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

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

Polychlorinated biphenyls (PCBs). Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substances. PCBs are colorless, odorless compounds that are chemically, electrically, and thermally stable and have proven to be toxic to both humans and animals.

Potential release site (PRS). A site suspected of releasing or having the potential to release contaminants into the environment. PRS is a generic term that includes solid waste management units, hazardous waste sites listed in Module 7 of the Laboratory's Hazardous Waste Facility Permit, and sites that have been identified as potentially contaminated by radioactivity.

Quality assurance. All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily in service.

Quality control (QC). (1) All those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements. QC is the process through which actual quality performance is measured and compared with standards. (2) All methods and procedures used to obtain accurate and reliable results from environmental sampling and analysis. Includes rules for when, where, and how samples are taken; sample storage, preservation and transport; and the use of blanks, duplicates, and split samples during the analysis.

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

RCRA facility investigation (RFI). The investigation that determines if a release has occurred and the nature and extent of the contamination at a hazardous waste facility. The RFI is generally equivalent to the remedial investigation portion of the Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) process.

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

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

Regional aquifer. Geologic material(s) or unit(s) of regional extent whose saturated portion yields significant quantities of water to wells, contains the regional zone of saturation, and is characterized by the regional water table or potentiometric surface.

Release. Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous waste or hazardous constituents into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any hazardous wastes or hazardous constituents).

Reporting limit. The numerical value that an analytical laboratory (in conjunction with its client) selects to determine if a target analyte is detected. Results below the RL are considered not detected, while results greater than the RL are considered detected. The RLs are not necessarily based on instrument sensitivity. RLs can be established at the instrument detection limit, method detection limit, estimated quantitation limit, and contract-required detection limit.

Resource Conservation and Recovery Act (RCRA). The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976. (40 CFR 270.2)

Runoff. The portion of the precipitation on a drainage area that is discharged from the area either by sheet flow or adjacent stream channels.

Run-on. Surface water flowing onto an area as a result of runoff occurring higher up the slope.

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

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

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

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

Sediment. (1) A mass of fragmented inorganic solid that comes from the weathering of rock and is carried or dropped by air, water, gravity, or ice; or a mass that is accumulated by any other natural agent and that forms in layers on the earth's surface such as sand, gravel, silt, mud, fill, or loess. (2) A solid material that is not in solution and either is distributed through the liquid or has settled out of the liquid.

Site characterization. Defining the pathways and methods of migration of the hazardous waste or constituents, including the media affected, the extent, direction and speed of the contaminants, complicating factors influencing movement, concentration profiles, etc. (U.S. Environmental Protection Agency, May 1994. "RCRA Corrective Action Plan, Final," Publication EPA-520/R-94/004, Office of Solid Waste and Emergency Response, Washington, DC)

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

Solid waste management unit (SWMU). Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. This definition includes regulated units (i.e., landfills, surface impoundments, waste piles, and land treatment units) but does not include passive leakage or one-time spills from production areas and units in which wastes have not been managed (e.g., product storage areas).

Spring. The site where groundwater discharges to the ground surface.

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

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

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

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

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

Tentatively identified compound (TIC). Chemical compound detected in a sample that is not a target analyte, IS, or surrogate compound. Up to 30 chromatographic peaks may be subject to mass spectral matching for identification as TICs.

Topography. The physical configuration of the land surface in an area.

Tracer. A substance, usually a radioactive isotope, added to a sample to determine the efficiency (chemical or physical losses) of the chemical extraction, reaction, or analysis. The tracer is assumed to behave in the same manner as that of the target radionuclides. Recovery guidelines for tracer results are 30% to 110% under the current contract laboratory statement of work and will be 40% to 105% under the new statement of work. Correction of the analytical results for the tracer recovery is performed for each sample. The concentration of the tracer added needs to be sufficient to result in a maximum of 10% uncertainty at the 95% confidence level in the measured recovery.

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

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

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

US Department of Energy (DOE). Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

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

Vadose zone. The unsaturated zone. Portion of the subsurface above the regional water table in which pores are not fully saturated.

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

A-3.0 METRIC CONVERSION TABLES

Metric to English Conversions

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (μg/g)	1	parts per million (ppm)
liters (l)	0.26	gallons (gal.)
milligrams per liter (mg/l)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

Metric Prefixes

Term	Power of 10	Symbol
mega-	10^6	M
kilo-	10^3	k
deci-	10^{-1}	d
centi-	10^{-2}	c
milli-	10^{-3}	m
micro-	10^{-6}	μ
nano-	10^{-9}	n
pico-	10^{-12}	p

Appendix B

VCM Checklist and Fact Sheet

Accelerated Corrective Action (ACA) Checklist and Field Work Authorization Form

PRS Number: 21-011(k) ☒ HSWA ☐ Non-HSWA

Yes	No	
X		Fact sheet describing planned activities is complete and attached to checklist.
X		COPC(s) for human health risk (HH), ecological risk (ECO), or other requirements are known or will be determined during accelerated site characterization.
X		Nature and extent of contamination is defined or accelerated site characterization is planned as part of this action to define nature and extent and to guide cleanup.
X		Cleanup levels/preliminary remediation goals (PRGs) are appropriate.
X		Remedy is obvious.
X		Time for removal is less than six months.
X		Remedy is final.
X		Land use assumptions are straightforward.
X		Treatment, Storage, and Disposal (TSD) Facilities are available for waste type and volume.
X		Cleanup cost is reasonable for the planned action and meets accelerated decision logic criterion for decision to proceed with ACA.
X		Briefing for NMED is required.

Explain criteria not checked above:

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Accelerated Corrective Action (ACA) Checklist and Field Work Authorization Form

Page 2 of 2

PRS Number: 21-011(k) ☒ HSWA ☐ Non-HSWA

Upon reviewing the Accelerated Corrective Action Fact Sheet and the criteria checklist above, the appropriate Accelerated Corrective Action approach for the PRS(s) is (check one): ☐ VCA ☒ VCM

Signatures of the Representative for UC-Laboratory, DOE-LAAO, and NMED-HRMB:

UC: John Hopkins, MDA Focus Area Leader
(Print Name and Title, then Sign) (Date)

DOE: Woody Woodworth, LAAO
(Print Name and Title, then Sign) (Date)

NMED: Vicki Maranville, NMED-HWB
(Print Name and Title, then Sign) (Date)

The undersigned have reviewed the final plan and believe that it fully satisfies the appropriate Accelerated Corrective Action Approach.

Signatures of the Representative for UC-LANL and DOE-LAAO

UC:
(Print Name and Title, then Sign) (Date)

DOE:
(Print Name and Title, then Sign) (Date)

Action	Date	Correspondence ID
VCA or VCM plan submitted to NMED		
NOD or RSI received from NMED		
Laboratory response to NOD or RSI		
NMED approval of VCA or VCM plan		

After reviewing the VCA or VCM plan for the site(s) listed above and believing that the ACA process and VCA or VCM criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager
(Signature) (Date)

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Voluntary Corrective Measure Fact Sheet for PRS 21-011(k)
Confirmation Sampling and Removal of Residual Contamination
SRS: 21-011(k) = 67
Erosion Matrix Score: 21-011(k) = 72

OPERATIONAL HISTORY

Potential Release Site (PRS) 21-011(k) was the national pollutant discharge elimination system (NPDES)-permitted outfall (NPDES outfall no. EPA050050) for treated industrial wastewater from Buildings TA-21-35 and -257, the former industrial wastewater treatment plants (WWTP) at TA-21, and is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit. The PRS consists of a drain line from two wastewater treatment tanks that discharged to an outfall ditch, which channeled wastewater to the canyon rim, and down the hillside toward DP Canyon. The ditch is no longer visible; however, a 4-inch cast iron drain line is located approximately 55 feet north of the TA-21 perimeter road in the area where the outfall ditch would have ended. A gently sloping, rocky surface extends from the outfall pipe approximately 30 feet to the canyon rim.

TA-21,the former plutonium processing facility at LANL, began plutonium operations in 1945 and ceased operations in 1978. The first WWTP, TA-21-35 was activated in 1952 and operated until 1967 when the new WWTP, TA-21-257, came on line. Both facilities treated wastes from DP West and DP East consisting of liquids remaining after plutonium extraction and processing of radioactive materials for nuclear weapons and space rocket research projects. The treatment process mixed the raw waste with lime, ferric sulfate, and coagulant aids. The waste was then pumped to a flocculator and onto a settling tank. Settled effluent was pumped through a pressure filter and sampled to verify treatment. If the effluent was determined to be adequately treated, it was pumped to two final effluent holding tanks (tanks TA-21-112 and TA-21-113). From tanks TA-21-112 and TA-21-113, the wastewater was piped northeast toward DP Canyon and discharged on the north side of DP Mesa (Fig. 1.0-1). This wastewater contained a variety of radioactive and chemical constituents. Discharges of treated wastewater to the outfall were discontinued in the early 1990's; however, Building TA-21-257 is still used for pretreatment of wastewater prior to discharge to the TA-50 waste line.

Previous Investigations and Contaminants of Potential Concern

PRS 21-011(k) was investigated in 1988 by DOE and by the ER Project in 1992 and 1993 and reported on in 1995 in the Final Draft for the OU 1106 Addendum to Phase 1B, 1C Report (LANL 1995, 52350). The initial radiation survey and soil sampling performed at PRS 21-011(k) in FY92 indicated the presence of radionuclide contamination. Additional soil sampling and a radiation survey were performed during the FY93 field season to further define the extent of contamination found in FY92.

An interim action (IA) plan was prepared in 1996 (LANL 1996, 01-0042). The IA was implemented during 1996 and 1997 and described in the *Interim Action Report for TA-21, Potential Release Site 21-011(k)*, submitted to NMED on April 10, 1997 (LANL 1997, 55648). The objectives of the IA were to remove a portion of the radionuclide source term from the outfall area of the PRS and install storm water control measures as a best management practice (BMP). Soil excavated from PRS 21-011(k) during the 1996 IA (390 cubic yards) was characterized in the field and transported to TA-54, MDA G for disposal. Storm water controls were installed in 1997 and upgraded in August 1999. The controls are routinely inspected and maintained by LANL ESH-18 representatives.

The COPCs for this PRS include americium-241, cesium-137, plutonium-238 and -239, and strontium-90. Although analytical results from the 1988, 1992 and 1993 investigations did not identify non-radioactive, RCRA-regulated organic and inorganic chemicals as COPCs, waste characterization samples and a percentage of confirmation samples will be submitted for analysis of metals, SVOCs, and radionuclides.

VOCs are not anticipated to be present at the surface because they were not detected when 390 cubic yards of soil were excavated during the IA in 1996. However, VOCs will be included in the analytical suite for a percentage of post excavation confirmation samples and waste characterization samples.

VCM Rationale

SWMU 21-011(k) is located on the north side of DP mesa on a hillside that leads to DP Canyon. The most northern extent of the slope's toe is within the high water table of the DP Canyon streambed. SWMU 21-011(k) has been identified as the primary source of radionuclide contamination in sediments in DP Canyon (LANL 1999, 63915). The existing radionuclide inventory in surface soils and sediment at the site is approximately four times greater than the inventory in the sediments in DP Canyon. Because of the site's high potential for erosion (erosion matrix score of 72 out of 100, Appendix C), there is the potential for radionuclides from the site to increase the radionuclide inventory in DP Canyon. Therefore, remediation of the site is considered a priority for both LANL and the New Mexico Environment Department (NMED).

SWMU 21-011(k) is located on DOE property that will remain under institutional control for at least the next 100 years. Land use for TA-21 is, and will continue to be, industrial under DOE ownership and control. However, the SWMU 21-011(k) site is not a typical industrial site as it is located on a steep hillside that slopes to the bottom of a canyon. Consequently, the more realistic trail user scenario is proposed for screening soil and sediment areas with potentially elevated radionuclide activity exceeding acceptable human health and ecological risk levels.

VCM Implementation

The Laboratory's ER Project will conduct the following activities to achieve the project objectives. The 4-inch cast iron drainline that delivered the contaminating industrial effluent to the site will be excavated and disposed.

Contaminated soil, tuff, and sediment from areas at the site with Cs-137 concentrations above 150 pCi/g and sediment in the western drainage with Am-241 concentrations above 170 pCi/g will be excavated and transported to Area G at TA-54 for disposal. Once all excavation is complete post excavation radiation surveys and confirmatory sampling will be conducted to ensure that the DOE 5400.5 elevated activity criterion has been achieved. The site will then be restored by installing an engineered cover over areas where soil, tuff, and sediment with Cs-137 concentrations above 150 pCi/g was removed and the area in the western drainage where sediment with Am-241 concentrations above 170 /Ci/g was removed will also be restored. The site will be reseeded and stormwater run-on and runoff controls will be installed.

Anticipated Waste Types and Volumes

Three separate waste streams are anticipated from this VCM as presented in the following table.

Waste Stream	Waste Type	Anticipated Volume
Radionuclide-contaminated soil and tuff	Solid — LLW	2,000 yd^3
Radionuclide-contaminated decon water from heavy equipment	Liquid — LLW	250 gallons
PPE, plastic sheeting, disposable sampling equipment, and soil samples	Solid — LLW	10 yd^3

Estimated Cost

Based on current resource estimates, all waste generated during this VCM is expected to be disposed of at TA-54 as LLW at a cost of approximately $1.2 million for waste disposal only. However, final disposal options will be re-evaluated during the VCM implementation planning process. With anticipated subcontractor costs and analytical costs the total estimated cost of this VCM is approximately $2.2 million.

Schedule

The field work portion of this VCM began in November 2002 and will be completed by July 2003. The fieldwork includes soil and tuff removal, confirmatory sample collection and analysis, waste management, and site restoration.

Reference List of Past Plans, Reports, etc.

Environmental Restoration Project, August 1999. "Evaluation of Sediment and Alluvial Groundwater in DP Canyon," Los Alamos National Laboratory report LA-UR-99-4238, Los Alamos, New Mexico. (Environmental Restoration Project 1999, 63915)

LANL (Los Alamos National Laboratory), May 1991. "RFI Work Plan for Operable Unit 1106, Section 15.4," Los Alamos National Laboratory Report LA-UR-91-962, Los Alamos, New Mexico. (LANL 1991, 07529)

LANL (Los Alamos National Laboratory), January 1995. "Final Draft for the OU 1106 Addendum to Phase 1B, 1C Report, TA-21," Los Alamos National Laboratory report LA-UR-94-4360, Los Alamos, New Mexico. (LANL 1995, 52350)

LANL (Los Alamos National Laboratory), 1996. "Interim Action Plan for TA-21: PRS 21-011(k)," Los Alamos National Laboratory report LA-UR-96-1609, Los Alamos, New Mexico. (LANL 1996, 54790.2)

LANL (Los Alamos National Laboratory), April 1997. "Interim Action Report for Potential Release Site 21-011(k) Discharge System," Los Alamos National Laboratory report, Los Alamos, New Mexico. (LANL 1997, 55648.2)

Appendix C

Standard Operating Procedure 2.01

STANDARD OPERATING PROCEDURE

Title:	Identifier:	Revision:	Effective Date:
Surface Water Site Assessments	**ER-SOP-2.01**	**0**	**9/21/99**
	ER Catalog Number:	**ER19990087**	

ER PROJECT

LOS ALAMOS NATIONAL LABORATORY

Surface Water Site Assessments

Table of Contents

Surface Water Site Assessments

NOTE: Environmental Restoration (ER) Project personnel may produce paper copies of this procedure printed from the controlled-document electronic file located at http://erinternal.lanl.gov/documents/Procedures/sops.htm. However, it is their responsibility to ensure that they are trained to and utilizing the current version of this procedure. The Quality Program Project Leader (QPPL) may be contacted if text is unclear.

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the process for determining whether a Los Alamos National Laboratory (Laboratory) ER Project site has the potential to adversely effect surface water quality.

Note: The ER Project at the Laboratory is responsible for the investigation and remediation of solid waste management units (SWMUs) under the Resource Conservation and Recovery Act (RCRA) and areas of concern (AOCs) under the direction of the Department of Energy (DOE). During the investigation and remediation phases, information may be gathered that indicates that contaminant conditions may be present at the site that might affect surface water quality. Depending on the contaminant found, its concentration, and the erosion/sediment transport potential, it may be necessary to develop an action plan to mitigate the problem. The mitigation could include site restoration and/or stabilization.

2.0 TRAINING

2.1 All users of this SOP are trained by self-study, and the training is documented in accordance with QP-2.2. For consistency, Water Quality and Hydrology Group (ESH-18) personnel may be contacted for assistance.

2.2 The **Field Team Leader** (FTL) will monitor the proper implementation of this procedure and ensure that relevant team members have completed all applicable training assignments in accordance with QP-2.2.

3.0 DEFINITIONS

3.1 *Area of concern (AOC)* — Any suspected release of hazardous waste or hazardous waste constituent which is not directly associated with a SWMU (EPA, 1986).

3.2 *Best Management Practices (BMPs)* — BMPs mean schedules of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States.

BMPs also include treatment requirements, operating procedures, and practices to control facility site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw-material storage areas.

3.3 _Canopy_ — The ground cover formed by the leafy upper branches of surrounding trees and shrubs.

3.4 _Chemical of potential concern (COPC)_ — A chemical detected at a specific site that has the potential to adversely affect human or animal receptors due to its concentration (e.g., above regulatory screening action levels [SALs] or upper tolerance limit [UTL] values), distribution, and mechanism of toxicity. The chemical remains a concern until exposure pathways and receptors are evaluated in a site-specific risk assessment.

3.5 _Ground cover_ — The covering of naturally occurring soils by either natural or man-made mechanisms (e.g., grasses, pine needles, asphalt, concrete, etc.).

3.6 _Gully erosion_ — The erosion process whereby water accumulates in narrow channels and, over short periods, removes the soil from this narrow area to considerable depths, which can range from 1 ft to as much as 50 ft.

3.7 _Potential release site (PRS)_ — A site suspected of releasing or having the potential to release contaminants into the environment. PRS is a generic term that includes SWMUs, hazardous-waste sites listed as Module VII of the Laboratory's Hazardous Waste Facility Permit, and sites that have been identified as potentially contaminated by radioactivity. The ER Project has the responsibility for investigating and, if necessary, cleaning up such sites on and around the Laboratory.

3.8 _Refuse_ — Includes food; swill; carrion; slops; and all substances from the preparation, cooking, and consumption of food. It also includes all substances that result from the handling, storage, and sale of food products; the carcasses of animals; junked parts of automobiles and other machinery; oil; discarded furniture; paper cartons; cans; bottles; tree branches; yard trimmings; ashes; and all unwholesome material.

3.9 _Rill erosion_ — An erosion process in which numerous small channels only several inches deep are formed by concentrated runoff that flows during and immediately following rain storms.

3.10 _Runoff_ — The portion of the precipitation on a drainage area that is discharged from the area either by sheet flow or adjacent stream channels.

3.11 _Run-on_ — Surface water flowing onto an area as a result of runoff occurring higher up the slope.

3.12 _Slope_ — A slope is a ratio of units of elevation change to units of horizontal change usually expressed in degrees.

3.13 _Solid Waste Management Unit (SWMU)_ — Any discernible unit where solid wastes have been or may have been placed at any time, regardless of whether the unit was intended for the management of solid or hazardous wastes. These areas include anywhere solid wastes have been routinely and systematically released. All SWMUs are listed in Module VIII of HSWA Permit.

3.14 _Watercourse_ — Any river, creek, arroyo, canyon, draw, wash, or other channel that has definite banks and beds with visual evidence of occasional flow of water.

3.15 _Water pollution_ — Either introducing or permitting the introduction into water, either directly or indirectly, of one or more water contaminants in such quantity and of such duration as may, with reasonable probability, injure human health, animal or plant life, or property, or to unreasonably interfere with the public welfare or the use of the property.

4.0 BACKGROUND AND PRECAUTIONS

Members of ESH-18 perform a variety of kinds of fieldwork around the Laboratory. All fieldwork conducted as part of this SOP will follow their group-specific activity hazards analysis (AHA) and additional requirements set forth by the Facility Management Unit (FMU).

5.0 EQUIPMENT

Equipment used when going into the field depends on the distance from the group office and the distance the field technician will be from the vehicle. Field personnel must have current certifications in First Aid and CPR. Additional training or specific PPE may be required; this depends on the work location. For this procedure the following equipment is needed before going into the field to perform any work:

- first aid kit in vehicle;
- radio or cellular phone communication;
- drinking water;
- camera for photodocumentation; and
- clipboard, pencils, markers, and/or white board.

6.0 PROCEDURE

Note: Deviations from SOPs are made in accordance with QP-4.2.

Streams, watercourses, and groundwater quality are regulated by the New Mexico Water Quality Control Commission (WQCC) Regulations. The water quality standards developed are enforced by the New Mexico Environment Department

(NMED) Surface and Ground Water Quality Bureaus (SWQB and GWQB, respectively) (see Attachment C for Summary Table). A surface water site assessment is made at a PRS using a checklist that has been developed to assess the erosion potential of each PRS. This evaluation checklist will aid in the prioritization of water-quality corrective actions and the BMPs necessary to protect surface water quality.

6.1 Overview Of Evaluation Process

PRSs are being investigated at the Laboratory to determine if they present a threat to human health or the environment. As information becomes available, water-quality concerns associated with a PRS may become evident. If contaminants are found to exist at the site above SALs in soil samples or above WQCC standards in surface water samples collected at the site and the topographic and vegetative state of the PRS suggests that migration of those contaminants could occur, a corrective action must be implemented.

6.2 Evaluating a PRS

The process is a two part evaluation. Apply this evaluation process to all ER Project sites that have not been recommended for "no further action" (NFA) *under criteria one, two, or three* as described in the April 1996, Document of Understanding (DOU). These three NFA criteria describe situations where either the site could not be located or did not exist, no waste or contamination is associated with the site, or no release to the environment from the site has occurred (e.g. the unit is inside of a building and no pathways to the environment exist, i.e., no floor drains exist).

Because of the large number of sites remaining in the project that do not fit the NFA criteria described above, sites must be prioritized for evaluation. The first sites that will be evaluated are those adjacent to drainages and canyon systems. After those are completed, evaluate the remaining sites.

6.2.1 The **ER Project** will initiate and complete Part A (see Attachment A) of the evaluation, which consists of compiling existing PRS analytical data, site maps, and knowledge of process information.

6.2.2 **ESH-18** personnel will complete Part B (see Attachment B) of the evaluation, which involves assessing the erosion/sediment transport potential at each PRS.

6.3 Implementing Corrective Actions

6.3.1 Prioritizing Evaluated PRSs for Site Actions

Parts A and B, when completed, will provide a basis for prioritizing and scheduling site actions needed to control undesirable-constituent surface-water runoff and constituent-laden sediments that are eroding from PRSs.

6.3.1.1 A Surface Water Assessment Team (SWAT), comprised of ER Project, ESH-18, DOE Oversight Bureau (DOE-OB), NMED SWQB, and facility representatives has been formed to evaluate the completed assessments.

6.3.1.2 To ensure the worst sites are evaluated first, the **SWAT** will prioritize sites identified as having bioaccumulators present (see Attachment D for bioaccumulator list). SWAT evaluations shall use only existing information and/or data for the PRS of interest as reported in Parts A and B of the ER-SOP-2.01 site assessment (Attachments A and B). The ability of the SWAT to efficiently evaluate a site is directly dependent upon the PRS documentation to date.

6.3.1.3 For sites where the Part B, Surface Water Site Assessment, score is higher than 50, the **SWAT** will complete an evaluation to assess the site for potential contaminant migration and to prioritize potential corrective actions for the site.

6.3.1.4 For sites where the Part B, Surface Water Site Assessment, score is equal to or less than 50, no immediate action is required. This score reflects a site where there is a low potential for constituents in surface water and/or sediment to migrate off the site. These sites may not be included in a SWAT evaluation, but shall continue, as necessary, to be evaluated for other possible unacceptable environmental risks, such as human health and ecological risks.

6.3.2 Implementing Site Actions and Tracking SWAT Recommendations

6.3.2.1 Sites with COPCs present and which have high erosion potential require the **SWAT** to write a summary to the appropriate owner of the site in which the recommended corrective action is described. These corrective actions can be either minimal activities such as BMPs, which will temporarily stabilize the site until a final remedy can be applied or the final remedy itself.

6.3.2.2 Temporary solutions require routine inspection and maintenance by the **site owner** to ensure their effectiveness. Final remedies will likely be contaminant removal or the application of an engineered solution to inhibit contamination migration while protecting state waters.

6.3.2.3 Upon completion of the corrective activities at a PRS, The **ER Project** and the **FMU** will generate an NFA report that describes the results of the actions.

6.3.2.4 **ESH-18** will review these written summaries in order to ensure all water-protection requirements are satisfied.

6.3.2.5 **ESH-18** will submit copies of these final reports to NMED and DOE-OB upon completion.

6.3.3 Financial Responsibility for Corrective Actions

6.3.3.1 The **ER Project** is responsible for ensuring that historic, inactive sites do not adversely effect the state's surface water quality. The ER Project will fund all corrective actions and stormwater BMPs at those sites.

6.3.3.2 For inactive sites that have been created since 1988 and active sites that might currently be affecting water quality, the **landlord** of those sites or **Facilities, Security, and Safeguard Division** (FSS) will fund those actions. ESH-18 will coordinate the implementation of corrective actions necessary at non-ER owned sites.

7.0 REFERENCES

The following documents have been cited within this procedure.

AP-02.1, Procedure for LANL ER Records Management

QP-2.2, Personnel Orientation and Training

QP-4.2, Standard Operating Procedure Development

EPA, "RCRA Facility Assessment Guidance," (OSWER, Washington, DC, 1986).

New Mexico Water Quality Control Commission, "State of New Mexico Ground and Surface Water Quality Protection Regulations," (New Mexico Water Quality Control Commission, Santa Fe, NM, 1995).

8.0 RECORDS

The **ER Project Office** is responsible for submitting the following records (processed in accordance with AP-02.1) to the Records Processing Facility.

8.1 Completed forms identified in Section 6.0

9.0 ATTACHMENTS

The document user may employ documentation formats different from those attached to/named in this procedure—as long as the substituted formats in use provide, as a minimum, the information required in the official forms developed by the procedure.

Attachment A: Constituent Assessment Form (form and completion instructions) (3 pages)

Attachment B: Surface Water Site Assessment (form, matrix, and completion instructions) (7 pages)

Attachment C: Table 1 - Summary of Regulatory Water Standards Used for ER Projects (5 pages)

Attachment D: Proposed ER Project Bioaccumulator List (1 page)

Constituent Assessment (Part A)

Site Information

1. PRS Number: ____________________ 2. Date/Time: ____________________

3. ER Point of Contact: ____________________ 4. FMU/Point of Contact: ______ / ________________

5. ☐ HSWA ☐ AOC (check both if AOC is on HSWA Permit) 6. Site Ranking System (SRS) #: ______________

7. Description of the historical operations of this PRS:

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

PRS Status

9. Action/Status to Date (check all that apply) — Date Completed or Anticipated

☐ None

Field Investigation ☐ Phase I ☐ Phase II .... ______________

Interim Measures ☐ IM ☐ BMPs .... ______________

Accelerated Cleanup ☐ VCA ☐ VCM .... ______________

Other ☐ Monitoring ☐ CMs .... ______________

Report Status ☐ RFI Report ☐ SAP .... ______________

☐ NFA/DOU — If checked, supply criteria number(s): ____________

Comments:

Sample Information

Y N

☐ ☐ 10. Have surface/sediment (depth less than 12 in.) samples been collected that reflect current site conditions?

If yes: 1) Attach data.
2) Include analyte name, value, units, location ID, sample ID, SAL, depth, and media (soil, tuff, etc.).
3) Please attach existing map that shows where samples were taken, if available.

☐ ☐ 11. Have surface water samples been collected that reflect site conditions?

If yes: 1) Attach data.
2) Include analyte name, value, units, location ID, filtered/nonfiltered, and flow data (if available).
3) Please attach existing map that shows where samples were taken, if available.

☐ ☐ 12. Is data pending? If yes: 1) List date data are anticipated: ____________________
2) Provide a list of COPCs identified in RFI Work Plan as an attachment.

13. ER Representative: ____
(Print name and title, then sign)

ER-SOP-2.01, R0

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Instructions for Completing a Constituent Assessment Form (Part A)

Part A of the procedure addresses both current and historic Laboratory operations that are known to have occurred at the PRS, the potential or probable constituents of concern for this PRS, and the status of work or actions taken at the PRS.

Completion of Part A shall use only existing information and/or data that are available for the PRS of interest. The form itself may be completed electronically or manually by attaching the historic and current operations description from an RFI work plan or RFI Report. Available data tables may be copied from a work plan/report or queried from Facility for Information, Management, Analysis and Display (FIMAD) but should be submitted as an attachment to the completed form. The ability to efficiently complete Part A is directly dependent upon the knowledge about the PRS of interest and the PRS documentation to date.

The FTL is responsible for the initiation and completion of the constituent-assessment process. Use an indelible dark-ink pen. Make an entry in each blank. For entry blanks for which no data are obtained, enter "UNK" for unknown, "N/A" for not applicable, or "ND" for not done, as appropriate. To change an entry, draw a single line through it, add the correct information above it, and date and initial the change. For all forms, complete the following information:

Site Information:

1. PRS Number — Use the PRS identification assigned by the ER Project for each site. If a map of the PRS and adjacent buildings within the Technical Area (TA) is available, please attach to Part A form.
2. Date/Time — The date and time when the measurement was made, in the following formats: DD-MMM-YY (e.g., 01-JAN-91) and the 24-hour clock time (0837 for 8:37 a.m. and 1912 for 7:12 p.m.).
3. ER Point of Contact — Provide the name of the individual who completed Part A or another individual who is very knowledgeable about the site and the information/data requested for Part A.
4. Facility Management Unit (FMU)/Responsible Party Contact — Provide the name of the individual who represents the facility where the PRS is located, and when coordination is necessary, is the point of contact for complying with Laboratory safety, security, or work-activity restrictions for the PRS.
5. Permit Information — Is this PRS listed on the Module VIII or is it an Area Of Concern (AOC) (potentially on the permit also)?
6. Site Ranking System Score — Provide the SRS score for this PRS from the most recent site ranking.
7. Description of the historic operations of this PRS — Provide information regarding past site activities that may typically be found in the SWMU report, an RFI work plan and/or RFI report. Include the identification of all constituents used at the PRS

as raw materials, known constituent product intermediates and product constituents for other known processes. If available, attach previous information not collected by the ER Project to Part A.

8. Description of current operations of this PRS (if any): Provide information regarding present site activities that may typically be found in the SWMU report, an RFI work plan and/or report or the current facility manager. Include the identification of all constituents used at the PRS as raw materials, known constituent-product intermediates and product constituents for other known processes. If information is available about these operations, attach the information to Part A.

PRS Status:

9. Action/Status to Date — Provide information on what type of field action has been proposed, completed, or is ongoing at a PRS. Also, provide information on the report/plan status of the site (e.g. RFI Work Plan, Sampling Analysis Plan, etc.). Check the appropriate fields on the form and provide the date that the action was completed or is anticipated to be completed. Provide additional information by circling the appropriate action (e.g., Phase I, under Field Investigation), or in the comment field.

Sample Information:

10. Soil/sediment sample descriptor information and sample data — Provide information/data that reflect only current ambient PRS field conditions which are above detection limits or background UTL values. Do not provide information/data with regard to past site conditions that no longer exist due to an action that has been taken at the PRS. Information/data are only for surface soils and sediments of less than 12 in. in depth.

    Provide additional information to support PRS data, (e.g., sample date; sample number; sample location coordinates' site map with sample locations; media — soil, sediment, tuff, etc.; data qualifiers; SALs; data detection/reporting limits; and supporting background data for the media where data is available). Editing or screening the data is not necessary at this time. All data that are available that meet the above specified identifiers should be reported.

11. Surface water sample descriptor information — If surface water sample information is available, provide information regarding sample date, location, whether sample was filtered/nonfiltered, and flow information if available. If surface water samples represent runoff from more than one PRS, the other involved PRSs and their constituents must also be identified.

12. If samples have been collected but data are not available, provide the anticipated date when the data could be available. Attach knowledge of process COPCs from RFI work plan.

13. ER Representative Identification — Print your name and position title, then sign.

Surface Water Site Assessment (Part B)

Site Information:

1a. PRS Number: __________ 1b. Structure Number: __________ 1c. FMU Number: __________

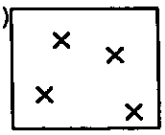
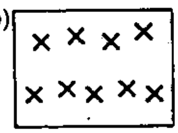
2. Date/Time: ____________________

Site Setting (check all that apply):

3. ☐ On mesa top (a).
☐ Within a bench of a canyon (b).
☐ In the canyon floor, but not in an established channel (c).
☐ Within an established channel in the canyon floor (d).

Explanation:

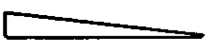
4. Estimated ground and/or canopy cover at site(deciduous leaves, pine needles, rocks, vegetation, trees, structures, asphalt, etc.):

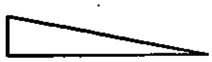
(a)

(b)

(c)

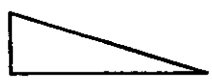

Estimated percentage of ground/canopy cover: ☐ 0% to 25% ☐ 25% to 75% ☐ 75% to 100%

Explanation:

5. Steepest slope at the impacted area:

(a)

☐ Less than 10%

(b)

☐ 10% to 30%

(c)

☐ 30% and greater

Explanation:

ER-SOP-2.01, R0	Los Alamos Environmental Restoration Project

Surface Water Site Assessment (Part B)

Runoff Factors:

Y N

☐ ☐ 6. Is there visible evidence of runoff discharging from the site? (If yes, answer questions 6a–6c below.)

☐ ☐ 6a. Is runoff channelized? If yes, describe: ☐ Man-made channel ☐ Natural channel

Explanation:

6b. Where does evidence of runoff terminate?

☐ Drainage or wetland (name) ____________________

☐ Within bench of canyon setting (name) ____________________

☐ Other (i.e., retention pond, meadow, mesa top) ____________________

Explanation:

☐ ☐ 6c. Has runoff caused visible erosion at the site? If yes, check type and explain below. ☐ Sheet ☐ Rill ☐ Gully

Explanation:

Run-on Factors:

Please rate the potential for stormwater to run onto this site (check either Item 7 or Item 9):

Y N

☐ ☐ 7. Are structures (i.e., buildings, roof drains, parking lots, storm drains) creating run-on to the site?

Explanation:

☐ ☐ 8. Are current operations (i.e., fire hydrants, NPDES outfalls) adversely impacting run-on to the site?

Explanation:

☐ ☐ 9. Are natural drainage patterns directing stormwater onto the site?

Explanation:

ER-SOP-2.01, R0	Los Alamos Environmental Restoration Project

Surface Water Site Assessment (Part B)

Assessment Finding:

Y N

❑ ❑ 10. Based on the criteria above and the assessment of this site, does a soil-erosion potential exist? (Refer to erosion-potential matrix)

11. Signature:

____

Water Quality/Hydrology Representative

______ Initials of the independent reviewer Check here when the information is entered in the database: ❑

This section is for ESH-18 notes, recommendations, and photographs.

Y N

❑ ❑ 12a. Is there visible trash/debris on the site?

❑ ❑ 12b. Is there visible trash/debris in the watercourse?

13a. Description of existing BMPs:

❑ ❑ 13b. Are BMPs being properly maintained? Provide description in "Other Internal Notes."

Other Internal Notes:

ER-SOP-2.01, R0	Los Alamos Environmental Restoration Project

Instructions for Completing a Surface Water Site Assessment Form (Part B)

ESH-18 or ER Project Regulatory Compliance personnel will complete Part B, the Surface Water Site Assessment. Part B addresses erosion potential and is part of a systematic approach to quantify surface-water impacts at Laboratory sites. This procedure describes the process for determining whether a site has the potential to adversely affect surface-water quality by erosion from run-off.

Field teams from ESH-18 or the ER Project will evaluate the field conditions to determine the potential for erosion or sediment migration. Based on the results of field evaluation, surface water corrective actions (BMPs) and/or NMED notifications may be required.

Photographs will be taken to help document the field characteristics at some sites. A consideration of the visual site conditions is necessary to accurately provide a frame of reference for the site. Photographs are taken to visually enhance the field-site condition descriptions.

Use an indelible dark-ink pen. Make an entry in each blank. For entry blanks for which no data are obtained, enter "UNK" for unknown, "N/A" for not applicable, or "ND" for not done, as appropriate. To change an entry, draw a single line through it, add the correct information above it, and date and initial the change. For all forms, complete the following information:

Site Information:

1a. PRS Number — Use the PRS identification assigned by the ER Project to the site.

1b. Structure Number — Provide the nearest technical area/structure number.

1c. FMU Number — Provide the facility management unit number.

2. Date/Time — The date and time when the measurement was made, in the following formats: DD-MMM-YY (e.g., 01-JAN-91) and the 24-hour clock time (0837 for 8:37 a.m. and 1912 for 7:12 p.m.).

Site Setting:

3. Check the appropriate setting(s) that best describes the location, in order of increasing concern, for the listed site.
   (a) Check "On mesa top" if site is situated on a defined mesa top (e.g., Three Mile Mesa).
   (b) Check "Within a bench in a canyon" if site is located over the edge of a mesa top and is either on a defined slope or bench (the original source may be located on mesa top).

(c) Check "In the canyon floor, but not in an established channel" if site is located in the bottom of the canyon exclusive of a defined drainage or bench setting. (A drainage is defined as having a bank and channel).

(d) Check "Within established channel in the canyon floor" if site is located in the defined drainage portion of the canyon channel. (A drainage is defined as having a bank and channel).

An explanation box is provided for a description of particular circumstances/ situations. Where more than one setting is checked, the most conservative will be used in scoring this criterion on the matrix. An example would be where a septic tank was located on a mesa top (a), but the outfall from the septic discharges over the mesa onto a defined slope or bench (b), the more conservative setting (b) would be used.

4. Check the appropriate percentage of canopy and ground cover that best compares with the provided pictorial illustration for the site location.

   - Check from 0% to 25% if ground/canopy cover at site visually compares best with example (a).
   - Check 25% to 75% if ground/canopy cover at site visually compares best with example (b).
   - Check greater than 75% if ground/canopy cover at site visually compares best with example (c).

   An explanation box is provided to describe the type(s) of ground cover (e.g., pine needles, grass, asphalt, rock, etc.) and canopy cover (e.g., pine/juniper, deciduous/evergreen) observed at the site. Where more than one percentage is checked, the most conservative will be used in scoring this criterion on the matrix. An example would be where a septic tank was located in a densely vegetated area (c), but the outfall from the septic discharges over the mesa top into a less vegetated area (b), the most conservative coverage (b) would be used

5. Check the appropriate slope(s) that best compare with the provided pictorial illustration for the site location.

   - Check less than 10% if slope at site visually compares to example (a).
   - Check 10% to 30% if slope at site visually compares to example (b).
   - Check greater than 30% if slope at site visually compares to example (c).

   An explanation box is provided to describe particular circumstances/situations. Where more than one slope steepness is checked, the most conservative will be used in scoring the criteria. An example would be where a septic tank was located on a mesa top (a), but the outfall from the septic discharges over the mesa onto a very steep slope (c), the most conservative slope (c) would be used.

Runoff Factors:

6. Is there visible evidence of water and/or sediment discharging from PRS? *If yes*, complete parts a, b, and c. *If no*, proceed to question number 7.

6a. Is runoff channelized? Check whether runoff discharges through man-made or natural drainage channels or from sheet flow. An explanation box is provided to describe the type of discharge.

6b. Where does evidence of runoff terminate? Check whether visual evidence of runoff terminates into a known canyon (e.g., Pajarito), into a known sub-drainage or wetland, or into other flat lying areas (e.g., bench setting, meadows, detention ponds, etc.). If runoff can be traced to an observable endpoint or drainage, provide an adequate description of that location.

6c. Has runoff caused visible erosion at the PRS? If yes, check sheet, rill, or gully erosion. An explanation box is provided to describe the visible signs of erosion and to provide an indication of the potential for the movement of surface sediments from the site.

Run-on Factors:

7. Are structures (i.e., buildings, roof drains, parking lots) creating run-on to this PRS?

   If structures, from existing or new construction for facilities, collect and/or divert storm water run-on onto the PRS being evaluated, check yes. An explanation box is provided to describe the potential for buildings, roof drains, and/or construction project sites larger than five acres, to increase the volume of run-on to the site.

8. Are current operations adversely impacting storm water run-on to the PRS?

   If current operations (e.g., NPDES outfalls, salvage material storage areas, septic discharges) could adversely impact run-on to the site being evaluated, check yes. Nonstormwater discharges such as fire-protection devices, potable-water-system tank overflow, and dust-suppression activities are also of interest. An explanation box is provided to describe which operations may be impacting run-on.

9. Are natural drainage patterns directing stormwater onto the PRS?

   If site is located in an area in which natural drainage patterns focus stormwater run-on onto a site, check yes. An explanation box is provided to describe the natural drainage that could potentially cause erosion.

   Typically, either question 7 or 9 would be selected independent of one another. If both are selected, then only one will be rated in the matrix because the weighting is identical.

Assessment Finding:

10 Based on the above criteria and the assessment of the site, does soil-erosion potential exist?

This is a subjective decision made by the field technician based on the evidence found at the site. The "potential" for soil erosion may exist without visible evidence of erosion being observed on the day of the assessment.

Signature:

11. Name of Water Quality/Hydrology or ER Project Representative — Provide name of person who completed the surface water site assessment for this site as a representative of ESH-18 or the ER Project. After completion, provide a copy to the appropriate representatives for the site.

ESH-18 Notes and Recommendations:

12a. Is there visible trash/debris located on site? If trash/debris is observed at the site, check yes and provide comments in "Other Internal Notes."

12b. Is there visible trash/debris in a watercourse? If trash/debris is observed within a watercourse as defined earlier in Section 3.15, check yes and provide comments in "Other Internal Notes".

13a. Description of existing BMPs. Provide a brief description of BMPs that currently exist at the site.

13b. Are BMPs being properly maintained? Check either yes/no and provide a description of the effectiveness or ineffectiveness of BMPs in "Other Internal Notes."

Summary of Regulatory Water Standards Used for ER Projects[a]

Analyte Code[b]	Chemical[c]	Drinking Water Standards: US EPA MCL[f] (µg/l)	Drinking Water Standards: NMED MCL[g] (µg/l)	NMED[d] WQCC[e] Surface Water Standards: Domestic Water Supply[h] (µg/l)	NMED WQCC Surface Water Standards: Livestock Watering[i] (µg/l)	NMED WQCC Surface Water Standards: Wildlife Habitat[j] (µg/l)	NMED WQCC Groundwater Standards: Human Health[k] (µg/l)	NMED WQCC Groundwater Standards: Domestic Water Supply[k] (µg/l)	NMED WQCC Groundwater Standards: Irrigation Use[k] (µg/l)
15972-60-8	Alachlor	2.0E+00	2.0E+00	—[m]	—	—	—	—	—
Al	Aluminum	5.0E+01[n]	—	—	5.0E+03	—	—	—	5.0E+03
Sb	Antimony	6.0E+00	6.0E+00	—	—	—	—	—	—
As	Arsenic (cancer endpoint)	5.0E+01	5.0E+01	5.0E+01	2.0E+02	—	1.0E+02	—	—
1912-24-9	Atrazine	3.0E+00	3.0E+00	—	—	—	—	—	—
Ba	Barium	2.0E+03	2.0E+03	1.0E+03	—	—	1.0E+03	—	—
71-43-2	Benzene	5.0E+00	5.0E+00	—	—	—	1.0E+01	—	—
50-32-8	Benzo[a]pyrene	2.0E-01	2.0E-01	—	—	—	7.0E-01	—	—
Be	Beryllium	4.0E+00	4.0E+00	—	—	—	—	—	—
117-81-7	Bis(2-ethylhexyl)phthalate (DEHP) (Di[ethylhexyl]phthalate)	6.0E+00	6.0E+00	—	—	—	—	—	—

[a] Compiled on 01/06/97 by Linda Nonno (665-0725, lnonno@lanl.gov). **Note: Values in this table are subject to change.** Verify that you are using current values by checking the ER Project web site before use (http://erinternal.lanl.gov).

[b] In order to enable joining in the FIMAD database, analyte codes replace CAS numbers for metals, radionuclides, and ions.

[c] Chemicals include inorganics, high explosives, and organic compounds (volatile and semivolatile organic compounds, pesticides, and polychlorinated biphenyls).

[d] New Mexico Environment Department

[e] Water Quality Control Commission

[f] Maximum Contaminant Level (MCL) concentration from "Drinking Water Regulations and Health Advisories," October 1996, US Environmental Protection Agency (EPA) Office of Water, Washington, DC. (EPA 1996,1380).

[g] Maximum Contaminant Level (MCL) concentration from "Drinking Water Regulations," Title 20, Chapter 7, Part 1, NMED Drinking Water Bureau, January 1995, Santa Fe, NM (State of New Mexico 1995,1268).

[h] Domestic Water Supply Standard from "Standards for Interstate and Intrastate Streams" (i.e., New Mexico surface water standards for domestic water supply), Title 20, Chapter 6, Part I, NMED WQCC, January 1995, Santa Fe, NM (State of New Mexico 1995,1267). Based on the dissolved (i.e., filtered) portion with the exception of mercury. For radium-226 + radium-228, tritium, and gross alpha, the standard is based on the total (i.e., nonfiltered) portion.

[i] Livestock Watering Standard from "Standards for Interstate and Intrastate Streams," Title 20, Chapter 6, Part 1, NMED WQCC, January 1995, Santa Fe, NM (State of New Mexico 1995,1264 Based on the dissolved (i.e., filtered) portion of water samples for inorganic chemicals with the exception of mercury.

[j] Wildlife Habitat Standard from "Standards for Interstate and Intrastate Streams," Title 20, Chapter 6, Part 1, NMED WQCC, January 1995, Santa Fe, NM (State of New Mexico 1995,1267). Based on total (i.e., nonfiltered) recoverable selenium and total mercury.

[k] Groundwater standard from "New Mexico Water Quality Control Commission Regulations,:" Title 20, Chapter 6, Part 2, NMED WQCC, December 1995, Santa Fe, NM (State of New Mexico 1995,1318). Based on dissolved (i.e., filtered) portion with the exception of *mercury*, organic chemicals, and nonaqueous phase liquids (such as oil).

[m] "—" = no standard.

[n] US EPA Secondary Maximum Contaminant Level (SMCL) concentration from "Drinking Water Regulations and Health Advisories," May 1995, US EPA Office of Water Washington, DC (EPA 1996,1380).

Summary of Regulatory Water Standards Used for ER Projects (continued)

Analyte Code	Chemical	Drinking Water Standards		NMED WQCC Surface Water Standards			NMED WQCC Groundwater Standards		
		US EPA MCL (µg/l)	NMED MCL (µg/l)	Domestic Water Supply (µg/l)	Livestock Watering (µg/l)	Wildlife Habitat (µg/l)	Human Health (µg/l)	Domestic Water Supply (µg/l)	Irrigation Use (µg/l)
B	Boron	—	—	—	5.0E+03	—	—	—	7.5E+02
Cd	Cadmium	5.0E+00	5.0E+00	1.0E+01	5.0E+01	—	1.0E+01	—	—
1563-66-2	Carbofuran	4.0E+01	4.0E+01	—	—	—	—	—	—
56-23-5	Carbon Tetrachloride	5.0E+00	5.0E+00	—	—	—	1.0E+01	—	—
57-74-9	Chlordane	2.0E+00	2.0E+00	—	—	—	—	—	—
Cl(-1)	Chloride	2.5E+05[n]	—	—	—	—	—	2.5E+05	—
108-90-7	Chlorobenzene (Monochlorobenzene)	1.0E+02	1.0E+02	—	—	—	—	—	—
67-66-3	Chloroform (Trichloromethane)	1.0E+02[o]	1.0E+02[o]	—	—	—	1.0E+02	—	—
Cr	Chromium (must include both trivalent and hexavalent forms)	1.0E+02	1.0E+02	5.0E+01	1.0E+03	—	5.0E+01	—	—
Co	Cobalt	—	—	—	1.0E+03	—	—	—	5.0E+01
Cu	Copper	1.3E+03[p]	1.3E+03[p]	—	5.0E+02	—	—	1.0E+03	—
Cn(-1)	Cyanide	2.0E+02	2.0E+02	2.0E+02	—	—	2.0E+02	—	—
75-99-0	Dalapon	2.0E+02	2.0E+02	—	—	—	—	—	—
96-12-8	1,2-Dibromo-3-chloropropane	2.0E-01	2.0E-01	—	—	—	—	—	—
106-93-4	1,2-Dibromoethane (Ethylene Dibromide)	5.0E-02	5.0E-02	—	—	—	1.0E-01	—	—
95-50-1	1,2-Dichlorobenzene(o)	6.0E+02	6.0E+02	—	—	—	—	—	—
541-73-1	1,3-Dichlorobenzene(m)	6.0E+02	—	—	—	—	—	—	—
106-46-7	1,4-Dichlorobenzene(p)	7.5E+01	7.5E+01	—	—	—	—	—	—
75-34-3	1,1-Dichloroethane	—	—	—	—	—	2.5E+01	—	—
107-06-2	1,2-Dichloroethane (EDC)	5.0E+00	5.0E+00	—	—	—	1.0E+01	—	—
75-35-4	1,1-Dichloroethylene (1,1-DCE)	7.0E+00	7.0E+00	—	—	—	5.0E+00	—	—
156-59-2	1,2-Dichloroethylene (cis)	7.0E+01	7.0E+01	—	—	—	—	—	—
156-60-5	1,2-Dichloroethylene (trans)	1.0E+02	1.0E+02	—	—	—	—	—	—
94-75-7	2,4-Dichlorophenoxyacetic Acid	7.0E+01	7.0E+01	—	—	—	—	—	—

[n] US EPA Secondary Maximum Contaminant Level (SMCL) concentration from "Drinking Water Regulations and Health Advisories," May 1995, US EPA Office of Water Washington, DC (EPA 1996,1380).

[o] The State (State of New Mexico 1995, 1268) and EPA (EPA 1996, 1380) MCL for chloroform is the MCL for total trihalomethanes. Total trihalomethanes is defined as the sum of the concentration of the following trihalomethane compounds: chloroform, dibromochloromethane, bromodichloromethane, and tribromomethane (bromoform).

[p] US EPA MCL is under review (EPA 1996,1380). Number presented is the EPA action level. Although the EPA MCL is under review, to NMED Drinking Water Bureau has adopted the action level.

Summary of Regulatory Water Standards Used for ER Projects (continued)

Analyte Code	Chemical	Drinking Water Standards: US EPA MCL (μg/l)	Drinking Water Standards: NMED MCL (μg/l)	NMED WQCC Surface Water Standards: Domestic Water Supply (μg/l)	NMED WQCC Surface Water Standards: Livestock Watering (μg/l)	NMED WQCC Surface Water Standards: Wildlife Habitat (μg/l)	NMED WQCC Groundwater Standards: Human Health (μg/l)	NMED WQCC Groundwater Standards: Domestic Water Supply (μg/l)	NMED WQCC Groundwater Standards: Irrigation Use (μg/l)
78-87-5	1,2-Dichloropropane	5.0E+00	5.0E+00	—	—	—	—	—	—
103-23-1	Di(2-ethylhexyl)adipate	4.0E+02	4.0E+02	—	—	—	—	—	—
88-85-7	Dinoseb	7.0E+00	7.0E+00	—	—	—	—	—	—
85-00-7	Diquat	2.0E+01	2.0E+01	—	—	—	—	—	—
145-73-3	Endothall	1.0E+02	1.0E+02	—	—	—	—	—	—
72-20-8	Endrin	2.0E+00	2.0E+00	—	—	—	—	—	—
100-41-1	Ethylbenzene	7.0E+02	7.0E+02	—	—	—	7.5E+02	—	—
F(-1)	Fluoride	4.0E+03[n]	4.0E+03	—	—	—	1.6E+03	—	—
1071-83-6	Glyphosate	7.0E+02	7.0E+02	—	—	—	—	—	—
76-44-8	Heptachlor	4.0E-01	4.0E-01	—	—	—	—	—	—
1024-57-3	Heptachlor epoxide	2.0E-01	2.0E-01	—	—	—	—	—	—
118-74-1	Hexachlorobenzene	1.0E+00	1.0E+00	—	—	—	—	—	—
58-89-9	HCH (gamma) Lindane	2.0E-01	2.0E-01	—	—	—	—	—	—
77-47-4	Hexachlorocyclopentadiene	5.0E+01	5.0E+01	—	—	—	—	—	—
Fe	Iron	3.0E+02[n]	—	—	—	—	1.0E+03	—	—
Pb	Lead	1.5E+01[p]	1.5E+01[p]	5.0E+01	1.0E+02	—	5.0E+01	—	—
Mn	Manganese	5.0E+01[n]	—	—	—	—	—	2.0E+02	—
Hg	Mercury (inorganic)	2.0E+00	2.0E+00	2.0E+00	1.0E+01	1.2E+02	2.0E+00	—	—
72-43-5	Methoxychlor	4.0E+01	4.0E+01	—	—	—	—	—	—
75-09-2	Methylene Chloride (Dichloromethane)	5.0E+00	5.0E+00	—	—	—	1.0E+02	—	—
Mo	Molybdenum	—	—	—	—	—	—	—	1.0E+03
n/a[q]	Naphthalene + monomethylnaphthalenes	—	—	—	—	—	3.0E+01	—	—
Ni	Nickel (soluble salts)	—	1.0E+02	—	—	—	—	—	2.0E+02
$NO_3(-1)$	Nitrate (as N)	1.0E+04	1.0E+04	1.0E+04	—	—	1.0E+04	—	—
NO_2/NO_3	Total Nitrate + Nitrate (as N)	1.0E+04	1.0E+04	—	—	—	—	—	—

[n] US EPA Secondary Maximum Contaminant Level (SMCL) concentration from "Drinking Water Regulations and Health Advisories," May 1995, US EPA Office of Water Washington, DC (EPA 1996,1380).

[p] US EPA MCL is under review (EPA 1996,1380). Number presented is the EPA action level. Although the EPA MCL is under review, to NMED Drinking Water Bureau has adopted the action level.

[q] n/a = not applicable

Summary of Regulatory Water Standards Used for ER Projects (continued)

Analyte Code	Chemical	Drinking Water Standards US EPA MCL (µg/l)	Drinking Water Standards NMED MCL (µg/l)	NMED WQCC Surface Water Standards Domestic Water Supply (µg/l)	NMED WQCC Surface Water Standards Livestock Watering (µg/l)	NMED WQCC Surface Water Standards Wildlife Habitat (µg/l)	NMED WQCC Groundwater Standards Human Health (µg/l)	NMED WQCC Groundwater Standards Domestic Water Supply (µg/l)	NMED WQCC Groundwater Standards Irrigation Use (µg/l)
NO_2(-1)	Nitrite (as N)	1.0E+03	1.0E+03	—	—	—	—	—	—
23135-22-0	Oxamyl	2.0E+02	2.0E+02	—	—	—	—	—	—
87-86-5	Pentachlorophenol	1.0E+00	1.0E+00	—	—	—	—	—	—
pH	pH	6.5–8.5 pH[n]	—	—	—	—	—	—	—
n/a[q]	Phenols (Total of all phenol cmpds)	—	—	—	—	—	—	5.0E+00	—
1918-02-1	Picloram	5.0E+02	5.0E+02	—	—	—	—	—	—
1336-36-3	Polychlorinated biphenyls (PCBs)	5.0E-01	5.0E-01	—	—	—	1.0E+00	—	—
Se	Selenium	5.0E+01	5.0E+01	5.0E+01	5.0E+01	2.0E+00	5.0E+01	—	—
Ag	Silver	1.0E+02[n]	—	5.0E+01	—	—	5.0E+01	—	—
122-34-9	Simazine	4.0E+00	4.0E+00	—	—	—	—	—	—
SO_4	Sulfate	2.5E+05[n]	—	—	—	—	—	6.0E+05	—
100-42-5	Styrene	1.0E+02	1.0E+02	—	—	—	—	—	—
1746-01-6	2,3,7,8-TCDD (Dioxin)	3.0E-05	3.0E-05	—	—	—	—	—	—
79-34-5	1,1,2,2-Tetrachloroethane	—	—	—	—	—	1.0E+01	—	—
127-18-4	Tetrachloroethylene (PCE)	5.0E+00	5.0E+00	—	—	—	2.0E+01	—	—
Tl	Thallium	2.0E+00	2.0E+00	—	—	—	—	—	—
108-88-3	Toluene	1.0E+03	1.0E+03	—	—	—	7.5E+02	—	—
TDS	Total Dissolved Solids	5.0E+05[n]	—	—	—	—	—	1.0E+06	
8001-35-2	Toxaphene	3.0E+00	3.0E+00	—	—	—	—	—	—
120-82-1	1,2,4-Trichlorobenzene	7.0E+01	7.0E+01	—	—	—	—	—	—
71-55-6	1,1,1-Trichloroethane	2.0E+02	2.0E+02	—	—	—	6.0E+01	—	—
79-00-5	1,1,2-Trichloroethane	5.0E+00	5.0E+00	—	—	—	1.0E+01	—	—
79-01-6	Trichloroethylene (TCE)	5.0E+00	5.0E+00	—	—	—	1.0E+02	—	—
93-72-1	2-(2,4,5-Trichlorophenoxy)propionic Acid (2,4,5-TP)	5.0E+01	5.0E+01	—	—	—	—	—	—
$U^{SOLUBLE}$	Uranium (soluble salts)	—	—	5.0E+03	—	—	5.0E+03	—	—
V	Vanadium	—	—	—	1.0E+02	—	—	—	—
75-01-4	Vinyl Chloride	2.0E+00	2.0E+00	—	—	—	1.0E+00	—	—

[n] US EPA Secondary Maximum Contaminant Level (SMCL) concentration from "Drinking Water Regulations and Health Advisories," May 1995, US EPA Office of Water Washington, DC (EPA 1996,1380).

[q] n/a = not applicable

ER-SOP-2.01, R0

Los Alamos
Environmental Restoration Project

Summary of Regulatory Water Standards Used for ER Projects (concluded)

Analyte Code	Chemical	Drinking Water Standards: US EPA MCL (µg/l)	Drinking Water Standards: NMED MCL (µg/l)	NMED WQCC Surface Water Standards: Domestic Water Supply (µg/l)	NMED WQCC Surface Water Standards: Livestock Watering (µg/l)	NMED WQCC Surface Water Standards: Wildlife Habitat (µg/l)	NMED WQCC Groundwater Standards: Human Health (µg/l)	NMED WQCC Groundwater Standards: Domestic Water Supply (µg/l)	NMED WQCC Groundwater Standards: Irrigation Use (µg/l)
1330-20-7	Xylene (mixed)	1.0E+04	1.0E+04	—	—	—	6.2E+02	—	—
Zn	Zinc	5.0E+03[n]	—	—	2.5E+04	—	—	1.0E+04	—
ALPHA	Gross Alpha (Does not include Radon or Uranium.)	1.5E+01	1.5E+01	1.5E+01	1.5E+01	—	—	—	—
$^{226/228}Ra$	Radium-226 + Radium-228	5.0E+00	5.0E+00	3.0E+01	.0E+01		.0E+01	—	—
^{90}Sr	Strontium-90	—	8.0E+00	—	—	—	—	—	—
U	Uranium (radionuclide)	2.0E+01 µg/l[r]	sect. 207(b)[f]	—	—	—	—	—	—
^{3}H	Tritium	—	2.0E+04	2.0E+04	2.0E+04	—	—	—	—

[f] Maximum Contaminant Level (MCL) concentration from "Drinking Water Regulations and Health Advisories," October 1996, US Environmental Protection Agency (EPA) Office of Water, Washington, DC. (EPA 1996,1380).

[n] US EPA Secondary Maximum Contaminant Level (SMCL) concentration from "Drinking Water Regulations and Health Advisories," May 1995, US EPA Office of Water Washington, DC (EPA 1996,1380).

[r] Proposed US EPA MCL (EPA 1996,1380). Number presented is the EPA action level.

ER Project List of Potential Bioaccumulation Compounds

The priority list of compounds with a potential for bioaccumulation at the Laboratory is provided with the stipulation that the list is still under development. Compounds are being evaluated based on

1) toxicity,
2) frequency of occurrence at the Laboratory including the use of the co-occurrence of a bioaccumulator with another chemical as a marker for the bioaccumulator when supported by historical data or site sampling data,
3) potential for receptors including sensitive species and habitat at the Laboratory, and
4) bioconcentration factor (BCF) adjusted for environmental factors at the Laboratory or based on site-specific data.

Use the following list of compounds—currently in the category of "high priority" bioaccumulators—in assessing SOP 2.01 concerns at the Laboratory.

- Cadmium
- Cesium-137
- Mercury
- Strontium-90
- All arochlors (PCBs)

Appendix D

Ecological Scoping Checklist

APPENDIX D ECOLOGICAL SCOPING CHECKLIST

Part A—Scoping Meeting Documentation

Site ID	SWMU 21-011(k)
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	Site was a former outfall associated with two 12,700 gal. effluent-holding tanks (TA-21-112 and TA-21-113) that discharged treated effluent from an industrial liquid waste treatment facility into DP Canyon via 21-011(k) outfall. Releases at the outfall were to the surface. The discharge flowed down the slope and eventually into the DP Canyon drainage, which is not part of this SWMU.
List of Primary Impacted Media (Indicate all that apply.)	**Surface soil** – **XX** – impacted by discharges at the outfall. **Surface water/sediment** – **X** – potentially impacted from the discharge into the canyon; sediment in bottom of canyon and possibly surface water including ephemeral stream channel in bottom of canyon. **Subsurface** – **Groundwater** – **XX** – alluvial groundwater impacted by discharges at the outfall. **Other, explain** –
FIMAD vegetation class based on Arcview vegetation coverage (Indicate all that apply.)	**Water** – **XX** – An ephemeral stream channel exists in the bottom of DP Canyon below the SWMU and flows eastward. It is located approximately 100 to 200 yards from outfall. **Bare Ground/Unvegetated** – **XX** – There are few areas of bare ground between vegetated areas. These areas are either exposed tuff or dirt often covered with pine needles and other plant litter. **Spruce/fir/aspen/mixed conifer** – **Ponderosa pine** – **XX**- Primary vegetation community; also ground cover of grasses and shrubs. **Piñon juniper/juniper savannah** – **Grassland/shrubland** – **XX** – in the bottom of DP Canyon, below the SWMU, with small patches of bare ground. **Developed** –.
Is T&E Habitat Present? If applicable, list species known or suspected to use the site for breeding or foraging.	The site is on the border of the core habitat for the Mexican spotted owl and peregrine falcon. This site is within an area that the owl may be assumed to forage with a moderate to low frequency.
Provide list of Neighboring/ Contiguous/ Up-gradient sites, include a brief summary of COPCs and form of releases for relevant sites and reference map as appropriate. (Use information to evaluate need to aggregate sites for screening.)	Neighboring/Contiguous/Up-gradient from SWMU 21-011(k) are: 21-001, 21-011(a), 21-019(g), 21-011(h), 21-011(j), 21-011(i), 21-011(e), 21-011(d), 21-011(g), 21-010(e), 21-011(f), 21-016(a), 21-010(f), 21-010(a), 21-010(c), 21-011(c), 21-028(a), 21-016(b), 21-010(b), 21-016(c), 21-010(h), and 21-010(g). The majority of the contamination contributing to SWMU 21-011(k) would have come from SWMUs 21-011(g) and (f), two 12,700 gal. effluent-holding tanks (TA-21-112 and TA-21-113) that discharged treated effluent from an industrial liquid waste treatment facility into DP Canyon. Additionally, SWMUs 21-016(a-c) (MDA T) where liquid radioactive waste was disposed is upgradient from SWMU 21-011(k).
Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water runon sources.**	The Erosion Matrix score for this SWMU is 72, with a score of 46 for runoff [visible evidence of runoff discharging (5.0), runoff terminates in a drainage/wetland (19.0), and runoff in a gully (22.0)] and a score of 0.0 for run-on (natural drainages onto site) scores. The score also reflects it is within the canyon floodplain, but not watercourse (13.0), ground cover is 25-75% (6.5), and slope is >10-30%. (6.5). Potential exists for soil erosion at this site. The runoff terminates in DP Canyon.

Part B—Site Visit Documentation

Site ID	SWMU 21-011(k)
Date of Site Visit	10/26/2000
Site Visit Conducted by	Rich Mirenda, Linda Causey, Jayne Jones

Receptor Information:

Estimate cover	Relative vegetative cover (high, medium, low, none) = high Relative wetland cover (high, medium, low, none) = none Relative structures/asphalt, etc. cover (high, medium, low, none) = none
Field notes on the FIMAD vegetation class to assist in ground-truthing the Arcview information	Site visit confirms that this SWMU is a combination of open areas and ponderosa pine. In some places the tuff is on the surface, in others it is several inches below the surface. Ground cover consists of grasses, shrubs, and young trees. As one goes from DP Road to the mesa top edge of DP Canyon, the vegetation increases and older ponderosa pine predominates. The ground is also covered with pin needles and litter from other plants.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	Site provides good to excellent habitat for foraging. While there is generally no habitat for nesting for T&E species, there are a few nearby dead trees that would make for excellent nesting of birds. The Mexican spotted owl and the peregrine falcon may forage in DP Canyon (Koch 1999, 63599)
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. Terrestrial receptors are present in and around the SWMU. Various songbirds were observed in the trees and circling raptors were observed. There was evidence of burrowing was observed in this area. Bear tracks were seen in the dry stream bed. Other large mammals such as deer, elk, coyotes and raccoons would be in the area. Plant life is abundant and healthy. No aquatic receptors are present in the canyon reach below the SWMU.

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Previously, the runoff flowed into a man-made (3 to 4 ft deep) gully and into DP Canyon. Runoff flow to this gully has been diverted during the 1996 Interim Action in order to prevent contaminants from being moved via water. The surface water runoff has now been diverted into DP Canyon via a drainage to the east and another to the far west of the site. Rain water that falls directly on the outfall portion of the SWMU would flow into DP Canyon via sheet flow. The terminal point of surface water transport is the intermittent stream channel in the bottom of DP Canyon. There is evidence of erosion into the canyon.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	Surface water transport is the primary off-site transport pathway. Air transport via particulates or fugitive dust would be a possibility due to surface contamination, however, there are no barren patches of ground that would be subjected to wind, there is ground cover and plant litter covering the dirt, and the area is protected from wind by trees. Ground water is a viable pathway because the alluvial aquifer is less than 5 ft from ground surface and it is suspected to be the source for DP Spring.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	An Interim Action has already occurred at this SWMU. Contaminated soil has been removed and runoff has been diverted from the contaminated west drainage and from the surface of the SWMU.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	The physical disturbances are the west drainage which shows signs of past remedial activities and BMPs.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. The area from the top of the mesa to the stream channel in the canyon bottom appear to be no different from the surrounding area.
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No. Current data does not support the implementation of an interim action at this SWMU. An Interim Action was implemented in 1996.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport. Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	**Nature** – Yes, full suite samples from past sampling adequately defines the nature of contamination. **Rate** – Yes, aerial photographs show that gamma shine starts in DP Canyon at SWMU 21-011(k) and continues down canyon, and sampling down stream of SWMU 21-011(k) in the canyon has been done by the Canyons Focus Area. **Extent** – Yes. Sampling has been conducted laterally vertically and downstream which is not part of this SWMU.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. The sampling proposed in the VCM will address the major potential transport pathway, i.e., surface water runoff down the drainage and into DP Canyon.

Part C—Ecological Pathways Conceptual Exposure Model

<u>Question A:</u>

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation: No volatile organic chemicals were detected in the samples collected before 2001. In the 2001 samples volatile organic chemicals (acetone, methylene chloride, 4-isopropyltoluene, 2-hexanone, and trichloroethene) were detected sporadically and in concentrations in the low part per billion range. One sample location (21-11205) was re-sampled and the volatile organic chemicals were not detected. Therefore, it is very possible that the volatile organic chemicals were analytical laboratory contaminants.

<u>Question B:</u>

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): likely

Provide explanation: Soil contamination is on the surface of the soil and is available to become dust where there are bare areas. However, most of the ground is covered with pine needles and litter from the overstory so fugitive dust would be rare or unlikely to occur. However, there is evidence of burrowing animals and they would have to burrow through the contamination at the surface.

<u>Question C:</u>

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each SWMU included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* Note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The major off-site transport pathway is surface water runoff into DP Canyon. However, there are no aquatic ecosystems in this reach of the canyon that would receive this runoff.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- Known or suspected presence of contaminants in groundwater.
- The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.
- Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).
- Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.

Answer (likely/unlikely/uncertain): Likely

Provide explanation: Alluvial water is close to the surface in the canyon, which is not part of the SWMU. Alluvia wells LAUZ-1 [located on the eastern edge of SWMU 21-011(k) next to the stream bed] and LAUZ-2 [located approximately 250 ft downgradient from LAUZ-1] encountered alluvial water at approximately 4.5 ft below the surface. The saturated zone at the time was approximately 3.5 ft thick. This alluvial water is thought to be a source for DP Spring. This spring flows from the south-facing slope of DP Canyon, approximately 3,000 ft downstream to the east from SWMU 21-011(k). The shallow alluvial water on site can discharge into the ephemeral stream at the canyon bottom. Contaminants are available to be taken up by terrestrial plants with roots in contact with the alluvial water. Terrestrial wildlife receptors can contact this alluvial water when it surfaces into the ephemeral stream at the bottom of DP Canyon. There are no seeps or springs up canyon from the SWMU.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Likely

Provide explanation: Plutonium-239/240, strontium-90, tritium, uranium-234, and uranium -235 are present in SWMU 21-011(k) soil. Plutonium-239/240, strontium-90, and uranium-234 have been observed in alluvial groundwater from LAUZ-1 and LAUZ-2 to DP Spring. Tritium and uranium-235 were detected in the alluvial groundwater from LAUZ-1 and LAUZ-2 (LANL 1999, 63915).

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- This question is only applicable to release sites located on or near the mesa edge.
- Consider the erodability of surficial material and the geologic processes of canyon/mesa edges.

Answer (likely/unlikely/uncertain): Likely

Provide explanation: While the slope is well vegetated, there is evidence of erosion. Mass wasting is not considered a potential release mechanism because the slope appears stable and vegetated.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: No volatile organics are expected to be present.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 2

Provide explanation: Although there is contamination on the surface, the ground is well covered with pine needles and litter from the established vegetation. However, there is evidence of burrowing animals.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**

- Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 3

Provide explanation: This is a complete pathway. The shallow nature of the contamination makes it available to roots. However, due to the ground cover rain splash is not a complete pathway.

<u>**Question J:**</u>

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation: The COPEC strontium-90, which is structurally similar to calcium, is incorporated into the body as bones and teeth. Isotopic uranium is a bioaccumulator. DDT and mercury were detected sporadically and at low concentrations.

<u>**Question K:**</u>

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation: This could be a major pathway because of the surficial nature of the contamination.

<u>**Question L:**</u>

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: Most suspected COPCs are not lipophilic. No organic chemicals were detected. However, the dermal pathway is a possible complete pathway for some receptors.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 3

Terrestrial Animals: 3

Provide explanation: Cesium 137, a gamma emitter, is a COPEC at this SWMU and the contamination is surficial.

Stream Channel

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: The contamination is surficial in nature and the alluvial ground water is close to the surface. Therefore, roots could directly uptake contaminants from alluvial ground water or sediment. Rain splash is, however, a very minor consideration because of the ground cover and plant litter on the ground surface.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment'

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: PCBs are not present at the site. DDT was detected sporadically, in the low part per billion levels, and the concentrations were qualified as estimated. Mercury was detected once, slightly above background. However, terrestrial animals could ingest the strontium-90 (that is preferentially taken up by plants), and isotopic uranium (a bioaccumulator).

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Although there are no aquatic systems present on the site or in the canyon below the SWMU, there is evidence that the contaminants have moved down horizontally slope and, once in the stream bed, down stream from the SWMU. This movement is due to water transporting contaminants either in a soluble form or on particulates. Terrestrial animals could have access to this water for drinking, if only for the period of rainwater or snow melt flow.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: Although there are no aquatic systems present on the site or in the canyon reach below the SWMU, there is evidence that the contaminants have moved horizontally down slope and, once in the stream bed, down stream from the SWMU. This movement is due to water transporting contaminants either in a soluble form or on particulates. Terrestrial animals could have access to this water for drinking and wading, if only for the period of rainwater or snow melt flow. During times of dryness, the terrestrial species may be dermally exposed to contaminants in the dry gully and stream bed.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- External irradiation effects are most relevant for gamma emitting radionuclides.
- Burial of contamination attenuates radiological exposure.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Cesium 137 is a COPEC at this SWMU and the contamination is surficial.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- Aquatic plants are in direct contact with water.
- Contaminants in sediment may partition into pore water, making them available to submerged roots.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: There are no aquatic systems present on site or in the canyon below the SWMU.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- Aquatic receptors may actively or incidentally ingest sediment while foraging.
- Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.
- Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There are no aquatic systems present on site or in the canyon below the SWMU.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- Lipophilic organic contaminants and some metals may concentrate in an organism's tissues
- Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: There are no aquatic systems present on site or in the canyon below the SWMU.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- External irradiation effects are most relevant for gamma emitting radionuclides.
- The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants: 0

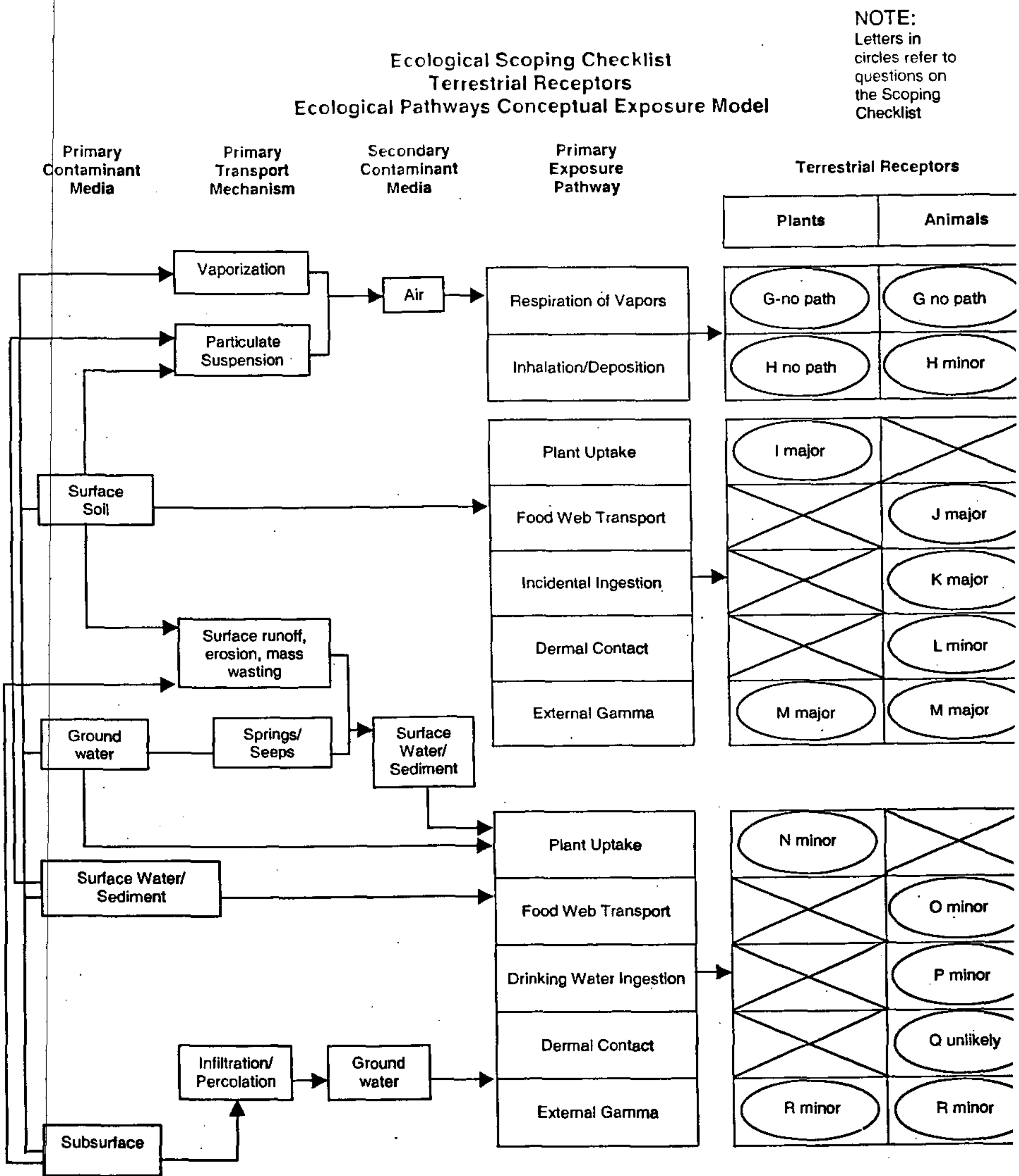
Aquatic Animals: 0

Provide explanation: There are no aquatic systems present on site or in the canyon below the SWMU.

REFERENCES

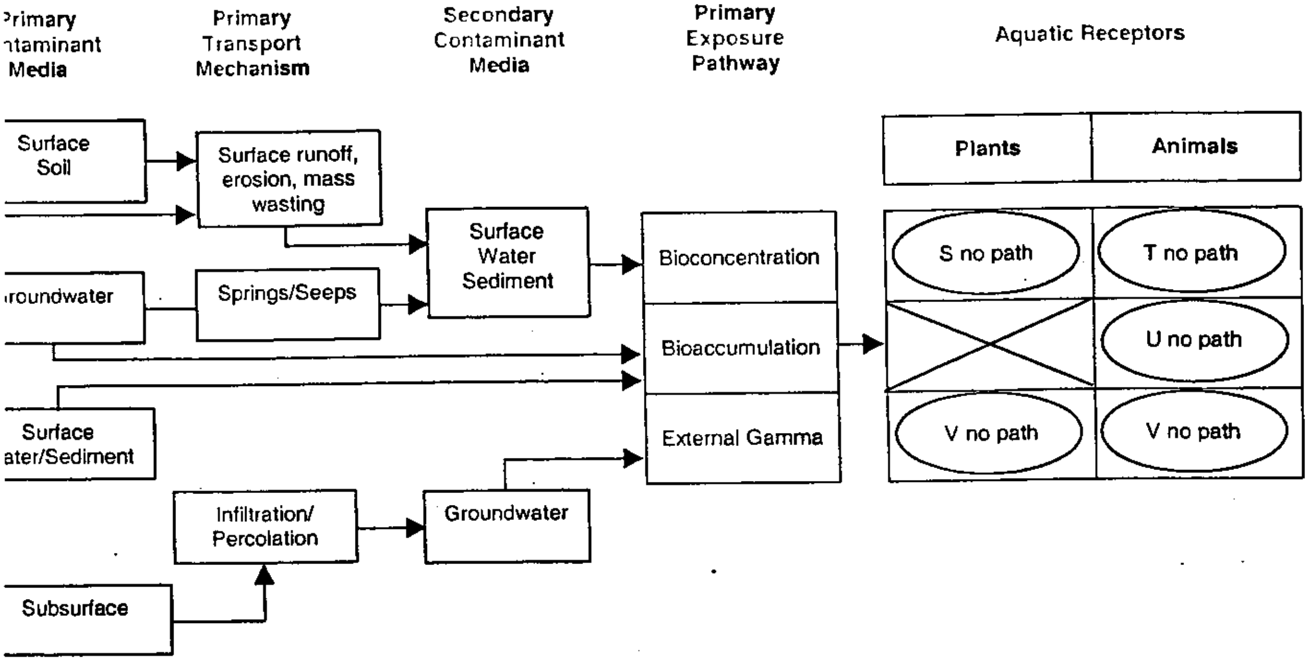
Koch, S., July 15, 1999. "Memorandum to Greg McDermott: Review of Potential Release Sites for Threatened and Endangered Species Habitat for the Purpose of Ecological Screening/Risk Assessment," Los Alamos National Laboratory Memorandum ESH-20/Ecol-98-0732, Los Alamos, New Mexico. (Koch 1999, 63599)

LANL, August 26, 1999. Evaluation of Sediment and Alluvial Groundwater in DP Canyon, Reaches DP-1, DP-2, DP-3, and DP-4. LA-UR-99-4238. (LANL 1999, 63915)


NOTE:
Letters in circles refer to questions on the Scoping Checklist
Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model
Primary Contaminant Media
Primary Transport Mechanism
Secondary Contaminant Media
Primary Exposure Pathway
Terrestrial Receptors
Plants
Animals
Vaporization
Particulate Suspension
Air
Respiration of Vapors
Inhalation/Deposition
G-no path
G no path
H no path
H minor
Surface Soil
Plant Uptake
Food Web Transport
Incidental Ingestion
Dermal Contact
External Gamma
I major
J major
K major
L minor
M major
M major
Surface runoff, erosion, mass wasting
Ground water
Springs/ Seeps
Surface Water/ Sediment
Surface Water/ Sediment
Plant Uptake
Food Web Transport
Drinking Water Ingestion
Dermal Contact
External Gamma
N minor
O minor
P minor
Q unlikely
R minor
R minor
Infiltration/ Percolation
Ground water
Subsurface

NOTE:
Letters in circles refer to questions on the Scoping Checklist

Ecological Scoping Checklist
Aquatic Receptors
Ecological Pathways Conceptual Exposure Model



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Linda Causey

Name (signature): Linda Causey

Organization: PMC Environmental

Phone number: 662-1365

Date Completed: 4/17/02

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Richard Mirenda

Name (signature): Richard Mirenda

Organization: RRES

Phone number: 665-6953

Date Completed: 4/17/02

Appendix E

Estimated Costs

APPENDIX E: ESTIMATED COSTS

ESTIMATED COST

Estimated Cost

Based on current resource estimates, the anticipated subcontractor costs and analytical costs of this VCM are approximately $2.2 million.

Schedule

The fieldwork portion of this VCM began in November FY02 and is anticipated to be completed in July 2003. The fieldwork includes soil, sediment, and tuff removal, confirmatory sample collection and analysis, radiation surveys, waste management, and site restoration including an engineered cover.

Appendix F

Data Analysis

APPENDIX F Data Analysis

Introduction

Appendix F.1 develops an estimate for the volume of soil to be removed based on Single Radionuclide Soil Guidelines (SRSG). Appendix F.2 develops SRSGs

F1 Data Analysis

The data analysis for SWMU 21-011(k) consisted of a two-stage process and involved two distinct data sets. The phased data analysis approach was designed to compliment the anticipated remedial field approach, which consists of surveying areas with a field instrument capable of collecting KCPM data. These field data, based on count rate, will then be converted to an estimate of each of the radionuclide COCs (^{90}Sr, ^{238}Pu, ^{239}Pu, ^{137}Cs, and ^{241}Am) using both the quantitative and qualitative information derived in the data analysis phase. Excavation limits will be developed in the field based on the results of the field survey and subsequent data conversion.

The first data set contains KCPM measurements at a location along with the corresponding ^{137}Cs activity based on analysis at a fixed-laboratory. These data were correlated and regressed using a parametric, linear regression. The results obtained from the regression have been used to quantify the relationship between the KCPM output of a field analytical device and the actual ^{137}Cs activity at the location. No other non-^{137}Cs radionuclide COC data (^{90}Sr, ^{238}Pu, ^{239}Pu, or ^{241}Am) were available for quantitative analysis.

The second data analysis phase applied nonparametric correlation and regression techniques (rank correlation) to a data set composed of samples collected during two separate programs: The 1996 verification sampling (post-excavation) and the 2001 site characterization. Each of the non-^{137}Cs radionuclides (^{90}Sr, ^{238}Pu, ^{239}Pu, and ^{241}Am) was regressed against ^{137}Cs to obtain a qualitative understanding as to the relationship between the two. In addition, the average ratio of activities of each of the radionuclides (^{90}Sr, ^{238}Pu, ^{239}Pu, and ^{241}Am) compared to ^{137}Cs was calculated. As with the nonparametric regression, this statistic provides a qualitative assessment of the contribution of non-^{137}Cs radionuclides to the total activity at a location.

Estimating Soil Cs-137 Concentrations From 2001 Gross Gamma Survey Data

This section provides a quantitative means of estimating cesium-137 concentrations from the 2001 gross gamma survey. This survey has also been referred to as an *in situ gamma survey* since it was performed using a SAM-935 multi-channel analyzer on site. The purpose of the survey was to obtain reliable information on both KCPM and Cs-137 at a series of locations.

Portions of the site deviate from ideal conditions for soil concentration estimation from count rate data. In particular, portions of the site present a seriously folded or buckled geometry instead of the idealized planar geometry. This is a probable contributor to the uncertainty ("noise") that is present in correlations between gross gamma count rate and Cs-137 concentration. It is expected that removal of areas of elevated activity will reduce this uncertainty.

During 2001, the following data (Table F1-1) were collected to correlate the gross gamma count rate for the SAM 935 multi-channel analyzer system to Cs-137 soil concentrations.

Table F1-1
Data Used to Correlate Gross Gamma to Cs-137 Using the SAM 935 Analyzer

KCPM*	Cs-137 (pCi/gm)
31.254	3.87
38.058	6.33
74.364	30.68
84.588	6.62
91.968	13.28
95.970	29.60
110.772	115.50
207.900	214.51
231.618	175.40
264.990	193.54
355.502	448.73

*KCPM = kilo counts per minute

The data point exhibiting the highest count rate (i.e. 355.502 KCPM) was rejected for two reasons. First, there was concern that the system dead time may have resulted in inaccurate counts. Second, the KCPM rate corresponds to a higher count rate than is necessary for field use since the count rate is well above any action level that would be used during the remediation. Using the remaining 10 data pairs, a parametric linear regression was performed. Count rate (KCPM) was chosen as the independent variable and Cs-137 activity as the dependent variable. The Cs-137 vs. count rate linear regression data are provided in Exhibit F1.A. Results of the correlation appear below.

Term	Coefficient	SE	p
Intercept	-41.9352	19.9759	0.0690
Slope	0.9815	0.1372	<0.0001

Based on the results shown above, the line recommended for the best estimate of the Cs-137 concentration from the observed count rate is:

$$^{137}Cs = [(0.9815)*(KCPM)] - (41.9\ pCi/g\ ^{137}Cs).$$

The coefficient of determination statistic, r^2, for this linear fit was 0.86. The correlation coefficient, r, is the square root of r^2, *and* is a dimensionless quantity, independent of the units of measurement, that ranges between –1 and 1. A positive r indicates a line with a positive slope where the variables tend to go up and down together. A negative slope indicates a situation where as one variable increases, the other decreases. A slope of zero indicates that there is no relationship between the variables and that the average of the measured variable is the best estimator. As such, r is also a measure of the linear relationship between the two variables, in this case, KCPM and Cs-137.

The absolute value of r is an indication of the improvement over using the average value of the measured parameter. It is desirable for r to be 0.95 or higher, which would indicate a very strong relationship between the two variables. An r value of 0.95 equates to an r^2 value of approximately 0.90. Whereas an r value above 0.95 may be considered a rule-of-thumb goal, r values below 0.95 or r^2 values below 0.90 are highly useful, as strong to moderately strong relationships still exist. Because of the strong correlation of ^{137}Cs to KCPM (r = 0.93), count rate of the field instrument will be used to obtain a quantitative estimation of the ^{137}Cs activity in the surface soil during remedial activities.

Best Estimates of Contaminant Activity Based on 2001 Walkover Gross Gamma Measurements

Best estimates of the radionuclides co-located with Cs-137 are derived from gross gamma count rate (CR) data as follows:

Concentration A =

[{(pCi/g Cs-137 / KCPM)* CR} – 41.9 pCi/g] * Slope A/Cs-137

This is illustrated using Sr-90 as a specific example:

Concentration Sr-90 =

[{(0.9815 pCi/g / KCPM) * CR} – 41.9 pCi/g] * 0.3027 pCi Sr90/pCi Cs-137.

At a count rate of 100 KCPM the best estimate of Sr-90 is 17.03 pCi/g.

Concentration americium-241=

[{(0.9815 pCi/g / KCPM) * CR – 41.9 pCi/g] * 0.0355 pCi americium-241/pCi Cs-137.

Concentration total Pu (TPU)=

[{(0.9815 pCi/g / KCPM) * CR – 41.9 pCi/g] * 0.0703 pCi TPU/pCi Cs-137.

Correlation of American Radiation Services (ARS) Cs-137 Results with 662 KeV Region of Interest Count Rate Data in Marinelli Geometry.

During 2001, data were collected to establish a correlation between count rate in the 662 KeV region of interest in Marinelli geometry and Cs-137 concentration. An excellent correlation between the two was obtained, as shown in Figure F1-1.

It is anticipated that the background and detector efficiency will be somewhat different if an alternative, but similar, system is used. In addition, the detection efficiency will be affected if a 500-ml wide mouth Nalgene jar is used as the source geometry. Use of the Marinelli geometry is not recommended because it presents a poor geometry for americium-241 screening with a single channel analyzer/PG-2.

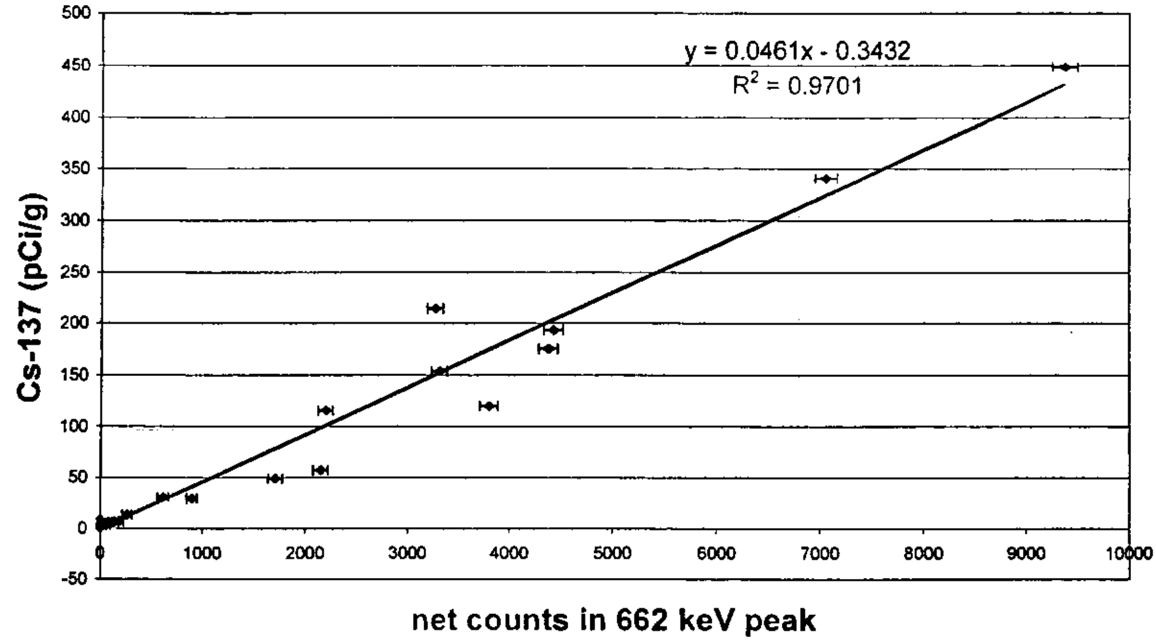


Figure F1-1. Correlation between net counts in 662 KeV region of interest and Cs-137 concentration

Fixed Laboratory Data Used to Establish Correlations

This section describes the second phase of the data analysis effort. Because the first phase data only represented KCPM to Cs-137 data, this phase completes the analysis to provide qualitative and quantitative estimates of the contributions of the remaining radionuclides to the total KCPM value.

The second phase of the data analysis employed two different methods of data analysis to determine which would provide the most useful predictor of non-Cs-137 radionuclide contribution to the field measurements. The first method used statistical correlations between sample pairs for data that were analyzed by a fixed laboratory data. The second method used the average contribution of each non-Cs-137 radionuclide (^{90}Sr, ^{238}Pu, ^{239}Pu, and ^{241}Am) as compared to Cs-137.

The results from the correlations and the average ratio approach along with the data analysis results described in the previous section to determine target Cs-137 and americium-241 concentrations for soil, sediment and tuff removal under this VCM. Removal to these levels, as estimated by field measurements, makes it likely that the residual contamination levels will not exceed the mixture Derived Concentration Guideline (DCGL), as defined in Appendix F-2 of this VCM Plan or the hot spot criteria given in DOE Order 5400.5, Chapter 4 (4)(a)(1).

The data used in the analyses below include the results of verification samples that were collected after the 1996 Interim Action and during the 2001 waste characterization sampling. The combined 1996 verification and 2001 surface characterization data are provided in Table F1-2. This summary data set was used first to establish nonparametric rank correlations among fixed laboratory results since isotopic ratio data are not acquired during the walkover survey of count rate. In addition, these data were used to determine the average activity contribution from each of the non-Cs radionuclides to the total Cs activity.

Zero values in Table F1-2 represent non-detects. For samples where there is no entry in the table for a given analyte, the result is not available.

Table F1-2
Pooled 1996 Verification and 2001 Waste Characterization Data for 21-011(k)

Sample ID	Sr-90 pCi/g	Pu-238 pCi/g	Pu-239 pCi/g	Am-241 pCi/g	Cs-137 pCi/g	Total Pu pCi/g
21-01-0021	1.7	0.034	0.122	0	1.43	0.156
21-01-0022	0	0	0.094	0	1.67	0.094
21-01-0025	7.1	0.293	1.93	2.2	40.5	2.223
21-01-0027	2.56	0.31	0.37	0	8.7	0.68
21-01-0029	0	0.048	0.036	0	1.03	0.084
21-01-0030	0.9	0.074	0.111	0	2.6	0.185
21-01-0033	26.1	0.63	13.2	13.7	150	13.83
21-01-0034	1.02	0.21	1.01	6.9	3.78	1.22
21-01-0036	3.75	0.122	1.18	0	29	1.302
21-01-0037	0.51	0	0.118	0	1.52	0.118
21-01-0039	30.8	0.74	11.3	7.9	109	12.04
21-01-0041	132	1.64	20.5	19	445	22.14
MD21-01-0025	7.1	0.293	1.93	2.2	40.5	2.223
MD21-01-0036	3.75	0.122	1.18	0	29	1.302
MD21-01-0039	30.8	0.74	11.3	7.9	109	12.04
MD21-01-0040	10.5	0.22	3.07	5.1	59.5	3.29
MD21-01-0044	103	0.8	32.6	14.9	246	33.4
MD21-01-0045	83	0.95	51.2	22.3	343	52.15
MD21-01-0069	268	1.02	59.2	32.5	690	60.22
0121-96-0301	0	0	0	0.307	0	0
0121-96-0302	0	0	0	25.3	15.7	0
0121-96-0303	0	0	0	0.93	9.39	0
0121-96-0801	74		20.088	10.6	351	20.088
0121-96-0802	240		45.959	32.3	621	45.959
0121-96-0804	33.8		8.73	10.5	85.3	8.73
0121-96-0805	1.4	0.0969	0.79054	0.281	7.05	0.88744
0121-96-0806	7.1	0.2365	1.8333	2.06	19.7	2.0698
0121-96-0808	219		50.95	20.2	877	50.95
0121-96-0809	24.9	0.964	6.2252	2.9	327	7.1892
0121-96-0810	60	4.8694	23.7568	14.3	222	28.6262
0121-96-0807	63		75.153	601	66.5	75.153
0121-96-0803	30.7	7.0991	25.1351	125	72.1	32.2342

All correlations and regressions presented in this section represent nonparametric rank correlations. Parametric linear correlations were run on the data as well, but the results did not show as strong a correlation as those for the nonparametric approach. The correlations and linear regressions were performed using a commercially available Excel spreadsheet add-in, Analyse-It 1.62, which is distributed by Analyse It Software, Ltd. (http://www.analyse-it.com).

The correlations and forecast errors provided in this section provide qualitative information for the calculation of isotopic ratios based on field analytical measurements of count data. The values were calculated by nonparametric regression taken into consideration as one method to derive the proposed target Cs-137 and americium-241 concentrations,[1] as estimated by field measurements, that would be removed.

Rank correlations, also known as Spearman rank correlations, were performed between Cs-137 and Sr-90, americium-241 to Cs-137, and Pu to Cs-137. The correlation and regression results for each of the analyses indicated moderately strong to strong correlations, with the Sr-90 to Cs-137 results providing the strongest correlation ($r = .94$; $r^2 = 0.89$). The next highest correlation observed was between total Pu and Cs-137 ($r = 0.90$; $r^2 = 0.81$), with americium-241 to Cs-137 results exhibiting the lowest degree of rank correlation ($r = 0.87$, $r^2 = 0.75$). Regression equations for the three pairings are as follows:

$$\text{pCi/g }^{90}\text{Sr} = [(0.3027)*(^{137}\text{Cs})] - (1.3330)$$

$$\text{pCi/g }^{241}\text{Am} = [(0.3550)*(^{137}\text{Cs})] - (1.9746)$$

$$\text{pCi/g }^{238+239}\text{Pu} = [(0.0703)*(^{137}\text{Cs})] - (1.4997)$$

Data analysis indicates that there are two distinct patterns of americium-241 to Cs-137 and total Pu to Cs-137 ratios on-site. High ratios are associated with the western drainage on the western boundary of the site, whereas a lower ratio is typical of the remainder of the site. There are not enough data to establish a reliable correlation of americium-241 to Cs-137 or Pu to Cs-137 activity in the western drainage.

The correlations above do not apply to the western drainage for americium-241 and total Pu to Cs-137. Of the 32 post IA and characterization surface samples, 29 do not appear to be associated with the western drainage. Locations 0121-96-0807, 0121-96-0803, and 0121-96-0302 were removed from the data set for correlations involving americium-241 and total Pu to Cs-137. The correlations of Sr-90 to Cs-137, americium-241 to Cs-137, and total Pu to Cs-137 appear in Exhibits F1.B to F1.D respectively.

The second method of data analysis used in the second phase used estimates of average radionuclide ratios derived from the data. Individual values for each non-Cs-137 radionuclide at a location were divided by the Cs-137 activity. For example, the Sr-90 value for sample 21-01-0021 (1.7 pCi/g) was divided by the Cs-137 value (1.43 pCi/g) to obtain the ratio value of 1.19. These individual ratio values were summed by COC (by column) and then averaged. Results of this exercise appear in Table F1-3.

[1] Cs-137 target: 150 pCi/g, Am-241 target 170 pCi/g based on field estimates.

Table F1-3
Ratios of Radionuclide COC Activity to Cs-137

Sample ID	Sr/Cs	Am/Cs	^{238}Pu/Cs	^{239}Pu/Cs
21-01-0021	1.19	0.00	0.02	0.09
21-01-0022	NA	NA	NA	0.06
21-01-0025	0.18	0.05	0.01	0.05
21-01-0027	0.29	0.00	0.04	0.04
21-01-0029	NA	NA	0.05	0.04
21-01-0030	0.35	NA	0.03	0.04
21-01-0033	0.17	0.09	0.00	0.09
21-01-0034	0.27	1.83	0.06	0.27
21-01-0036	0.13	NA	0.00	0.04
21-01-0037	0.34	NA	NA	0.08
21-01-0039	0.28	0.07	0.01	0.10
21-01-0041	0.30	0.04	0.00	0.05
MD21-01-0025	0.18	0.05	0.01	0.05
MD21-01-0036	0.13	NA	0.00	0.04
MD21-01-0039	0.28	0.07	0.01	0.10
MD21-01-0040	0.18	0.09	0.00	0.05
MD21-01-0044	0.42	0.06	0.00	0.13
MD21-01-0045	0.24	0.07	0.00	0.15
MD21-01-0069	0.39	0.05	0.00	0.09
0121-96-0301	NA	NA	NA	NA
0121-96-0302	0.00	1.61	0.00	0.00
0121-96-0303	0.00	0.10	0.00	0.00
0121-96-0801	0.21	0.03	NA	0.06
0121-96-0802	0.39	0.05	NA	0.07
0121-96-0804	0.40	0.12	NA	0.10
0121-96-0805	0.20	0.04	0.01	0.11
0121-96-0806	0.36	0.10	0.01	0.09
0121-96-0808	0.25	0.02	NA	0.06
0121-96-0809	0.08	0.01	0.00	0.02
0121-96-0810	0.27	0.06	0.02	0.11
0121-96-0807	0.95	9.04	NA	1.13
0121-96-0803	0.43	1.73	0.10	0.35
Average	0.30	0.62	0.016	0.12

Table F1- 4 summarizes the gross gamma count-rates obtained with the SAM 935 multi-channel analyze system and the corresponding best estimate radionuclide concentrations. It is anticipated that gross gamma count rates will be somewhat different if an alternative gross gamma measurement system is used. The columns of Table F1-4 pertaining to the fraction of the derived concentration guideline (DCGL) are based on Single radionuclide soil guidelines for the recreational land use scenario that are derived in Appendix F.2 of this document.

The columns of Table F1-4 that are concerned with americium-241 and total Pu do not apply to the western drainage on the west end of SWMU 21-011(k).

Table F1-4
Relationship Among of SAM-935 Gross Gamma Count Rate and Regression Estimates of Radionuclide Concentrations

Count rate, KCPM	Cs-137 Regression Estimate, pCi/g	Sr-90 Regression Estimate, pCi/g	Americium-241 Regression Estimate, pCi/g	Total Pu Regression Estimate, pCi/g	Fraction of Mixture DCGL, Regression Estimate
50	7.2	0.84	0.57	0.0	0.026
100	56.3	15.6	18.0	2.5	0.238
150	105.3	30.6	35.4	5.9	0.451
200	154.4	45.4	52.8	9.4	0.664
250	164.2	60.3	70.3	12.8	0.877
300	174.0	75.1	87.7	16.3	1.091

Table F1-5
Relationship Among of SAM-935 Gross Gamma Count Rate and Average Ratio Estimates of Radionuclide Concentrations

Count rate, KCPM	Cs-137 Average Ratio Estimate, pCi/g	Sr-90 Average Ratio Estimate, pCi/g	Americium-241 Average Ratio Estimate, pCi/g	Total Pu Average Ratio Estimate, pCi/g	Fraction of Mixture DCGL, Average Ratio Estimate
50	7.2	2.2	1.9	0.98	0.029
100	56.3	16.9	15.2	7.66	0.229
150	105.3	31.6	28.4	14.32	0.428
200	154.4	46.3	41.7	21.00	0.628
250	203.5	61.1	28.5	27.68	0.827
300	252.6	75.8	35.4	34.35	1.027

Table F1-5 displays the results of using the average ratio approach to estimate radionuclide activity in the surface soils. Note that the column of Table F1-5 that lists americium-241 does not apply to the western drainage on the west end of SWMU 21-011(k). The fraction of DCGL values column in Table F1-5 (sum o ratios) indicates that the average ratio approach produces nearly identical activity values as the regression (rank correlation) approach. This means that these separate and distinct methods both provide a qualitative confirmation of the other, and essentially the same answer. One should note that the regression approach takes some liberties with statistical theory, as it relies on two separate regressions that are not jointly quantifiable. This is because the Cs-137/KCPM regression used parametric technique whereas the Cs-137/radionuclide regression used a nonparametric technique. Also, the nonparametric regression uses a value that itself was derived from regression, which introduces a potentially undesirable uncertainty to the estimate. However, in the end, the regression estimates are slightly more conservative. In comparison, the average ratio approach does not carry the problems that the regression approach contains, but is not quite as conservative.

As a practical matter, the fraction of DCGL (sum of ratios) values in Tables F1-4 and F1-5 are so close that either approach may be used to select a maximum count rate for remediation. Selection of a count rate cutoff for remediation by either method will most likely result in the same KCPM value. Even in the upper ranges of the risk estimates, the sum of ratios values both reach a total of 1.0 at just under 300 KCPM. Based on the values listed in Table F1-5, excavation will be initiated in areas that exhibit KCPM measurements in excess of 200 KCPM.

Estimated Volumes of Soil to be Removed

This section explains how the soil volumes to be removed were estimated.

It was assumed that the removal volume of contaminated soil located in the western drainage is based on the removal of americium-241. For this analysis, the soil volume is assumed to be 100 yd^3.

The following discussion is presented in terms of gross gamma count rate with the SAM 935 multi-channel analyzer with a 2x2-inch sodium iodide scintillation detector. The system to be used during removal could be more or less sensitive. A correlation will be performed between these count rates and the count rates on the system actually used during the removal. The count rates given in this section would be adjusted accordingly.

Removal of soil from other parts of the site would be based on Cs-137 concentration. The Cs-137 concentration would be based on gross gamma count rates using a SAM 935 multi-channel analyzer (or equivalent) or a ratemeter/scaler with a 2x2 inch sodium iodide scintillation detector.

The aerial extent of soil removal was based on count rate data obtained during the 2001 in situ gross gamma walkover survey. ArcView GIS software was used to estimate the aerial extent for the following count rates: 100 KCPM (nominal 56. pCi/g Cs-137), 125 KCPM (nominal 81 pCi/g Cs-137), 150 KCPM (nominal 105. pCi/g Cs-137), 175 KCPM (nominal 130 pCi/g Cs-137), 200 KCPM (nominal 154 pCi/g Cs-137), 225 KCPM (nominal 179 pCi/g Cs-137) and 250 KCPM (nominal 203 pCi/g Cs-137). Aerial extent estimates are provided in Figure F1-2.

The distribution with depth was also characterized during 2001. This data is presented in Figure F1-3. It is assumed for estimation purposes that removal from areas of elevated contamination occurs to a depth of 24 inches. This would be sufficient to reduce concentrations by a factor of 4 on average based on the exponential constant presented in Figure F1-3.

The estimated volumes of soil that would be removed for various count rates are depicted in Figure F1-4.

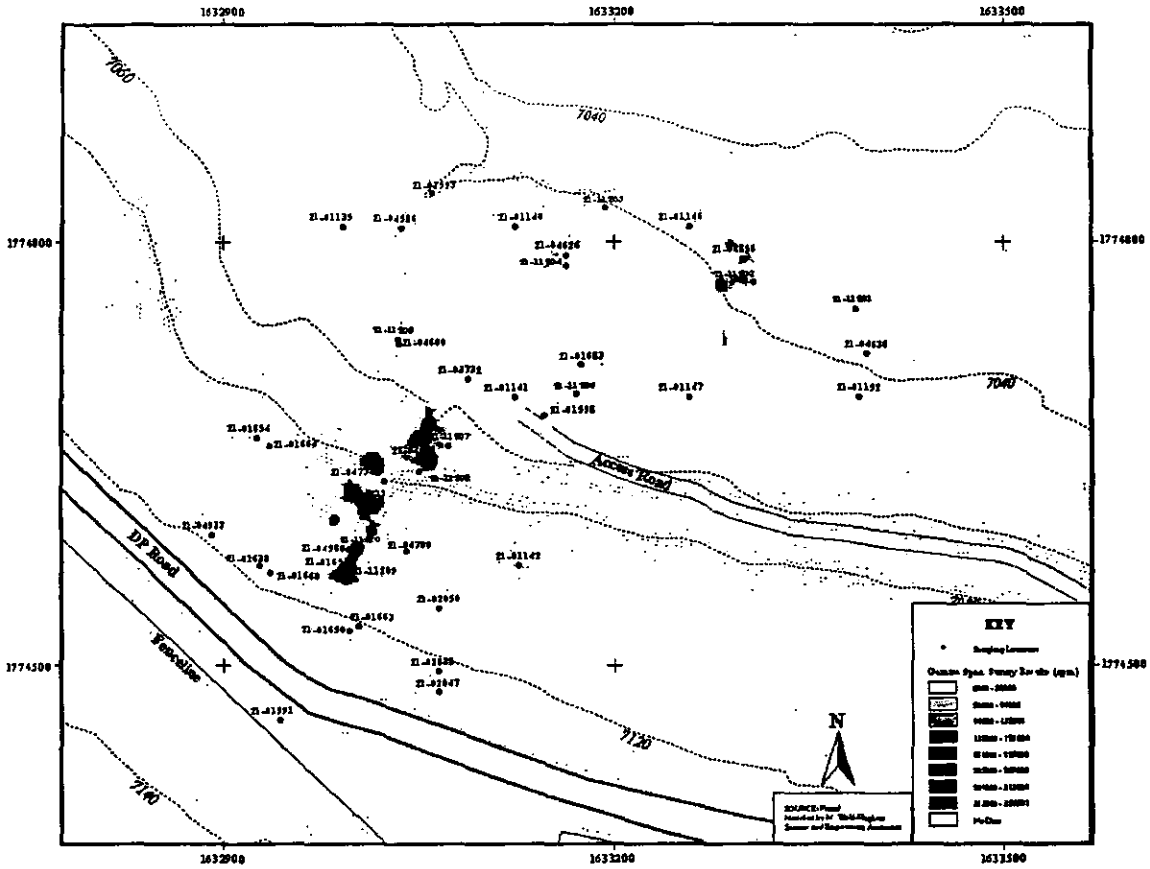


Figure F1-2. SAM 935 Gross Gamma Count rates at 21-011(k)

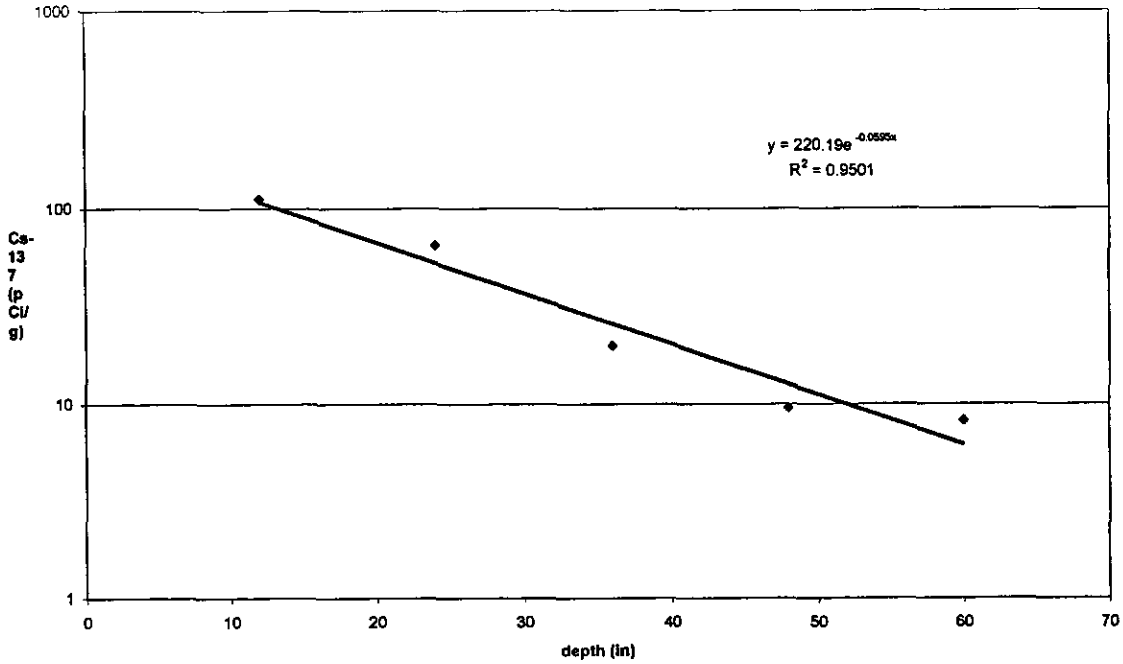


Figure F1-3. Correlation of Cs-137 concentration with depth

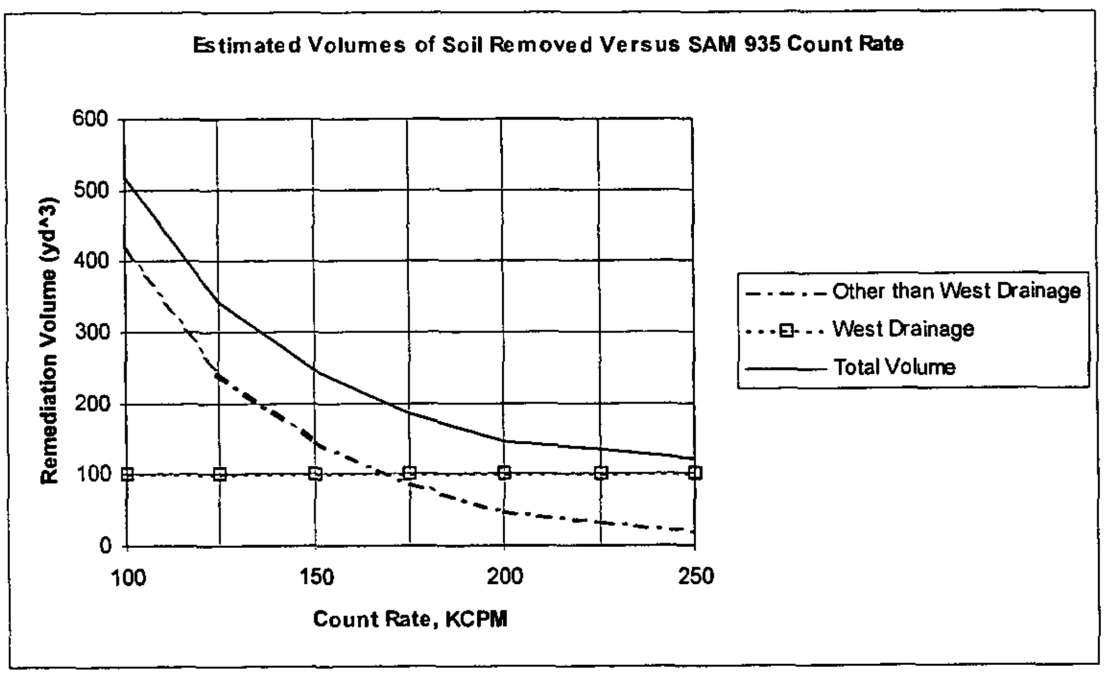


Figure F1-4. Soil Volume estimates.

It is proposed that surface soils be removed from areas having Cs-137 soil concentrations in excess of 154 pCi/g, as estimated from screening results, (200 KCPM per the 2001 gross gamma survey). Areas that exhibit higher concentrations have a significant chance of exceeding the mixture derived concentration guideline presented in Appendix F2. Removal of these areas is consistent with DOE's 5400.5 "As Low as Reasonably Achievable" (ALARA) policy since

- some of these elevated activity areas would already meet the DOE hot spot criteria if it was rigorously applied, even if a cover were absent, and
- placement of restoration backfill and cover materials over contaminated further reduces dose.

analysed with: Analyse-it + General 1.62

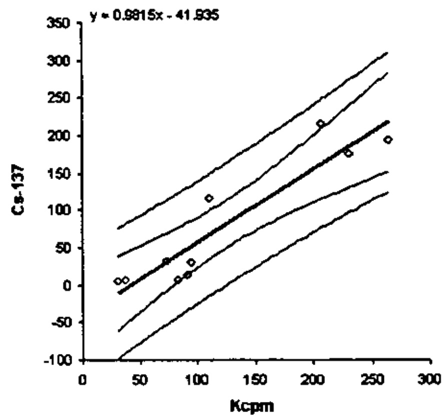
Linear regression
Data from Table 10. FSR report
Cs-137 v Kcpm
Rick Haaker

13 February 2002

n	10
R^2	0.86
Adjusted R^2	0.85
SE	33.7299

Term	Coefficient	SE	p	95% CI of Coefficient
Intercept	-41.9352	19.9759	0.0690	-87.9998 to 4.1294
Slope	0.9815	0.1372	<0.0001	0.6652 to 1.2978

Source of variation	SSq	DF	MSq	F	p
Due to regression	58264.479	1	58264.479	51.21	<0.0001
About regression	9101.669	8	1137.709		
Total	67366.140	9			



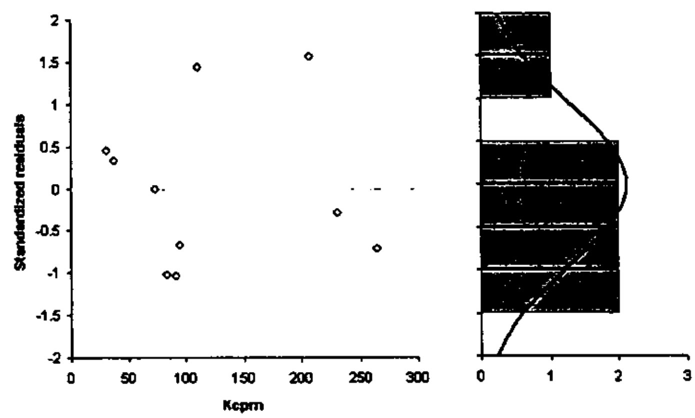


Exhibit F1.A: Correlation of Cs-137 to SAM 935 Count Rate Data

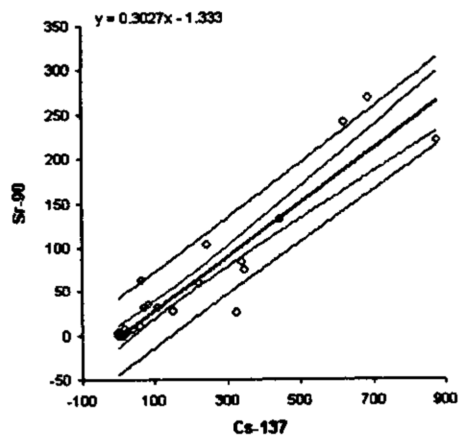
analysed with: Analyse-it + General 1.62

Linear regression
2001 Data TA21-011(k)
Sr-90 v Cs-137
Performed by [illegible] Date 19 March 2002

n	32
R^2	0.89
Adjusted R^2	0.88
SE	24.9661

Term	Coefficient	SE	p	90% CI of Coefficient
Intercept	-1.3330	5.3886	0.8063	-10.4788 to 7.8129
Slope	0.3027	0.0198	<0.0001	0.2691 to 0.3364

Source of variation	SSq	DF	MSq	F	p
Due to regression	145033.310	1	145033.310	232.68	<0.0001
About regression	18699.210	30	623.307		
Total	163732.520	31			



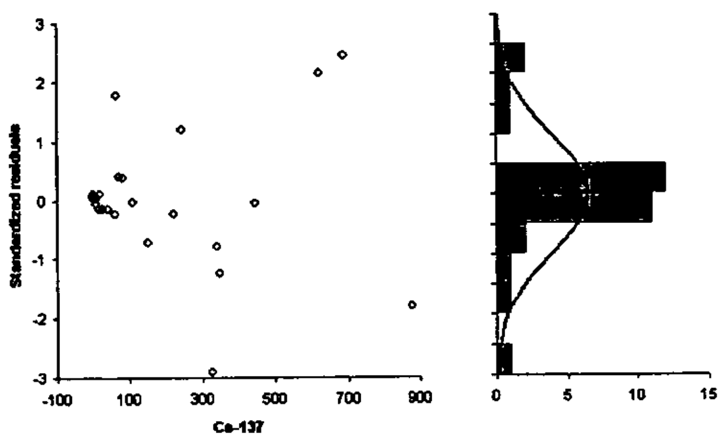


Exhibit F1.B: Correlation of Sr-90 to Cs-137 Data

analysed with: Analyse-it + General 1.6

Test	Linear regression
	2001 Data TA21-011(k)
	Am-241 v Cs-137
Performed by	[illegible]

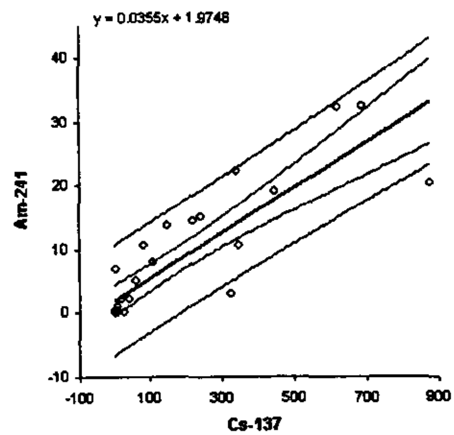
Date 20 March 2002

n	29

R^2	0.75
Adjusted R^2	0.74
SE	4.9626

Term	Coefficient	SE	p	90% CI of Coefficient
Intercept	1.9746	1.1365	0.0937	0.0388 to 3.9104
Slope	0.0355	0.0040	<0.0001	0.0287 to 0.0423

Source of variation	SSq	DF	MSq	F	p
Due to regression	1951.575	1	1951.575	79.24	<0.0001
About regression	664.944	27	24.628		
Total	2616.519	28			



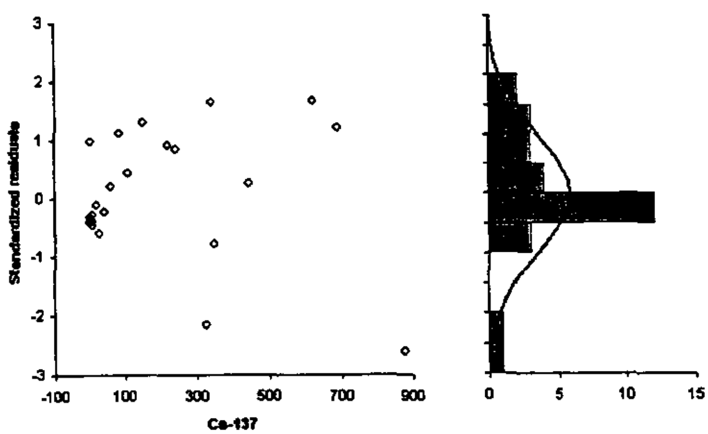


Exhibit F1.C: Correlation of Americium-241 to Cs-137 Data

analysed with: Analyse-it - General 1.[illegible]

Linear regression
2001 Data TA21-011(k)
Total Pu v Cs-137

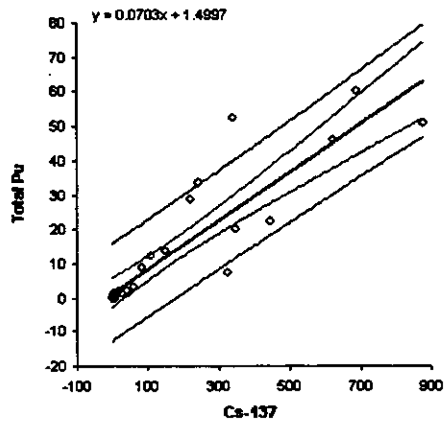
Performed by Rick Haaker **Date** 20 March 2002

n	29

R^2	0.81
Adjusted R^2	0.80
SE	8.2147

Term	Coefficient	SE	p	90% CI of Coefficient
Intercept	1.4997	1.8813	0.4323	-1.7046 to 4.7041
Slope	0.0703	0.0066	<0.0001	0.0591 to 0.0816

Source of variation	SSq	DF	MSq	F	p
Due to regression	7637.817	1	7637.817	113.19	<0.0001
About regression	1821.975	27	67.481		
Total	9459.791	28			



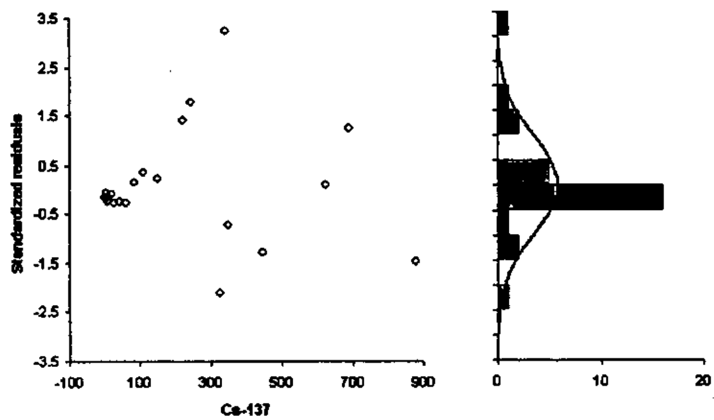


Exhibit F1.D: Correlation of Total Pu to Cs-137 Data

F2 RESRAD INPUTS, RESULTS, SINGLE RADIONUCLIDE SOIL GUIDELINES

RESRAD 6.1 was used to calculate dose estimates from a recreational trail user (Yu et al., 2001, 71420).

Recreational Trail User Scenario

The recreational trail user scenario represents an individual who regularly walks on the site. The person visits the site 140 times per year and stays for a period of one-hour per visit; this corresponds to a value for the *fraction of time spent outdoors (on site)* parameter (FOTD) 0.016.[2]

The soil ingestion rate while on-site is assumed to be 67 mg/h;[3] this corresponds to ingestion of 9,392 mg/y of on-site soil per year.[4] The RESRAD *soil ingestion rate* parameter (SOIL) was set to 587 g/y to obtain this desired soil ingestion rate.

Table F2-1
Parameters for Derivation of Single Radionuclide Soil Guidelines (SRSG) Under the Recreational Trail User Scenario Without Cover

Parameter	Value Used	Explanation
Pathways Active	External Gamma Inhalation (w/o radon) Soil Ingestion	These are the active pathways for the pathway described
Area of contaminated zone (AREA)	10,000 m^2	This is a conservative estimate of the area affected at SWMU 21-011(k).
Thickness of contaminated zone (THICKO)	2 m	(LANL 2001, 69683)
Fraction of time spent outdoors (onsite) (FOTD)	0.016 y/y	ESH-20 recommended value that corresponds to hiking on-site for 140 hours per year.
Soil ingestion rate (SOIL)	587 g/y	ESH-20 recommended value that corresponds to 67 mg/h while on-site.
Inhalation rate (INHAL)	14,000 m^3/y	ESH-20 recommended value that corresponds to 1.6 m^3/h while onsite.
Mass loading for inhalation (INHALR)	2.0 E-5 g/m^3	(LANL 2001)
Density of contaminated zone (DENSCZ)	1.5 g/cm^3	ESH-20 recommended value. RESRAD default.
Humidity in Air (HUMID)	5.55 g/m^3	(LANL 2001, 69683)
Annual average wind speed (WIND)	3 m/s	(LANL 2001, 69683)
Evapotranspiration coefficient (EVAPTR)	0.999 unitless	(LANL 2001, 69683)
Precipitation (PRECIP)	0.35 m/y	(LANL 2001, 69683)
Irrigation (RI)	0.0 m/y	(LANL 2001, 69683)
Basic radiation dose limit (BRDL)	15 mrem/y	(LANL 2001, 69683)

[2] FOTD = 0.016 = 140 h/y / (24 h/d * 365 d/y)
[3] mg/h onsite = SOIL * 1000 mg/g / (365 d/y * 24 h/d) = 587 * 1000 / (365 * 24) = 67
[4] mg/y onsite = SOIL * 1000 mg/g * FOTD = 587 * 1000 * 0.016 = 9392

Recreational Trail User Single Radionuclide Soil Guidelines

The SRSG for a given radionuclide represents the site average soil concentration that corresponds to the dose criterion, which is 15 mrem/y. The SRSGs for SWMU 21-011(k) listed in Table F2-2 were calculated using RESRAD 6.1 based on the parameters listed in Table F2-1.

Table F2-2
SRSGs Derived Under the Recreational Trail User Scenario

Radionuclide	SRSG (pCi/g)
Americium-241	427
Cs-137	294
Pu-238	496
Pu-239	447
Sr-90	8,288

Since there is a mixture of radionuclides present at the site, the SRSGs do not apply independently. A sum of ratios rule applies instead and the derived concentration guideline (DCGL) is met if the sum of ratios is for the mixture adds to less than 1:

$$\sum \text{Concentration of isotope i / SSRG of isotope I} < 1$$

or

$$\frac{\text{Conc. americium-241}}{427} + \frac{\text{Conc. Cs-137}}{294} + \frac{\text{Conc. total Pu}}{447} + \frac{\text{Conc. Sr-90}}{8{,}288} < 1$$

Figure F2-1 is a dose versus time plot produced by RESRAD 6.1 for the recreational trail user following excavation, but before any site restoration has been performed. This figure illustrates several important points regarding SWMU 21-011(k). The present day dose to a hypothetical recreational trail user is less than one-half the typical dose criterion of 15 mrem/y. The present day dose rate is mostly due to short-lived radioactive materials (Cs-137), and the dose rate will decline to less-than 2 mrem/y within 200 years The proposed corrective measure removes local areas of elevated contamination and converts the highest activity material into a form that resists migration for a time period that allows the concentrations of short-lived Cs-137 and Sr-90 to decay to insignificant levels. Figure F2-2 is a dose versus time plot for the recreational trail user with a cover.

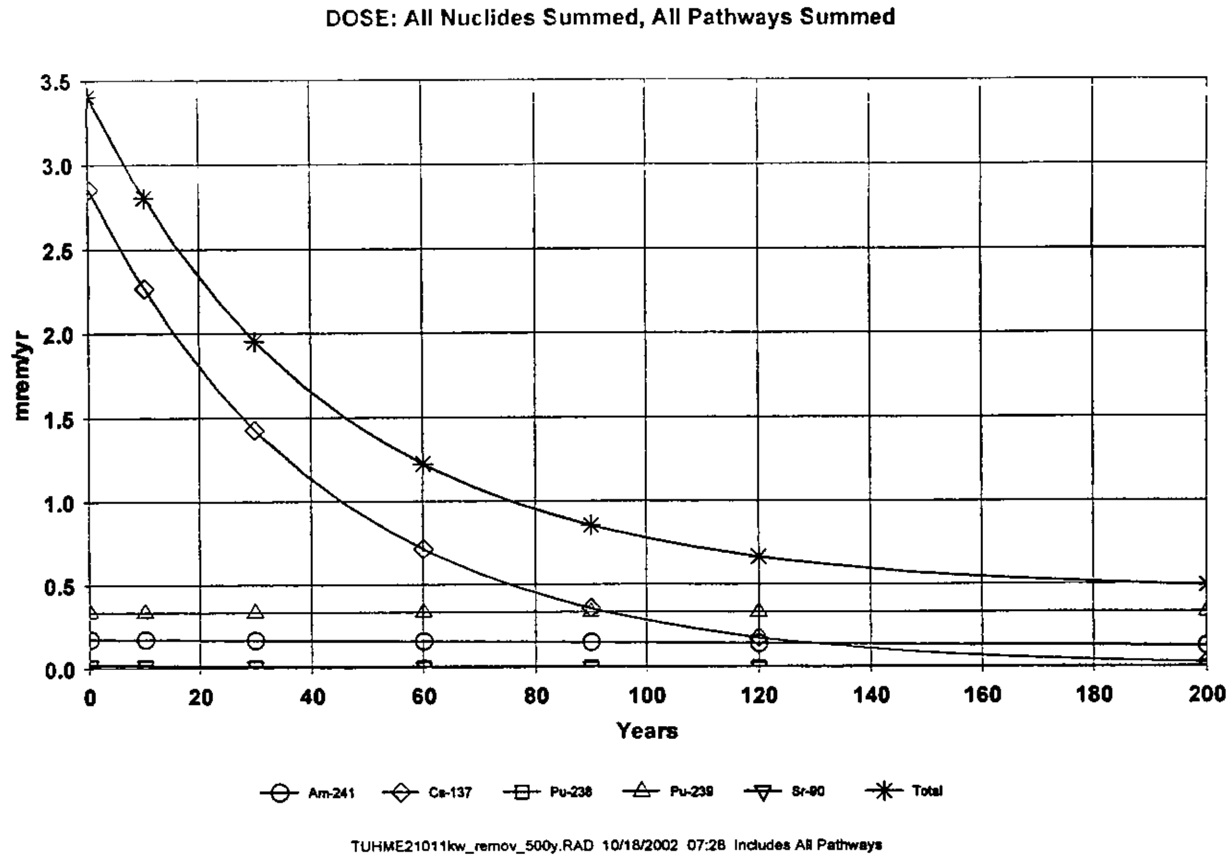


Figure F2-1. RESRAD 6.1 plot of dose versus time for the recreational trail user scenario without cover.

REFERENCES

LANL, 2001. "Derivation and Use of Radionuclide Screening Action Levels," Los Alamos National Laboratory report LA-UR-01-990, Los Alamos, New Mexico. (LANL 2001, 69683.)

Mirenda, R, 2001. "Derivation and Use of Radionuclide Screening Action Levels," Los Alamos National Laboratory Report LA-UR-01-990, Los Alamos, New Mexico. (Mirenda 2001, 69683.1)

Salvatore, D, 1982. *Theory and Problems in Statistics and Econometrics*, Schaum's Outline Series, McGraw-Hill Book Company, New York. (Salvatore 1982, 72707)

Yu, C, A.J. Zielen, J.J. Cheng, D. J. LePoire, E. Gnanapragasam, S, Kamboj, J. Arnish, A. Wallo III, W. A. Williams, and H Peterson, 2001. User's Manual for RESRAD Version 6, ANL/EAD-4, Argonne National Laboratories, Argonne, IL. (Yu et.al 2001, 71420)

Exhibit F2.1. RESRAD Summary Report for the Recreational Trail User Scenario Without Cover.

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 1
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean concentration w/removal of 500 yd^3
File : TUHME21011kw_remov_500y.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines
===

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 2
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion—21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

Current Menu	Parameter	Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(3)
B-1	H-	6.400E-08	6.400E-08	DCF2(4)
B-1	Np-237+	5.400E-01	5.400E-01	DCF2(5)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(6)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(7)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(8)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(9)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(10)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(11)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(12)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(13)
B-1	U-233	1.350E-01	1.350E-01	DCF2(14)
B-1	U-234	1.320E-01	1.320E-01	DCF2(15)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(16)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(17)
D-1	Dose conversion factors for ingestion, mrem/pCi			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(3)
D-1	H-3	6.400E-08	6.400E-08	DCF3(4)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(5)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(6)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(7)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(8)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(9)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(10)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(11)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(12)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(13)
D-1	U-233	2.890E-04	2.890E-04	DCF3(14)
D-1	U-234	2.830E-04	2.830E-04	DCF3(15)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(16)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(17)
D-34	Food transfer factors			
D-34	Ac-227+Dplant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	Cs-137+D plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Cs-137+D beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(3,2)
D-34	Cs-137+D milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(3,3)

1RESRAD, Version 6.21   T½ Limit = 0.5 year   10/18/2002 07:28 Page 3
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion--21-0011k mean conc w/r
File   : TUHME21011kw_remov_500y.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	H-3 plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(4,1)
D-34	H-3 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(4,2)
D-34	H-3 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(4,3)
D-34				
D-34	Np-237+Dplant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(5,1)
D-34	Np-237+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Np-237+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Pa-231plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(6,1)
D-34	Pa-231beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(6,2)
D-34	Pa-231milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	Pb-210+Dplant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(7,1)
D-34	Pb-210+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(7,2)
D-34	Pb-210+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(7,3)
D-34				
D-34	Pu-238plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Pu-238beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Pu-238milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(8,3)
D-34				
D-34	Pu-239plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Pu-239beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Pu-239milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(9,3)
D-34				
D-34	Ra-226+Dplant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(10,1)
D-34	Ra-226+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(10,2)
D-34	Ra-226+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(10,3)
D-34				
D-34	Sr-90+D plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(11,1)
D-34	Sr-90+D beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(11,2)
D-34	Sr-90+D milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(11,3)
D-34	Th-229+Dplant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Th-229+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Th-229+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Th-230plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
D-34	Th-230beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
D-34	Th-230milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	U-233 plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(14,1)
D-34	U-233 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(14,2)
D-34	U-233 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(14,3)
D-34				
D-34	U-234 plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(15,1)
D-34	U-234 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(15,2)
D-34	U-234 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(15,3)
D-34				

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Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion—21-0011k mean conc w/r
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Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Current Menu	Parameter	Parameter	Value	Default	Name
D-34	U-235+D	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	U-235+D	beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(16,2)
D-34	U-235+D	milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(16,3)
D-34					
D-34	U-238+D	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-238+D	beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-238+D	milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-5	Bioaccumulation factors, fresh water, L/kg:				
D-5	Ac-227+D	fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D	crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5					
D-5	Am-241	fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241	crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5					
D-5	Cs-137+D	fish	2.000E+03	2.000E+03	BIOFAC(3,1)
D-5	Cs-137+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5					
D-5	H-3	fish	1.000E+00	1.000E+00	BIOFAC(4,1)
D-5	H-3	crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(4,2)
D-5					
D-5	Np-237+D	fish	3.000E+01	3.000E+01	BIOFAC(5,1)
D-5	Np-237+D	crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(5,2)
D-5					
D-5	Pa-231	fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	Pa-231	crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(6,2)
D-5					
D-5	Pb-210+D	fish	3.000E+02	3.000E+02	BIOFAC(7,1)
D-5	Pb-210+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
D-5					
D-5	Pu-238	fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Pu-238	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5					
D-5	Pu-239	fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Pu-239	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(9,2)
D-5					
D-5	Ra-226+D	fish	5.000E+01	5.000E+01	BIOFAC(10,1)
D-5	Ra-226+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(10,2)
D-5					
D-5	Sr-90+D	fish	6.000E+01	6.000E+01	BIOFAC(11,1)
D-5	Sr-90+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5					
D-5	Th-229+D	fish	1.000E+02	1.000E+02	BIOFAC(12,1)
D-5	Th-229+D	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(12,2)
D-5					
D-5	Th-230	fish	1.000E+02	1.000E+02	BIOFAC(13,1)
D-5	Th-230	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(13,2)
D-5					
D-5	U-233	fish	1.000E+01	1.000E+01	BIOFAC(14,1)
D-5	U-233	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(14,2)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Current Menu	Parameter	Parameter	Value	Default	Name
D-5	U-234	fish	1.000E+01	1.000E+01	BIOFAC(15,1)
D-5	U-234	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(15,2)
D-5					
D-5	U-235+D	fish	1.000E+01	1.000E+01	BIOFAC(16,1)
D-5	U-235+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(16,2)
D-5					
D-5	U-238+D	fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-238+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)

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Site-Specific Parameter Summary

Menu	Parameter	User Input	Used by RESRAD Default (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+04	1.000E+04	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	TI
R011	Times for calculations (yr)	1.000E+01	1.000E+00	T(2)
R011	Times for calculations (yr)	3.000E+01	3.000E+00	T(3)
R011	Times for calculations (yr)	6.000E+01	1.000E+01	T(4)
R011	Times for calculations (yr)	9.000E+01	3.000E+01	T(5)
R011	Times for calculations (yr)	1.200E+02	1.000E+02	T(6)
R011	Times for calculations (yr)	2.000E+02	3.000E+02	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	5.000E+00	0.000E+00	S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-137	5.600E+01	0.000E+00	S1(3)
R012	Initial principal radionuclide (pCi/g): Pu-238	5.000E-01	0.000E+00	S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+01	0.000E+00	S1(9)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.300E+01	0.000E+00	S1(11)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	W1(2)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	W1(3)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	W1(8)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	W1(9)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	W1(11)
R013	Cover depth (m)	0.000E+00	0.000E+00	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	BCZ
R013	Average annual wind speed (m/sec)	3.000E+00	2.000E+00	WIND
R013	Humidity in air (g/m**3)	5.500E+00	8.000E+00	HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01	EVAPTR
R013	Precipitation (m/yr)	3.500E-01	1.000E+00	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	RI
R013	Irrigation mode	overhead	overhead	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	HCSZ

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone hydraulic gradient	not used	2.000E-02		HGWT
R014	Saturated zone b parameter	not used	5.300E+00		BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03		VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01		DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND		MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02		UW
R015	Number of unsaturated zone strata	not used	1		NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00		H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00		DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01		TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01		EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01		FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00		BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01		HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01		DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01		DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01		DCNUCS(2)
R016	Leach rate (/yr) ALEACH(2)	0.000E+00	0.000E+00	4.636E-06	
R016	Solubility constant SOLUBK(2)	0.000E+00	0.000E+00	not used	
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03		DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03		DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03		DCNUCS(3)
R016	Leach rate (/yr) ALEACH(3)	0.000E+00	0.000E+00	9.332E-08	
R016	Solubility constant SOLUBK(3)	0.000E+00	0.000E+00	not used	
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03		DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03		DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03		DCNUCS(8)
R016	Leach rate (/yr) ALEACH(8)	0.000E+00	0.000E+00	4.666E-08	
R016	Solubility constant SOLUBK(8)	0.000E+00	0.000E+00	not used	
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03		DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03		DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03		DCNUCS(9)
R016	Leach rate (/yr) ALEACH(9)	0.000E+00	0.000E+00	4.666E-08	
R016	Solubility constant SOLUBK(9)	0.000E+00	0.000E+00	not used	
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01		DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	3.000E+01		DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	3.000E+01		DCNUCS(11)
R016	Leach rate (/yr) ALEACH(11)	0.000E+00	0.000E+00	3.097E-06	
R016	Solubility constant SOLUBK(11)	0.000E+00	0.000E+00	not used	

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Used by RESRAD Default (If different from user input)	Parameter Name	
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	DCNUCC(1)	
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	DCNUCU(1,1)	
R016	Saturated zone (cm**3/g)	not used	2.000E+01	DCNUCS(1)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.636E-06	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	DCNUCC(4)	
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	DCNUCU(4,1)	
R016	Saturated zone (cm**3/g)	not used	0.000E+00	DCNUCS(4)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.000E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(5
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	DCNUCU(5,1)	
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	DCNUCS(5)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.624E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(6)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(6,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(6)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	DCNUCC(7)	
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	DCNUCU(7,1)	
R016	Saturated zone (cm**3/g)	not used	1.000E+02	DCNUCS(7)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.321E-07	ALEACH(7
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	DCNUCC(10)	
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	DCNUCU(10,1)	
R016	Saturated zone (cm**3/g)	not used	7.000E+01	DCNUCS(10)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.331E-06	ALEACH(1
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	DCNUCC(12)	
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	DCNUCU(12,1)	
R016	Saturated zone (cm**3/g)	not used	6.000E+04	DCNUCS(12)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.556E-09	ALEACH(1
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1

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Site-Specific Parameter Summary (continued)

Menu	Parameter	Input	Default	Name (If different from user input)	
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	DCNUCC(13)	
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	DCNUCU(13,1)	
R016	Saturated zone (cm**3/g)	not used	6.000E+04	DCNUCS(13)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.556E-09	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(14)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(14,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(14)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(15)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(15,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(15)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(16)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(16,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(16)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(17)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(17,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(17)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R017	Inhalation rate (m**3/yr)	1.400E+04	8.400E+03	INHALR	
R017	Mass loading for inhalation (g/m**3)	2.000E-05	1.000E-04	MLINH	
R017	Exposure duration	3.000E+01	3.000E+01	ED	
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	SHF3	
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	SHF1	
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	FIND	
R017	Fraction of time spent outdoors (on site)	1.600E-02	2.500E-01	FOTD	
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

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Site-Specific Parameter Summary (continued)

Menu	Parameter	Input	Default (If different from user input)	Name
R017	Radii of shape factor array (used if FS = -1):			
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:			
R017	Ring 1	not used	1.000E+00	FRACA(1)
R017	Ring 2	not used	2.732E-01	FRACA(2)
R017	Ring 3	not used	0.000E+00	FRACA(3)
R017	Ring 4	not used	0.000E+00	FRACA(4)
R017	Ring 5	not used	0.000E+00	FRACA(5)
R017	Ring 6	not used	0.000E+00	FRACA(6)
R017	Ring 7	not used	0.000E+00	FRACA(7)
R017	Ring 8	not used	0.000E+00	FRACA(8)
R017	Ring 9	not used	0.000E+00	FRACA(9)
R017	Ring 10	not used	0.000E+00	FRACA(10)
R017	Ring 11	not used	0.000E+00	FRACA(11)
R017	Ring 12	not used	0.000E+00	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	DIET(6)
R018	Soil ingestion rate (g/yr)	5.870E+02	3.650E+01	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	FDW
R018	Contamination fraction of household water	not used	1.000E+00	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	FR9
R018	Contamination fraction of plant food	not used -1	FPLANT	
R018	Contamination fraction of meat	not used -1	FMEAT	
R018	Contamination fraction of milk	not used -1	FMILK	
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	LSI

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Used by RESRAD (If different from user input)	Default	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used		1.000E-04	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01		1.500E-01	DM
R019	Depth of roots (m)	not used		9.000E-01	DROOT
R019	Drinking water fraction from ground water	not used		1.000E+00	FGWDW
R019	Household water fraction from ground water	not used		1.000E+00	FGWHH
R019	Livestock water fraction from ground water	not used		1.000E+00	FGWLW
R019	Irrigation fraction from ground water	not used		1.000E+00	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used		7.000E-01	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used		1.500E+00	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used		1.100E+00	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used		1.700E-01	TE(1)
R19B	Growing Season for Leafy (years)	not used		2.500E-01	TE(2)
R19B	Growing Season for Fodder (years)	not used		8.000E-02	TE(3)
R19B	Translocation Factor for Non-Leafy	not used		1.000E-01	TIV(1)
R19B	Translocation Factor for Leafy	not used		1.000E+00	TIV(2)
R19B	Translocation Factor for Fodder	not used		1.000E+00	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used		2.500E-01	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used		2.500E-01	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used		2.500E-01	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used		2.500E-01	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used		2.500E-01	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used		2.500E-01	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used		2.000E+01	WLAM
C14	C-12 concentration in water (g/cm**3)	not used		2.000E-05	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used		3.000E-02	C12CZ
C14	Fraction of vegetation carbon from soil	not used		2.000E-02	CSOIL
C14	Fraction of vegetation carbon from air	not used		9.800E-01	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used		3.000E-01	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used		7.000E-07	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used		1.000E-10	REVSN
C14	Fraction of grain in beef cattle feed	not used		8.000E-01	AVFG4
C14	Fraction of grain in milk cow feed	not used		2.000E-01	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used		8.894E+01	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01		1.400E+01	STOR_T(1)
STOR	Leafy vegetables	1.000E+00		1.000E+00	STOR_T(2)
STOR	Milk	1.000E+00		1.000E+00	STOR_T(3)
STOR	Meat and poultry	2.000E+01		2.000E+01	STOR_T(4)
STOR	Fish	7.000E+00		7.000E+00	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00		7.000E+00	STOR_T(6)
STOR	Well water	1.000E+00		1.000E+00	STOR_T(7)
STOR	Surface water	1.000E+00		1.000E+00	STOR_T(8)
STOR	Livestock fodder	4.500E+01		4.500E+01	STOR_T(9)
R021	Thickness of building foundation (m)	not used		1.500E-01	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used		2.400E+00	DENSFL
R021	Total porosity of the cover material	not used		4.000E-01	TPCV

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Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Used by RESRAD Default (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):			
R021	in cover material	not used	2.000E-06	DIFCV
R021	in foundation material	not used	3.000E-07	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	HRM
R021	Building interior area factor	not used	0.000E+00	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	EMANA(2)
TITL	Number of graphical time points	32	---	NPTS
TITL	Maximum number of integration points for dose	17	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

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Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g	
Area: 10000.00 square meters	Am-241	5.000E+00
Thickness: 2.00 meters	Cs-137	5.600E+01
Cover Depth: 0.00 meters	Pu-238	5.000E-01
	Pu-239	1.000E+01
	Sr-90	1.300E+01

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
TDOSE(t):	3.402E+00	2.805E+00	1.952E+00	1.222E+00	8.532E-01	6.645E-01	4.922E-01
M(t):	2.268E-01	1.870E-01	1.301E-01	8.150E-02	5.688E-02	4.430E-02	3.281E-02

Maximum TDOSE(t): 3.402E+00 mrem/yr at t = 0.000E+00 years

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Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
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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)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	3.390E-03	0.0010	1.463E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.708E-01	0.0502
Cs-137	2.827E+00	0.8309	1.165E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.600E-02	0.0076
Pu-238	1.192E-06	0.0000	1.288E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.497E-0	0.0044
Pu-239	4.532E-05	0.0000	2.830E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.325E-01	0.0977
Sr-90	4.750E-03	0.0014	1.110E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.846E-02	0.0054
Total	2.835E+00	0.8333	4.434E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.627E-01	0.1654

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	1.757E-01	0.0516
Cs-137	0.000E+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	2.853E+00	0.8385
Pu-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	1.510E-02	0.0044
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.353E-01	0.0986
Sr-90	0.000E+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	2.322E-02	0.0068
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.402E+00	1.0000

*Sum 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)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	3.336E-03	0.0012	1.440E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.681E-01	0.0599
Cs-137	2.244E+00	0.8000	9.246E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.063E-02	0.0074
Pu-238	1.101E-06	0.0000	1.190E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.383E-02	0.0049
Pu-239	4.531E-05	0.0000	2.829E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.324E-01	0.1185
Sr-90	3.744E-03	0.0013	8.750E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.455E-02	0.0052
Total	2.251E+00	0.8025	4.398E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.495E-01	0.1959

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.728E-01	0.0616
Cs-137	0.000E+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	2.264E+00	0.8073
Pu-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	1.395E-02	0.0050
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.353E-01	0.1195
Sr-90	0.000E+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	1.830E-02	0.0065
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.805E+00	1.0000

*Sum 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)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	3.231E-03	0.0017	1.394E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.628E-01	0.0834
Cs-137	1.414E+00	0.7241	5.825E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.300E-02	0.0067
Pu-238	9.404E-07	0.0000	1.016E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.181E-02	0.0060
Pu-239	4.529E-05	0.0000	2.827E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.322E-01	0.1702
Sr-90	2.326E-03	0.0012	5.435E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.038E-03	0.0046
Total	1.419E+00	0.7269	4.329E-03	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.288E-01	0.2709

0

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

0 Water Dependent Pathways

0

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	1.674E-01	0.0857
Cs-137	0.000E+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	1.427E+00	0.7307
Pu-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	1.191E-02	0.0061
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.351E-01	0.1716
Sr-90	0.000E+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	1.137E-02	0.0058
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.952E+00	1.0000

*Sum 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 = 6.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	fract.	Inhalation mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	Soil mrem/yr	fract.
Am-241	3.080E-03	0.0025	1.329E-03	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.551E-01	0.1269
Cs-137	7.068E-01	0.5781	2.912E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.499E-03	0.0053
Pu-238	7.422E-07	0.0000	8.017E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.318E-03	0.0076
Pu-239	4.525E-05	0.0000	2.825E-03	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.319E-01	0.2715
Sr-90	1.139E-03	0.0009	2.661E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.425E-03	0.0036
Total	7.110E-01	0.5816	4.237E-03	0.0035	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.072E-01	0.4149

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 6.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	fract.	Fish mrem/yr	fract.	Radon mrem/yr	fract.	Plant mrem/yr	fract.	Meat mrem/yr	fract.	Milk mrem/yr	fract.	All Pathways* mrem/yr	fract.
Am-241	0.000E+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	1.595E-01	0.1305
Cs-137	0.000E+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	7.133E-01	0.5834
Pu-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	9.399E-03	0.0077
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.348E-01	0.2738
Sr-90	0.000E+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	5.566E-03	0.0046
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.222E+00	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 18
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 9.000E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	2.935E-03	0.0034	1.266E-03	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.478E-01	0.1732
Cs-137	3.534E-01	0.4142	1.456E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.249E-03	0.0038
Pu-238	5.859E-07	0.0000	6.326E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.352E-03	0.0086
Pu-239	4.522E-05	0.0001	2.823E-03	0.0033	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.316E-01	0.3887
Sr-90	5.574E-04	0.0007	1.303E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.166E-03	0.0025
Total	3.569E-01	0.4183	4.153E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.922E-01	0.5768

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 9.000E+01 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.520E-01	0.1781
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.566E-01	0.4180
Pu-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	7.416E-03	0.0087
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.345E-01	0.3920
Sr-90	0.000E+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	2.725E-03	0.0032
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.532E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 19
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.200E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	2.798E-03	0.0042	1.206E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.408E-01	0.2119
Cs-137	1.767E-01	0.2659	7.281E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.625E-03	0.0024
Pu-238	4.627E-07	0.0000	4.991E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.801E-03	0.0087
Pu-239	4.518E-05	0.0001	2.820E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.313E-01	0.4986
Sr-90	2.729E-04	0.0004	6.378E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.061E-03	0.0016
Total	1.798E-01	0.2706	4.077E-03	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.806E-01	0.7233

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.200E+02 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	1.448E-01	0.2179
Cs-137	0.000E+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	1.783E-01	0.2683
Pu-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	5.851E-03	0.0088
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.342E-01	0.5029
Sr-90	0.000E+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	1.334E-03	0.0020
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.645E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 20
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	2.462E-03	0.0050	1.061E-03	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.238E-01	0.2516
Cs-137	2.783E-02	0.0565	1.147E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.559E-04	0.0005
Pu-238	2.472E-07	0.0000	2.654E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.083E-03	0.0063
Pu-239	4.509E-05	0.0001	2.814E-03	0.0057	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.306E-01	0.6717
Sr-90	4.064E-05	0.0001	9.497E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.579E-04	0.0003
Total	3.037E-02	0.0617	3.901E-03	0.0079	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.579E-01	0.9304

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+02 years
Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	1.274E-01	0.2588
Cs-137	0.000E+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	2.808E-02	0.0571
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.110E-03	0.0063
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.334E-01	0.6775
Sr-90	0.000E+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	1.987E-04	0.0004
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.922E-01	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 21
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion—21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	Am-241	1.000E+00	3.513E-02	3.457E-02	3.348E-02	3.190E-02	3.040E-02	2.896E-02	2.547E-02
Am-241	Np-237	1.000E+00	9.506E-09	1.981E-07	5.662E-07	1.097E-06	1.602E-06	2.084E-06	3.260E-06
Am-241	U-233	1.000E+00	6.666E-16	2.195E-13	1.831E-12	7.090E-12	1.561E-11	2.725E-11	7.240E-11
Am-241	Th-229	1.000E+00	3.538E-19	1.635E-15	3.966E-14	3.056E-13	1.010E-12	2.354E-12	1.049E-11
Am-241	§DSR(j)	3.513E-02	3.457E-02	3.348E-02	3.190E-02	3.040E-02	2.897E-02	2.547E-02	
0Cs-137	Cs-137	1.000E+00	5.095E-02	4.044E-02	2.547E-02	1.274E-02	6.368E-03	3.184E-03	5.015E-04
0Pu-238	Pu-238	1.000E+00	3.020E-02	2.790E-02	2.382E-02	1.880E-02	1.483E-02	1.170E-02	6.220E-03
Pu-238	U-234	1.000E+00	3.890E-09	7.859E-08	2.114E-07	3.751E-07	5.042E-07	6.060E-07	7.843E-07
Pu-238	Th-230	1.000E+00	2.284E-14	7.369E-12	5.903E-11	2.156E-10	4.490E-10	7.431E-10	1.734E-09
Pu-238	Ra-226	1.000E+00	8.336E-17	3.791E-13	8.903E-12	6.545E-11	2.068E-10	4.616E-10	1.847E-09
Pu-238	Pb-210	1.000E+00	1.946E-19	1.102E-14	6.737E-13	8.475E-12	3.506E-11	9.236E-11	4.678E-10
Pu-238	§DSR(j)	3.020E-02	2.790E-02	2.382E-02	1.880E-02	1.483E-02	1.170E-02	6.220E-03	
0Pu-239	Pu-239	1.000E+00	3.353E-02	3.353E-02	3.351E-02	3.348E-02	3.345E-02	3.342E-02	3.334E-02
Pu-239	U-235	1.000E+00	6.953E-12	1.460E-10	4.239E-10	8.405E-10	1.257E-09	1.673E-09	2.780E-09
Pu-239	Pa-231	1.000E+00	3.588E-16	1.187E-13	1.001E-12	3.935E-12	8.801E-12	1.559E-11	4.311E-11
Pu-239	Ac-227	1.000E+00	4.776E-18	2.055E-14	4.350E-13	2.797E-12	7.902E-12	1.606E-11	5.341E-11
Pu-239	§DSR(j)	3.353E-02	3.353E-02	3.351E-02	3.348E-02	3.345E-02	3.342E-02	3.334E-02	
0Sr-90	Sr-90	1.000E+00	1.786E-03	1.408E-03	8.745E-04	4.282E-04	2.096E-04	1.026E-04	1.528E-05

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
§ is used to indicate summation; the Greek sigma is not included in this font.
The DSR includes contributions from associated (half-life <= 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	4.270E+02	4.339E+02	4.481E+02	4.702E+02	4.935E+02	5.178E+02	5.889E+02
Cs-137	2.944E+02	3.709E+02	5.888E+02	1.178E+03	2.355E+03	4.711E+03	2.991E+04
Pu-238	4.968E+02	5.376E+02	6.296E+02	7.980E+02	1.011E+03	1.282E+03	2.411E+03
Pu-239	4.473E+02	4.474E+02	4.477E+02	4.481E+02	4.485E+02	4.488E+02	4.499E+02
Sr-90	8.398E+03	1.065E+04	1.715E+04	3.503E+04	7.156E+04	1.462E+05	9.816E+05

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 22
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

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 = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	5.000E+00	0.000E+00	3.513E-02	4.270E+02	3.513E-02	4.270E+02
Cs-137	5.600E+01	0.000E+00	5.095E-02	2.944E+02	5.095E-02	2.944E+02
Pu-238	5.000E-01	0.000E+00	3.020E-02	4.968E+02	3.020E-02	4.968E+02
Pu-239	1.000E+01	0.000E+00	3.353E-02	4.473E+02	3.353E-02	4.473E+02
Sr-90	1.300E+01	0.000E+00	1.786E-03	8.398E+03	1.786E-03	8.398E+03

1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 23
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

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

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	Am-241	1.000E+00	1.757E-01	1.728E-01	1.674E-01	1.595E-01	1.520E-01	1.448E-01	1.273E-01
Np-237	Am-241	1.000E+00	4.753E-08	9.903E-07	2.831E-06	5.483E-06	8.010E-06	1.042E-05	1.630E-05
U-233	Am-241	1.000E+00	3.333E-15	1.097E-12	9.155E-12	3.545E-11	7.807E-11	1.363E-10	3.620E-10
Th-229	Am-241	1.000E+00	1.769E-18	8.176E-15	1.983E-13	1.528E-12	5.050E-12	1.177E-11	5.246E-11
Cs-137	Cs-137	1.000E+00	2.853E+00	2.264E+00	1.427E+00	7.133E-01	3.566E-01	1.783E-01	2.808E-02
Pu-238	Pu-238	1.000E+00	1.510E-02	1.395E-02	1.191E-02	9.399E-03	7.415E-03	5.851E-03	3.110E-03
U-234	Pu-238	1.000E+00	1.945E-09	3.929E-08	1.057E-07	1.875E-07	2.521E-07	3.030E-07	3.921E-07
Th-230	Pu-238	1.000E+00	1.142E-14	3.685E-12	2.951E-11	1.078E-10	2.245E-10	3.715E-10	8.672E-10
Ra-226	Pu-238	1.000E+00	4.168E-17	1.896E-13	4.451E-12	3.273E-11	1.034E-10	2.308E-10	9.233E-10
Pb-210	Pu-238	1.000E+00	9.730E-20	5.509E-15	3.368E-13	4.238E-12	1.753E-11	4.618E-11	2.339E-10
Pu-239	Pu-239	1.000E+00	3.353E-01	3.353E-01	3.351E-01	3.348E-01	3.345E-01	3.342E-01	3.334E-01
U-235	Pu-239	1.000E+00	6.953E-11	1.460E-09	4.239E-09	8.405E-09	1.257E-08	1.673E-08	2.780E-08
Pa-231	Pu-239	1.000E+00	3.588E-15	1.187E-12	1.001E-11	3.935E-11	8.801E-11	1.559E-10	4.311E-10
Ac-227	Pu-239	1.000E+00	4.776E-17	2.055E-13	4.350E-12	2.797E-11	7.902E-11	1.606E-10	5.341E-10
Sr-90	Sr-90	1.000E+00	2.322E-02	1.830E-02	1.137E-02	5.566E-03	2.725E-03	1.334E-03	1.987E-04

BRF(i) is the branch fraction of the parent nuclide.
§ is used to indicate summation; the Greek sigma is not included in this font.

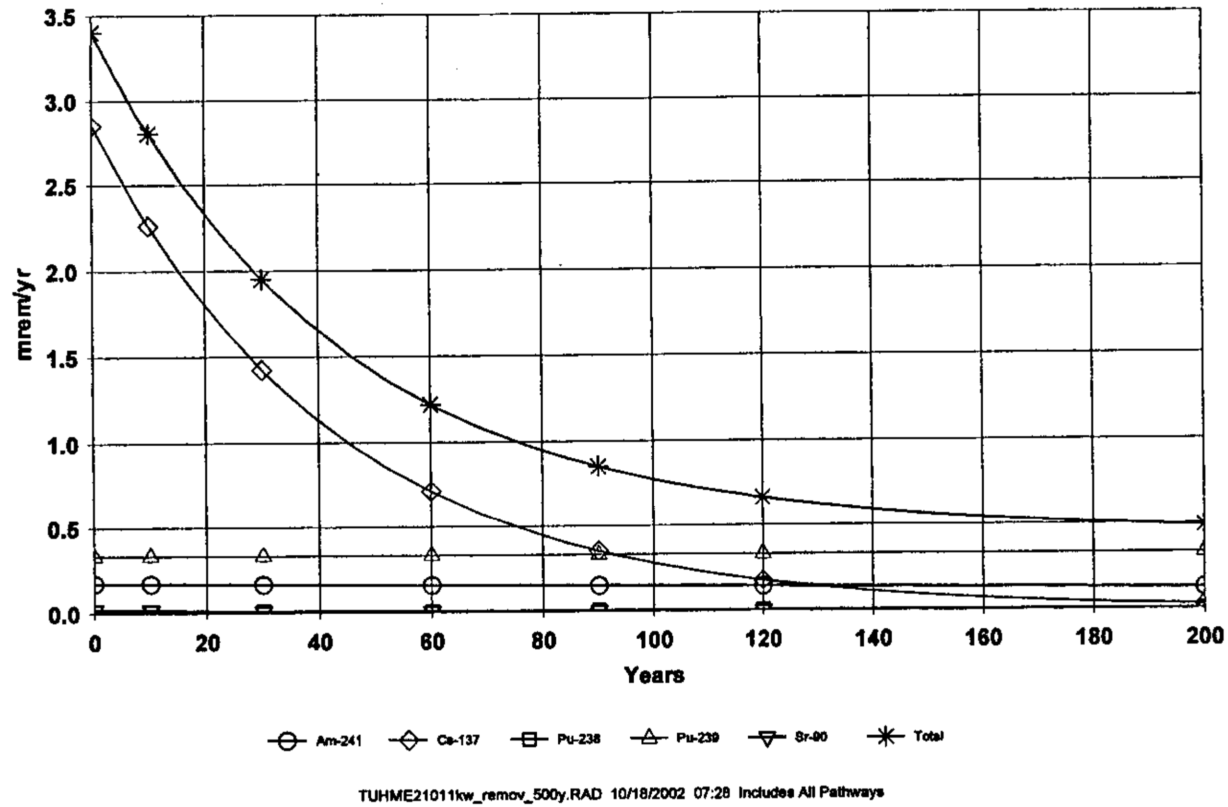
1RESRAD, Version 6.21 T½ Limit = 0.5 year 10/18/2002 07:28 Page 24
Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r
File : TUHME21011kw_remov_500y.RAD

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	Am-241	1.000E+00	5.000E+00	4.920E+00	4.764E+00	4.540E+00	4.326E+00	4.122E+00	3.625E+00
Np-237	Am-241	1.000E+00	0.000E+00	1.607E-05	4.743E-05	9.263E-05	1.357E-04	1.767E-04	2.769E-04
U-233	Am-241	1.000E+00	0.000E+00	3.522E-10	3.136E-09	1.235E-08	2.734E-08	4.785E-08	1.275E-07
Th-229	Am-241	1.000E+00	0.000E+00	1.110E-13	2.971E-12	2.347E-11	7.822E-11	1.831E-10	8.202E-10
Cs-137	Cs-137	1.000E+00	5.600E+01	4.445E+01	2.800E+01	1.400E+01	7.000E+00	3.500E+00	5.512E-01
Pu-238	Pu-238	1.000E+00	5.000E-01	4.620E-01	3.945E-01	3.113E-01	2.456E-01	1.938E-01	1.030E-01
U-234	Pu-238	1.000E+00	0.000E+00	1.363E-05	3.786E-05	6.772E-05	9.128E-05	1.099E-04	1.424E-04
Th-230	Pu-238	1.000E+00	0.000E+00	6.215E-10	5.313E-09	1.973E-08	4.131E-08	6.856E-08	1.605E-07
Ra-226	Pu-238	1.000E+00	0.000E+00	9.024E-13	2.339E-11	1.763E-10	5.615E-10	1.259E-09	5.060E-09
Pb-210	Pu-238	1.000E+00	0.000E+00	6.624E-14	4.625E-12	6.013E-11	2.515E-10	6.660E-10	3.394E-09
Pu-239	Pu-239	1.000E+00	1.000E+01	9.997E+00	9.991E+00	9.983E+00	9.974E+00	9.965E+00	9.942E+00
U-235	Pu-239	1.000E+00	0.000E+00	9.847E-08	2.953E-07	5.904E-07	8.852E-07	1.180E-06	1.964E-06
Pa-231	Pu-239	1.000E+00	0.000E+00	1.042E-11	9.372E-11	3.747E-10	8.426E-10	1.497E-09	4.153E-09
Ac-227	Pu-239	1.000E+00	0.000E+00	1.023E-12	2.388E-11	1.574E-10	4.481E-10	9.142E-10	3.054E-09
Sr-90	Sr-90	1.000E+00	1.300E+01	1.025E+01	6.365E+00	3.116E+00	1.526E+00	7.469E-01	1.112E-01

BRF(i) is the branch fraction of the parent nuclide.
§ is used to indicate summation; the Greek sigma is not included in this font.
RESCALC.EXE execution time = 2.33 seconds

DOSE: All Nuclides Summed, All Pathways Summed



Appendix G

Results of Previous Field Investigations

APPENDIX G RESULTS OF PREVIOUS FIELD INVESTIGATIONS

G-1.0 PREVIOUS FIELD INVESTIGATIONS

The results of previous investigations at SWMU 21-011(k) in 1988, 1992, and 1993 are presented and summarized. The data are compared to current Laboratory-wide background values (Ryti et al. 1998, 59730.2) and human health screening action levels (SALs) for chemicals and radionuclides. The chemical SALs are based on a residential exposure scenario and are derived according to the approach presented in "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639), which is based on NMED and EPA Region 6 guidance (NMED 2000, 68554.1; EPA 2001, 71466.1). The radionuclide SALs are also based on a residential exposure scenario and are derived according to the methodology presented in the Derivation and Use of Radionuclide Screening Action Levels (LANL 2001, 69683.1).

G1.1 1988 DOE Reconnaissance Sampling

PRS 21-011(k) was sampled during a 1988 DOE Headquarters Environmental Survey of the Laboratory. One surface sample (0–3 in.) was collected from each of three locations (Figure G1.1-1). Sample LA30201 was collected 23 ft from the end of the outfall pipe, Sample LA30202 was located approximately 30 ft below the edge of the mesa, and Sample LA30203 was located approximately 35 ft north of the beginning of the flat area in the canyon bottom. Samples were analyzed for metals and radionuclides. The areas of Sample LA30201 (23 ft from the end of the outfall pipe) and Sample LA30202 (30 ft from the edge of the mesa) were excavated during the 1996 interim action (IA). Therefore, the soil sampled in these areas is no longer present at the site and the contaminant concentrations are not represented by later sample data. The results of this sampling effort are discussed in more detail in the TA-21 OU RFI Phase Report 1C (LANL 1994, 31591.1).

G1.2 Results of 1988 DOE Reconnaissance Sampling

Table G1.2-1 presents the inorganic chemical results above current soil background values from the 1988 DOE Headquarters Environmental Survey of the Laboratory. Uranium was detected above its background value in the sample collected from below the edge of the mesa (LA30202).The sample collected from near the end of the outfall pipe (LA30201) had six inorganic chemicals detected at concentrations greater than their background value. Two of those chemicals, lead and zinc, were detected at values within the range of the background data set are therefore similar to background. The remaining four chemicals, cadmium, copper, nickel, and uranium, were above the range of the background data set. None of the inorganic chemicals exceeded their SALs.

Americium-241, plutonium-238, -239, strontium-90 and uranium-235 were detected at concentrations greater than the background/fallout values in Sample LA30201 located 23 ft from the outfall pipe (Table G1.2-2). The concentrations of each of these radionuclides decreased at the two sample locations located below the canyon rim (LA30202 and LA 30203) with the exception of americium-241, which increased in LA30202 then decreased in LA30203, and cesium-137, which was not detected above background in LA30201 was above fallout in LA30202 then decreased to below fallout in LA30203. Plutonium-238, plutonium-239, and strontium-90 were detected at concentrations greater than SAL in Sample LA30201, while strontium-90 and cesium-137 were present at concentrations greater than SAL in Sample LA30202; 30 ft from the edge of the mesa (Table G1.2-2). None of the radionuclides were detected at a concentration greater than SAL in Sample LA30203, approximately 35 ft north of the beginning of the flat area in the canyon bottom.

Table G1.2-1
Inorganic Chemicals Detected Above Background in 1988 DOE Reconnaissance Samples

Sample/Location ID	Analyte	Sample Interval (inches)	Sample Value (mg/kg)	Soil Background Values (mg/kg)	Soil SAL (mg/kg)
LA30201	Cadmium	0–3	24.7	0.4	70
LA30201	Copper	0–3	45.8	14.7	2800
LA30201	Lead	0–3	26.1	22.3	400
LA30201	Nickel	0–3	64.3	15.4	1500
LA30201	Uranium	0–3	8.0	1.82	230[1]
LA30202	Uranium	0–3	9.0	1.82	230
LA30201	Zinc	0–3	60.5	48.8	23000

[1]USEPA 4/2/2002 Region III Risk Based Concentration Table (Website: www.EPA.gov/reg3hwmd/risk/index.htm)

Table G1.2-2
Radionuclides Detected Above Background in 1988 DOE Reconnaissance Samples

Sample/Location ID	Radionuclide	Sample Interval Depth (in.)	Sample Value (pCi/g)	Soil Background Values (pCi/g)	Soil SALs (pCi/g)
LA30201	Uranium-235	0–3	1.7	0.2	17
LA30201	Plutonium-238	0–3	105	0.023	49
LA30201	Plutonium-239	0–3	377	0.054	44
LA30201	Americium-241	0–3	1.4	0.013	39
LA30201	Strontium-90	0–3	414	1.31	5.7
LA30202	Uranium-235	0–3	0.21	0.2	17
LA30202	Plutonium-238	0–3	0.34	0.023	49
LA30202	Plutonium-239	0–3	1.9	0.054	44
LA30202	Americium-241	0–3	2.6	0.013	39
LA30202	Strontium-90	0–3	17	1.31	5.7
LA30202	Cesium-137	0–3	51.8	1.65	5.3
LA30203	Plutonium-238	0–3	0.046	0.023	49
LA30203	Plutonium-239	0–3	0.25	0.054	44
LA30203	Americium-241	0–3	0.52	0.013	39

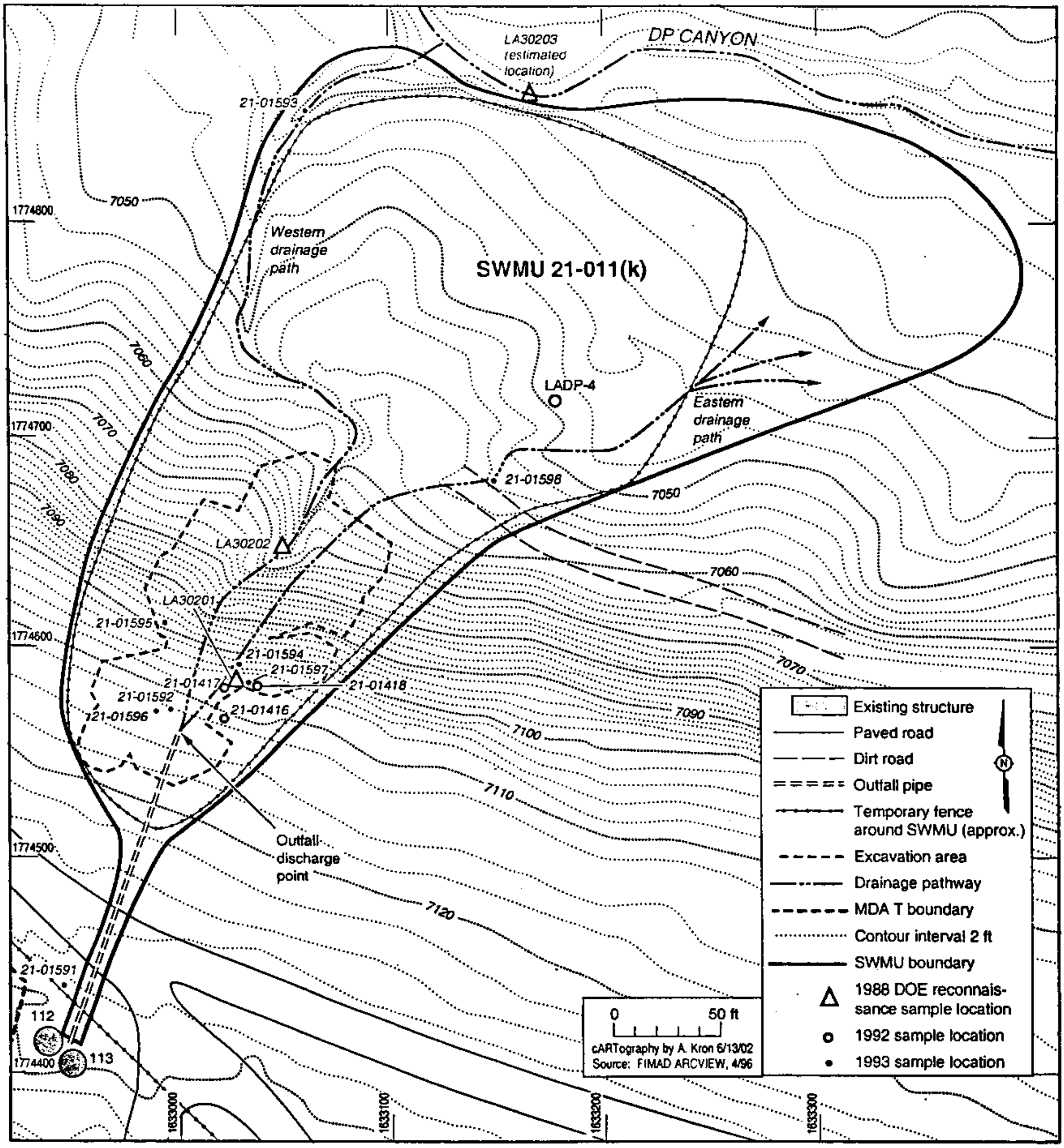


Figure G1.1-1 Sample locations at PRS 21-011(k)

G1.3 1992 RFI Sampling

Characterization of SWMU 21-011(k) was performed in 1992 as prescribed in the TA-21 Operable Unit RFI Work Plan (LANL 1991, 07528.1). The 1992 investigation consisted of a radiological field survey and the collection of soil samples at three locations: 21-01416, 21-01417, and 21-01418 (Figure G1.1-1). One surface sample (0–6 in.) and two near surface samples (6-12 in. and 12-18 in.) were collected at each location except location 21-1416 where refusal was encountered at 5 in. Samples were analyzed for semivolatile organic compounds (SVOCs), metals, and radionuclides. The areas of Sample Locations 21-01416, 21-01417 and 21-01418 were excavated during the 1996 IA. Therefore, the soil sampled in these areas is no longer present at the site and the contaminant concentrations are not represented by later sample data. These data are presented in the Phase Report Addendum 1B and 1C Operable Unit 1106, RCRA Facility Investigation (LANL 1994, 52350.1).

G1.4 Results of 1992 RFI Sampling

Tables G1.4-1 (SVOCs), G1.4-2 (inorganic chemicals), and G1.4-3 (radionuclides) present the results of the 1992 RFI sampling. Two organic chemicals, bis(2-ethylhexyl)phthalate and di-n-butylphthalate, were detected slightly above the estimated quantitation limits (EQLs) and well below their respective SALs at Sample Location 21-01418 (Table G1.4-1). Cadmium, calcium, copper, lead, nickel, silver, thallium, uranium, and zinc were detected above their soil background values or had detected limits above their background values. In addition, lithium and strontium, which do not have background values, were detected in the soil. None of the inorganic chemicals were detected above their SALs, however, thallium had detection limits slightly above its SAL at all three sample locations The radionuclides americium-241, plutonium-238, plutonium-239, strontium-90, and tritium were detected above their soil background/fallout values. The concentrations for americium-241 (locations 21-01416 and 21-01417), plutonium-239/240 (locations 21-01417 and 21-01418), and strontium-90 (locations 21-01416, -01417, -01418) were detected greater than their respective SALs.

Table G1.4-1
SVOCs Detected in the 1992 RFI Samples

Location ID	Sample ID	Media	Depth (in)	Analyte	Sample Value (mg/kg)	SAL (mg/kg)
21-01418	AAA0908	Soil	6-12	Bis(2-ethylhexyl)phthalate	0.34	35
21-01418	AAA0909	Soil	0-6	Di-n-butylphthalate	0.6	6100

Table G1.4-2
Inorganic Analytes Detected Above Background Values in 1992 RFI Samples[1]

ıple D	Location ID	Depth (ft)	Media	Cadmium	Calcium	Copper	Lead	Lithium	Nickel	Silver	Strontium	Thallium	Uranium	Zinc
;oil Background Value				0.4	6120	14.7	22.3	N/a[2]	15.4	1	N/a	0.73	1.82	48.8
Soil SAL				70	N/A[3]	2800	400	1600	1500	380	37000	6.1	230[4]	23000
.0833	21-01416	0–0.42	Soil	52	46000	132.2	50.4	6.92	224.4	20.6	157	7.3 (U)	54.2	196.6
.0906	21-01417	0–0.5	Soil	9.6	—[5]	34.8	—	6.2	44.4	2.5 (U)	39.2	5.2 (U)	6.9	—
.0907	21-01417	0.50–1.0	Soil	9.8 (U)	—	—	—	5.1	21.4	3.2 (U)	14.2	—	4.5	—
.0908	21-01418	0.00–0.5	Soil	9.8 (U)	—	—	—	6.1	25.1	3.1 (U)	41.4	6.4 (U)	5.3	—
.0909	21-01418	0.50–1.0	Soil	10 (U)	—	—	—	4.9	18.7	3.2 (U)	25.5	6.5 (U)	4.3	—

[1]All soil values are in units of mg/kg
[2] "N/a" denotes "not available" because these chemicals were not included in the background study
[3] "N/A" denotes "not applicable" because calcium is an essential nutrient
[4]USEPA 4/2/2002 Region III Risk Based Concentration Table (Website: www.EPA.gov/reg3hwmd/risk/index.htm)
[5] "—"denotes a value not exceeding the background value

Table G1.4-3
Radionuclides Detected Above Fallout Values in 1992 RFI Sampling

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Plutonium-238 (pCi/g)	Plutonium-239 (pCi/g)	Strontium-90 (pCi/g)	Tritium[1] (pCi/g)
Soil FalloutValue				0.013	0.023	0.054	1.31	0.075
Soil SAL				39	49	44	5.7	880
AAA0833	21-01416	0.00–0.42	Soil	2600	—[2]	—	1800	0.023
AAA0906	21-01417	0.00–0.50	Soil	289	—	—	600	0.02
AAA0907	21-01417	0.50–1.00	Soil	38	2.2	53	220	0.001
AAA0908	21-01418	0.00–0.50	Soil	29.8	2.8	49	170	0.0005
AAA0909	21-01418	0.50–1.00	Soil	29.8	0.77	14	180	0.0009

[1]Tritium soil background value and sample results were converted to pCi/g using an average percent moisture of 9% from the Phase Report Addendum 1B and 1C (LANL 1994, 52350.1)
[2]"—" denotes that the radionuclide was not detected.

G1.5 1993 RFI Sampling

Additional characterization of SWMU 21-011(k) was conducted in 1993 due to the elevated radionuclide concentrations encountered in the 1992 RFI sampling. The additional sampling included a radiological survey with direct reading instruments to further delineate the extent of contamination and to guide the placement of sampling locations. Eight additional sampling locations (Location IDs 21-01591 through -1598) (Figure G1.1-1) were selected based on the radiological survey. The survey extended to the bottom of DP Canyon including small drainage channels leading from the discharge point. Surface samples (0-6 in.) were collected at all eight locations and near-surface samples (6–12 and 12–18 in.) were collected at three locations and analyzed for radionuclides. The results of this sampling effort are also discussed in more detail in the TA-21 Addendum to OU RFI Phase Reports 1B and 1C (LANL 1994, 52350.1)

G1.6 Results of 1993 RFI Sampling

Americium-241, cesium-137, plutonium-238, -239, strontium-90, thorium-228, tritium, uranium-234 and -235 were all detected at levels above background (Table G1.6-1). Of these radionuclides, americium-241, cesium-137, plutonium-239, strontium-90, and thorium-228 exceeded their respective SALs. Americium-241 was only detected above SAL at Sample Location 21-01593, plutonium-239 was detected above SAL at two locations (Location IDs 21-01594 and 21-01597), and thorium-228 was detected once above SAL at Location ID 21-01597. Cesium-137 and strontium-90 were detected above SAL at all 1993 sample locations (Location IDs 21-01591 through 21-01598). The soils at Location IDs 21-01592 and 21-01594 through -1597 were excavated during the 1996 IA. Therefore, the soil sampled in these areas is no longer present at the site and the contaminant concentrations are not represented by later sample data.

Table G1.6-1
Radionuclides Detected Above Background/Fallout In The 1993 RfI Samples[1]

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Strontium-90	Thorium-228	Tritium[3]	Uranium-234	Uranium-235
Soil Background/Fallout Value				0.013	1.65	0.023	0.054	1.31	2.28	0.075	2.59	0.2
SAL				39	5.3	49	44	5.7	2.0	880	63	17
AAA4009	21-01591	0.00-0.50	Soil	9	42.6	0.86	12.8	8.6	—[2]	0.011	—	—
AAA4010	21-01592	0.00-0.50	Soil	12.8	753	0.88	27.6	238	—	0.017	—	—
AAA4011	21-01593	0.00-0.50	Soil	125.2	81.3	7.9	21.5	47.5	—	0.019	6.3	0.27
AAA4012	21-01594	0.00-0.50	Soil	28	510	1.8	53.9	174	—	0.059	-	—
AAA4013	21-01595	0.00-0.50	Soil	0.83	259	0.078	3.2	202	—	0.023	-	—
AAA4015	21-01596	0.00-0.50	Soil	5.7	268	0.28	13.8	85.6	—	0.016	-	—
AAA4016	21-01596	0.50-1.00	Soil	3.8	418	0.23	10.1	245	—	0.08	-	—
AAA4017	21-01596	1.00-1.50	Soil	0.84	414	0.065	3.3	178	—	0.041	-	—
AAA4018	21-01597	0.00-0.50	Soil	—	2675	47.8	773	1234	2.4	0.21	4	—
AAA4019	21-01597	0.50-1.00	Soil	—	3226	19.8	283	1155	—	0.25	2.8	—
AAA4021	21-01597	1.00-1.50	Soil	—	1648	32.6	196	431	—	0.55	7.9	0.26
AAA4022	21-01598	0.00-0.50	Soil	3.7	190	1.5	7.8	31.2	—	0.017	—	—
AAA4023	21-01598	0.50-1.00	Soil	1.0	234	0.39	2.9	32.3	—	0.037	—	—
AAA4024	21-01598	1.00-1.50	Soil	0.4	32.1	0.098	2.3	21.7	—	0.021	—	—

[1]All soil values are in units of pCi/g
[2]"—" denotes a value not exceeding the background/fallout value
[3]Tritium soil background value and sample results were converted to pCi/g using an average percent moisture of 9% from the Phase Report Addendum 1B and 1C (LANL 1994, 52350.1)

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The following list includes all references cited in this appendix. Parenthetical information following each reference provides the author, publication date, and the ER record identification (ER ID) number. This information also is included in the citations in the text. ER ID numbers are assigned by the Laboratory's ER Project to track records associated with the Project. These numbers can be used to locate copies of the actual documents at the ER Project's Records Processing Facility and, where applicable, with the ER Project reference library titled "Reference Set for Material Disposal Areas, Technical Area 21."

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous Waste Bureau; the Department of Energy Los Alamos Area Office; United States Environmental Protection Agency, Region 6; and the ER Project MDAs Focus Area. This library is a living collection of documents that was developed to ensure that the administrative authority has all the necessary material to review the decisions and actions proposed in this document. However, documents previously submitted to the administrative authority are not included.

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Appendix H

2001 Pre-Excavation Characterization Sampling

APPENDIX H 2001 PRE-EXCAVATION CHARACTERIZATION SAMPLING

Table H-1 presents the summary of the samples collected during the pre-VCM characterization effort performed at SWMU 21-011(k) in March of 2001. Eleven sample locations were selected with input from NMED and were based on preliminary results from the in situ gamma spectrometry survey conducted in November 2000.

Table H-1 2001 Waste Characterization Sample Summaries

In Situ Gamma Survey ID	Location ID	Depth (ft)	Sample ID	Date/Time	Analytical Suites	Sample Type
256 (Low)	21-11201	0-1	256-0		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		1-2	MD21-01-0021	3/6/01 10:05	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		2-3	256-2		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		3-4	256-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		4-5	MD21-01-0023	3/6/01 10:30	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		0-5	MD21-01-0024	3/6/01 9:55	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite
352 (Mid)	21-11202	0-1	MD21-01-0025	3/6/01 11:11	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs(Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete

Table H-1 (continued)

In Situ Gamma Survey ID	Location ID	Depth (ft)	Sample ID	Date/Time	Analytical Suites	Sampl Type
		1-2	352-1		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		2-3	352-2		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		3-4	352-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		4-5	MD21-01-0022	3/6/01 12:33	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discret
		0-5	MD21-01-0026	3/6/01 12:20	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Compos
67 (Low)	21-11203	0-1	67-0		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		1-2	MD21-01-0027	3/7/01 9:31	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discret
		2-3	67-2		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		3-4	67-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		4-5	MD21-01-0029	3/7/01 9:44	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discre
		0-5	MD21-01-0028	3/7/01 9:36	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Wast Compo
331 (Mid)	21-11204	0-1	331-0		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Fielc Screen

Table H-1 (continued)

In Situ Gamma Survey ID	Location ID	Depth (ft)	Sample ID	Date/Time	Analytical Suites	Sample Type
		1-2	331-1		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		2-3	MD21-01-0030	3/7/01 10:18	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		3-4	331-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		4-5	MD21-01-0031	3/7/01 10:27	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		0-5	MD21-01-0032	3/7/01 10:23	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite
122 (Mid)	21-11205	0-1	122-1		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		1-2	MD21-01-0033	3/7/01 12:29	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		2-3	122-2		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		3-4	122-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		4-5	MD21-01-0034	3/7/01 12:57	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		0-5	MD21-01-0035	3/7/01 12:38	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite

Table H-1 (continued)

In Situ Gamma Survey ID	Location ID	Depth (ft)	Sample ID	Date/Time	Analytical Suites	Sampl Type
496 (Mid)	21-11206	0-1	MD21-01-0036	3/8/01 10:30	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discret
		1-2	496-1		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		2-3	496-2		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		3-4	496-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		4-5	MD21-01-0037	3/8/01 10:52	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discret
		0-5	MD21-01-0038	3/8/01 22:44	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Compos
547 (High)	21-11207	0-1	MD21-01-0039	3/8/01 11:41	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discret
		1-1.5	547-1		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screeni
		0-1.5	MD21-01-0040	3/8/01 11:41	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Wast Compo
554 (High)	21-11208	0-1	554-0		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screen
		1-2	MD21-01-0041	3/8/01 13:09	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discre
		2-3	554-2		Gross alpha/beta, Gross gamma,	Fielc

Table H-1 (continued)

In Situ Gamma Survey ID	Location ID	Depth (ft)	Sample ID	Date/Time	Analytical Suites	Sample Type
					Cesium-137, Americium-241	Screening
		3-4	554-3		Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Field Screening
		4-5	MD21-01-0042	3/8/01 13:49	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Discrete
		0-5	MD21-01-0043	3/8/01 13:49	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite
595 (High)	21-11209	0-1	MD21-01-0044	3/9/01 9:35	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs(Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite
583 (High)	21-11210	0-1	MD21-01-0045	3/9/01 9:55	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite
564 (High)	21-11211	0-1	MD21-01-0069	3/9/01 10:20	Perchlorate, Gamma Spec, Isotopic Plutonium, Sr-90, TAL Metals, TCLP Metals, TCLP VOCs, TCLP SVOCs, Pesticides, PCBs, VOCs (Encore), Gross alpha/beta, Gross gamma, Cesium-137, Americium-241	Waste Composite

Sample locations were chosen by performing a rank and percentile analysis of the survey data as shown in Figure H-1. Samples were selected from low, mid, and high ranges as shown in Table H-2.

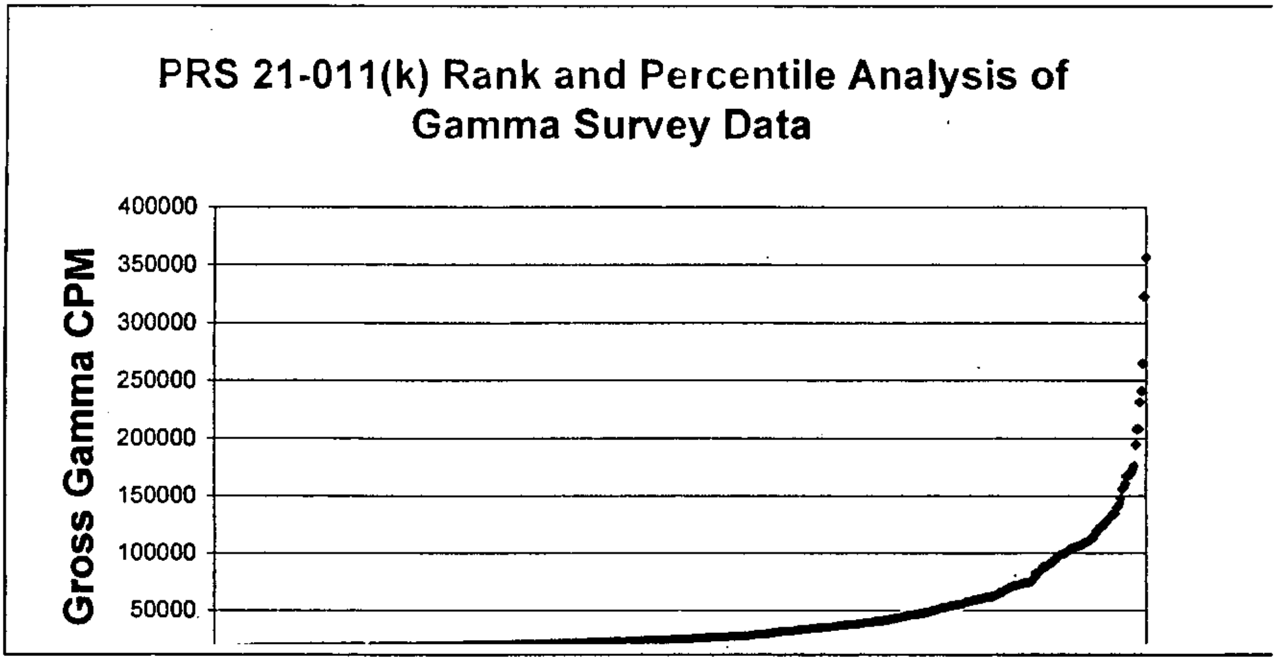


Figure H-1 Rank and Percentile Analysis of Gamma Radiation Survey Data

During the in situ gamma surface radiation survey, 650 locations were measured for gross gamma radiation. Approximately 77% of these values were below 50,000 counts per minute (CPM). Approximately 91% of the measurements taken were below 100,000 CPM and 100% of the measurements were below 400,000 CPM. Eleven in situ gamma survey locations were chosen to conduct depth profiling of the primary radionuclides at the site and to complete waste characterization activities prior to the planned VCM. As shown in Table H-2, two locations with in situ gamma survey results in the low range were chosen for waste characterization sample collection, in addition to four locations exhibiting mid-range survey results, and five locations exhibiting high range survey results. The guidance established for waste characterization sample collection specified that a minimum of one discrete sample was to be collected from each auger hole location. If no elevated radioactivity was detected, then the discrete sample would be collected from the bottom of the auger hole. Two discrete samples were to be collected from any auger hole advanced to a depth of 5 feet or deeper with sample collection intervals based on field screening results and/or the bottom of the hole. Samples submitted for VOC analyses were to be collected from the depth intervals with the highest radioactivity screening results and/or the bottom of the auger hole and not from the top six-inch sample interval. A composite sample, also for waste characterization purposes, was then to be collected from the remaining core at each of the 11 locations.

Table H-2 Sample Location Selection Criteria

Survey ID	X_Coordinate	Y_Coordinate	Elevation	Gross CPM	Range
256	1633386.108	1774761.007	7046.355	31254	Low
67	1633193.959	1774839.47	7049.203	38058	Low
352	1633307.191	1774782.117	7049.189	74364	Mid
331	1633164.585	1774795.306	7050.476	84588	Mid
496	1633172.271	1774695.58	7052.654	91968	Mid
122	1633036.628	1774737.631	7058.224	95970	Mid
547	1633076.448	1774654.923	7067.518	110772	High
554	1633059.719	1774646.382	7072.723	231618	High
583	1633005.769	1774577.311	7114.731	207900	High
595	1632998.255	1774557.402	7113.792	264990	High
564	1633015.987	1774612.395	7099.214	356502	High

2001 Waste Characterization Discrete Sample Results

The analytical results of the waste characterization sampling for discrete intervals are listed in Tables H-3 through H-6.

Table H-3
Target Analyte List (TAL) for Inorganics Screening against Sediment and Soil Background (Discrete Sample Intervals Only)*

Sample Id	*Location Id*	*Depth Interval*	*Aluminum*	*Antimony*	*Arsenic*	*Barium*	*Beryllium*	*Cadmium*	*Calcium*	*Chromium*	*Cobalt*	*Copper*	*Iron*	*Lead*
ll Background	**NA**	**NA**	**29200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**21500**	**22.3**
ient Background	**NA**	**NA**	**15400**	**0.83**	**3.98**	**127**	**1.31**	**0.4**	**4420**	**10.5**	**4.73**	**11.2**	**13800**	**19.7**
D21-01-0021	21-11201	1-2 ft	3800	0.34 B	2.3	66	0.47 B	0.11 B	970	6	4.1	3.1	7100	8.6
D21-01-0023	21-11201	4-5 ft	2000	0.28 B	1.3	30	0.29 B	0.06 B	520	2.7	2	1.5	5900	6.4
D21-01-0025	21-11202	0-1 ft	4800	-	2.8	86	0.56 B	0.13 B	1600	5.4	4.3	4.7	8300	11
D21-01-0022	21-11202	4-5 ft	6200	0.34 B	2.7	110	0.78	0.092 B	1800	7.1	[illegible]	5	11000	12
D21-01-0027	21-11203	1-2 ft	5300	0.28 B	2.3	89	0.62	0.1	1000	5.7	4.2	5	8600	8.8
D21-01-0029	21-11203	4-5 ft	4400		2.3	63	0.49 B	0.081 B	870	4.5	2.1	3.2	8100	8
D21-01-0030	21-11204	2-3 ft	8300	0.62 B	3.8	120	0.88	0.14 B	1300	8.5	[illegible]	7.9	13000	12
D21-01-0031	21-11204	4-5 ft	8100	0.4 B	3.5	130	0.89	0.16 B	1900	8.6	[illegible]	8	13000	12
D21-01-0033	21-11205	1-2 ft	5300	0.4 B	2.4	55	0.69	0.33	1800	5.2	2.7	4.8	7700	9.1
D21-01-0034	21-11205	4-5 ft	5000	-	2.1	43	0.98	0.11 B	760	6.5	1.4	3.5	6500	7.1
D21-01-0036	21-11206	0-1 ft	4800	-	2.4	89	0.55 B	0.11 B	1700	4.5	3.8	3.9	7700	9.8
D21-01-0037	21-11206	4-5 ft	7100	0.35 B	2.6	64	1.3	0.08 B	1500	12	1.7	5.9	8400	7.7
D21-01-0039	21-11207	0-1 ft	7100	0.48 B	3.5	74	0.9	0.18 B	1500	7.9	3.5	6.3	10000	10
D21-01-0041	21-11208	1-2 ft	3500	-	2.5	32	0.73	0.87	1500	4	1.6	5.5	5900	7.8
D21-01-0042	21-11208	4-5 ft	3100	-	1.7	17	0.99	0.56 B	670	3.5	0.8 B	3.8	4600	4.4
D21-01-0044	21-11209	0-1 ft	4500	0.38 B	2.8	82	0.56 B	0.55 B	9000	5.9	[illegible]	8.7	7600	17
D21-01-0045	21-11210	0-1 ft	4900	0.39 B	2.6	54	0.55 B	[illegible]	3600	8.8	2.5	10	8300	15
D21-01-0069	21-11211	0-1 ft	6000	-	2.1	58	0.53 B	[illegible]	9300	6	2.3	7.7	8500	16

Table H-3 - Continued

Sample Id	Location Id	Depth Interval	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Vanadium	Zin
Soil Background	NA	NA	4610	671	15.4	3460	1.52	1	915	39.6	4
Sediment Background	NA	NA	2370	543	9.38	2690	0.3	1	1470	19.7	6
MD21-01-0021	21-11201	1-2 ft	710	300	5.1	710	-	-	470	12	1
MD21-01-0023	21-11201	4-5 ft	360	210	2.2	360	-	-	160	7.2	2
MD21-01-0025	21-11202	0-1 ft	1000	320	5.2	1200	-	0.091 B	290	14	2
MD21-01-0022	21-11202	4-5 ft	1400	380	6.4	1200	[redacted]	-	370	18	2
MD21-01-0027	21-11203	1-2 ft	890	310	5.1	1700	-	-	[redacted]	14	2
MD21-01-0029	21-11203	4-5 ft	810	190	3.3	920	-	-	610	11	2
MD21-01-0030	21-11204	2-3 ft	1600	310	7.6	2000	[redacted]	-	[redacted]	[redacted]	2
MD21-01-0031	21-11204	4-5 ft	1900	390	[redacted]	1600	-	-	860	18	3
MD21-01-0033	21-11205	1-2 ft	940	240	5.6	1700	-	-	610	10	2
MD21-01-0034	21-11205	4-5 ft	710	260	6.2	1300	-	-	550	7.4	3
MD21-01-0036	21-11206	0-1 ft	930	260	4.4	1200	-	-	65 B	13	2
MD21-01-0037	21-11206	4-5 ft	1200	130	[redacted]	1200	-	-	600	9.7	3
MD21-01-0039	21-11207	0-1 ft	1400	250	[redacted]	2400	[redacted]	-	900	14	2
MD21-01-0041	21-11208	1-2 ft	560	180	6.7	1200	-	0.16 B	330	7.8	2
MD21-01-0042	21-11208	4-5 ft	410	140	4.5	850	-	-	270	5.2	2
MD21-01-0044	21-11209	0-1 ft	1000	330	[redacted]	1500	-	-	130 B	13	2
MD21-01-0045	21-11210	0-1 ft	930	240	[redacted]	1300	-	0.15 B	78 B	11	2
MD21-01-0069	21-11211	0-1 ft	1500	260	[redacted]	2100	-	0.21 B	190	9.9	3

Table H-3 - Key

= greater than sediment background value

= greater than soil background value

= greater than sediment and soil background value

Table H-4
TCLP Metals Analysis Results (Discrete Sample Intervals Only)*

Sample Id	Location Id	Depth Interval	Arsenic	Barium	Cadmium	Chromium	Lead
MD21-01-0021	21-11201	1-2 ft	0.021 B	0.6 B	-	0.005 B	-
MD21-01-0022	21-11202	4-5 ft	0.019 B	0.6 B	-	-	-
MD21-01-0023	21-11201	4-5 ft	-	0.49 B	-	-	-
MD21-01-0025	21-11202	0-1 ft	-	0.81 B	-	0.0099 B	-
MD21-01-0027	21-11203	1-2 ft	-	1.5	-	0.034 B	0.026 B
MD21-01-0029	21-11203	4-5 ft	-	0.72 B	-	0.0056 B	-
MD21-01-0030	21-11204	2-3 ft	-	0.66 B	-	-	-
MD21-01-0031	21-11204	4-5 ft	-	0.63 B	-	0.0075 B	-
MD21-01-0033	21-11205	1-2 ft	-	0.52 B	-	-	-
MD21-01-0034	21-11205	4-5 ft	-	0.53 B	-	-	-
MD21-01-0036	21-11206	0-1 ft	-	0.64 B	-	-	-
MD21-01-0037	21-11206	4-5 ft	-	0.57 B	-	-	-
MD21-01-0039	21-11207	0-1 ft	-	0.48 B	-	0.013 B	-
MD21-01-0041	21-11208	1-2 ft	-	0.45 B	0.0043 B	0.014 B	0.011 B
MD21-01-0042	21-11208	4-5 ft	-	-	0.0031 B	-	-
MD21-01-0044	21-11209	0-1 ft	-	0.87 B	0.0079 B	0.013 B	-
MD21-01-0045	21-11210	0-1 ft	-	0.82 B	0.012 B	-	0.27
MD21-01-0069	21-11211	0-1 ft		0.56 B	0.0052 B	-	-

*All Units in mg/L

Table H-5

Organic Detects (Analyte Suites include Pesticides, PCBs, VOCS (Encore), TCLP SVOCs, TCLP VOCs) (Discrete Sample Intervals Only)*

I	Location Id	Depth Interval	4,4'-DDT(ug/Kg)	Acetone (ug/Kg)	Methylene chloride (ug/Kg)	4-Isopropyltoluene (ug/Kg)	2-Hexanone (ug/Kg)	Trichloroethene (mg/L)
0021	21-11201	1-2 ft	-	-	-	-	-	-
0023	21-11201	4-5 ft	-	-	-	-	-	-
0025	21-11202	0-1 ft	0.44 J	-	-	-	-	-
0022	21-11202	4-5 ft	-	13 J	-	7.3	-	0.007 J
0027	21-11203	1-2 ft	-	-	-	-	-	-
0029	21-11203	4-5 ft	-	-	-	-	-	-
-0030	21-11204	2-3 ft	-	-	-	-	-	-
-0031	21-11204	4-5 ft	-	-	-	-	-	-
-0033	21-11205	1-2 ft	0.57 J	-	-	-	-	-
-0034	21-11205	4-5 ft	-	50	72	26	-	-
-0036	21-11206	0-1 ft	0.39 J	-	-	-	-	-
-0037	21-11206	4-5 ft	-	-	-	-	-	-
-0039	21-11207	0-1 ft	-	-	7.6	-	-	-
-0041	21-11208	1-2 ft	-	-	8.2	-	-	-
-0042	21-11208	4-5 ft	-	-	9.2	-	-	-
-0044	21-11209	0-1 ft	0.69 J	-	-	-	-	-
-0045	21-11210	0-1 ft	0.51 J	-	-	-	26 J	-
-0069	21-11211	0-1 ft	0.88 J	21 J	-	-	-	-

Table H-5 - Continued

Sample Id	Location Id	Depth Interval	2-Butanone (mg/L)
MD21-01-0021	21-11201	1-2 ft	-
MD21-01-0023	21-11201	4-5 ft	-
MD21-01-0025	21-11202	0-1 ft	-
MD21-01-0022	21-11202	4-5 ft	-
MD21-01-0027	21-11203	1-2 ft	-
MD21-01-0029	21-11203	4-5 ft	-
MD21-01-0030	21-11204	2-3 ft	0.031 J
MD21-01-0031	21-11204	4-5 ft	-
MD21-01-0033	21-11205	1-2 ft	-
MD21-01-0034	21-11205	4-5 ft	-
MD21-01-0036	21-11206	0-1 ft	-
MD21-01-0037	21-11206	4-5 ft	-
MD21-01-0039	21-11207	0-1 ft	-
MD21-01-0041	21-11208	1-2 ft	-
MD21-01-0042	21-11208	4-5 ft	-
MD21-01-0044	21-11209	0-1 ft	-
MD21-01-0045	21-11210	0-1 ft	-
MD21-01-0069	21-11211	0-1 ft	-

Table H-6
2001 Discrete Sample Radionuclide Concentrations Screened against Sediment Background Values

Sample ID	Location ID	Depth Interval	Cs-137	Sr-90	Pu-239	Am-241	Pu-238
Background sediment	NA	NA	0.9	1.04	0.068	0.04	0.006
MD21-01-0021	21-11201	1-2 ft	[redacted]	[redacted]	[redacted]	-	[redacted]
MD21-01-0022	21-11202	4-5 ft	[redacted]	-	[redacted]	-	-
MD21-01-0023	21-11201	4-5 ft	0.51	-	0.051	-	-
MD21-01-0025	21-11202	0-1 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0027	21-11203	1-2 ft	[redacted]	[redacted]	[redacted]	-	[redacted]
MD21-01-0029	21-11203	4-5 ft	[redacted]	-	0.036	-	[redacted]
MD21-01-0030	21-11204	2-3 ft	[redacted]	0.9	[redacted]	-	[redacted]
MD21-01-0031	21-11204	4-5 ft	0.74	-	-	-	-
MD21-01-0033	21-11205	1-2 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0034	21-11205	4-5 ft	[redacted]	1.02	[redacted]	[redacted]	[redacted]
MD21-01-0036	21-11206	0-1 ft	[redacted]	[redacted]	[redacted]	-	[redacted]
MD21-01-0037	21-11206	4-5 ft	[redacted]	0.51	[redacted]	-	-
MD21-01-0039	21-11207	0-1 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0041	21-11208	1-2 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0042	21-11208	4-5 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0044	21-11209	0-1 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0045	21-11210	0-1 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
MD21-01-0069	21-11211	0-1 ft	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

= greater than sediment background value

2001 Waste Characterization Composite Sample Results

The composite waste characterization samples were analyzed for perchlorates, TCLP metals, TCLP VOCs, TCLP SVOCs, pesticides, PCBs, gamma spec (Cs-137 and Am-241), isotopic plutonium, and strontium-90 (Table H-7 and H-8). Only detects are reported. No TCLP VOCS or SVOCs were detected above reporting limits in the composite waste characterization samples.

Table H-7
Composite Waste Samples - TCLP Metals Results

Sample ID	Location Id	Depth Interval	Arsenic mg/L	Barium mg/L	Cadmium mg/L	Chromium mg/L	Lead mg/L	Selenium mg/L
MD21-01-0024	21-11201	0-5 ft	-	0.79 B	-	-	-	-
MD21-01-0026	21-11202	0-5 ft	-	0.74 B	-	0.0069 B	-	-
MD21-01-0028	21-11203	0-5 ft	0.019 B	1.2	-	0.036 B	0.033	-
MD21-01-0032	21-11204	0-5 ft	-	0.65 B	-	-	-	-
MD21-01-0035	21-11205	0-5 ft	0.022 B	0.5 B	0.0063 B	-	-	0.031 B
MD21-01-0038	21-11206	0-5 ft	-	0.68 B	-	-	-	-
MD21-01-0040	21-11207	0-1.5 ft	-	0.61 B		0.009 B	-	-
MD21-01-0043	21-11208	0-5 ft	-	0.27 B	0.006 B	0.0048 B	-	-

Table H-8
Composite Waste Samples - Radionuclide Concentrations

Sample ID	Location Id	Depth Interval	Cs-137 pCi/g	Sr-90 pCi/g	Pu-239 pCi/g	Am-241 pCi/g	Pu-238 pCi/g
MD21-01-0024	21-11201	0-5 ft	1.48	1.1	0.225	-	0.035
MD21-01-0026	21-11202	0-5 ft	9.3	1.42	0.46	-	-
MD21-01-0028	21-11203	0-5 ft	3.3	1.46	0.245	-	0.165
MD21-01-0032	21-11204	0-5 ft	3.49	2.28	0.374	0.61	0.115
MD21-01-0035	21-11205	0-5 ft	22.5	10.4	13.4	67.8	3.08
MD21-01-0038	21-11206	0-5 ft	6	1.93	0.226	-	-
MD21-01-0040	21-11207	0-1.5 ft	59.5	10.5	3.07	5.1	0.22
MD21-01-0043	21-11208	0-5 ft	150	52.8	8.6	28.3	2.18

Appendix I

Photos

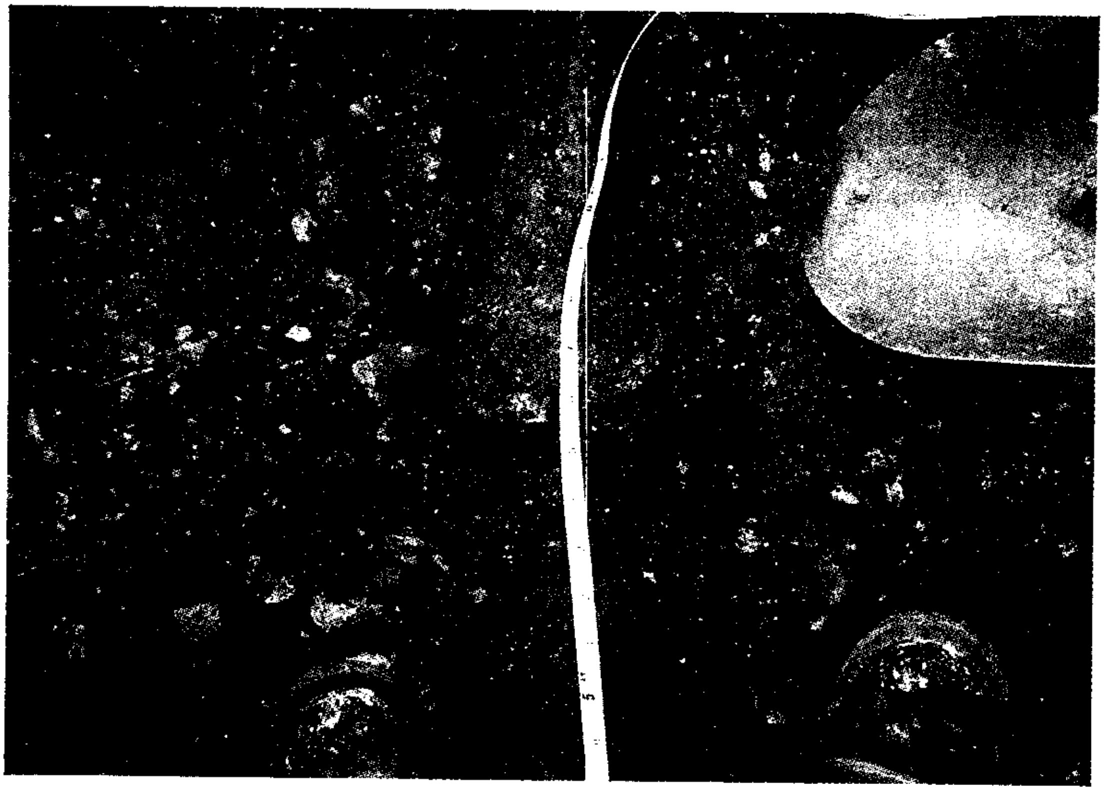


Photo I-1: Closeup of outfall pipe.

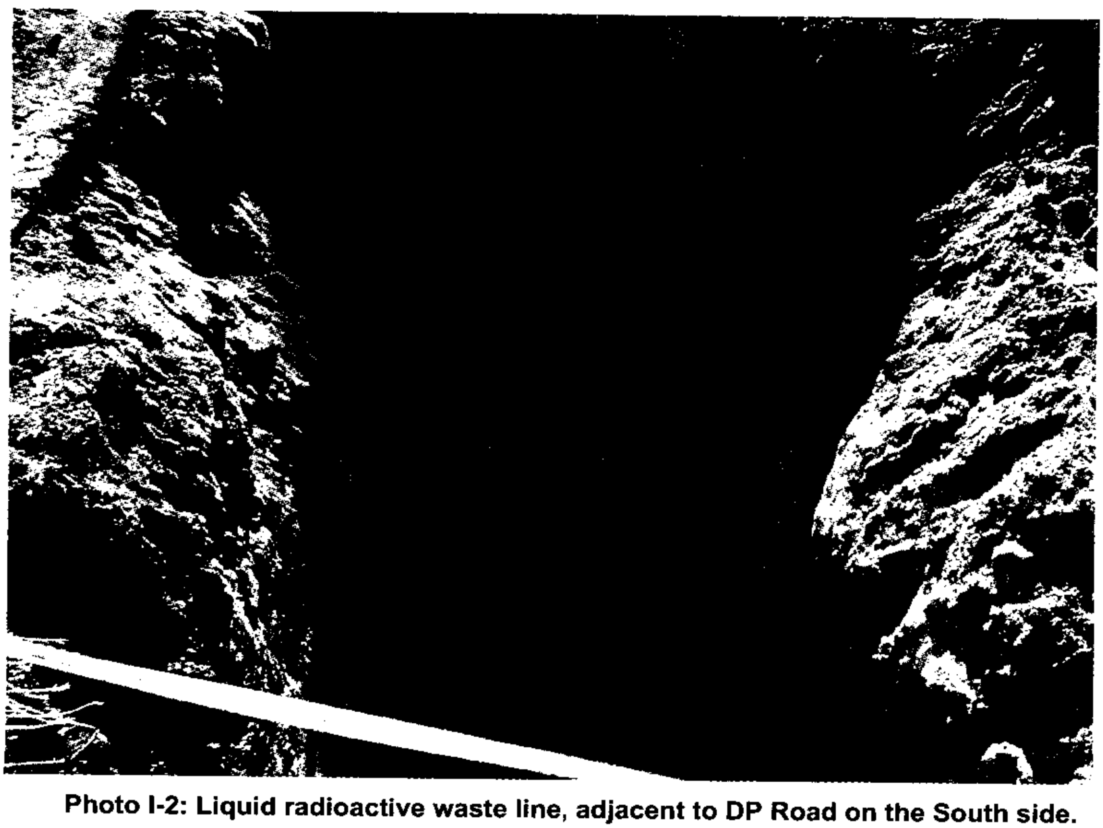


Photo I-2: Liquid radioactive waste line, adjacent to DP Road on the South side.

Photo I-3: Outfall pipe excavation.

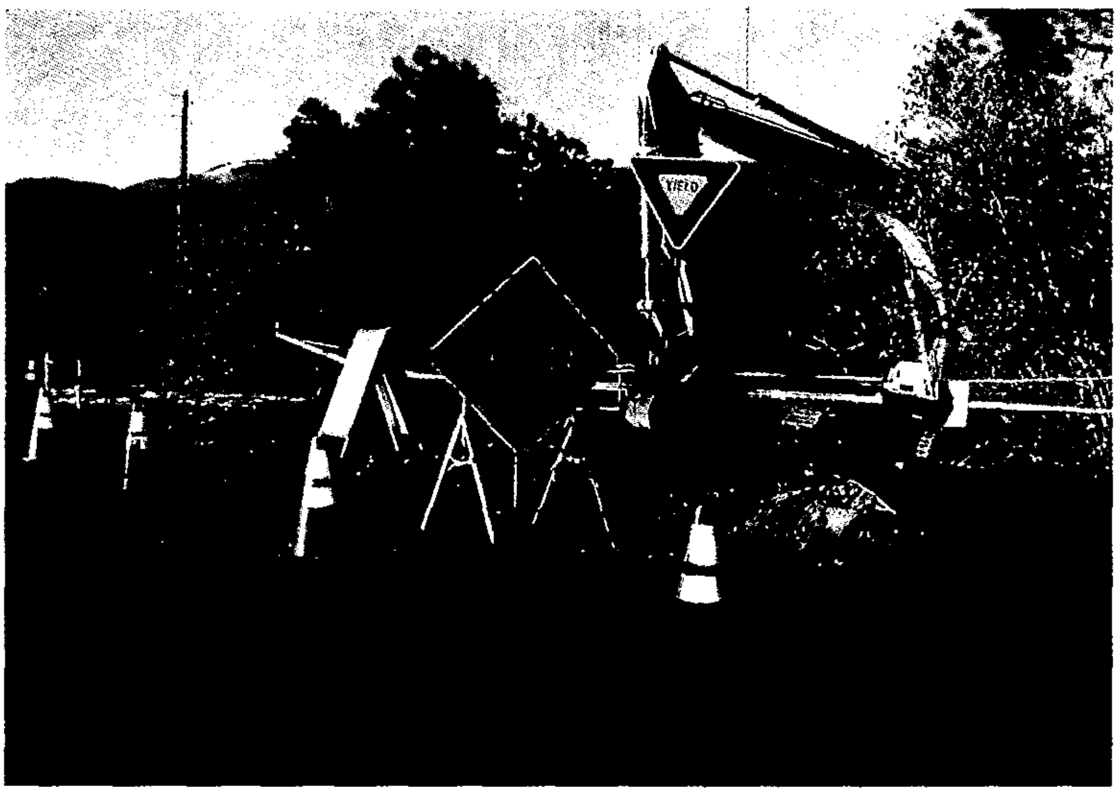


Photo I-4: Continuation of outfall pipe excavation on North side of road, looking WNW

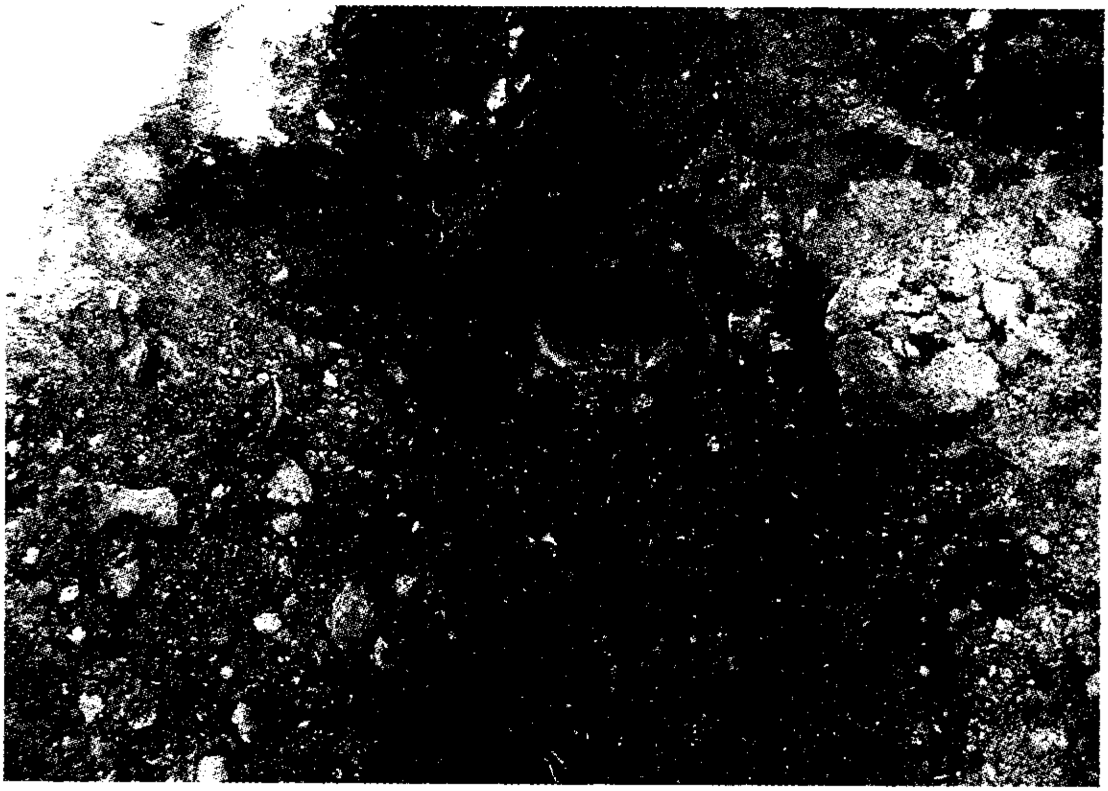


Photo I-5: Outfall pipe detail

Photo I-6: Sections of outfall pipe.

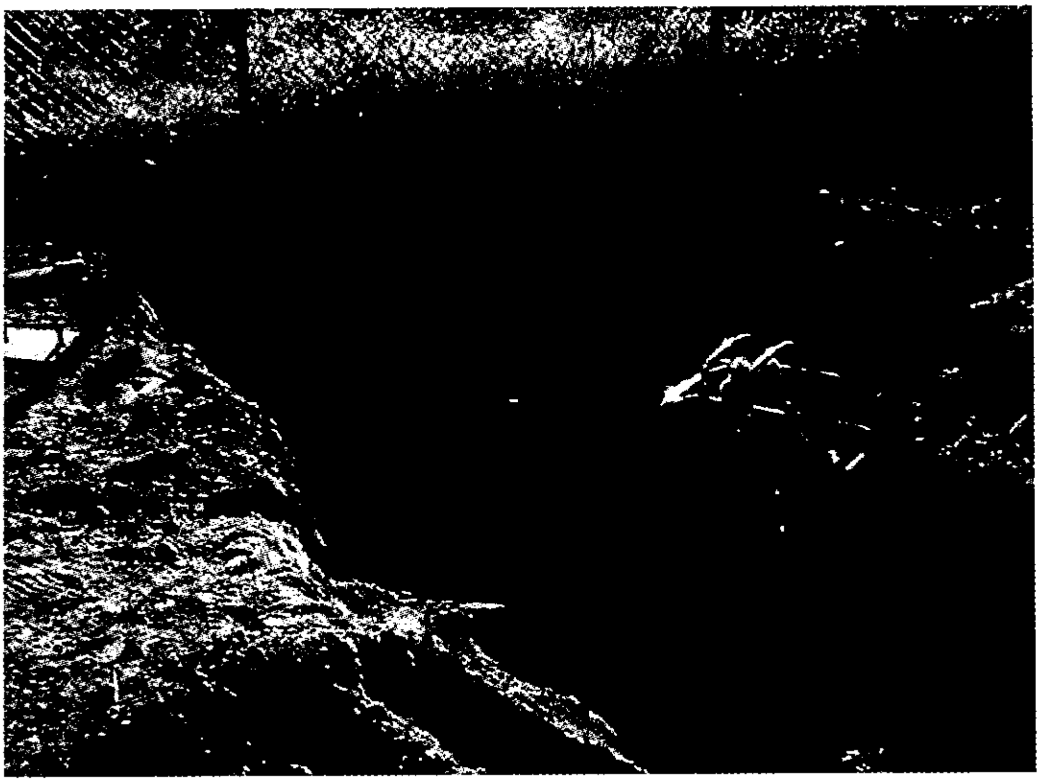


Photo I-7: Compaction of roadcut on South side of DP Road.

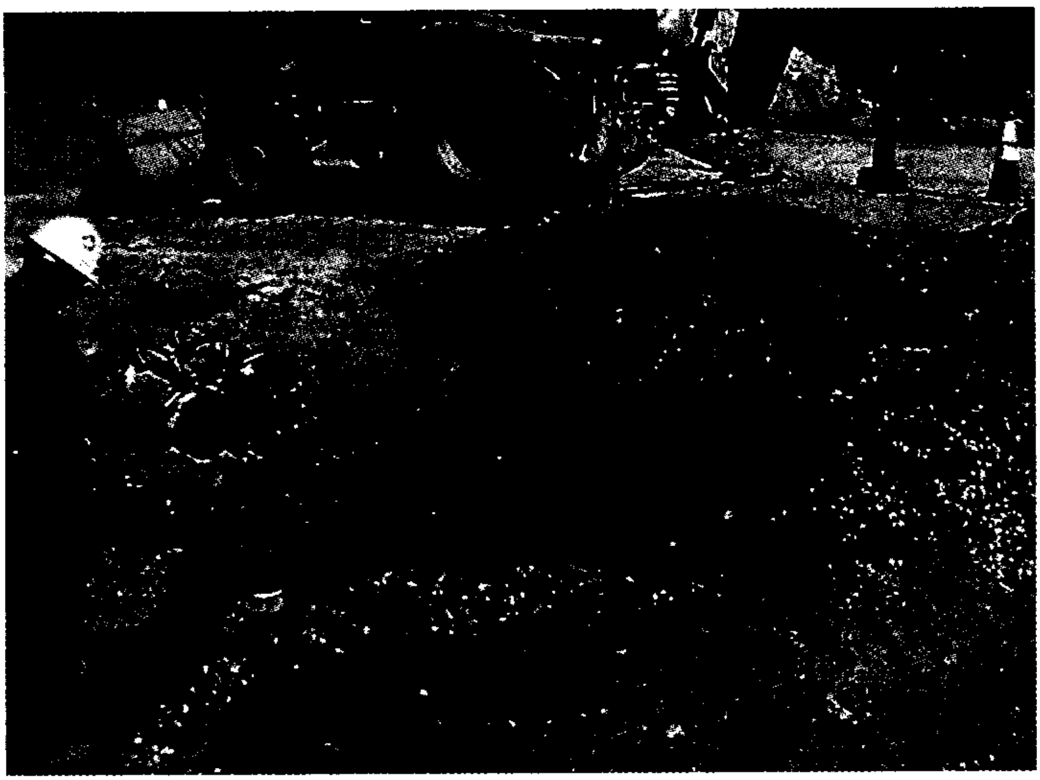


Photo I-8: Compaction of roadcut on South side of DP Road.

Photo I-9: Area 1 excavation, looking NE

Photo I-10: Area 1 stockpile and excavation, looking West.

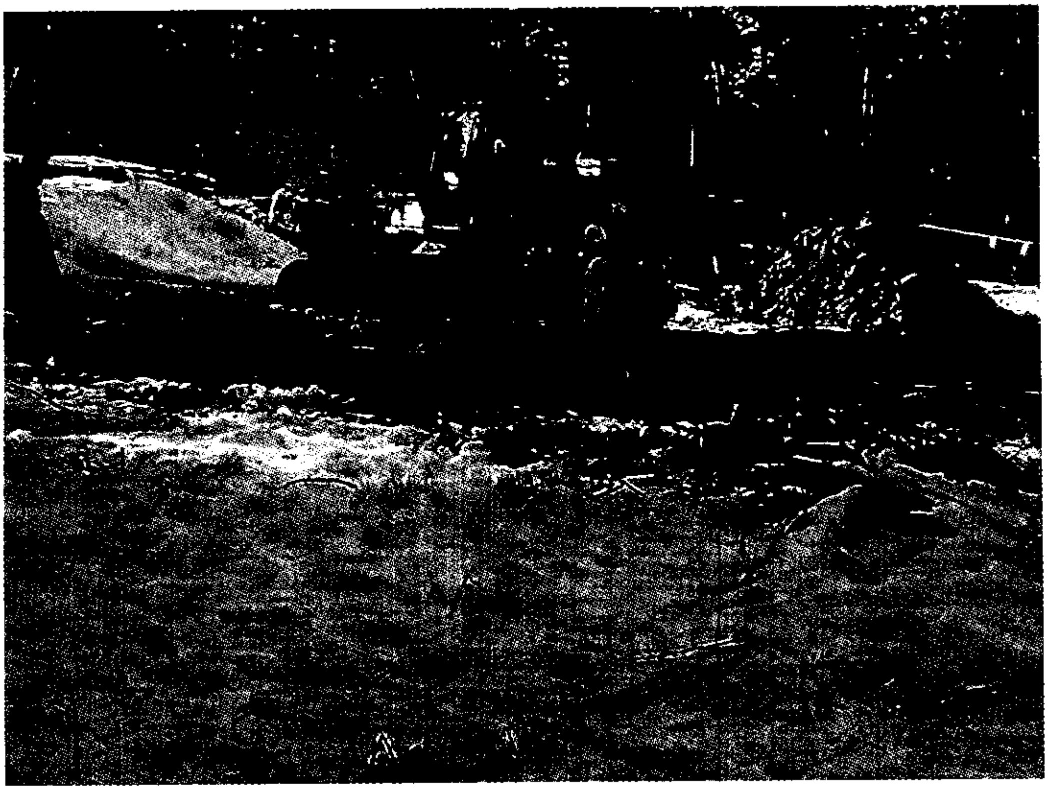


Photo I-11: Area 2 excavation, looking West.

Photo I-12: Excavation of Area 3, flags mark sample locations, looking SW.

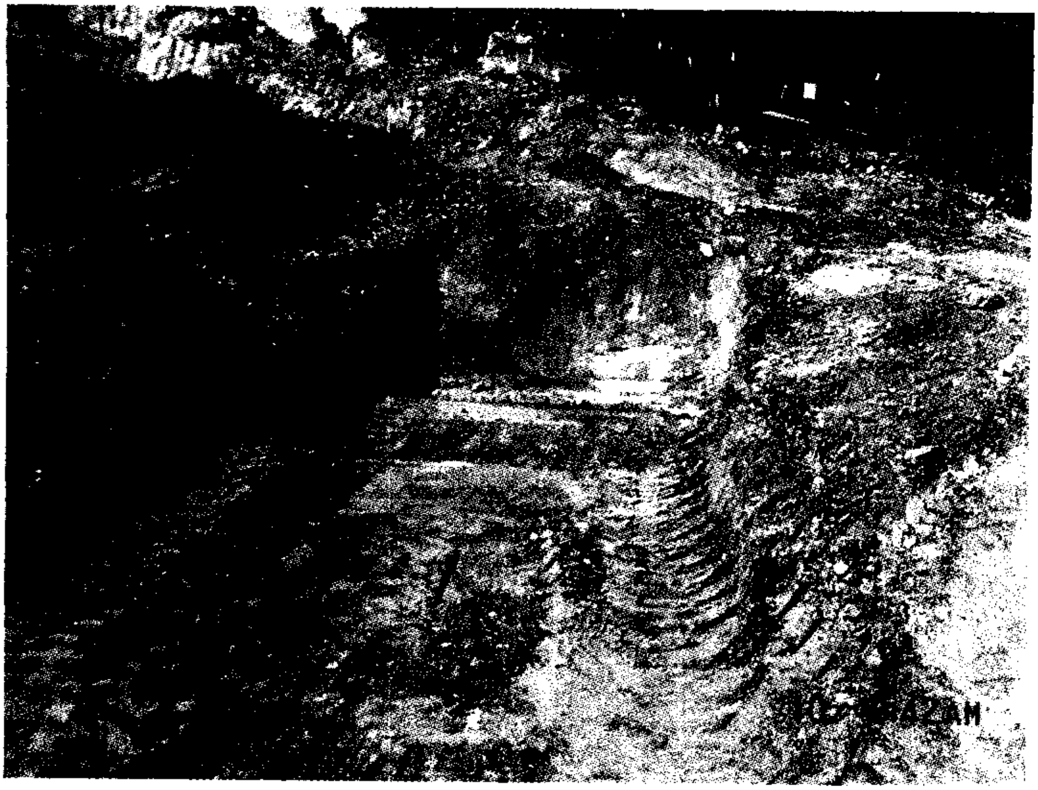


Photo I-13: Area 4 excavation, looking SW towards lower slope.

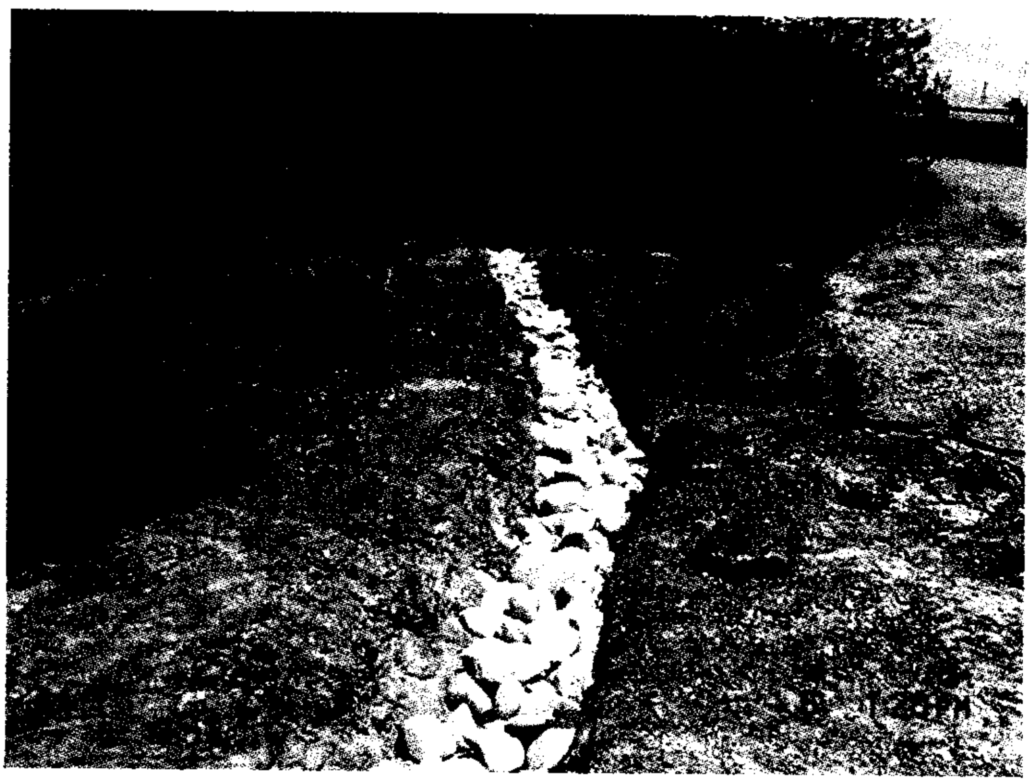


Photo I-14: Diversion channel east of upper slope, adjacent to DP Road, looking east.

Photo I-15: Excavator constructing access road to middle of slope, looking East.

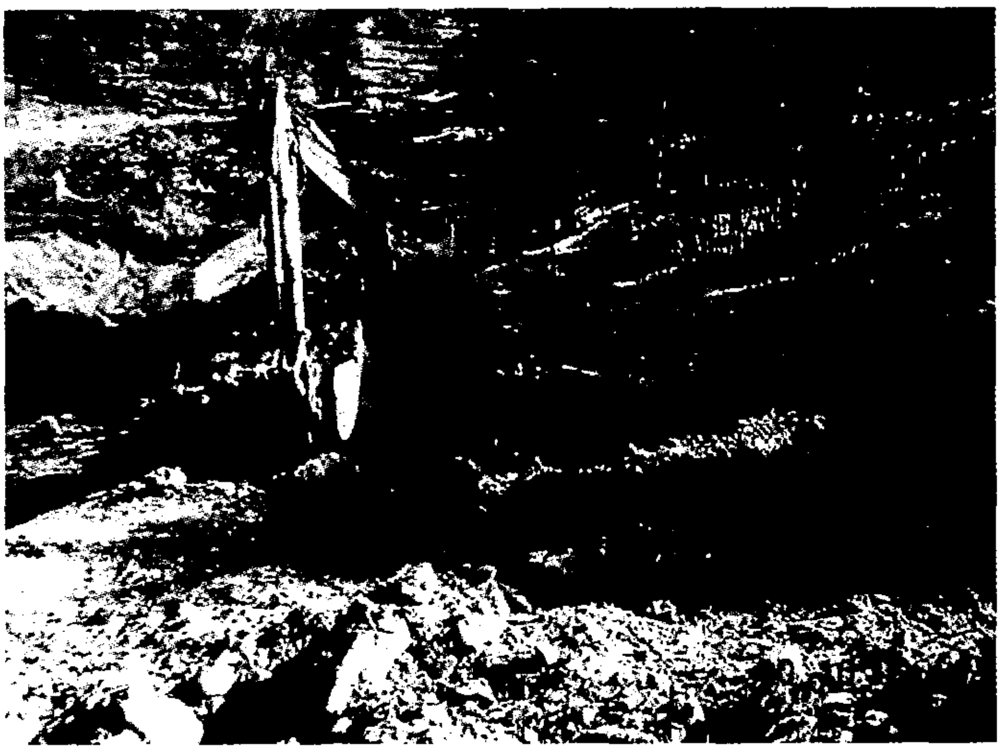


Photo I-16: Lower slope excavation, looking NE.

Photo I-17: Slope excavation, looking South.

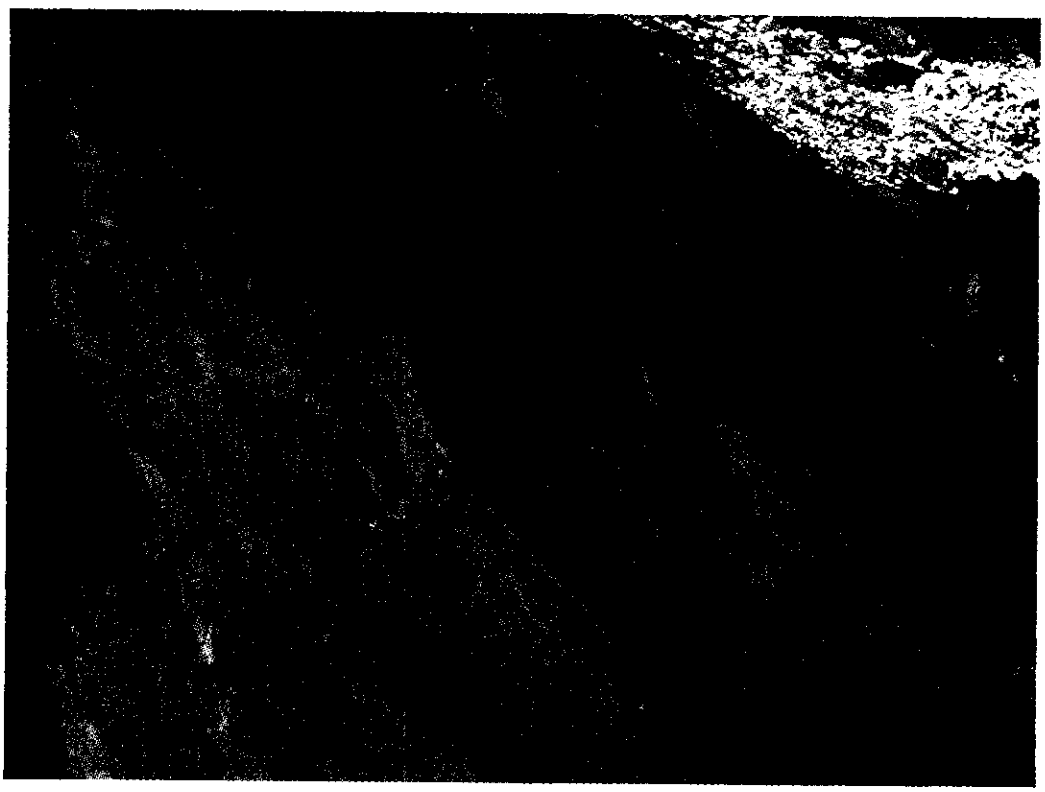


Photo I-18: Slope excavation, close up of clay filled fracture after partial excavation.

Photo I-19: Slope excavation, removing material around fracture.

After

Before

Photo I-20

Photo I-21: Stockpiles from Areas 2 and 1, looking West.

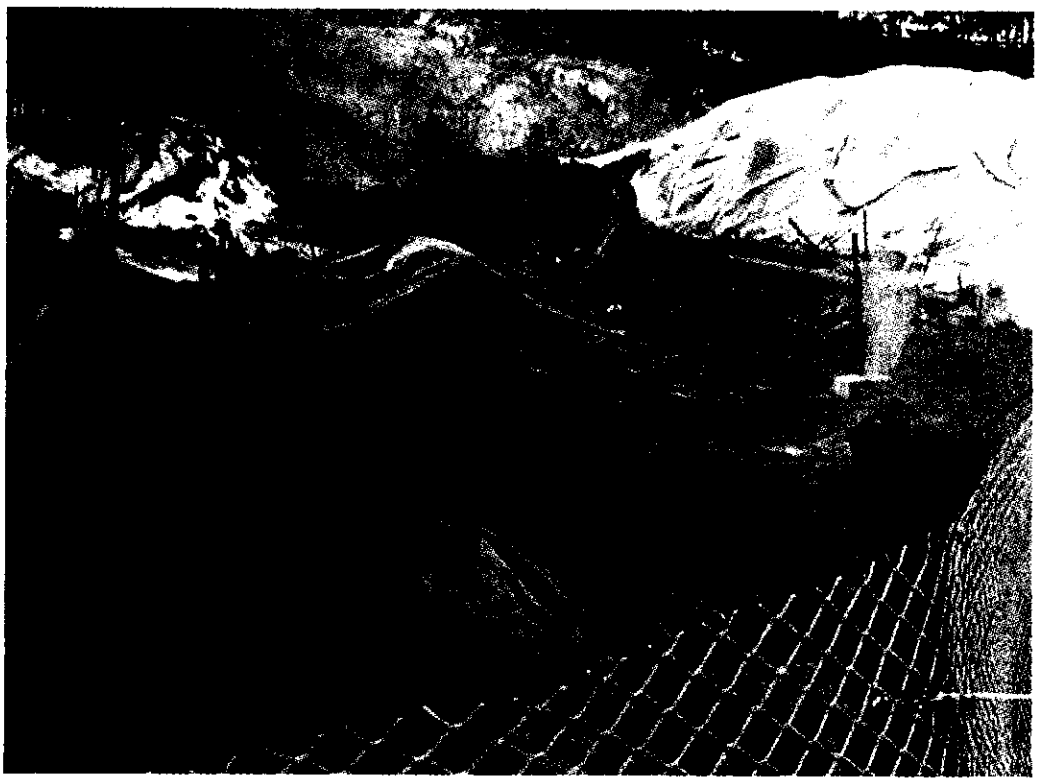


Photo I-22: Stockpiles in Areas 3, 4, and slope looking SW.

Photo I-23: Stockpile at top of upper slope adjacent to DP Road, looking Northwest.

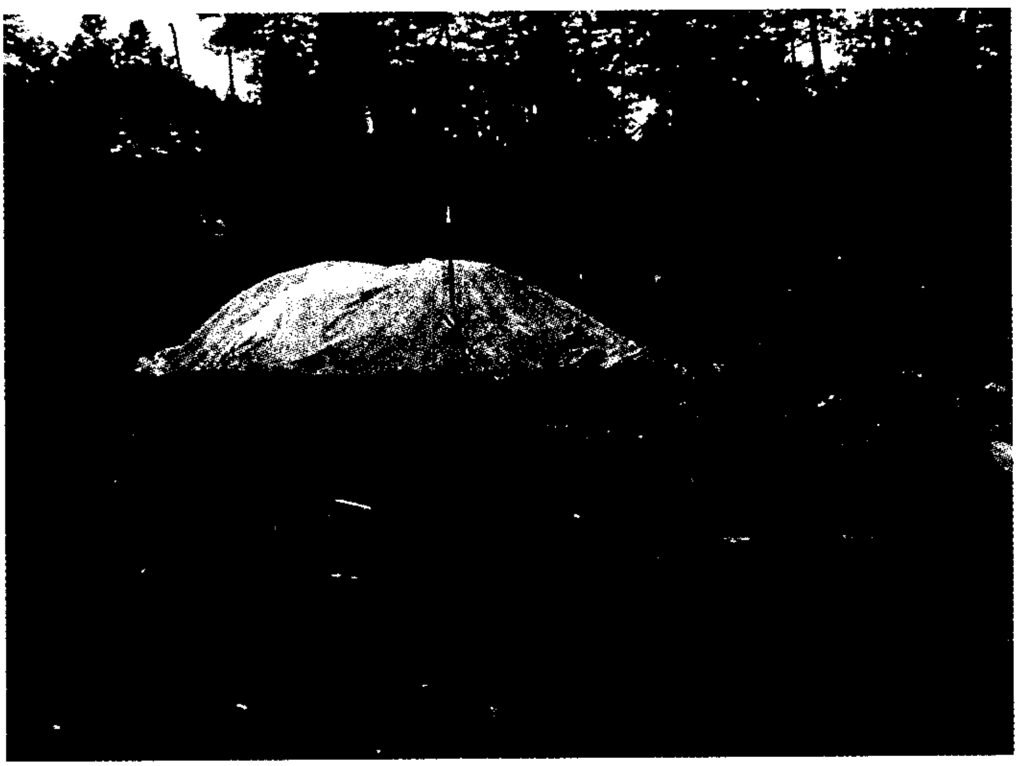


Photo I-24: Western drainage stockpile looking West

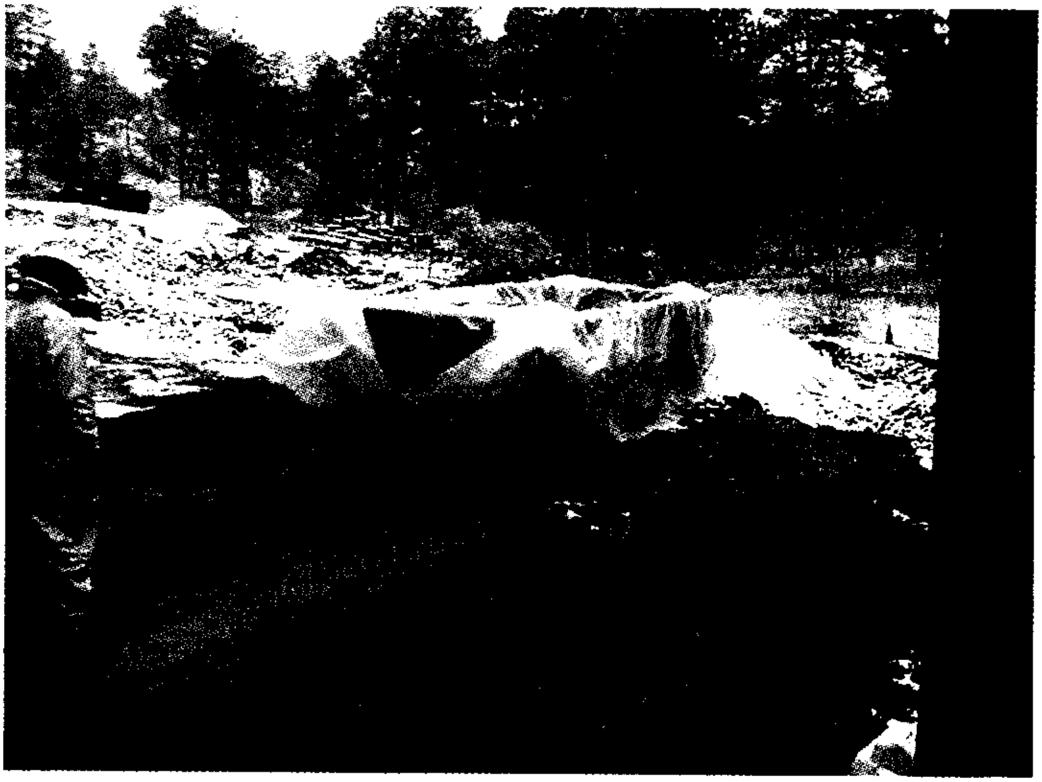


Photo I-25: Lined bin in loading area at NE corner of site, looking West.

Photo I-26: Bin being loaded at NE corner of site, looking West.

Photo I-27: Rigging fall protection to excavator before starting slope survey.

Photo I-28: Surveying western edge of slope, looking NW.

Photo I-29: Upper slope restoration, looking NE.

Photo I-30: Lower area restoration, looking North from the upper slope.

Photo I-31: Lower slope and Area 3 restoration, looking NE.

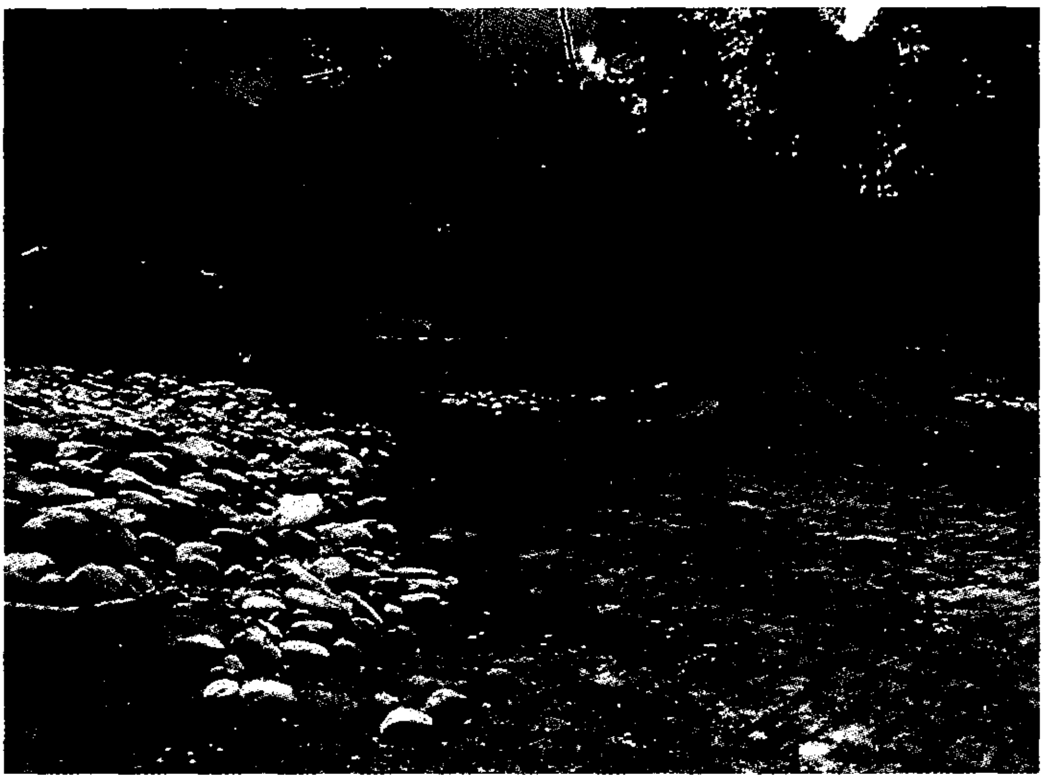


Photo I-32: Eastern edge of lower slope restoration, looking SW.

Photo I-33: Western drainage restoration, looking down hill from upper slope.

Photo I-34: Western drainage and Area 4 restoration, looking NW.

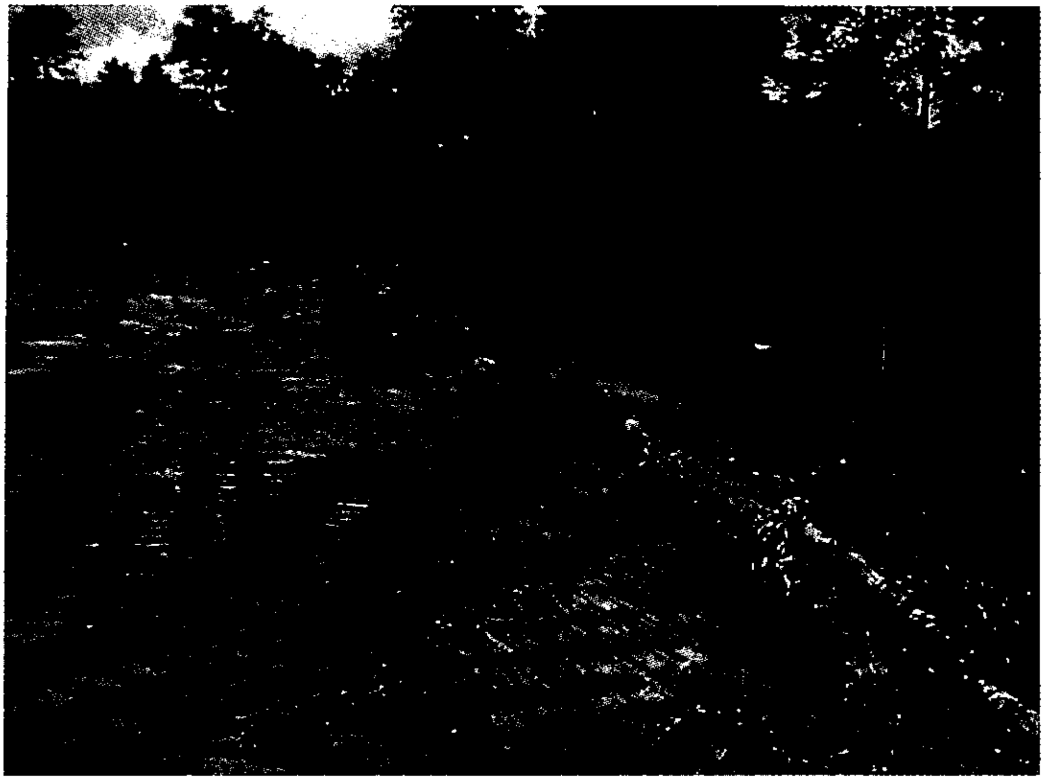


Photo I-35: Northern edge of site restoration and BMP, looking West.

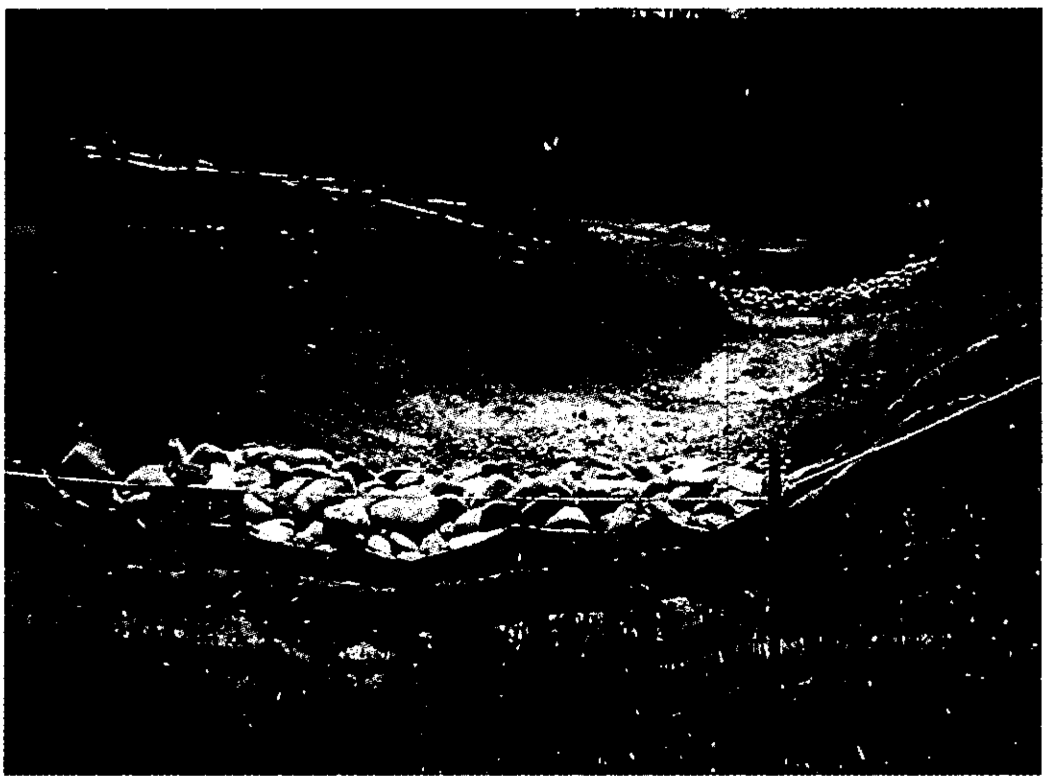


Photo I-36: Northern end of western drainage at confluence with streambed.

Photo I-37: Restored area looking South across DP streambed.

Photo I-38: Restored slope, western drainage and Area 3 from north side of DP Canyon.

Photo I-39: Hydro seeding and mulching operations.

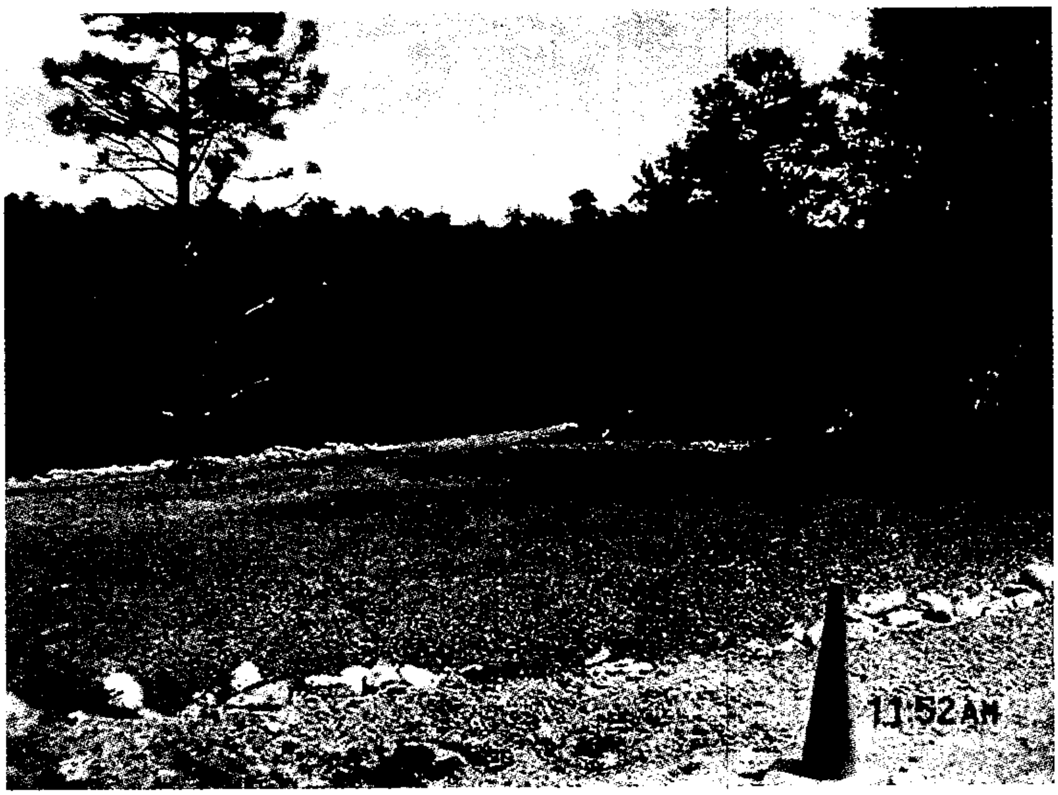


Photo I-40: Site reseeded and mulched.

Photo I-41: Site reseeded and mulched

Photo I-42: Site reseeded and mulched

Photo I-43: Planting Ponderosa pines and Gambel oaks on upper area.

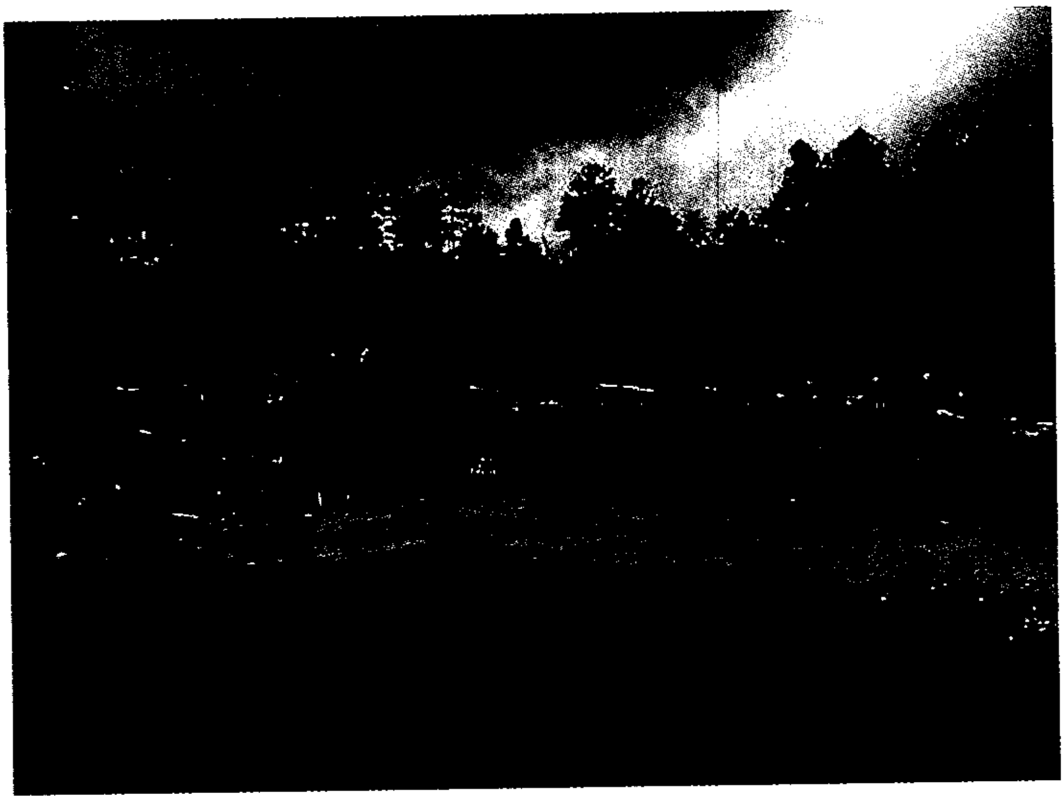


Photo I-44: Planting Ponderosa pines and Gambel oaks on lower area.

Photo I-45: Site replanting complete.

Photo I-46: Site replanting complete.

Appendix J

Correspondence

Los Alamos National Laboratory/University of California
Risk Reduction & Environmental Stewardship (RRES)
Environmental Restoration (ER) Project, MS M992
Los Alamos, New Mexico 87545
RRES (505) 667-0808/FAX (505) 665-4747

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

Date: November 5, 2002
Refer to: ER2002-0749

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: REQUEST FOR "NO LONGER CONTAINED IN" DETERMINATION FOR SOIL, TUFF, AND SEDIMENT AT SOLID WASTE MANAGEMENT UNIT 21-011(k), AT TECHNICAL AREA (TA) 21

Dear Mr. Young:

The purpose of this letter is to request that the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) use their discretionary authority to determine that environmental media to be generated during excavation of soil, sediment, and tuff as part of the Laboratory's Voluntary Corrective Measure[1] (VCM) for Solid Waste Management Unit (SWMU) 21-011(k), do not warrant management as F-listed hazardous waste.

The excavation activities at SWMU 21-011(k) will involve excavating environmental media in an effort to reduce potential dose from radionuclides present in soil, sediment, and tuff. Some of this excavated material may contain low levels of acetone, toluene, methylene chloride, and trichloroethylene that may have originated from processes for which listed wastes are identified.

The Los Alamos National Laboratory (LANL) proposes to use the Environmental Protection Agency (EPA) Region 6 Human Health Medium-Specific Screening Levels (MSSLs) and NMED Soil Screening Levels (SSLs) for comparison to maximum detected concentrations to determine whether any of the organic constituents detected in excavated environmental media from SWMU 21-011(k) warrant management as F-listed hazardous waste. The proposed MSSLs and SSLs are based on the industrial receptor using direct exposure routes (inhalation, ingestion, and dermal contact) and are derived using conservative exposure parameters for reasonable maximum exposure. These MSSLs and SSLs, based on an industrial receptor, are appropriate because the environmental media excavated during these removal activities will be properly disposed in an onsite engineered low-level radioactive waste disposal facility. All of the maximum

[1] This letter does not address or concede Hazardous Waste Act authority over this unit. LANL remediates this unit pursuant to a comprehensive program that addresses contaminants at all Potential Release Sites on site.

detected concentrations of the acetone, toluene, methylene chloride, and trichloroethylene in the environmental media to date are below MSSLs and SSLs.

According to EPA documents and associated guidance, the authorized state may also make a determination on a case-specific basis as to how the Land Disposal Restrictions (LDRs) apply to the waste when a "no longer contained in" determination has been made. Because all of the maximum detected concentrations of acetone, toluene, methylene chloride, and trichloroethylene in the environmental media at SWMU 21-011(k) are below their respective LDRs, it is LANL's expectation that LDR treatment standards will not apply to this environmental media.

The organic constituents, maximum concentration detected to date, the proposed MSSLs and SSLs, and LDR treatment standards are shown in the table below:

Organic Constituent	Maximum Concentration (mg/kg)	MSSL (mg/kg)	SSL (mg/kg)	LDR Treatment Standards (mg/kg)
Acetone	0.013(J)	7600	NA	160
Methylene chloride	0.072	25	2700	30
Toluene	1.0 (J)	520	180	10
Trichloroethylene	1.8(J)	7.6	18	6

(J) = estimated value between method detection limit (MDL) and practical quantification limit (PQL).
(NA) = no SSL available for this constituent

The organic constituent concentrations listed above were detected in discrete waste characterization samples collected from soil, tuff, and sediment planned for excavation and removal from SWMU 21-011(k). Since the maximum detected concentrations in the environmental media to be excavated are below the MSSLs or SSLs, the material will be managed as low-level radioactive waste unless and until it meets another listing criteria or exhibits a hazardous characteristic.

Enclosed are the validated analytical results for volatile organic compounds (VOCs) from the pre-VCM waste characterization samples collected at SWMU 21-011(k). Please note that based on the organic chemical concentrations observed for Sample Location 21-11205, Sample IDs MD21-01-0033, and -0034, three additional samples were collected from the same sample location (21-11205), Sample IDs MD21-01-0519, -0520, and –0521 in October 2001 and reanalyzed for VOCs to determine the presence or absence of acetone, methylene chloride, and 4-isopropyltoluene detected at this location in two of the samples collected in March 2001. (See Table 2.2-2 in the VCM Plan for SWMU 21-011(k), Rev. 2). None of the organic chemicals detected in the two samples collected in March 2001 from Sample Location 21-11205 were detected in the three samples collected from the same location and depths in October 2001. In addition, target analytes acetone and methylene chloride were detected in the method blank but not in the samples for Sample IDs MD21-01-0520 and -0521. Reported results for acetone, toluene and trichloroethylene are estimated because the values are less than the Practical Quantification Limit (PQL) but above the Method Detection Limit (MDL).

LANL believes that a "no longer contained in" determination for the organic constituents listed above is appropriate. It would be protective of human health and the environment, and would allow for cost-effective removal of the environmental media at SWMU 21-011(k). If you have any questions, please contact Mark Thacker at (505) 665-5342 or Woody Woodworth at (505) 665-5820.

Sincerely,

David McInroy, Acting Program Manager
Environmental Restoration Project
Los Alamos National Laboratory

Sincerely,

Everett Trollinger, Project Manager
Department of Energy
Office of Los Alamos Site Operations

DM/ET/PB/MT/eim

Enclosure: Analytical Results for Volatile Organic Compounds from Pre-VCM Waste Characterization Samples at SWMU 21-011(k)

Cy:
P. Bertino, RRES-R, MS M992
N. Quintana, RRES-R, MS 992
M. Thacker, RRES-R, MS M992
M. Wetovsky, RRES-R, MS M992
W. Woodworth, OLASO, MS A906
V. Maranville, NMED-HWB
S. Yanicak, NMED-OB
L. King, EPA Region 6
IM-5, MS A150
RPF MS M707
RRES-CT#839 File MS M992

Cy:(w/o enclosure)
D. McInroy, RRES-R, MS M992
B. Ramsey, RRES-DO, MS J591
J. Bearzi, NMED-HWB
J. Davis, NMED-SWB
J. Parker, NMED-OB
RRES-R File, MS M992

Los Alamos
NATIONAL LABORATORY

Los Alamos National Laboratory/University of California
Risk Reduction & Environmental Stewardship (RRES)
Remediation (R) Program, MS M992
Los Alamos, New Mexico 87545
RRES

Date: November 14, 2002
Refer to: ER2002-0797

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: SAMPLING NOTIFICATION

Dear Mr. Young:

During the week of November 25, 2002, the Los Alamos National Laboratory (LANL) Risk Reduction and Environmental Stewardship-Remediation (RRES-R) Project is planning to collect confirmation samples beneath the outfall drainline that discharged to Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21 as described in Section 5.1 of the "Voluntary Corrective Measures Plan for Solid Waste Management Unit 21-011(k) at Technical Area 21, Revision 2," (LA-UR-02-6797). RRES-R will initiate removal of the outfall drainline during the week of November 18, 2002. A minimum of ten confirmation samples will then be collected from five locations within the drainline excavation in accordance with Section 5.1 of the VCM plan.

The RRES-R Project will verbally confirm and/or notify the New Mexico Environment Department-Hazardous Waste Bureau (NMED-HWB) staff of any changes to the schedule. Results from the sampling will be presented in the VCM Completion Report for SWMU 21-011(k). The sampling is summarized in the following table, which indicates the minimum number of samples to be collected:

Document	Location	Number of Samples	Sample Type	Analyses
1. Voluntary Corrective Measures Plan for Solid Waste Management Unit 21-011(k) at TA-21, Revision 2, (LA-UR-02-6797)	Beneath outfall drainline at SWMU 21-011(k), TA-21	10	Subsurface soil/tuff from two depth intervals	Gamma spectroscopy for cesium-137; alpha spectroscopy for americium-241; isotopic plutonium; gas proportional counting for strontium-90; and gross alpha, beta and gamma

If you have any questions, please feel free to give me a call at (505) 667-0819.

Sincerely,

Roy Bohn
Environmental Restoration Project
Los Alamos National Laboratory

RB/PB/vn

Cy:
P. Bertino, RRES-R, MS M992
M. Thacker, RRES-R, MS M992
N. Quintana, RRES-R, MS 992
M. Wetovsky, RRES-R, MS M992
W. Woodworth, OLASO, MS A906
V. Maranville, NMED-HWB
S. Yanicak, NMED-OB, MS J993
D. McInroy, RRES-R, MS M992
B. Ramsey, RRES-DO, MS J591
J. Bearzi, NMED-HWB
J. Parker, NMED-OB
RRES-R File, MS M992
IM-5, MS A150
RPF MS M707

(17) #73725

ENVIRONMENTAL RESTORATION PROJECT COMMUNICATION RECORD

Date: 11/18/02	**Time:** 9:00 a.m.	**Recorded By:** P. Bertino
To: Vickie Maranville VM · 11·18·02	**From:** P. Bertino, LANL RRES-R	**Telephone No.:** 665-2198

Affiliation: NMED-HWB

Other Parties: Mark Thacker (LANL RRES-R), Woody Woodworth (OLASO), and John Crocker (WGII)

Discussion: This communication record was prepared at the request of Vickie Maranville, of the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) to document the submittal of offsite analytical laboratory data to validate the proposed screening method to be used during the implementation of the voluntary corrective measures (VCM) at Solid Waste Management Unit (SWMU) 21-011(k) at TA-21. The provision of this data to NMED-HWB is called for in Sections 4.2.2 and 4.2.3 of the VCM Plan for SWMU 21-011(k), Revision 2, (LA-UR-02-6797).

Action Items: LANL will discuss the radiological screening methodology and provide all screening and offsite analytical results from the VCM at SWMU 21-011(k) in the VCM completion report.

Distribution:
V. Maranville/J. Young, NMED-HWB
M. Thacker, RRES-R
L. Woodworth, OLASO
P. Bertino, RRES-R
J. Crocker, WGII

DI-4.3, R0	**LOS ALAMOS** **Environmental Restoration Project**

VMaranville 11·18·02
reviewed/approved.

Pre-Excavation Offsite Contract Laboratory Analytical Results for Verification of Field Screening Approach to be used During the VCM of SWMU 21-011(k)

In accordance with Section 4.2 of the VCM Plan for SWMU 21-011(k), Revision 2, 14 soil, tuff and/or sediment samples were collected at SWMU 21-011(k) between August 16 and 21, 2002 and screened in the field in accordance with the Washington Group International's (WGII) SOP 10.15, Rev. 0 *(Use of Gamma Scintillation Detectors for Soil Screening)*. Following this procedure, count rates from each sample were used to calculate estimated cesium-137 (Cs-137) and americium-241 (Am-241) concentrations (pCi/g). For comparison, aliquots of each of the 14 samples were analyzed at the ARS screening laboratory by gamma spectroscopy. The approximate sample locations are shown in the attached map.

Cs-137 and Am-241 results from the two data sets were compared by linear regression. A correlation coefficient of greater than 99.5% was obtained for the Cs-137 data sets. However, the screening method was found to underestimate Cs-137 activity reported from the ARS screening lab by a factor of 2.4593, (i.e., fixed lab results = 2.4593 x screening results). This empirical correction will be incorporated into the calculation used to estimate Cs-137 concentrations in accordance with WGII SOP 10.15, Rev 0.

A correlation coefficient of 94% was obtained for the Am-241 data sets. The screening method was found to underestimate Am-241 activity from the ARS screening lab results by a factor of 1.5039. This empirical correction will be incorporated into the calculation used to estimate Am-241 concentrations in accordance with WGII SOP 10.15, Rev 0. With the correction factors applied to the screening results, the accuracy and precision of the screening procedure are deemed sufficient to guide excavation of contaminated material in the field during implementation of the VCM at SWMU 21-011(k).

For final confirmation of the SOP 10.15, Rev. 0 procedure, a subset of the 14 soil samples discussed above was submitted to Severn-Trent Laboratories for offsite contract laboratory analysis. Linear regression was performed using the field screening data ***after applying the correction factors, as stated above***. The Severn-Trent gamma spectroscopy results for Cs-137 and Am-241 are presented below in Table 1. Linear regression of the Cs-137 and Am-241 data sets yielded the following results: 1) use of the screening data overestimates Cs-137 activity by approximately 31%, and 2) use of the screening data overestimates Am-241 activity by approximately 34%.

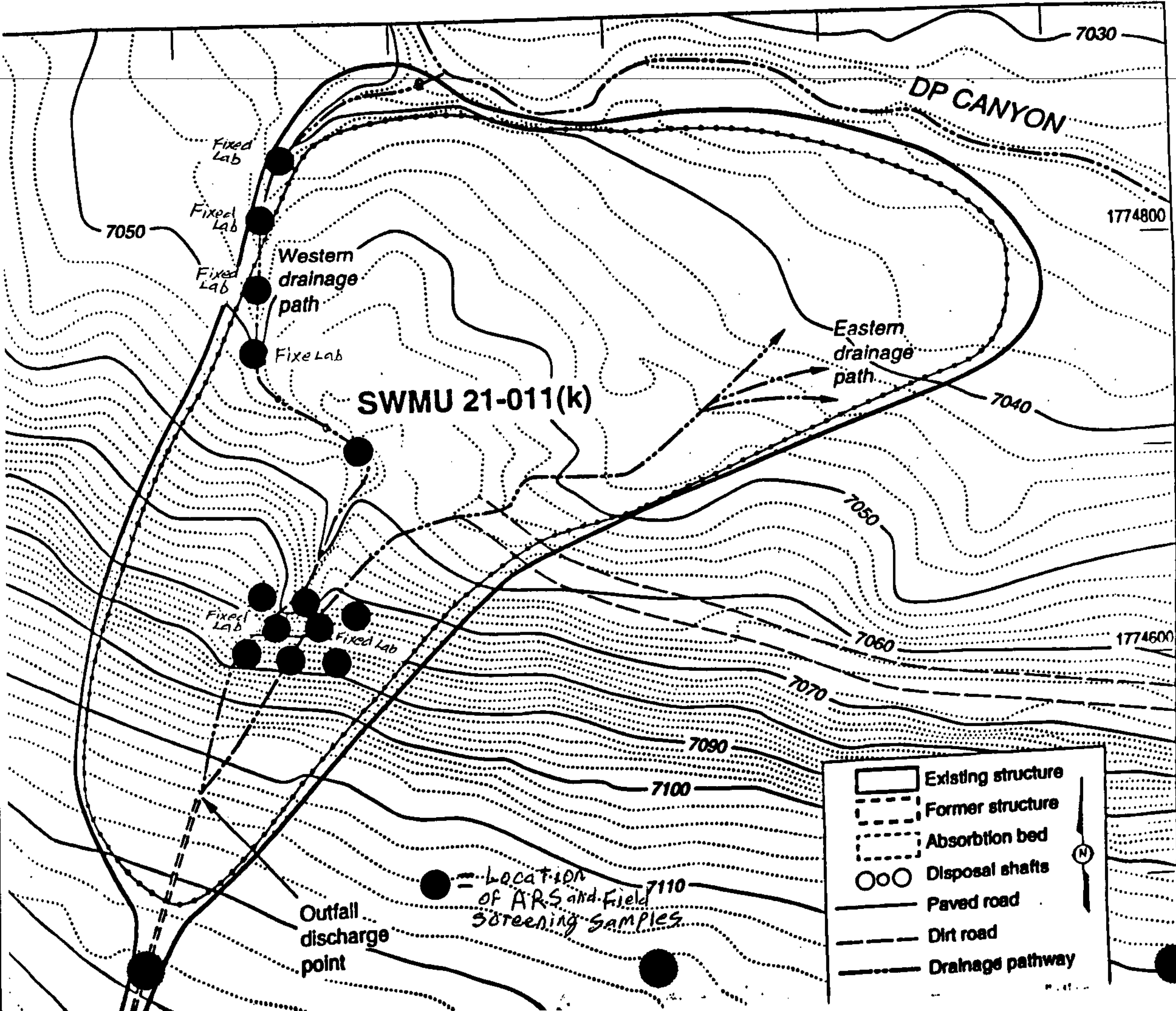
The second comparison indicates that correction factors derived in the first analysis were larger than necessary. However, use of these factors with screening results will result in overestimation of Cs-137 and Am-241 activity in the field and ensure that the cleanup goals (150 pCi/g for Cs-137 and 170 pCi/g for Am-241) will be met. Specifically, when the screening results indicate that a cleanup goal has been achieved, offsite contract laboratory results for post-excavation confirmation samples should indicate that the residual activity level is actually lower than the cleanup goal.

Table 1: Offsite Contract Laboratory Pre-Excavation Gamma Spectroscopy Results for Americium-241 and Cesium-137

		Severn-Trent Results for Cs-137 pCi/g	Severn-Trent Results for Am-241 pCi/g
Location ID	Sample ID		
21-02-19961	21-02-49373	10	12
21-02-19962	21-02-49374	2	3
21-02-19963	21-02-49375	24	73
21-02-19964	21-02-49376	13	23
21-02-19967	21-02-49377	72	184
21-02-19967	21-02-49378	82	281
21-02-19969	21-02-49380	384	211
21-02-19970	21-02-49381	166	32

Pre-Excavation Offsite Contract Laboratory Analytical Results for Verification of Field Screening Approach to be used During the VCM of SWMU 21-011(k)

Copies of the Severn-Trent gamma spectroscopy analytical data for Cs-137 and Am-241 are attached. The screening and offsite contract laboratory analytical results discussed herein will be included in the VCM completion report for SWMU 21-011(k) in addition to correlation coefficients from the post excavation screening and confirmation sample analytical results.


DP CANYON
7030
7040
7050
7060
7070
7090
7100
7110
1774800
1774600
SWMU 21-011(k)
Western drainage path
Eastern drainage path
Outfall discharge point
Fixed Lab
Fixe Lab
= Location of ARS and Field Screening Samples
Existing structure
Former structure
Absorption bed
Disposal shafts
Paved road
Dirt road
Drainage pathway
N

Data Validation Cover Sheet

Section I. Data Record Package Identification

Request Number: 1186S Validation Date: 04-Nov-02 Lab Code: ____

Contract Laboratory Name: Severn- Trent- St Louis

Validator: Keith Greene Organization: RRES

Analytical Suite(s): (check all that apply)

- ☐ Volatile Organics
- ☐ Semivolatile Organics
- ☐ Organochlorine Pesticides/Polychlorinated Biphenyls
- ☐ Other: ____ (describe)
- ☐ High Explosives
- ☐ Inorganics
- ☒ Radiochemistry

Section II. Completeness Check

Yes	No	n/a	(check one)	Yes	No	n/a	(check one)
☒	☐	☐	1. Chain-of-custody form(s)	☒	☐	☐	6. Raw/BSS data
☒	☐	☐	2. Case narrative	☒	☐	☐	7. Quality control forms
☒	☐	☐	3. Sample result forms	☒	☐	☐	8. Quantitation reports
☐	☐	☒	4. Sample chromatograms	☐	☐	☒	9. TICs forms
☐	☐	☒	5. Standard chromatograms	☐	☐	☒	10. TICs mass spectra

Identify any samples in the assigned Request Number that are missing:

Comments/problems noted (include information about requests for further information submitted to the contract laboratory and agreed upon date of resolution and contract laboratory point of contact): ISOPU - All Qc within limits.

Sr-90 - All QC within limits.

Gamma spec - results qualified not detected (U, R5) because results were less than the MDC. Several analytes qaulifed as not detected (U, R11) because the results were less than 3 times the total propagated uncertainty.

All other QC within limits.

(Attach additional comment sheets as necessary)

Validator's signature: [signature] Date: 11/4/02

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49380

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110280-001
Work Order: E73P4
Matrix: SOLID

Date Collected: 09/06/02 0000
Date Received: 09/11/02 0900

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	211		13	1	0.0	09/13/02	09/17/02	2256499	
Antimony 125	0.70 U, R5	U	0.68	2.3	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	2.5	U	1.3	4.3	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	1.11 U, R11		0.40	0.96	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	0.3 U, R5	U	2.1	6.8	0.0	09/13/02	09/17/02	2256499	
Cerium 139	0.11	U	0.11	0.37	0.0	09/13/02	09/17/02	2256499	
Cesium 134	0.13	U	0.14	0.43	0.0	09/13/02	09/17/02	2256499	
Cesium 137	384		21	0.4	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	0.054 U, R5	U	0.044	0.18	0.0	09/13/02	09/17/02	2256499	
Europium 152	0.30	U	0.15	0.72	0.0	09/13/02	09/17/02	2256499	
Europium 154	0.10	U	0.39	1.4	0.0	09/13/02	09/17/02	2256499	
Europium 155	-0.08	U	0.35	1.2	0.0	09/13/02	09/17/02	2256499	
Lead 212	1.33		0.37	0.87	0.0	09/13/02	09/17/02	2256499	
Lead 214	0.82 U, R5	U	0.44	1.4	0.0	09/13/02	09/17/02	2256499	
Mercury 203	0.03	U	0.18	0.62	0.0	09/13/02	09/17/02	2256499	
Potassium 40	31.8		2.4	0.8	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	0.49 U, R5	U	0.34	1.2	0.0	09/13/02	09/17/02	2256499	
Radium (226)	1.11 U, R11		0.39	0.96	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.57 U, R5	U	0.30	1.6	0.0	09/13/02	09/17/02	2256499	
Radium 223	-1.5	U	1.5	4.9	0.0	09/13/02	09/17/02	2256499	
Radium 224	6.0	U	3.9	10	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	-0.02	U	1.3	4.2	0.0	09/13/02	09/17/02	2256499	
Sodium 22	-0.035	U	0.048	0.17	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-0.30	U	0.19	0.63	0.0	09/13/02	09/17/02	2256499	
Thallium 208	0.41	U	0.17	0.53	0.0	09/13/02	09/17/02	2256499	
Thorium 227	0.8	U	1.2	3.3	0.0	09/13/02	09/17/02	2256499	
Thorium 231	1.1	U	1.1	3.8	0.0	09/13/02	09/17/02	2256499	
Thorium 234	-0.3	U	1.4	4.5	0.0	09/13/02	09/17/02	2256499	
Tin 113	-0.10	U	0.29	0.95	0.0	09/13/02	09/17/02	2256499	
Uranium 235	-0.25	U	0.73	2.5	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	0.012	U	0.021	0.11	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Thorium 232	1.62		0.40	1.4	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	141		13	0.8	3	09/16/02	09/27/02	2259564	87
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	12.3		1.2	0.02	0.006	10/09/02	10/17/02	2280439	97
Plutonium 239/40	52.3		5.0	0.006	0.0	10/09/02	10/17/02	2280439	97

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49381

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110280-002
Work Order: E73QQ
Matrix: SOLID

Date Collected: 09/06/02 0000
Date Received: 09/11/02 0900

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	**32.4**		2.1	0.7	0.0	09/13/02	09/17/02	2256499	
Antimony 125	-0.34 U, RS	U	0.47	1.5	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	2.26	U	0.85	2.9	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	**1.01**		0.26	0.71	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	1.6 U, RS	U	1.5	5.0	0.0	09/13/02	09/17/02	2256499	
Cerium 139	0.047	U	0.076	0.26	0.0	09/13/02	09/17/02	2256499	
Cesium 134	-0.289	U	0.0997	0.25	0.0	09/13/02	09/17/02	2256499	
Cesium 137	**166**		11	0.3	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	-0.014 U, RS	U	0.040	0.16	0.0	09/13/02	09/17/02	2256499	
Europium 152	-0.12	U	0.18	0.64	0.0	09/13/02	09/17/02	2256499	
Europium 154	0.12	U	0.31	1.2	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.06	U	0.24	0.82	0.0	09/13/02	09/17/02	2256499	
Lead 212	**1.06**		0.21	0.60	0.0	09/13/02	09/17/02	2256499	
Lead 214	0.48 U, RS	U	0.28	0.94	0.0	09/13/02	09/17/02	2256499	
Mercury 203	0.11	U	0.13	0.43	0.0	09/13/02	09/17/02	2256499	
Potassium 40	**28.4**		2.2	0.9	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	-0.20 U, RS	U	0.23	0.77	0.0	09/13/02	09/17/02	2256499	
Radium (226)	**1.00**		0.26	0.71	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.02 U, RS	U	0.35	1.2	0.0	09/13/02	09/17/02	2256499	
Radium 223	-0.8	U	1.0	3.3	0.0	09/13/02	09/17/02	2256499	
Radium 224	**14.5**		4.8	7.4	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	-0.68 U, RS	U	0.79	2.7	0.0	09/13/02	09/17/02	2256499	
Sodium 22	0.028	U	0.036	0.14	0.0	09/13/02	09/17/02	2256499	
Strontium 85	0.17	U	0.13	0.44	0.0	09/13/02	09/17/02	2256499	
Thallium 208	**0.69**		0.16	0.33	0.0	09/13/02	09/17/02	2256499	
Thorium 227	-0.91 U, RS	U	0.82	2.3	0.0	09/13/02	09/17/02	2256499	
Thorium 231	-1.14	U	0.81	2.7	0.0	09/13/02	09/17/02	2256499	
Thorium 234	2.17	U	0.996	3.4	0.0	09/13/02	09/17/02	2256499	
Tin 113	0.12	U	0.19	0.64	0.0	09/13/02	09/17/02	2256499	
Uranium 235	-0.52	U	0.54	1.7	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	0.019	U	0.028	0.13	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	**3.43**		0.37	0.63	0.43	09/16/02	09/26/02	2259564	79
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	**3.39**		0.33	0.02	0.009	10/09/02	10/17/02	2280439	95
Plutonium 239/40	**16.2**	•	1.5	0.03	0.01	10/09/02	10/17/02	2280439	95

NOTE(S)

Data are incomplete without the case narrative.

MDC is determined by instrument performance only.

Bold results are greater than the MDC

U Result is less than the sample detection limit.

CHAIN OF CUSTODY DOCUMENT NUMBER: 1186SC

Los Alamos
NATIONAL LABORATORY

REQUEST NUMBER: 1186S

ANALYSIS TYPE: RAD

ATTN: Mark Loeb
Severn Trent Laboraties, Inc., St. Louis
13715 Rider Trail N.
Earth City, MO 63045

SAMPLE ID	CONT ID	CONTAINER DESCRIPTION	ORDER TEMPLATE CODE	PRESERVATIVE	MATRIX
MD21-02-49380	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49381	2	1 L POLY	GS+ISOPU+SR90	NONE	S.

Final Page of CHAIN OF CUSTODY DOCUMENT FOR REQUEST NUMBER 1186S

Relinquished By:		Date	Time	Received By:		Date	Time
Padilla	[signature]	9/10/02	1400	CHAS CLIFFORD	[signature]	9/11/02	0900
PRINTED NAME	SIGNATURE			PRINTED NAME	SIGNATURE		
PRINTED NAME	SIGNATURE			PRINTED NAME	SIGNATURE		
PRINTED NAME	SIGNATURE			PRINTED NAME	SIGNATURE		

Received for DISPOSAL By: Date Time

PRINTED NAME SIGNATURE

Remarks:

Data Validation Cover Sheet

Section I. Data Record Package Identification

Request Number: 1182S   Validation Date: 04-Nov-02   Lab Code:

Contract Laboratory Name: Severn- Trent- St. Louis

Validator: Keith Greene   Organization: RRES

Analytical Suite(s): (check all that apply)

- ☐ Volatile Organics
- ☐ Semivolatile Organics
- ☐ Organochlorine Pesticides/Polychlorinated Biphenyls
- ☐ Other: ______ (describe)
- ☐ High Explosives
- ☐ Inorganics
- ☒ Radiochemistry

Section II. Completeness Check

Yes	No	n/a	(check one)	Yes	No	n/a	(check one)
☒	☐	☐	1. Chain-of-custody form(s)	☒	☐	☐	6. Raw/BSS data
☒	☐	☐	2. Case narrative	☒	☐	☐	7. Quality control forms
☒	☐	☐	3. Sample result forms	☒	☐	☐	8. Quantitation reports
☐	☐	☒	4. Sample chromatograms	☐	☐	☒	9. TICs forms
☐	☐	☒	5. Standard chromatograms	☐	☐	☒	10. TICs mass spectra

Identify any samples in the assigned Request Number that are missing:

Comments/problems noted (include information about requests for further information submitted to the contract laboratory and agreed upon date of resolution and contract laboratory point of contact): ISOPU - Results qualified as not detected (U, R5) because result was less than the MDC.

Sr-90 - Results qualified as not detected (U, R5) because result was less than the MDC.

Gamma spec - results qualified not detected (U, R5) because results were less than the MDC. Several analytes qaulifed as not detected (U, R11) because the results were less than 3 times the total propagated uncertainty.

All other QC within limits.

(Attach additional comment sheets as necessary)

Validator's signature: [signature]   Date: 11/4/02

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49373

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110288-001
Work Order: E73RW
Matrix: SOLID

Date Collected: 08/15/02 0000
Date Received: 09/11/02 0900

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	11.9		0.73	0.36	0.0	09/13/02	09/17/02	2256499	
Antimony 125	0.06	U, RS U	0.22	0.79	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	4.33		0.55	1.9	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	1.16		0.16	0.59	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	10.2		2.8	7.7	0.0	09/13/02	09/17/02	2256499	
Cerium 139	1.3	U, RS U	1.2	4.3	0.0	09/13/02	09/17/02	2256499	
Cesium 134	0.025	U	0.075	0.26	0.0	09/13/02	09/17/02	2256499	
Cesium 137	9.90		0.61	0.14	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	0.036	U, RS U	0.044	0.19	0.0	09/13/02	09/17/02	2256499	
Europium 152	0.12	U	0.11	0.58	0.0	09/13/02	09/17/02	2256499	
Europium 154	-0.16	U	0.35	1.3	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.006	U	0.13	0.47	0.0	09/13/02	09/17/02	2256499	
Lead 212	3.22		0.28	0.44	0.0	09/13/02	09/17/02	2256499	
Lead 214	1.34		0.17	0.59	0.0	09/13/02	09/17/02	2256499	
Mercury 203	3100	U, R11	3200	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	26.2		2.2	1.3	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	-0.155	U, RS U	0.081	0.26	0.0	09/13/02	09/17/02	2256499	
Radium (226)	1.25		0.10	0.27	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.35	U, RS U	0.40	1.7	0.0	09/13/02	09/17/02	2256499	
Radium 223	-0.04	U	0.40	1.4	0.0	09/13/02	09/17/02	2256499	
Radium 224	3.7	U	1.4	4.9	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	-1	U	1.4	4.9	0.0	09/13/02	09/17/02	2256499	
Sodium 22	-0.008	U	0.079	0.30	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-470	U	170	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	1.04		0.16	0.60	0.0	09/13/02	09/17/02	2256499	
Thorium 227	-0.11	U, RS U	0.31	0.92	0.0	09/13/02	09/17/02	2256499	
Thorium 231	0.36	U	0.38	1.3	0.0	09/13/02	09/17/02	2256499	
Thorium 234	0.56	U	0.45	1.7	0.0	09/13/02	09/17/02	2256499	
Tin 113	-1	U	5.1	18	0.0	09/13/02	09/17/02	2256499	
Uranium 235	0.09	U	0.21	0.72	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	1.6	U	4.0	19	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	1.76		0.32	0.64	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.39		0.21	0.38	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	4.04		0.58	0.94	0.37	09/16/02	09/26/02	2259564	51
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	0.483		0.055	0.020	0.007	10/09/02	10/17/02	2280439	8[illegible]
Plutonium 239/40	1.59		0.16	0.02	0.006	10/09/02	10/17/02	2280439	85

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49374

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110288-002
Work Order: E73TG
Matrix: SOLID

Date Collected: 08/15/02 0000
Date Received: 09/11/02 0900

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Bits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	3.27		0.26	0.29	0.0	09/13/02	09/17/02	2256499	
Antimony 125	-0.34 U, RS	U	0.15	0.48	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	4.50		0.49	1.6	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	1.20		0.14	0.29	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	9.9		1.6	5.8	0.0	09/13/02	09/17/02	2256499	
Cerium 139	-1.1 U, RS	U	1.1	3.8	0.0	09/13/02	09/17/02	2256499	
Cesium 134	-0.051	U	0.087	0.25	0.0	09/13/02	09/17/02	2256499	
Cesium 137	1.70		0.17	0.16	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	-0.035 U, RS	U	0.058	0.21	0.0	09/13/02	09/17/02	2256499	
Europium 152	0.12	U	0.19	0.78	0.0	09/13/02	09/17/02	2256499	
Europium 154	-0.49	U	0.31	1.0	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.19	U	0.12	0.42	0.0	09/13/02	09/17/02	2256499	
d 212	3.34		0.26	0.35	0.0	09/13/02	09/17/02	2256499	
d 214	1.35		0.099	0.21	0.0	09/13/02	09/17/02	2256499	
Mercury 203	1300 U, R11		2500	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	35.7		2.8	1.4	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	-0.011 U, RS	U	0.057	0.20	0.0	09/13/02	09/17/02	2256499	
Radium (226)	1.04		0.15	0.52	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.53 U, RS	U	0.55	1.8	0.0	09/13/02	09/17/02	2256499	
Radium 223	0.23	U	0.35	1.2	0.0	09/13/02	09/17/02	2256499	
Radium 224	6.4	U	2.1	7.9	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	0.2	U	1.4	5.1	0.0	09/13/02	09/17/02	2256499	
Sodium 22	-0.059	U	0.087	0.30	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-230	U	130	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	1.16		0.18	0.54	0.0	09/13/02	09/17/02	2256499	
Thorium 227	0.38 U, RS	U	0.27	0.83	0.0	09/13/02	09/17/02	2256499	
Thorium 231	0.23	U	0.33	1.2	0.0	09/13/02	09/17/02	2256499	
Thorium 234	2.19		0.36	1.6	0.0	09/13/02	09/17/02	2256499	
Tin 113	7.9 U, RS	U	4.0	15	0.0	09/13/02	09/17/02	2256499	
Uranium 235	0.153	U	0.077	0.56	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	-1.3	U	4.7	19	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	1.56		0.24	0.55	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.56		0.23	0.34	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	11.1		1.1	0.5	0.7	09/16/02	09/26/02	2259564	88
o PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	0.187		0.025	0.011	0.003	10/09/02	10/17/02	2280439	91
Plutonium 239/40	0.934		0.097	0.011	0.003	10/09/02	10/17/02	2280439	91

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49375

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110288-003
Work Order: E73TN
Matrix: SOLID

Date Collected: 08/14/02 0000
Date Received: 09/11/02 0900

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Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	72.7		4.5	0.7	0.0	09/13/02	09/17/02	2256499	
Antimony 125	0.63 U, R5	U	0.35	1.2	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	3.31		0.61	1.9	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	0.60 U, R11		0.21	0.56	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	6.9 U, R5	U	3.3	8.0	0.0	09/13/02	09/17/02	2256499	
Cerium 139	-0.8	U	1.6	5.4	0.0	09/13/02	09/17/02	2256499	
Cesium 134	-0.04	U	0.11	0.32	0.0	09/13/02	09/17/02	2256499	
Cesium 137	24.2		1.7	0.2	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	0.015 U, R5	U	0.060	0.25	0.0	09/13/02	09/17/02	2256499	
Europium 152	0.24	U	0.19	0.85	0.0	09/13/02	09/17/02	2256499	
Europium 154	-0.51	U	0.36	1.2	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.08	U	0.16	0.56	0.0	09/13/02	09/17/02	2256499	
Lead 212	2.35		0.34	0.71	0.0	09/13/02	09/17/02	2256499	
Lead 214	1.02		0.19	0.58	0.0	09/13/02	09/17/02	2256499	
Mercury 203	3000 U, R11		4300	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	26.5		2.1	0.9	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	-0.1 U, R5	U	0.11	0.36	0.0	09/13/02	09/17/02	2256499	
Radium (226)	0.90		0.12	0.36	0.0	09/13/02	09/17/02	2256499	
Radium 228	0.78 U, R5	U	0.34	1.1	0.0	09/13/02	09/17/02	2256499	
Radium 223	0.59	U	0.53	1.8	0.0	09/13/02	09/17/02	2256499	
Radium 224	29.7		9.0	11	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	-2.7 U, R5	U	1.8	5.8	0.0	09/13/02	09/17/02	2256499	
Sodium 22	0.150	U	0.082	0.34	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-610	U	210	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	1.34		0.21	0.64	0.0	09/13/02	09/17/02	2256499	
Thorium 227	0.52 U, R5	U	0.42	1.2	0.0	09/13/02	09/17/02	2256499	
Thorium 231	-0.58	U	0.52	1.5	0.0	09/13/02	09/17/02	2256499	
Thorium 234	1.18	U	0.56	2.0	0.0	09/13/02	09/17/02	2256499	
Tin 113	-3.1	U	7.9	27	0.0	09/13/02	09/17/02	2256499	
Uranium 235	-0.17	U	0.26	0.85	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	4.6	U	4.0	20	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	1.39		0.30	0.57	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.79		0.28	0.55	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	4.21		0.77	0.59	0.41	09/16/02	09/26/02	2259564	76
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	3.79		0.36	0.01	0.004	10/09/02	10/17/02	2280439	1[illegible]
Plutonium 239/40	11.8		1.1	0.004	0.0	10/09/02	10/17/02	2280439	110

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49376

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110288-004
Work Order: E73TQ
Matrix: SOLID

Date Collected: 08/14/02 0000
Date Received: 09/11/02 0900

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	23.3		1.5	0.5	0.0	09/13/02	09/17/02	2256499	
Antimony 125	-0.35 U, RS	U	0.25	0.85	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	4.20		0.59	1.8	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	1.15		0.18	0.61	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	5.5 U, RS	U	4.8	7.9	0.0	09/13/02	09/17/02	2256499	
Cerium 139	-1	U	1.3	4.4	0.0	09/13/02	09/17/02	2256499	
Cesium 134	-0.036	U	0.087	0.26	0.0	09/13/02	09/17/02	2256499	
Cesium 137	12.5		0.75	0.17	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	-0.048 U, RS	U	0.053	0.19	0.0	09/13/02	09/17/02	2256499	
Europium 152	-0.004	U	0.19	0.76	0.0	09/13/02	09/17/02	2256499	
Europium 154	-0.09	U	0.35	1.3	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.13	U	0.14	0.48	0.0	09/13/02	09/17/02	2256499	
Lead 212	3.56		0.31	0.53	0.0	09/13/02	09/17/02	2256499	
Lead 214	1.30		0.18	0.57	0.0	09/13/02	09/17/02	2256499	
Mercury 203	3700 U, R11		3300	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	28.8		2.3	0.9	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	0.106 U, RS	U	0.085	0.31	0.0	09/13/02	09/17/02	2256499	
Radium (226)	1.31		0.11	0.26	0.0	09/13/02	09/17/02	2256499	
Radium 228	0.63 U, RS	U	0.38	1.0	0.0	09/13/02	09/17/02	2256499	
Radium 223	0.33	U	0.43	1.5	0.0	09/13/02	09/17/02	2256499	
Radium 224	3.1	U	1.4	5.3	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	1.4	U	1.4	5.5	0.0	09/13/02	09/17/02	2256499	
Sodium 22	0.015	U	0.069	0.28	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-410	U	170	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	1.11		0.18	0.65	0.0	09/13/02	09/17/02	2256499	
Thorium 227	-0.03 U, RS	U	0.33	0.96	0.0	09/13/02	09/17/02	2256499	
Thorium 231	-0.006	U	0.43	1.3	0.0	09/13/02	09/17/02	2256499	
Thorium 234	1.70	U	0.58	1.9	0.0	09/13/02	09/17/02	2256499	
Tin 113	-10.6	U	6.2	20	0.0	09/13/02	09/17/02	2256499	
Uranium 235	0.33	U	0.21	0.75	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	1.8	U	4.1	20	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	1.94		0.32	0.61	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.48		0.24	0.42	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	7.44		0.55	0.84	0.51	09/16/02	09/26/02	2259564	59
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	1.30		0.13	0.01	0.004	10/09/02	10/17/02	2280439	92
Plutonium 239/40	7.03		0.67	0.01	0.004	10/09/02	10/17/02	2280439	92

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49377

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110288-005 (handwritten initials) Date Collected: 08/14/02 0000
Work Order: E73TV Date Received: 09/11/02 0900
Matrix: SOLID

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	184		11	1	0.0	09/13/02	09/17/02	2256499	
Antimony 125	0.51 U, RS	U	0.53	1.6	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	3.34		0.70	2.5	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	1.06		0.22	0.67	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	5.0 U, RS	U	4.0	12	0.0	09/13/02	09/17/02	2256499	
Cerium 139	-0.9	U	2.4	8.0	0.0	09/13/02	09/17/02	2256499	
Cesium 134	0.19	U	0.14	0.44	0.0	09/13/02	09/17/02	2256499	
Cesium 137	72.4		4.1	0.3	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	-0.003 U, RS	U	0.046	0.19	0.0	09/13/02	09/17/02	2256499	
Europium 152	0.32	U	0.24	1.0	0.0	09/13/02	09/17/02	2256499	
Europium 154	0.04	U	0.32	1.2	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.03	U	0.23	0.78	0.0	09/13/02	09/17/02	2256499	
Lead 212	2.82		0.43	0.94	0.0	09/13/02	09/17/02	2256499	
Lead 214	1.03		0.22	0.79	0.0	09/13/02	09/17/02	2256499	
Mercury 203	-9500 U, RS	U	6200	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	27.8		2.3	1.4	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	-0.03 U, RS	U	0.16	0.54	0.0	09/13/02	09/17/02	2256499	
Radium (226)	1.05		0.22	0.67	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.00 U, RS	U	0.28	1.0	0.0	09/13/02	09/17/02	2256499	
Radium 223	0.26	U	0.74	2.5	0.0	09/13/02	09/17/02	2256499	
Radium 224	10.7	U	4.8	11	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	-0.9	U	2.8	9.6	0.0	09/13/02	09/17/02	2256499	
Sodium 22	0.006	U	0.081	0.31	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-760	U	300	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	0.79		0.26	0.75	0.0	09/13/02	09/17/02	2256499	
Thorium 227	-0.43 U, RS	U	0.61	1.7	0.0	09/13/02	09/17/02	2256499	
Thorium 231	-1.10	U	0.63	2.0	0.0	09/13/02	09/17/02	2256499	
Thorium 234	1.40	U	0.79	2.5	0.0	09/13/02	09/17/02	2256499	
Tin 113	-16	U	12	41	0.0	09/13/02	09/17/02	2256499	
Uranium 235	0.36	U	0.14	1.3	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	-1.9	U	3.2	13	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	1.20		0.39	0.80	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.36		0.31	0.68	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	34.5		5.2	0.7	1.0	09/16/02	09/26/02	2259564	71
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	8.74		0.82	0.004	0.0	10/09/02	10/17/02	2280439	
Plutonium 239/40	24.1		2.2	0.004	0.0	10/09/02	10/17/02	2280439	

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49378

Severn Trent Laboratories - Radiochemistry

Lab Sample ID:	F2I110288-006	Date Collected:	08/14/02	0000
Work Order:	E73TW	Date Received:	09/11/02	0900
Matrix:	SOLID			

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	281		17	1	0.0	09/13/02	09/17/02	2256499	
Antimony 125	0.84 U, RS	U	0.58	1.9	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	3.2 U, R11		1.1	2.5	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	0.76		0.20	0.59	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	-4.2 U, RS	U	3.6	12	0.0	09/13/02	09/17/02	2256499	
Cerium 139	-0.4	U	2.5	8.5	0.0	09/13/02	09/17/02	2256499	
Cesium 134	0.28	U	0.13	0.41	0.0	09/13/02	09/17/02	2256499	
Cesium 137	81.6		5.5	0.2	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	-0.061 U, RS	U	0.057	0.21	0.0	09/13/02	09/17/02	2256499	
Europium 152	0.19	U	0.20	0.83	0.0	09/13/02	09/17/02	2256499	
Europium 154	0.46	U	0.37	1.5	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.07	U	0.25	0.84	0.0	09/13/02	09/17/02	2256499	
Lead 212	2.56		0.48	1.0	0.0	09/13/02	09/17/02	2256499	
Lead 214	0.98 U, R11		0.34	0.76	0.0	09/13/02	09/17/02	2256499	
Mercury 203	7500		6600	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	28.6		2.2	1	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	0.05 U, RS	U	0.19	0.56	0.0	09/13/02	09/17/02	2256499	
Radium (226)	0.75		0.20	0.58	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.22 U, RS	U	0.44	1.7	0.0	09/13/02	09/17/02	2256499	
Radium 223	-0.71	U	0.81	2.7	0.0	09/13/02	09/17/02	2256499	
Radium 224	34		11	13	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	-0.03 U, RS	U	2.4	8.5	0.0	09/13/02	09/17/02	2256499	
Sodium 22	-0.043	U	0.079	0.28	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-320	U	310	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	0.84		0.22	0.65	0.0	09/13/02	09/17/02	2256499	
Thorium 227	0.46 U, RS	U	0.64	1.8	0.0	09/13/02	09/17/02	2256499	
Thorium 231	-0.08	U	0.65	2.2	0.0	09/13/02	09/17/02	2256499	
Thorium 234	1.82	U	0.78	2.7	0.0	09/13/02	09/17/02	2256499	
Tin 113	-23	U	13	43	0.0	09/13/02	09/17/02	2256499	
Uranium 235	0.66	U	0.21	1.3	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	-1.4	U	3.2	13	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	2.19		0.37	0.55	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.12		0.29	0.75	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	54.6		3.4	0.8	1.2	09/16/02	09/26/02	2259564	57
Iso PLUTONIUM (LONG CT) HAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	19.2		1.8	0.01	0.007	10/09/02	10/18/02	2280439	92
Plutonium 239/40	34.9		3.3	0.01	0.005	10/09/02	10/18/02	2280439	92

LOS ALAMOS NATIONAL LABORATORY

Client Sample ID: MD21-02-49379

Severn Trent Laboratories - Radiochemistry

Lab Sample ID: F2I110288-007
Work Order: E73T0
Matrix: SOLID

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Date Collected: 08/15/02 0000
Date Received: 09/11/02 0900

Parameter	Result	Qual	Total Uncert. (1 σ+/-)	MDC	DLC	Prep Date	Analysis Date	Batch #	Yld %
Gamma Cs-137 & Hits by DOE RP-730 MOD				pCi/g		RP-730 MOD			
Americium 241	0.094 U,RS	U	0.074	0.27	0.0	09/13/02	09/17/02	2256499	
Antimony 125	0.01	U	0.14	0.52	0.0	09/13/02	09/17/02	2256499	
Bismuth 211	3.71		0.47	1.6	0.0	09/13/02	09/17/02	2256499	
Bismuth 214	1.06		0.15	0.56	0.0	09/13/02	09/17/02	2256499	
Cadmium 109	0.9 U,RS	U	2.0	7.2	0.0	09/13/02	09/17/02	2256499	
Cerium 139	1.3	U	1.0	3.8	0.0	09/13/02	09/17/02	2256499	
Cesium 134	-0.024	U	0.064	0.21	0.0	09/13/02	09/17/02	2256499	
Cesium 137	0.604		0.076	0.14	0.0	09/13/02	09/17/02	2256499	
Cobalt 60	-0.099 U,RS	U	0.046	0.13	0.0	09/13/02	09/17/02	2256499	
Europium 152	-0.003	U	0.11	0.48	0.0	09/13/02	09/17/02	2256499	
Europium 154	0.48	U	0.34	1.4	0.0	09/13/02	09/17/02	2256499	
Europium 155	0.11	U	0.10	0.38	0.0	09/13/02	09/17/02	2256499	
Lead 212	3.05		0.26	0.32	0.0	09/13/02	09/17/02	2256499	
Lead 214	1.15		0.15	0.51	0.0	09/13/02	09/17/02	2256499	
Mercury 203	-2300 U,RS	U	2400	0.0	0.0	09/13/02	09/17/02	2256499	
Potassium 40	30.8		2.4	1.1	0.0	09/13/02	09/17/02	2256499	
Protactinium 233	0.033 U,RS	U	0.054	0.20	0.0	09/13/02	09/17/02	2256499	
Radium (226)	1.08		0.091	0.22	0.0	09/13/02	09/17/02	2256499	
Radium 228	1.72 U,RS	U	0.42	1.7	0.0	09/13/02	09/17/02	2256499	
Radium 223	0.25	U	0.32	1.2	0.0	09/13/02	09/17/02	2256499	
Radium 224	3.3	U	1.2	3.4	0.0	09/13/02	09/17/02	2256499	
Ruthenium 106	1.1	U	1.2	4.8	0.0	09/13/02	09/17/02	2256499	
Sodium 22	0.070	U	0.070	0.30	0.0	09/13/02	09/17/02	2256499	
Strontium 85	-570	U	130	0.0	0.0	09/13/02	09/17/02	2256499	
Thallium 208	1.04		0.16	0.60	0.0	09/13/02	09/17/02	2256499	
Thorium 227	-0.11 U,RS	U	0.20	0.61	0.0	09/13/02	09/17/02	2256499	
Thorium 231	0.43	U	0.33	1.3	0.0	09/13/02	09/17/02	2256499	
Thorium 234	0.96	U	0.41	1.6	0.0	09/13/02	09/17/02	2256499	
Tin 113	6.6	U	4.1	16	0.0	09/13/02	09/17/02	2256499	
Uranium 235	0.120	U	0.067	0.60	0.0	09/13/02	09/17/02	2256499	
Yttrium 88	3.1	U	4.3	21	0.0	09/13/02	09/17/02	2256499	
--- Other Detected Radionuclides ---									
Actinium 228	1.61		0.29	0.49	0.0	09/13/02	09/17/02	2256499	
Thorium 232	1.39		0.21	0.35	0.0	09/13/02	09/17/02	2256499	
SR-90 BY GFPC DOE 7500-SR MOD				pCi/g		7500-SR MOD			
Strontium 90	0.42 U,RS	U	0.16	0.58	0.28	09/16/02	09/26/02	2259564	94
Iso PLUTONIUM (LONG CT) NAS & DOE MOD				pCi/g		3058/RP-725			
Plutonium 238	0.0082 U,RS	U	0.0048	0.015	0.0092	10/09/02	10/18/02	2280439	91
Plutonium 239/40	0.867		0.088	0.004	0.0	10/09/02	10/18/02	2280439	91

Los Alamos
NATIONAL LABORATORY

REQUEST NUMBER: 1182S

ANALYSIS TYPE: RAD

TTN: Mark Loeb
Severn Trent Laboraties, Inc., St. Louis
13715 Rider Trail N.
Earth City, MO 63045

SAMPLE ID	CONT ID	CONTAINER DESCRIPTION	ORDER TEMPLATE CODE	PRESERVATIVE	MATRIX
MD21-02-49373	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49374	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49375	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49376	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49377	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49378	2	1 L POLY	GS+ISOPU+SR90	NONE	S
MD21-02-49379	2	1 L POLY	GS+ISOPU+SR90	NONE	S

Final Page of CHAIN OF CUSTODY DOCUMENT FOR REQUEST NUMBER 1182S

Relinquished By:		Date	Time	Received By:		Date	Time
Padilla	Padilla	9/10/02	1400	CHRIS CLIFFORD	[signature]	9/11/02	0900
PRINTED NAME	SIGNATURE			PRINTED NAME	SIGNATURE		
PRINTED NAME	SIGNATURE			PRINTED NAME	SIGNATURE		
PRINTED NAME	SIGNATURE			PRINTED NAME	SIGNATURE		

Received for DISPOSAL By:		Date	Time	Remarks:
PRINTED NAME	SIGNATURE			

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

GARY E. JOHNSON
GOVERNOR

JOHN R. D'ANTONIO, Jr.
SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 25, 2002

Dr. John Browne, Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop A100
Los Alamos, New Mexico 87545

Mr. Everett Trollinger, Project Manager
Office of Los Alamos Site Operations
Department of Energy
528 35th Street, Mail Stop A316
Los Alamos, New Mexico 87544

RE: "CONTAINED-IN" DETERMINATION FOR SOLID WASTE MANAGEMENT UNIT (SWMU) 21-011(k), TECHNICAL AREA 21

Dear Dr. Browne and Mr. Trollinger:

The Hazardous Waste Bureau of the New Mexico Environment Department (NMED) is in receipt of "Request for 'No Longer Contained In' Determination for Soil, Tuff, and Sediment at Solid Waste Management Unit 21-011(k), at Technical Area (TA) 21," dated November 5, 2002 and referenced by ER2002-0749. The "contained-in" determination is being requested by Los Alamos National and the Department of Energy for environmental media contaminated with low concentrations of F-listed hazardous waste: acetone, methylene chloride, toluene, and trichloroethylene. The environmental media consist primarily of soil, sediment, and tuff that will be excavated during implementation of voluntary corrective measures (VCM) activities proposed for SWMU 21-011(k). NMED is in receipt of the VCM Plan for SWMU 21-011(k) at Technical Area 21, Revision 2 (LA-UR-02-6797 and ER2002-0745); however, NMED has not conducted technical review or issued approval of the VCM Plan. NMED evaluated the analytical and risk assessment data in accordance with current "contained-in" guidance to determine whether the environmental media to be excavated must be managed as F-listed hazardous waste.

The "contained-in" determination is based on conservative, health-based soil concentrations (i.e., US EPA Region 6 Human Health Medium-Specific Screening Levels) for direct exposure to an industrial receptor using a reasonable maximum exposure scenario. An industrial worker scenario is appropriate for this determination because the environmental media to be excavated will be properly disposed of in an appropriate landfill, further reducing the risk to human health and the environment. Based on the information provided, NMED believes that the media to be excavated during implementation of proposed VCM activities at 21-011(k), which contain acetone, methylene chloride, toluene, and trichloroethylene at concentrations below the health-based screening levels, will not need to be managed as F-listed hazardous waste. On order to account for simultaneous exposure to two carcinogens the health-based concentration for methylene chloride and trichloroethylene are each one-half of the value proposed in LANL's request. The requested approval is granted if the excavated material (i.e., environmental media) is managed as solid waste that will be properly disposed in an appropriate facility. Any material with hazardous constituents in concentrations equal to or greater than the proposed health-based concentrations specified above and meet land disposal restrictions (LDRs), shall be managed as F-listed hazardous waste.

Waste characterization samples must be collected from the waste generated at a rate of one (1) sample per 100 cubic yards (yd^3). Each sample collected must be analyzed for total Appendix VIII (40 CFR Part 261) volatile organic compounds (VOCs), and the results submitted to NMED in the VCM Completion Report for 21-011(k). In order for the waste to be disposed, all sample results must meet LDRs and be less than health-based (industrial) concentrations for detected VOCs. Should any detected VOC not meet LDRs and industrial health-based screening levels, NMED must be immediately notified and the waste must be managed appropriately.

This "contained-in" determination is limited to only the four (4) contaminants mentioned; the contaminated environmental media for which the data and assessment were submitted and reviewed; and the activities conducted during this activity. The waste must be managed in the manner described above.

If you have any questions regarding this "contained-in" determination, please contact me at (505) 428-2546 or John Young at (505) 428-2538.

Sincerely,

VMaranville

Vickie Maranville
Project Leader
Permits Management Program

Cc: J. Bearzi, NMED HWB
D. Cobrain, NMED HWB
J. Young, NMED HWB
J. Davis, NMED SWQB
J. Parker, NMED DOE OB
S. Yanicak, NMED DOE OB, MS J993
L. King, EPA 6PD-N
W. Woodworth, DOE OLASO, MS A316
D. McInroy, LANL RRES/ER, MS M992
N. Quintana, LANL RRES/ER, MS M992
B. Ramsey, LANL RRES/DO, MS J591
File: Reading and LANL TA-21 (21-011(k) Outfall)

Los Alamos National Laboratory/University of California
Risk Reduction & Environmental Stewardship (RRES)
Remediation (R) Program, MS M992
Los Alamos, New Mexico 87545
RRES (505) 667-0808/FAX (505) 665-4747

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

Date: January 16, 2003
Refer to: ER2003-0040

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: SUBMITTAL OF RESPONSE TO NOTICE OF DEFICIENCY (NOD), VOLUNTARY CORRECTIVE MEASURE (VCM) PLAN FOR SOLID WASTE MANAGEMENT UNIT (SWMU) 21-011(K) AT TECHNICAL AREA (TA) 21 (REVISION 2. LOS ALAMOS NATIONAL LABORATORY EPA ID NO: NM0890010515 TASK NUMBER HWB-02-020)

Dear Mr. Young:

Enclosed are two copies of the Los Alamos National Laboratory (LANL) Risk Reduction and Environmental Stewardship Remediation (RRES-R) Programs Response to the NOD received on December 23, 2003 on Revision 2 of the VCM Plan for SWMU 21-011(k). Per personnel communication and follow-up electronic confirmation from Vickie Maranville of your staff LANL is submitting the enclosed NOD response at this time in lieu of a revised VCM Plan. Once the response to the NOD has been approved by the New Mexico Environment Department (NMED) LANL will submit a revised VCM plan within 15 days of NMEDs written approval.

If you have any questions, please contact Mark Thacker at (505) 665-5342.

Sincerely,

David McInroy, Acting Program Manager
Remediation Program
Los Alamos National Laboratory

Sincerely,

Everett Trollinger, Project Manager
Department of Energy
Office of Los Alamos Site Operations

Response to Notice of Deficiency (NOD) on the Voluntary Corrective Measure (VCM) Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area 21, Revision 2
Los Alamos National Laboratory, EPA ID#NM0890010515

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the letter. Los Alamos National Laboratory's (LANL's) responses follow each NMED comment.

GENERAL COMMENTS

NMED Comment

1. *Maps displaying data using a colorimetric scale must be submitted in color. Since the maps were not submitted in color, it is difficult for the reader to determine contaminant distribution. In addition, color photographs (Attachment 1) should be submitted in color, not black and white. Please revise all maps displaying data using a colorimetric scale and submit color maps and photographs to NMED in the revised VCM Plan.*

LANL Response

1. Maps displaying data using a colorimetric scale are included as Attachment 1 to this NOD. The photographs provided in Attachment 1 of Revision 2 of the VCM plan (Release/Discharge Notification PRS 21-011k) were taken by an employee who is no longer with LANL. As of the submittal of this NOD response, the original photographs have not been located. If the photographs are located color copies of the photographs will be transmitted to NMED.

NMED Comment

2. *Ecological risk at the site is not addressed in the VCM Plan. The Permittees must assess ecological risk from uptake of residual contaminants through plants into the food chain using LANL ecological screening levels (ESLs) for contaminants or sampling results from vegetation removed from the site. Results of ecological risk can be presented in the VCM Completion Report.*

LANL Response

2. Results of ecological risk screening assessment will be presented in the VCM Completion Report for SWMU 21-011(k).

SPECIFIC COMMENTS

NMED Comment

1. ***Section 1.2 Regulatory History, Page 4***

   Table 1.2-2 Regulatory Activity for SWMU 21-011(k).

   The above referenced Table is incomplete as submitted, missing plan submittals, and NMED and the Permittees correspondence. Please update the Table to accurately reflect the regulatory activity for SWMU 21-011 (k).

LANL Response

1. Table 1.2-1, presented below, has been updated to reflect plan submittals and NMED and the Permittees correspondence.

Table 1.2-1
Regulatory Activity for SWMU 21-011(k)

Date	Activity	Document
1988	Sampling	1994 TA-21 OU RFI Phase Report 1C (LANL 1994, 31591.1)
1991	LANL TA-21 RFI Work Plan	1991 TA-21 Operable Unit RFI Work Plan for Environmental Restoration (LANL 1991, 07528.1)
1992-93	RFI Site Characterization	1994 Addendum to TA-21 Phase Reports 1B and 1C (LANL 1994, 52350.1)
1996/1997	Interim Action	1996 Interim Action Plan for PRS 21-011(k) (LANL 1996, 54790.2); 1997 Interim Action Report for PRS 21-011(k) (LANL 1997, 55648.2)
2001	VCM Implementation Approach for SWMU 21-011(k)	Communication Record (LANL 2002, 70217)
2002	Submittal of VCM Plan for SWMU 21-011(k) at TA-21	"Voluntary Corrective Measures Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21," LA-UR-02-2218, (LANL 2002, 73085.2)
2002	NMED Issues Comments on SWMU 21-011(k) VCM Plan	Notice of Technical Incompleteness, VCM Plan for SWMU 21-011(k), (NMED 2002, 73201)
2002	Submittal of Revision 1 of the VCM Plan for SWMU 21-011(k) at TA-21	"Voluntary Corrective Measures Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21, Revision 1" LA-UR-02-3807, (LANL 2002, 73654.2)
2002	Withdrawal of Revision 1 of the VCM Plan for SWMU 21-011(k) at TA-21	Withdrawal Letter (LANL 2002, 73605)
2002	Submittal of Revision 2 of the VCM Plan for SWMU 21-011(k) at TA-21	"Voluntary Corrective Measures Plan for Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21, Revision 2" LA-UR-02-6797, (LANL 2002, 73722)
2002	Submittal of Request for "No Longer Contained In" determination for soil, tuff, and sediment at SWMU 21-011(k), at TA-21	Letter Requesting No Longer Contained in Determination, (LANL 2002, 73721)
2002	NMED Issues No Longer Contained-In Determination for material to be excavated from SWMU 21-011(k), TA-21	Approval letter from NMED, (NMED 2002, 73720)
2002	Submittal of VCM Confirmation Sampling Notification	Sampling Notification Letter, ER2002-0797, (LANL 2002, 73723)
2002	Submittal of offsite analytical laboratory data to validate the proposed screening method to be used during the VCM at SWMU 21-011(k)	Communication Record, ER2002-0800, (LANL 2002, 73725)
2002	NMED issues Notice of Deficiency on SWMU 21-011(k) VCM Plan	Notice of Deficiency, VCM Plan for SWMU 21-011(k), (NMED 2002, 73724)

NMED Comment

2. ***Section 1.3 Rationale for Proposed Corrective Measure, Page 4***

LANL Statement: "Consequently, the trail-user land use scenario is proposed for this VCM (LANL 2001, 70217) and used to screen soil and sediment areas with potentially elevated radionuclide concentration exceeding the acceptable human health dose level (15 mrem/yr)."

A dose of 15 mrem/yr may be considered acceptable to the Permittees; however, NMED does not evaluate human health based on dose per year. NMED evaluates risk to human health based on lifetime carcinogenic risk. Please revise the above statement to indicate that a dose of 15 mrem/yr. is acceptable to the Permittees, but may not be acceptable to NMED.

In order to determine if the proposed VCM could be considered a final remedy the risk assessment must contain an estimate of dose and risk over time for a residential receptor based on the starting residual level of radionuclides in soil being equivalent to the target goals and demonstrating how many years would be required for the risk to reach no further action (NFA) criteria of 10^{-5} excess risk for a residential receptor.

LANL Response

2. LANL recognizes that NMED has an interest in receiving information on radionuclides present at corrective action sites. For this reason, LANL voluntarily provides NMED with the information in this NOD Response for SWMU 21-011(k) that it provides to DOE pursuant to DOE Orders. However, NMED's requested response exceeds the agency's authority under the New Mexico Hazardous Waste Act. LANL is subject to DOE's authority under the Atomic Energy Act for radioactive materials at corrective action sites, and declines to revise the text as requested.

NMED Comment

3. ***Section 1.3-1 Present-day dose vs. time for trail-user scenario at SWMU 21-011(k), Page 5***

LANL Statement: "This remedial approach is a cost-effective and proactive remedial alternative, and is preferred over no action, fencing of the site, and/or stabilization and placement in an on-site containment cell."

The VCM Plan submitted to NMED in April 2000 (LA-UR-02-2218) and deemed technically deficient (NMED letter dated May 15, 2000) stated in Section 1.3, page 6, "The estimated cost savings of onsite stabilization compared to transportation and disposal at Area G is expected to be approximately $2 million because onsite stabilization eliminates the costs associated with the coordination and implementation of transporting low level contaminated waste over public roadways, through public areas, and disposal at Area G." The current plan does not demonstrate that removal and disposal at Area G will result in a cost savings. In addition, the current proposed remedial method (removal and off-site disposal) requires contaminated material to be transported through the town of Los Alamos. Also, the cost estimate provided in the current revision of the VCM Plan Appendix B (VCM Checklist and Fact Sheet), Page B-5 is the same fact sheet as previously submitted to NMED. Please explain in more detail the benefits of the selected remedial alternative.

LANL Response

3. As stated in the September 17, 2002 correspondence "Withdrawal of Revision 1 of the VCM plan for SWMU 21-011(k), at Technical Areas 21" ER2002-0643, "Subsequent to the submittal of the VCM plan to NMED-HWB, the decision to stabilize contaminated material in place was revisited based on a much reduced volume of contaminated soil identified in the field as needing remediation as well as identifying a lower rate for disposal costs. As a result, the cost of excavation and disposal of the contaminated material was virtually the same as the cost for onsite stabilization. At the same time the Department of Energy (DOE) underscored its goal of minimizing the number of ER Project sites that will require long-term stewardship. As a result, the LANL ER Project and the DOE Los Alamos Site Office determined that the excavation and disposal of radioactively contaminated material from SWMU 21-011(k) at Area G at TA-54 is more in keeping with current cost efficiencies and long-term property management strategies."

   As stated in the referenced correspondence pre-VCM field activities refined the original estimate of 1500 yd^3 of material requiring removal to approximately 560 yd^3. After submission of the July 2002 VCM plan to NMED a bulk disposal rate was negotiated with Area G at TA-54, which greatly reduced the cost of disposal. Therefore, the reduced volume estimate and lower disposal cost made the cost of excavation and disposal at Area G essentially identical to those that would have been incurred for excavation, stabilization, and on-site disposal while significantly reducing long-term stewardship requirements. This approach was validated by members of the public and the Northern New Mexico Citizens Advisory Board (NNMCAB) during a site tour in 2002 when DOE and ER Project staff were reminded of DOE's stated goal of limiting DOE's "footprint" at LANL, which is in line with the current selected remedial alternative.

NMED Comment

4. ***3.0 Basis for Cleanup Levels, Page 16***

   LANL Statement: "By comparison, the calculated dose to a hypothetical recreational trail user following implementation of the proposed excavation and disposal of 500 yd^3 of contaminated material with concentrations of Cs-137 greater than 150pCi/g and approximately 60 yd^3 of contaminated sediment in the western drainage with Am-241 concentrations greater than 170 pCi/g is between 3 and 4 mrem/yr or about 1/4 the criterion of 15 mrem/yr for the free-release of real property (DOE 2000, 67489)."

   Please explain why the selected remedy is preferred over stabilization in place. Stabilization in place, prior to installation of the engineered cover, was estimated to provide between 2 and 3 mrem/yr or 1/5 the Department of Energy (DOE) criterion of 15 mrem/yr for free-release of real property, whereas the selected remedy is estimated to provide between 3 and 4 mrem/yr or 1/4 the DOE criterion. Also, please provide risk estimates for each remedy proposed.

LANL Response

4. The discussion regarding the preference of the selected remedy is included in our response to specific comment number 3 above. The primary reason for the increase in dose following the implentation of the preferred remedy is that the amount of material requiring removal to meet the cleanup criteria (approximately 560 yd^3) is substantially less than the 1500-yd^3 estimate used in the RESRAD model calculations presented in previous versions of the VCM plan for SWMU 21-011(k). RESRAD results using 1500 yd^3 equated to a lower overall site wide residual concentration remaining after implementation of excavation, solidification, and placement in an on-site stabilization cell. Based on

RESRAD results using 560 yd^3, the selected remedy presented in Revision 2 of the VCM plan is shown to be protective of human health and the environment based on current and projected future land use.

Risk estimates for a remedy other than the proposed remedy have not been completed. A full screening assessment, based on dose, will be included in the VCM Completion Report for SWMU 21-011(k), consistent with DOE Orders.

NMED Comment

5. ***3.0 Basis for Cleanup Levels, Page 16***

LANL Statement: "The total dose rate is projected to decline to less than 2 mrem/yr within approximately 30 years after excavation due solely to the decay of Cs-137, thereby decreasing the dose within 1/8 the time without VCM implementation. "

The above statement is confusing; please clarify the estimated risk after 30 years with and without implementation of the proposed VCM activities.

LANL Response

5. The text has been modified as presented below, please note the $1/8^{th}$ was a carryover from the original VCM plan, by comparing the time required to reach 2 mrem/yr on Figures 1.3-1 and 3.0-1 the correct fraction is $1/3^{rd}$.

The total dose rate is projected to decline to less than 2 mrem/yr within approximately 30 years after excavation due solely to the decay of Cs-137. This is approximately 1/3 the time that would be required to reach 2 mrem/yr without the source reduction achieved through implementation of the VCM.

NMED Comment

6. ***3.0 Basis for Cleanup Levels, Page 16***

LANL Statement: "Figure 3.0-1 is a dose versus time plot produced by RESRAD 6.1 (Appendix F, Exhibit F.C) for the recreational trail user following implementation of the proposed excavation and disposal of 50yd^3 of contaminated material with concentrations of Cs-137 greater than 150pCi/g . . . "

Based on information provided in Section 1.1 Purpose and Scope, page I of the VCM Plan, approximately 500 yd^3 of contaminated soil, tuff, and sediment, and approximately 60 yd^3 of contaminated sediment are proposed for removal during the VCM activities. Please correct the above statement to reflect actual amount of material planned for removal during the proposed VCM activities.

LANL Response

6. The text has been corrected to read "disposal of 560 yd^3 of contaminated material..."

Attachment 2 to this NOD response includes the RESRAD output results for the recreational trail user following implementation of the VCM at SWMU 21-011(k). The RESRAD results included in Exhibit F2.2 of Revision 2 of the VCM Plan were from a previous version of the VCM plan.

NMED Comment

7. ***3.0 Basis for Cleanup Levels, Page 17***

LANL Statement: "The mixture derived concentration guideline (DCGL) (Appendix F) for soil is satisfied when the sum of ratios or the radionuclides present is less than or equal to 1. Based on site average concentrations current dose at SMWU 21-011 (k) is 7.3 mrem/yr for a recreational trail-user scenario, well below the 15 mrem/yr dose-based criteria."

Although a calculated dose of 7.3 mrem/yr may be a legitimate dose to DOE, it does not satisfy NMED requirements. NMED requires risk to be calculated for each radionuclide present, the risk for individual radionuclides can then be summed to determine total risk at the site. Estimates of excess risk corresponding to the estimated doses should be included; the excess risk should be estimated for a 30-year exposure for the trail-user and for the residential scenario where that scenario is considered. The trail-user scenario adequately estimates current potential exposure, but in order to determine if the proposed VCM could be considered a final remedy the risk assessment must contain an estimate of dose and risk over time for a residential receptor based on the starting residual level of radionuclides in soil being equivalent to the target goals and demonstrating how many years would be required for the risk to reach NFA criteria of 10^{-5} excess risk for a residential receptor.

LANL Response

7. See response to Specific Comment #2.

NMED Comment

8. ***4.1 Conceptual Model, Page 19***

LANL Statement: "The SWMU is vegetated, and portions of it are covered with plant litter, thereby minimizing any contaminant transport via wind and fugitive dust."

Based on communication between the Permittees and NMED, the site had been cleared of vegetation during the summer of 2002 in preparation for solidification activities that were proposed to NMED in prior submittals of the VCM Plan. Please clarify or revise the above statement to reflect actual site conditions.

LANL Response

8. The text has been modified to state the following: "During the summer of 2002 the woody vegetation from the SWMU was removed in anticipation of VCM activities. Grasses and plant litter remain over much of the site which help minimize contaminant transport via wind and fugitive dust."

NMED Comment

9. ***4.3 Remedial Approach, Page 21***

LANL Statement: "Site preparation activities will include clearing and grubbing of vegetation in areas to be excavated; set-up of site trailers; survey and staking of area to be excavated; construction of site support zones; installation of sanitary facilities; tree removal and chipping . . . "

Based on communication between the Permittees and NMED, the site had been cleared of vegetation, grubbed, and the trees removed and chipped during the summer of 2002 in preparation for *solidification activities that were proposed to NMED in the prior submittals of the VCM Plan. In addition, the following paragraphs in section 4.3 of the VCM Plan detail site clearing activities. The above statement is confusing to the reader; please revise or remove the statement to reflect actual site conditions. If clearing and grubbing have in fact been successfully completed, state that clearing activities have already been conducted and provide the details of such activities.*

LANL Response

9. Section 4.3 of the text has been updated to reflect current conditions as follows:

4.3 Remedial Approach

Following the readiness review, mobilization and site preparation for remedial activities commenced. Mobilization activities included the delivery of site trailers, materials, and heavy equipment. Site preparation activities included clearing and grubbing of vegetation in areas to be excavated; set-up of site trailers; survey and staking of areas to be excavated; construction of site support zones; installation of sanitary facilities; tree removal and chipping; improvement and extension of the existing haul road; fence removal; installation of temporary fencing; and installation of stormwater BMPs.

Tree trunks over 8 in. in diameter were cut into nominal 15-ft lengths for subsequent use as stormwater run-on and runoff control diversion barriers. Prior to clearing and grubbing, on-site vegetation was sampled for waste characterization purposes as described in detail in Section 6.0. The material was cleared and stored in rolloff containers. After receipt and review of waste characterization results the material will be disposed of at Area G at TA-54. The drainline from the northern fence line of the two holding tanks (structures 21-112 and -113) to the outfall at the southern end of the SWMU has been removed. This 4-in. diameter, cast iron drainline extended 80 ft from the south side of the North Perimeter Road to a discharge point just below the canyon rim. The soil above the cast iron drainline was excavated and the drainline removed. The drainline excavation trench was field screened using a gamma instrument and PG-2 detector in the same manner being followed for guiding the soil removal. Samples were collected immediately below the removed line and following collection of confirmation samples, the trench was backfilled. Based on soil screening results some soil removal and additional sampling will be required along the section of the drainline that formerly ran under the road. Once that work is accomplished the road will be repaired as described in Section 5.

During field activities, the Laboratory is monitoring worker exposure to radionuclide-contaminated soil at SWMU 21-011(k) based on the requirements of the site-specific health and safety plan (SSHASP). The two high-volume air samplers proposed in the previous version of this VCM plan are not being used. Upon further review of the project, Laboratory Air Quality Group personnel determined that high-volume air samples located in close proximity to the site, (i.e., across the DP Canyon drainage channel to the north) would not detect contamination present in suspended particulates from the VCM, because 1) once suspended, the particulates travel a much further distance before being deposited on the ground, and 2) the high-volume samplers will not collect an aliquot of sample sufficient for analysis in a short time period. In lieu of the high-volume samplers, the Laboratory is monitoring exposure to members of the public during remediation of 21-011(k) by use of existing airnet stations. The Laboratory operates four airnet stations near the Los Alamos Airport and DP Road (Airnet stations: 9 - Los Alamos Airport, 68 - Airport Road, 62 - Crossroads Bible Church, and 69 - DP Road West Entrance). Airnet station 72 is just south of the site and is also being operated during the VCM. Airnet station 69 was shut down at the end of December 2002. These stations are downwind of SWMU 21-011(k) and in the predominant wind direction and will be used to monitor potential exposure to the public from field activities at 21-011k. The data collected from these stations during the implementation of the VCM will be reported in the VCM Completion Report for SWMU 21-011(k).

The Air Quality Group personnel conducted a new source review for the SWMU 21-011(k) VCM to determine if a new air sampling station is required by National Emissions Standards for Hazardous Air Pollutants (NESHAPs) as adopted by 20.2.78 of the New Mexico Administrative Code (NMAC), and LANL Air Quality Group criteria. The soil characterization data for radionuclides was used with the appropriate release factors, as described in Appendix D of 40 CFR Part 61, to calculate an emissions estimate for excavating, transporting and treating the contaminated material onsite (1500 yd^3). This calculation was conducted prior to the decision to excavate the material and transport it to Area G at TA-54 for disposal and before the total volume estimate had been refined. Therefore, with the change in the remediation approach, the current volume estimate is lowered to 560 yd^3. The calculated emission estimate represents a conservative estimate of the potential effective dose equivalent. Dose assessments from the emissions estimates were calculated using CAP88, an EPA-approved dispersion-modeling program. Based on the previous modeling results, the potential effective dose equivalent from excavation and transport of the material to Area G at TA-54 (560 yd^3 of contaminated soil) to the nearest receptor along State Road 502 (based on predominant wind direction) would conservatively be 0.07 mrem/yr (based on the original 1500 yds^3), which is below the monitoring threshold of 0.1 mrem/yr specified in Title 40 of the Code of Federal Regulations (40 CFR) Part 61, Subpart H (Radionuclide-NESHAPs).

Areas of the site with concentrations above 150 pCi/g Cs-137 and 170 pCi/g Am-241 have been surveyed and staked for excavation based on an initial walkover radiation survey conducted prior to the start of excavation. These areas showed excellent correlation to those shown in Figure 3.0-2. As these areas are excavated, real-time radiological screening combined with real-time mapping of gross gamma radiation is being used to determine whether enough media has been removed to achieve the established clean-up level. Excavated soil, sediment, and tuff are being staged on site within the bermed stockpile areas and covered with plastic sheeting. Silt fences, silt dikes, and/or straw wattles are being used to control run-on and runoff as described in the Storm Water Pollution Prevention Plan for 21-011(k) (LANL 2002, 73189). As a BMP, soil/sediment currently located near the northern SWMU boundary and along the western and eastern edges of SWMU 21-011(k) with Cs-137 concentrations just below the target clean-up level is being excavated first and staged on site. Confirmation sampling and a radiological survey of the entire site will be conducted prior to recontouring and placement of the vegetative cover over the site in accordance with Section 5.0, Confirmation Surveys and Sampling.

NMED Comment

10. ***4.3 Remedial Approach, Page 22***

LANL Statement: "Roll off containers will be bought on site and the excavated material will be loaded into the containers with a front-end loader. Trucks will then be used to transport the full rolloff containers to Area G at TA-54."

Excavated material must be sampled and managed in accordance with the NMED letter entitled "Contained-In Determination for Solid Waste Management Unit (SWMU) 21 -011 (k), Technical Area 21" dated November 25, 2002.

LANL Response

10. The text has been updated to present current conditions as follows:

As the excavation process proceeds, the contaminated material is being placed in individual stockpiles from the various excavation areas until all of the material with Cs-137 concentrations greater than 150 pCi/g and material in the western drainage with Am-241 concentrations greater than 170 pCi/g have been excavated. All stockpile areas are in level easily-accessible portions of the site. In accordance with the No Longer Contained-In determination received from NMED on November 25, 2002, each 100 yd^3 of excavated material will be sampled for Appendix VIII volatile organic compounds (VOCs), the results reviewed with NMED prior to disposal of the soil at Area G at TA-54, and the results included in the VCM Completion Report for SWMU 21-011(k). After receipt and review of the VOC results with NMED, rolloff containers will be brought on site and the excavated material will be placed into the containers using a front-end loader. Trucks will then be used to transport the full rolloff containers to Area G at TA-54. The trucks and rolloff containers will be surveyed by Health, Safety, and Radiation Protection (HSR-1) Radiological Control Technicians (RCTs) prior to being released from the site. To ensure efficient disposal at Area G, all waste shipping paperwork will be compiled in advance of transport.

NMED Comment

11. ***5.2 Confirmation Surveys and Sampling of Soil Removal Area, page 25***

LANL Statement: "Upon completion of the excavation and removal activities, but before restoration occurs, confirmation samples will be collected at a rate of at least one from each area where 25 yd of contaminated material has been removed. At least one surface sample will be collected from each discrete excavated area, even if the area is smaller than 25 yd2. A minimum of one surface sample per 500 yd' of area not requiring excavation will be collected at random... Samples will be analyzed by gamma spectroscopy for Cs-137 and by alpha spectroscopy for Am-241 and isotopic Pu, and for Sr-90 to confirm the excavated areas meet the requirements of DOE order 5400.5. A minimum of one sample from each excavated area will be collected from the surface to a depth of approximately 12 in. In areas greater than 25 m^2 at least one sample per 25 m^2 will be collected. "

The proposed plan for confirmatory sampling is not clear. Based on the above-referenced text it is unclear to NMED if the proposed sampling frequency is adequate to determine total risk of residual contaminants left at the site following excavation and removal activities. Please revise or clarify, with consistent units, the proposed confirmatory sampling plan.

SWMU 21-011(k) is listed on the Facility operating permit, and based on historical records RCRA-regulated constituents are present at the site. NMED is concerned that the proposed sampling suite may not be adequate to address all potential contaminants that may be present at the site due to historical releases from the outfall. Based on Table H-3 (page H-7 of the VCM Plan), barium, cadmium, calcium, chromium, cobalt, nickel, selenium, sodium, vanadium, mercury, and other RCRA-regulated constituents outlined in the "contained in" request (submitted to NMED by the Permittees on November 5, 2002) were detected at low levels in waste characterization and sampling results for discrete sampling intervals. The confirmation sampling does not include sampling for inorganic constituents. Please provide rationale for not including inorganic constituents in the confirmatory sampling suite or revise the suite to include inorganic constituents in the confirmatory sampling plan. Since the activities proposed in the VCM plan are intended to be a final remedy, it is essential that the nature and extent of all potential contaminants of concern, in addition to radionuclides, be fully evaluated.

LANL Response

11. The text has been modified as follows:

"Confirmation that cleanup goals have been met will be made through collection of samples from both remediated (soil removal) areas and site-wide unremediated areas. Sampling frequencies are different for each type of excavated area. In each discrete remediated area, a minimum of one surface (0- to

12-in.) confirmation sample will be collected regardless of the area's size. For remediated areas larger than 25 m^2, samples will be collected at a rate of one per every 25 m^2. Unremediated areas will be sampled at a rate of one surface sample per every 500 m^2. Samples will be analyzed by gamma spectroscopy for Cs-137 and by alpha spectroscopy for Am-241,isotopic Pu, and Sr-90 to confirm the excavated areas meet the requirements of DOE order 5400.5."

Rational for not including inorganic constituents in the confirmatory sampling suite at SWMU 21-011(k)

In March 2001 samples were collected during the pre-VCM site and waste characterization effort (Appendix H of the VCM Plan). During a February 26, 2001 meeting with NMED, 11 locations at SWMU 21-011(k) were selected for the collection of site and waste characterization samples. The sample locations were based on gross gamma radiation results from the in situ gamma spectroscopy survey conducted at the site in November 2000, which identified areas of high (> 100,000 counts pre minute (cpm)), medium (betwwen 50,000 and 100,000 cpm), and low (< 50,000 cpm) gross gamma activity. Five sample locations were selected within areas of the site with high gamma activity, 4 sample locations were selected within areas with medium gamma activity, and 2 sample locations were selected within areas with low gamma activity based on the assumption that areas at SWMU 21-011(k) with the measured highest gamma activity and portions of areas with medium gamma activity would be addressed by the VCM and would also be the most likely location of any non-radioactive hazardous constituents present at the site. NMED recommended that in addition to the waste characterization samples, a minimum of one discrete sample should be collected from each of the 11 sample locations for site characterization purposes and analyzed for a full suite of analytes which included: perchlorates, gamma spectroscopy, isotopic plutonium, strontium-90, TAL metals, TCLP metals, TCLP VOCs, TCLP SVOCs, pesticides, PCBs, VOCs (via Encore), cesium-137, amercium-241, and gross alpha, beta, and gamma radiation.

Wherever possible, two discrete site characterization samples were collected from different depth intervals. Discrete samples were collected from two depths at seven of the eleven sample locations. Frozen tuff and snow present at the four other sample locations prevented the collection of additional depth samples. As documented in an August 14, 2001 ER Project Communication Record from Paula Bertino to Vickie Maranville of NMED-HWB, the results of this sampling effort and the 1996 confirmation sampling data were presented to NMED during a July 30, 2001 meeting (LANL 2001, 70217). Analytical results from the pre-VCM characterization sampling effort indicated that some inorganic constituents (barium, cadmium, calcium, chromium, cobalt, nickel, selenium, sodium, vanadium, mercury) were detected at concentrations above their respective background levels, primarily in waste characterization composite samples at locations with high and medium measured gross gamma activity (Appendix H of the VCM Plan). As discussed during the July 30, 2001 meeting between the LANL ER Project and NMED-HWB staff and in all previous versions of the VCM plan, mercury was the only inorganic chemical detected above its background level in three composite waste characterization samples, at three different locations, all with high measured gross gamma activity that will be removed during the VCM (Appendix H of the VCM plan). None of the inorganic chemicals detected above background showed a clear trend that would be indicative of further site contamination. In addition, none of the inorganic chemicals detected exceeds its respective screening action level (SAL) and therefore are below any cleanup level that would be derived for the site. The pre-VCM site characterization results confirmed that contamination from relatively short-lived radionuclides, (primarily Cs-137 and Am-241) are the drivers for the VCM at SWMU 21-011(k).

NMED Comment

12. ***7.0 PROPOSED SCHEDULE AND UNCERTAINTIES, Page 29***

LANL Statement: "The VCM Completion Report will be prepared and submitted to NMED Hazardous Waste Bureau (HWB) by the end of fiscal year 2003."

Based on the current schedule provided in the VCM Plan, submittal of the VCM Completion Report by the end of fiscal year 2003 is not acceptable to NMED. The VCM Completion Report must be submitted within 90-days of completion of field activities. Based on the schedule provided in the VCM Plan, the VCM Completion Report must be submitted on or before July 18, 2003. Should the schedule change, the actual submittal date may vary based on the final completion of the field activities, but should not be longer than 90-days after completion of field activities.

LANL Response

12. The VCM completion report will be submitted to NMED-HWB within 90-days of completion of field activities.

NMED Comment

13. ***Table 7.0-1 VCM Field Work Schedule, Page 29***

Please revise the above-referenced Table to reflect actual site conditions (i.e., start date for field activities, and report submittal date).

LANL Response

13. The schedule has been updated and is presented below.

Please note the laboratory holiday shutdown is not included in the total approximate working days, the schedule is weather dependent, and the duration of field activities has been increased due to winter site conditions and additional sampling and waste management activities required by the No Longer Contained In determination.

Table 7.0-1
VCM Field Work Schedule

Activity	Workday Duration	Start	Finish
Submit VCM plan to NMED	**N/A**	**N/A**	**TBD**
Readiness review/mobilization/pre-excavation radiological survey	15 days	November 14, 2002	November 29, 2002
Site preparation	6 days	November 14, 2002	November 20, 2002
Excavation, confirmation sampling, and post-excavation radiological survey	84 days	November 21, 2002	February 14, 2003
Review/Transmit VOC results	60 days	February 17, 2003	April 15, 2003
Waste management/disposal	60 days	February 17, 2003	April 15, 2003
Site restoration and final radiological survey	10 days	April 15, 2003	April 25, 2003
Demobilization	7 days	April 28, 2003	May 2, 2003
Approximate VCM working days	96 days	November 11, 2002	April 29, 2003
VCM Completion Report Submittal	NA	NA	August 1, 2003

TBD – to be determined

NMED Comment

14. ***A-1.0 ACRONYMS, Page A-I***

HRMB no longer exists, and is not used in the VCM Plan. Please replace HRMB with Hazardous Waste Bureau (HWB), which is used in the VCM Plan.

LANL Response

14. The acronym HRMB has been removed from the acronym list.

NMED Comment

15. . ***A-2.0 GLOSSARY, Page A-3***

LANL Statement: "DOE Order 5400.5, Elevated Activity Criterion... are given in DOE/CH-8901 "

Please provide a copy of DOE/CH-8901 to NMED for review.

LANL Response

15. DOE Order 5400.5 can be found at the following universal resource locator:

www.nirs.org/radrecycle/54005.pdf

Attachment 3 to this NOD includes the requested information taken from the "Manual for Implementing Residual Radiactive Material Guidelines Using RESRAD, Version 5.0." The information from this reference is included because finding DOE/CH-8901 within DOE Order 5400.5 is very difficult and when the guidance is downloaded, the formulas do not print out correctly.

NMED Comment

18. Appendix B, VCM Checklist and Fact Sheet, Page B-5

The Estimated Cost and Schedule provided on page B-5 is incorrect. Please correct the typographical errors (the proposed action is a VCM not VCA) and revise the cost to reflect actual proposed activities at the site. The Cost and Schedule provided are identical to the Cost and Schedule provided as part of the Revision I of the VCM plan that was submitted in July 2002 and subsequently withdrawn.

LANL Response

18. The text has been modified to change all references to VCA to VCM. The cost for disposal of the approximate 560 yd^3 of soil, sediment, and tuff at Area G at TA-54 is $100,000 based on the negotiated disposal rate. As provided in the response to specific comment 13 the VCM began in November 2002 and will be completed by May 2003 based on the current schedule.

NMED Comment

19. Appendix E, Estimated Cost, Page E-1

Appendix E should be revised to reflect proposed excavation and removal activities for the site. The estimate cost schedule provided is similar to the schedule provided for stabilization (VCM Plan Revision 1, dated July 2002 and referenced by LA-UR-02-3807). In addition, the proposed cost ($1.4 million) is not the same as the proposed cost outlined in page B-5 of this VCM Plan. Page B-5 states the total cost, which would include subcontractor, analytical, and disposal costs would be approximately $2.2 million, not $1.4 that is stated on page E-1. Please correct the inaccuracies and provide a revised cost estimate for excavation and removal.

LANL Response

19. Appendix E has been revised as follows:

Note: The $1.4 million referenced is the projected cost from completion of the plan through the VCM Completion Report. The entire project is budgeted at $2.2 million

APPENDIX E: ESTIMATED COSTS

Estimated Cost

Estimated Cost

Based on current resource estimates, the anticipated subcontractor costs and analytical costs of this VCM are approximately $2.2 million.

Schedule

The fieldwork portion of this VCM began in November FY02 and is anticipated to be completed in May 2003. The fieldwork includes soil, sediment, and tuff removal, confirmatory sample collection and analysis, radiation surveys, waste management, and site restoration including an engineered cover.

Attachment 1

Maps Displaying Colorimetric Scale from the

VCM Plan for SWMU 21-011(k), Revision 2

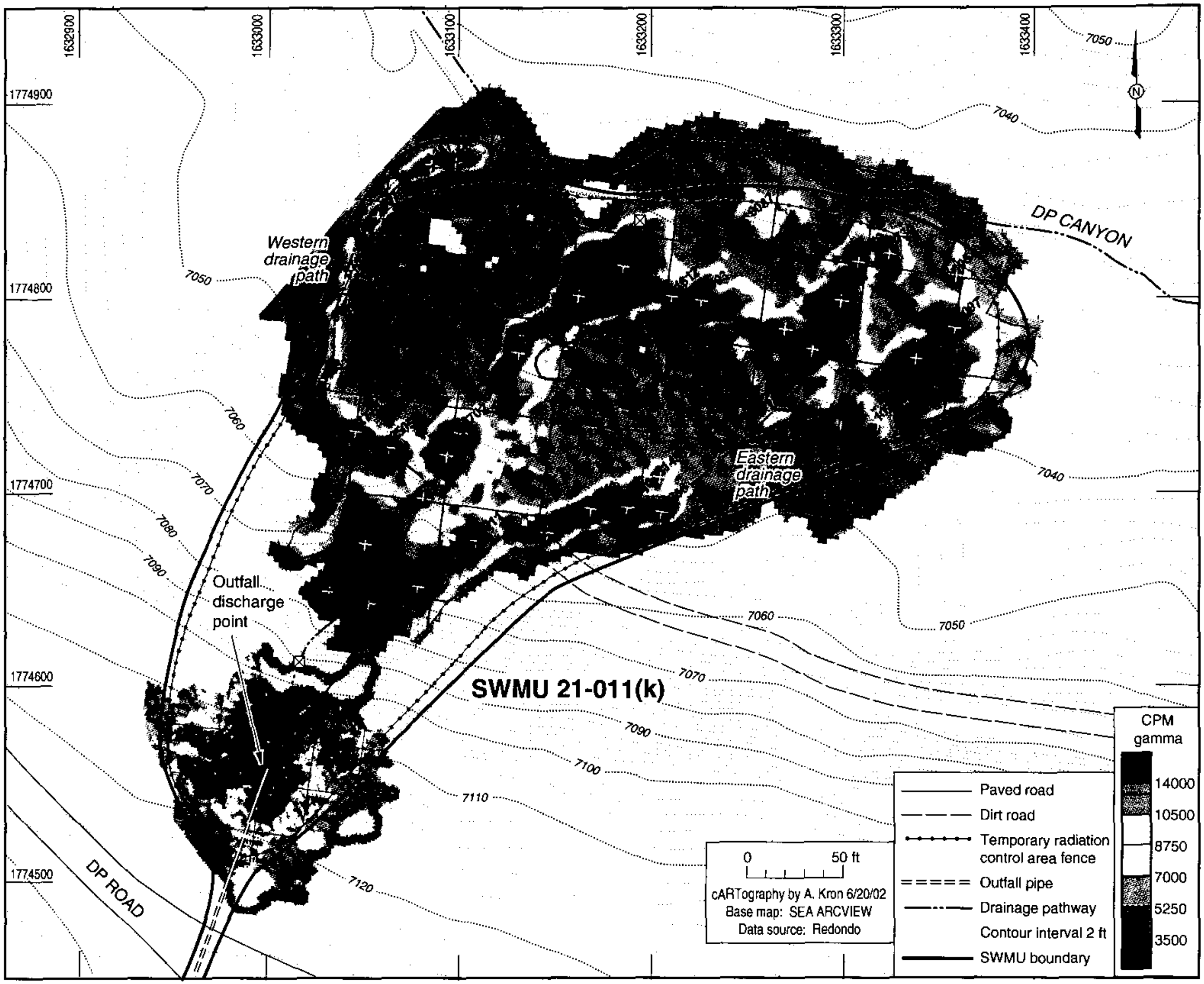

Figure 2.2-3 July 2000 Chemrad gross gamma survey results at SWMU 21-011(k)

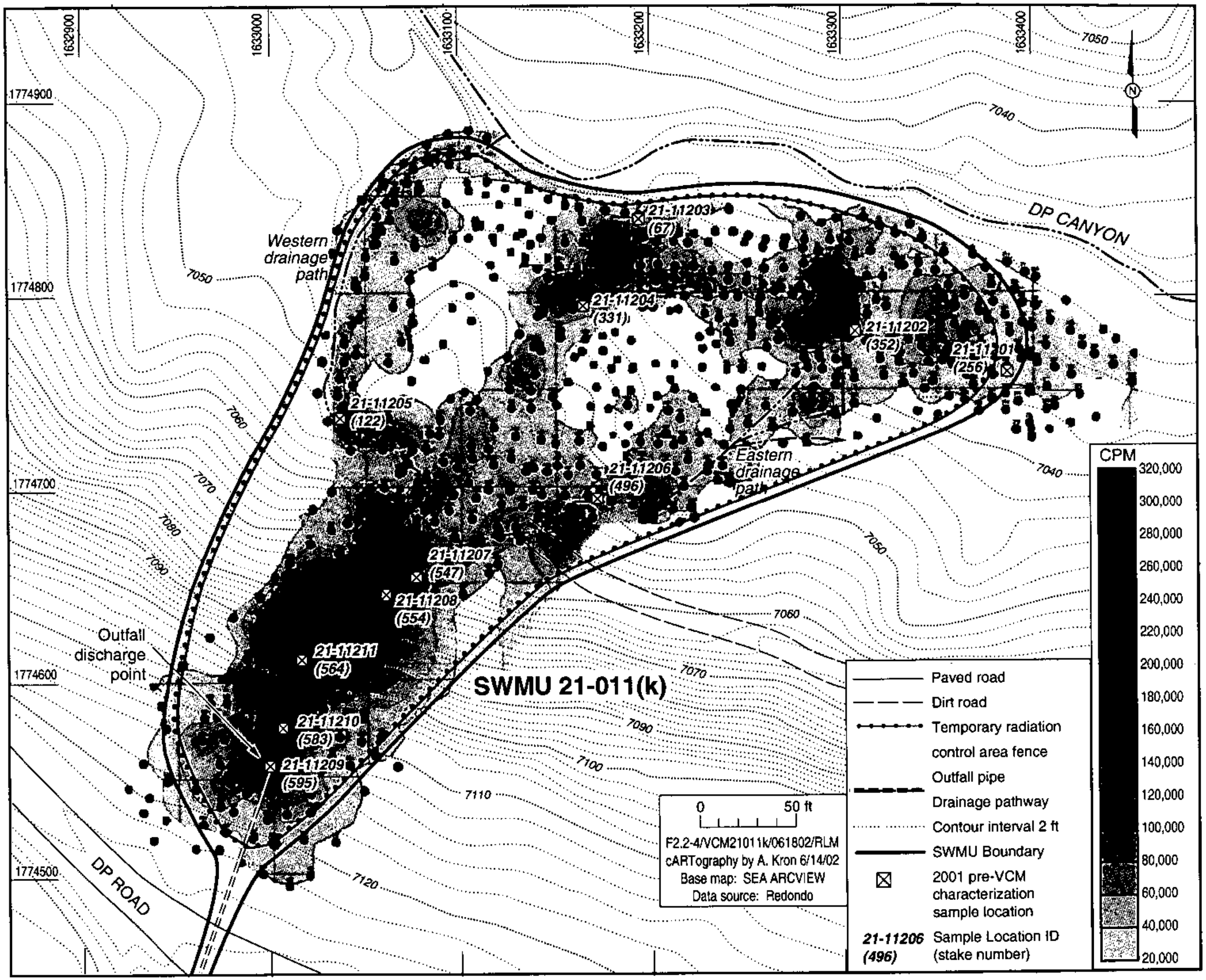

Figure 2.2-4 November 2000 in situ gamma survey results and March 2001 pre-VCM characterization sample locations at SWMU 21-011(k)

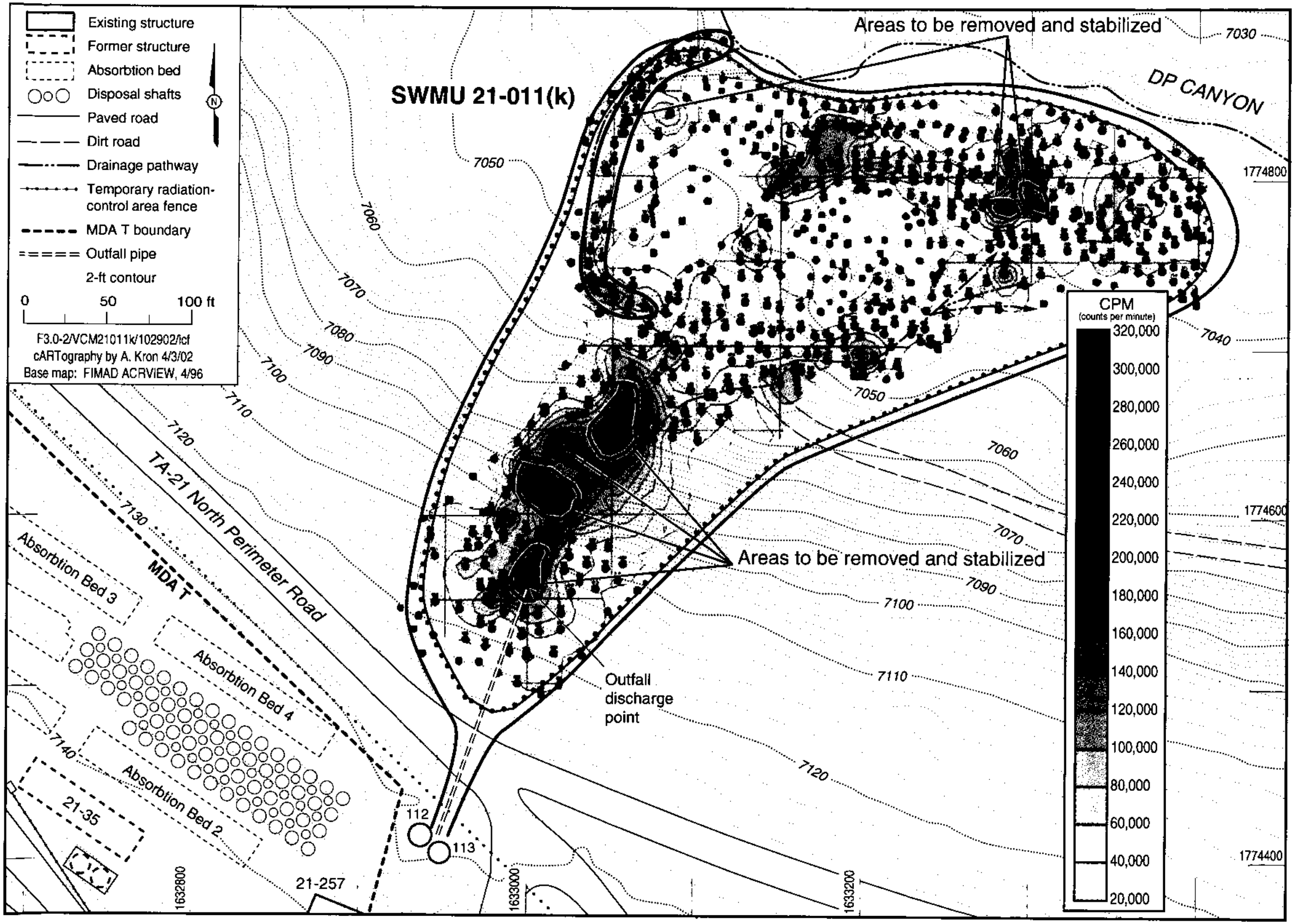

Figure 3.0-2 November 2000 in situ gross gamma survey results at SWMU 21-011(k) with circled areas planned for removal

Attachment 2

RESRAD Summary Report for the Recreational Trail-User Scenario

Following Implementation of the VCM

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines
===

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

0 Menu	Parameter	Current Value	Parameter Default	Name
B-1	Dose conversion factors for inhalation, mrem/pCi			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(3)
B-1	H-	6.400E-08	6.400E-08	DCF2(4)
B-1	Np-237+	5.400E-01	5.400E-01	DCF2(5)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(6)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(7)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(8)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(9)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(10)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(11)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(12)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(13)
B-1	U-233	1.350E-01	1.350E-01	DCF2(14)
B-1	U-234	1.320E-01	1.320E-01	DCF2(15)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(16)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(17)
D-1	Dose conversion factors for ingestion, mrem/pCi			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(3)
D-1	H-3	6.400E-08	6.400E-08	DCF3(4)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(5)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(6)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(7)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(8)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(9)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(10)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(11)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(12)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(13)
D-1	U-233	2.890E-04	2.890E-04	DCF3(14)
D-1	U-234	2.830E-04	2.830E-04	DCF3(15)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(16)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(17)
D-34	Food transfer factors			
D-34	Ac-227+Dplant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	Cs-137+D plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Cs-137+D beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(3,2)
D-34	Cs-137+D milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(3,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

0

Menu	Parameter	Current Value	Default	Parameter Name
D-34	H-3 plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(4,1)
D-34	H-3 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(4,2)
D-34	H-3 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(4,3)
D-34				
D-34	Np-237+Dplant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(5,1)
D-34	Np-237+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Np-237+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Pa-231plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(6,1)
D-34	Pa-231beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(6,2)
D-34	Pa-231milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	Pb-210+Dplant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(7,1)
D-34	Pb-210+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(7,2)
D-34	Pb-210+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(7,3)
D-34				
D-34	Pu-238plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Pu-238beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Pu-238milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(8,3)
D-34				
D-34	Pu-239plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
D-34	Pu-239beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Pu-239milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(9,3)
D-34				
D-34	Ra-226+Dplant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(10,1)
D-34	Ra-226+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(10,2)
D-34	Ra-226+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(10,3)
D-34				
D-34	Sr-90+D plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(11,1)
D-34	Sr-90+D beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(11,2)
D-34	Sr-90+D milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(11,3)
D-34	Th-229+Dplant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Th-229+Dbeef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Th-229+Dmilk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Th-230plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
D-34	Th-230beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
D-34	Th-230milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	U-233 plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(14,1)
D-34	U-233 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(14,2)
D-34	U-233 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(14,3)
D-34				
D-34	U-234 plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(15,1)
D-34	U-234 beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(15,2)
D-34	U-234 milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(15,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

0 Menu		Parameter	Current Value	Default	Parameter Name
D-34	U-235+D	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	U-235+D	beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(16,2)
D-34	U-235+D	milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(16,3)
D-34					
D-34	U-238+D	plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-238+D	beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-238+D	milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-5	Bioaccumulation factors, fresh water, L/kg:				
D-5	Ac-227+D	fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D	crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5					
D-5	Am-241	fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241	crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5					
D-5	Cs-137+D	fish	2.000E+03	2.000E+03	BIOFAC(3,1)
D-5	Cs-137+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5					
D-5	H-3	fish	1.000E+00	1.000E+00	BIOFAC(4,1)
D-5	H-3	crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(4,2)
D-5					
D-5	Np-237+D	fish	3.000E+01	3.000E+01	BIOFAC(5,1)
D-5	Np-237+D	crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(5,2)
D-5					
D-5	Pa-231	fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	Pa-231	crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(6,2)
D-5					
D-5	Pb-210+D	fish	3.000E+02	3.000E+02	BIOFAC(7,1)
D-5	Pb-210+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
D-5					
D-5	Pu-238	fish	3.000E+01	3.000E+01	BIOFAC(8,1)
D-5	Pu-238	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(8,2)
D-5					
D-5	Pu-239	fish	3.000E+01	3.000E+01	BIOFAC(9,1)
D-5	Pu-239	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(9,2)
D-5					
D-5	Ra-226+D	fish	5.000E+01	5.000E+01	BIOFAC(10,1)
D-5	Ra-226+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(10,2)
D-5					
D-5	Sr-90+D	fish	6.000E+01	6.000E+01	BIOFAC(11,1)
D-5	Sr-90+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5					
D-5	Th-229+D	fish	1.000E+02	1.000E+02	BIOFAC(12,1)
D-5	Th-229+D	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(12,2)
D-5					
D-5	Th-230	fish	1.000E+02	1.000E+02	BIOFAC(13,1)
D-5	Th-230	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(13,2)
D-5					
D-5	U-233	fish	1.000E+01	1.000E+01	BIOFAC(14,1)
D-5	U-233	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(14,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

0 Menu		Parameter	Current Value	Parameter Default	Name
D-5	U-234	fish	1.000E+01	1.000E+01	BIOFAC(15,1)
D-5	U-234	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(15,2)
D-5					
D-5	U-235+D	fish	1.000E+01	1.000E+01	BIOFAC(16,1)
D-5	U-235+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(16,2)
D-5					
D-5	U-238+D	fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-238+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)

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Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+04	1.000E+04		AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00		THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02		LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01		BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00		TI
R011	Times for calculations (yr)	1.000E+01	1.000E+00		T(2)
R011	Times for calculations (yr)	3.000E+01	3.000E+00		T(3)
R011	Times for calculations (yr)	6.000E+01	1.000E+01		T(4)
R011	Times for calculations (yr)	9.000E+01	3.000E+01		T(5)
R011	Times for calculations (yr)	1.200E+02	1.000E+02		T(6)
R011	Times for calculations (yr)	2.000E+02	3.000E+02		T(7)
R011	Times for calculations (yr)	not used	1.000E+03		T(8)
R011	Times for calculations (yr)	not used	0.000E+00		T(9)
R011	Times for calculations (yr)	not used	0.000E+00		T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	5.000E+00	0.000E+00		S1(2)
R012	Initial principal radionuclide (pCi/g): Cs-137	5.600E+01	0.000E+00		S1(3)
R012	Initial principal radionuclide (pCi/g): Pu-238	5.000E-01	0.000E+00		S1(8)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+01	0.000E+00		S1(9)
R012	Initial principal radionuclide (pCi/g): Sr-90	1.300E+01	0.000E+00		S1(11)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00		W1(2)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00		W1(3)
R012	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00		W1(8)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00		W1(9)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00		W1(11)
R013	Cover depth (m)	0.000E+00	0.000E+00		COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00		DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03		VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00		DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03		VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01		TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01		FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01		HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00		BCZ
R013	Average annual wind speed (m/sec)	3.000E+00	2.000E+00		WIND
R013	Humidity in air (g/m**3)	5.500E+00	8.000E+00		HUMID
R013	Evapotranspiration coefficient	9.990E-01	5.000E-01		EVAPTR
R013	Precipitation (m/yr)	3.500E-01	1.000E+00		PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01		RI
R013	Irrigation mode	overhead	overhead		IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01		RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06		WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03		EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00		DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01		TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01		EPSZ
R014	Saturated zone field capacity	not used	2.000E-01		FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02		HCSZ

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone hydraulic gradient	not used	2.000E-02		HGWT
R014	Saturated zone b parameter	not used	5.300E+00		BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03		VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01		DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND		MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02		UW
R015	Number of unsaturated zone strata	not used	1		NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00		H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00		DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01		TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01		EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01		FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00		BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01		HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01		DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01		DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01		DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		4.636E-06
	ALEACH(2)				
R016	Solubility constant	0.000E+00	0.000E+00		not used
	SOLUBK(2)				
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03		DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03		DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03		DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		9.332E-08
	ALEACH(3)				
R016	Solubility constant	0.000E+00	0.000E+00		not used
	SOLUBK(3)				
R016	Distribution coefficients for Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03		DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03		DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03		DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		4.666E-08
	ALEACH(8)				
R016	Solubility constant	0.000E+00	0.000E+00		not used
	SOLUBK(8)				
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03		DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+03		DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+03		DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		4.666E-08
	ALEACH(9)				
R016	Solubility constant	0.000E+00	0.000E+00		not used
	SOLUBK(9)				
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	3.000E+01	3.000E+01		DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	3.000E+01		DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	3.000E+01		DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00		3.097E-06
	ALEACH(11)				
R016	Solubility constant	0.000E+00	0.000E+00		not used
	SOLUBK(11)				

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	DCNUCC(1)	
R016	Unsaturated zone 1 (cm**3/g)	not used	2.000E+01	DCNUCU(1,1)	
R016	Saturated zone (cm**3/g)	not used	2.000E+01	DCNUCS(1)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.636E-06	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	DCNUCC(4)	
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	DCNUCU(4,1)	
R016	Saturated zone (cm**3/g)	not used	0.000E+00	DCNUCS(4)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.000E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	-1.000E+00	DCNUCU(5,1)	
R016	Saturated zone (cm**3/g)	not used	-1.000E+00	DCNUCS(5)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.624E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(6)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(6,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(6)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	DCNUCC(7)	
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	DCNUCU(7,1)	
R016	Saturated zone (cm**3/g)	not used	1.000E+02	DCNUCS(7)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.321E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	DCNUCC(10)	
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	DCNUCU(10,1)	
R016	Saturated zone (cm**3/g)	not used	7.000E+01	DCNUCS(10)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.331E-06	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	DCNUCC(12)	
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	DCNUCU(12,1)	
R016	Saturated zone (cm**3/g)	not used	6.000E+04	DCNUCS(12)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.556E-09	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	DCNUCC(13)	
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	DCNUCU(13,1)	
R016	Saturated zone (cm**3/g)	not used	6.000E+04	DCNUCS(13)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.556E-09	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(14)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(14,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(14)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(15)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(15,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(15)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(16)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(16,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(16)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for daughter U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	DCNUCC(17)	
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	DCNUCU(17,1)	
R016	Saturated zone (cm**3/g)	not used	5.000E+01	DCNUCS(17)	
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.862E-06	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R017	Inhalation rate (m**3/yr)	1.400E+04	8.400E+03	INHALR	
R017	Mass loading for inhalation (g/m**3)	2.000E-05	1.000E-04	MLINH	
R017	Exposure duration	3.000E+01	3.000E+01	ED	
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	SHF3	
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	SHF1	
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	FIND	
R017	Fraction of time spent outdoors (on site)	1.600E-02	2.500E-01	FOTD	
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:		not used	5.000E+01	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:		not used	7.071E+01	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:		not used	0.000E+00	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:		not used	0.000E+00	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:		not used	0.000E+00	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:		not used	0.000E+00	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:		not used	0.000E+00	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:		not used	0.000E+00	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:		not used	0.000E+00	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:		not used	0.000E+00	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:		not used	0.000E+00	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:		not used	0.000E+00	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1		not used	1.000E+00	FRACA(1)
R017	Ring 2		not used	2.732E-01	FRACA(2)
R017	Ring 3		not used	0.000E+00	FRACA(3)
R017	Ring 4		not used	0.000E+00	FRACA(4)
R017	Ring 5		not used	0.000E+00	FRACA(5)
R017	Ring 6		not used	0.000E+00	FRACA(6)
R017	Ring 7		not used	0.000E+00	FRACA(7)
R017	Ring 8		not used	0.000E+00	FRACA(8)
R017	Ring 9		not used	0.000E+00	FRACA(9)
R017	Ring 10		not used	0.000E+00	FRACA(10)
R017	Ring 11		not used	0.000E+00	FRACA(11)
R017	Ring 12		not used	0.000E+00	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)		not used	1.600E+02	DIET(1)
R018	Leafy vegetable consumption (kg/yr)		not used	1.400E+01	DIET(2)
R018	Milk consumption (L/yr)		not used	9.200E+01	DIET(3)
R018	Meat and poultry consumption (kg/yr)		not used	6.300E+01	DIET(4)
R018	Fish consumption (kg/yr)		not used	5.400E+00	DIET(5)
R018	Other seafood consumption (kg/yr)		not used	9.000E-01	DIET(6)
R018	Soil ingestion rate (g/yr)	5.870E+02	3.650E+01		SOIL
R018	Drinking water intake (L/yr)		not used	5.100E+02	DWI
R018	Contamination fraction of drinking water		not used	1.000E+00	FDW
R018	Contamination fraction of household water		not used	1.000E+00	FHHW
R018	Contamination fraction of livestock water		not used	1.000E+00	FLW
R018	Contamination fraction of irrigation water		not used	1.000E+00	FIRW
R018	Contamination fraction of aquatic food		not used	5.000E-01	FR9
R018	Contamination fraction of plant food		not used -1		FPLANT
R018	Contamination fraction of meat		not used -1		FMEAT
R018	Contamination fraction of milk		not used -1		FMILK
R019	Livestock fodder intake for meat (kg/day)		not used	6.800E+01	LFI5
R019	Livestock fodder intake for milk (kg/day)		not used	5.500E+01	LFI6
R019	Livestock water intake for meat (L/day)		not used	5.000E+01	LWI5
R019	Livestock water intake for milk (L/day)		not used	1.600E+02	LWI6
R019	Livestock soil intake (kg/day)		not used	5.000E-01	LSI

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04		MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01		DM
R019	Depth of roots (m)	not used	9.000E-01		DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00		FGWDW
R019	Household water fraction from ground water	not used	1.000E+00		FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00		FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00		FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01		YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00		YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00		YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01		TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01		TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02		TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01		TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00		TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00		TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01		RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01		RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01		RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01		RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01		RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01		WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05		C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02		C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02		CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01		CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01		DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07		EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10		REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01		AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01		AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01		CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01		STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00		STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00		STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01		STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00		STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00		STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00		STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00		STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01		STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01		FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00		DENSFL
R021	Total porosity of the cover material	not used	4.000E-01		TPCV

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01		TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02		PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02		PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06		DIFCV
R021	in foundation material	not used	3.000E-07		DIFFL
R021	in contaminated zone soil	not used	2.000E-06		DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00		HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01		REXG
R021	Height of the building (room) (m)	not used	2.500E+00		HRM
R021	Building interior area factor	not used	0.000E+00		FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00		DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01		EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01		EMANA(2)
TITL	Number of graphical time points	32	---		NPTS
TITL	Maximum number of integration points for dose	17	---		LYMAX
TITL	Maximum number of integration points for risk	257	---		KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions	Initial Soil Concentrations, pCi/g	
Area: 10000.00 square meters	Am-241	5.000E+00
Thickness: 2.00 meters	Cs-137	5.600E+01
Cover Depth: 0.00 meters	Pu-238	5.000E-01
	Pu-239	1.000E+01
	Sr-90	1.300E+01

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
TDOSE(t):	3.402E+00	2.805E+00	1.952E+00	1.222E+00	8.532E-01	6.645E-01	4.922E-01
M(t):	2.268E-01	1.870E-01	1.301E-01	8.150E-02	5.688E-02	4.430E-02	3.281E-02

Maximum TDOSE(t): 3.402E+00 mrem/yr at t = 0.000E+00 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 = 0.000E+00 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	3.390E-03	0.0010	1.463E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.708E-01	0.0502
Cs-137	2.827E+00	0.8309	1.165E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.600E-02	0.0076
Pu-238	1.192E-06	0.0000	1.288E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.497E-0	0.0044
Pu-239	4.532E-05	0.0000	2.830E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.325E-01	0.0977
Sr-90	4.750E-03	0.0014	1.110E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.846E-02	0.0054
Total	2.835E+00	0.8333	4.434E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.627E-01	0.1654

0

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
0 Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.757E-01	0.0516
Cs-137	0.000E+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	2.853E+00	0.8385
Pu-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	1.510E-02	0.0044
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.353E-01	0.0986
Sr-90	0.000E+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	2.322E-02	0.0068
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.402E+00	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	3.336E-03	0.0012	1.440E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.681E-01	0.0599
Cs-137	2.244E+00	0.8000	9.246E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.063E-02	0.0074
Pu-238	1.101E-06	0.0000	1.190E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.383E-02	0.0049
Pu-239	4.531E-05	0.0000	2.829E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.324E-01	0.1185
Sr-90	3.744E-03	0.0013	8.750E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.455E-02	0.0052
Total	2.251E+00	0.8025	4.398E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.495E-01	0.1959

0

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
0 Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.728E-01	0.0616
Cs-137	0.000E+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	2.264E+00	0.8073
Pu-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	1.395E-02	0.0050
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.353E-01	0.1195
Sr-90	0.000E+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	1.830E-02	0.0065
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.805E+00	1.0000

0*Sum of all water independent and dependent pathways.

Summary : Trail User, Hiker, 140 hrs/yr, 67 mg/hr soil ingestion---21-0011k mean conc w/r

File : TUHME21011kw_remov_500y.RAD

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

0 Water Independent Pathways (Inhalation excludes radon)

0 Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	3.231E-03	0.0017	1.394E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.628E-01	0.0834
Cs-137	1.414E+00	0.7241	5.825E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.300E-02	0.0067
Pu-238	9.404E-07	0.0000	1.016E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.181E-02	0.0060
Pu-239	4.529E-05	0.0000	2.827E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.322E-01	0.1702
Sr-90	2.326E-03	0.0012	5.435E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.038E-03	0.0046
Total	1.419E+00	0.7269	4.329E-03	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.288E-01	0.2709

0

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

0 Water Dependent Pathways

0 Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.674E-01	0.0857
Cs-137	0.000E+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	1.427E+00	0.7307
Pu-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	1.191E-02	0.0061
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.351E-01	0.1716
Sr-90	0.000E+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	1.137E-02	0.0058
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.952E+00	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 6.000E+01 years

0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	3.080E-03	0.0025	1.329E-03	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.551E-01	0.1269
Cs-137	7.068E-01	0.5781	2.912E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.499E-03	0.0053
Pu-238	7.422E-07	0.0000	8.017E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.318E-03	0.0076
Pu-239	4.525E-05	0.0000	2.825E-03	0.0023	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.319E-01	0.2715
Sr-90	1.139E-03	0.0009	2.661E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.425E-03	0.0036
Total	7.110E-01	0.5816	4.237E-03	0.0035	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.072E-01	0.4149

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 6.000E+01 years

0 Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.595E-01	0.1305
Cs-137	0.000E+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	7.133E-01	0.5834
Pu-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	9.399E-03	0.0077
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.348E-01	0.2738
Sr-90	0.000E+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	5.566E-03	0.0046
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.222E+00	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 9.000E+01 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	2.935E-03	0.0034	1.266E-03	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.478E-01	0.1732
Cs-137	3.534E-01	0.4142	1.456E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.249E-03	0.0038
Pu-238	5.859E-07	0.0000	6.326E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.352E-03	0.0086
Pu-239	4.622E-05	0.0001	2.823E-03	0.0033	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.316E-01	0.3887
Sr-90	5.574E-04	0.0007	1.303E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.166E-03	0.0025
Total	3.569E-01	0.4183	4.153E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.922E-01	0.5768

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 9.000E+01 years
0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	1.520E-01	0.1781
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.566E-01	0.4180
Pu-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	7.416E-03	0.0087
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.345E-01	0.3920
Sr-90	0.000E+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	2.725E-03	0.0032
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.532E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.200E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	2.798E-03	0.0042	1.206E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.408E-01	0.2119
Cs-137	1.767E-01	0.2659	7.281E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.625E-03	0.0024
Pu-238	4.627E-07	0.0000	4.991E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.801E-03	0.0087
Pu-239	4.518E-05	0.0001	2.820E-03	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.313E-01	0.4986
Sr-90	2.729E-04	0.0004	6.378E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.061E-03	0.0016
Total	1.798E-01	0.2706	4.077E-03	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.806E-01	0.7233

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.200E+02 years
0 Water Dependent Pathways

0 Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+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	1.448E-01	0.2179
Cs-137	0.000E+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	1.783E-01	0.2683
Pu-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	5.851E-03	0.0088
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.342E-01	0.5029
Sr-90	0.000E+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	1.334E-03	0.0020
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.645E-01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+02 years

0 Water Independent Pathways (Inhalation excludes radon)

0 Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	2.462E-03	0.0050	1.061E-03	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.238E-01	0.2516
Cs-137	2.783E-02	0.0565	1.147E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.559E-04	0.0005
Pu-238	3.472E-07	0.0000	2.654E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.083E-03	0.0063
Pu-239	4.509E-05	0.0001	2.814E-03	0.0057	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.306E-01	0.6717
Sr-90	4.064E-05	0.0001	9.497E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.579E-04	0.0003
Total	3.037E-02	0.0617	3.901E-03	0.0079	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.579E-01	0.9304

0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+02 years

0 Water Dependent Pathways

0 Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	0.000E+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	1.274E-01	0.2588
Cs-137	0.000E+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	2.808E-02	0.0571
Pu-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.110E-03	0.0063
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.334E-01	0.6775
Sr-90	0.000E+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	1.987E-04	0.0004
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.922E-01	1.0000

0*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	Am-241	1.000E+00	3.513E-02	3.457E-02	3.348E-02	3.190E-02	3.040E-02	2.896E-02	2.547E-02
Am-241	Np-237	1.000E+00	9.506E-09	1.981E-07	5.662E-07	1.097E-06	1.602E-06	2.084E-06	3.260E-06
Am-241	U-233	1.000E+00	6.666E-16	2.195E-13	1.831E-12	7.090E-12	1.561E-11	2.725E-11	7.240E-11
Am-241	Th-229	1.000E+00	3.538E-19	1.635E-15	3.966E-14	3.056E-13	1.010E-12	2.354E-12	1.049E-11
Am-241	§DSR(j)	3.513E-02	3.457E-02	3.348E-02	3.190E-02	3.040E-02	2.897E-02	2.547E-02	
0Cs-137	Cs-137	1.000E+00	5.095E-02	4.044E-02	2.547E-02	1.274E-02	6.368E-03	3.184E-03	5.015E-04
0Pu-238	Pu-238	1.000E+00	3.020E-02	2.790E-02	2.382E-02	1.880E-02	1.483E-02	1.170E-02	6.220E-03
Pu-238	U-234	1.000E+00	3.890E-09	7.859E-08	2.114E-07	3.751E-07	5.042E-07	6.060E-07	7.843E-07
Pu-238	Th-230	1.000E+00	2.284E-14	7.369E-12	5.903E-11	2.156E-10	4.490E-10	7.431E-10	1.734E-09
Pu-238	Ra-226	1.000E+00	8.336E-17	3.791E-13	8.903E-12	6.545E-11	2.068E-10	4.616E-10	1.847E-09
Pu-238	Pb-210	1.000E+00	1.946E-19	1.102E-14	6.737E-13	8.475E-12	3.506E-11	9.236E-11	4.678E-10
Pu-238	§DSR(j)	3.020E-02	2.790E-02	2.382E-02	1.880E-02	1.483E-02	1.170E-02	6.220E-03	
0Pu-239	Pu-239	1.000E+00	3.353E-02	3.353E-02	3.351E-02	3.348E-02	3.345E-02	3.342E-02	3.334E-02
Pu-239	U-235	1.000E+00	6.953E-12	1.460E-10	4.239E-10	8.405E-10	1.257E-09	1.673E-09	2.780E-09
Pu-239	Pa-231	1.000E+00	3.588E-16	1.187E-13	1.001E-12	3.935E-12	8.801E-12	1.559E-11	4.311E-11
Pu-239	Ac-227	1.000E+00	4.776E-18	2.055E-14	4.350E-13	2.797E-12	7.902E-12	1.606E-11	5.341E-11
Pu-239	§DSR(j)	3.353E-02	3.353E-02	3.351E-02	3.348E-02	3.345E-02	3.342E-02	3.334E-02	
0Sr-90	Sr-90	1.000E+00	1.786E-03	1.408E-03	8.745E-04	4.282E-04	2.096E-04	1.026E-04	1.528E-05

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
§ is used to indicate summation; the Greek sigma is not included in this font.
The DSR includes contributions from associated (half-life <= 0.5 yr) daughters.
0

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	4.270E+02	4.339E+02	4.481E+02	4.702E+02	4.935E+02	5.178E+02	5.889E+02
Cs-137	2.944E+02	3.709E+02	5.888E+02	1.178E+03	2.355E+03	4.711E+03	2.991E+04
Pu-238	4.968E+02	5.376E+02	6.296E+02	7.980E+02	1.011E+03	1.282E+03	2.411E+03
Pu-239	4.473E+02	4.474E+02	4.477E+02	4.481E+02	4.485E+02	4.488E+02	4.499E+02
Sr-90	8.398E+03	1.065E+04	1.715E+04	3.503E+04	7.156E+04	1.462E+05	9.816E+05

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 = 0.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	5.000E+00	0.000E+00	3.513E-02	4.270E+02	3.513E-02	4.270E+02
Cs-137	5.600E+01	0.000E+00	5.095E-02	2.944E+02	5.095E-02	2.944E+02
Pu-238	5.000E-01	0.000E+00	3.020E-02	4.968E+02	3.020E-02	4.968E+02
Pu-239	1.000E+01	0.000E+00	3.353E-02	4.473E+02	3.353E-02	4.473E+02
Sr-90	1.300E+01	0.000E+00	1.786E-03	8.398E+03	1.786E-03	8.398E+03

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

0Nuclide (i)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	Am-241	1.000E+00	1.757E-01	1.728E-01	1.674E-01	1.595E-01	1.520E-01	1.448E-01	1.273E-01
Np-237	Am-241	1.000E+00	4.753E-08	9.903E-07	2.831E-06	5.483E-06	8.010E-06	1.042E-05	1.630E-05
U-233	Am-241	1.000E+00	3.333E-15	1.097E-12	9.155E-12	3.545E-11	7.807E-11	1.363E-10	3.620E-10
Th-229	Am-241	1.000E+00	1.769E-18	8.176E-15	1.983E-13	1.528E-12	5.050E-12	1.177E-11	5.246E-11
Cs-137	Cs-137	1.000E+00	2.853E+00	2.264E+00	1.427E+00	7.133E-01	3.566E-01	1.783E-01	2.808E-02
Pu-238	Pu-238	1.000E+00	1.510E-02	1.395E-02	1.191E-02	9.399E-03	7.415E-03	5.851E-03	3.110E-03
U-234	Pu-238	1.000E+00	1.945E-09	3.929E-08	1.057E-07	1.875E-07	2.521E-07	3.030E-07	3.921E-07
Th-230	Pu-238	1.000E+00	1.142E-14	3.685E-12	2.951E-11	1.078E-10	2.245E-10	3.715E-10	8.672E-10
Ra-226	Pu-238	1.000E+00	4.168E-17	1.896E-13	4.451E-12	3.273E-11	1.034E-10	2.308E-10	9.233E-10
Pb-210	Pu-238	1.000E+00	9.730E-20	5.509E-15	3.368E-13	4.238E-12	1.753E-11	4.618E-11	2.339E-10
Pu-239	Pu-239	1.000E+00	3.353E-01	3.353E-01	3.351E-01	3.348E-01	3.345E-01	3.342E-01	3.334E-01
U-235	Pu-239	1.000E+00	6.953E-11	1.460E-09	4.239E-09	8.405E-09	1.257E-08	1.673E-08	2.780E-08
Pa-231	Pu-239	1.000E+00	3.588E-15	1.187E-12	1.001E-11	3.935E-11	8.801E-11	1.559E-10	4.311E-10
Ac-227	Pu-239	1.000E+00	4.776E-17	2.055E-13	4.350E-12	2.797E-11	7.902E-11	1.606E-10	5.341E-10
Sr-90	Sr-90	1.000E+00	2.322E-02	1.830E-02	1.137E-02	5.566E-03	2.725E-03	1.334E-03	1.987E-04

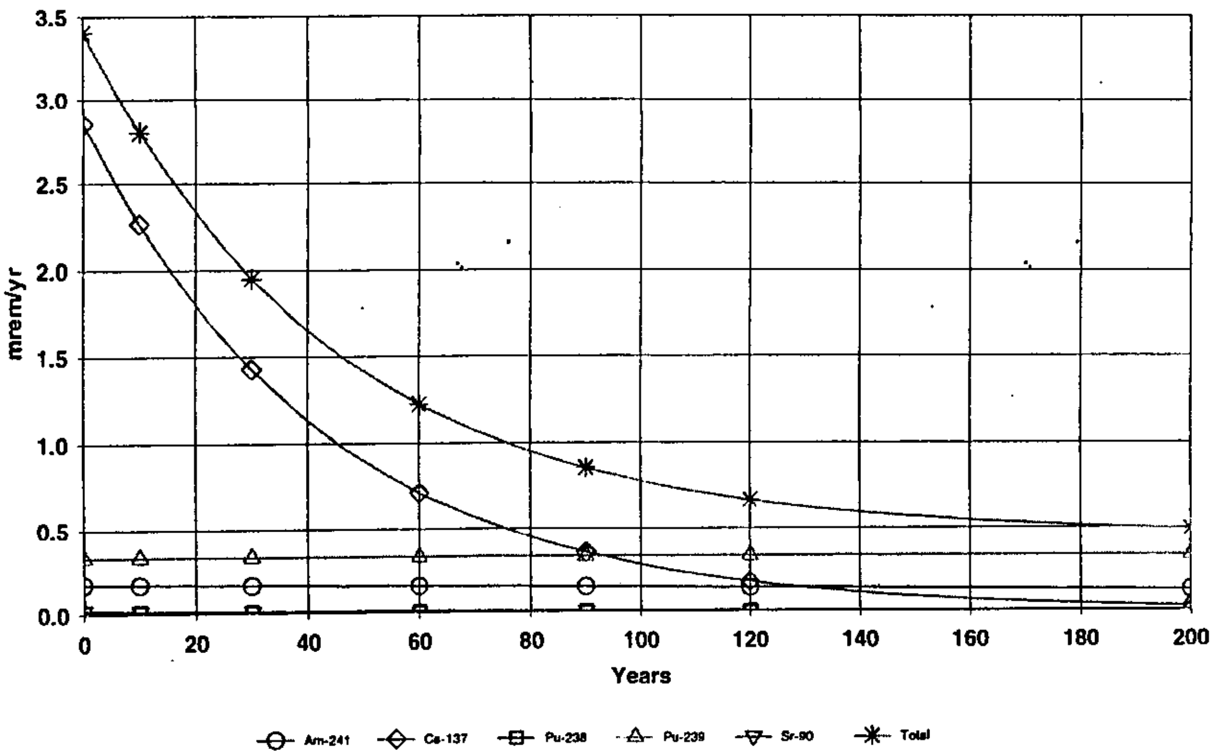
BRF(i) is the branch fraction of the parent nuclide.
§ is used to indicate summation; the Greek sigma is not included in this font.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (i)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+01	3.000E+01	6.000E+01	9.000E+01	1.200E+02	2.000E+02
Am-241	Am-241	1.000E+00	5.000E+00	4.920E+00	4.764E+00	4.540E+00	4.326E+00	4.122E+00	3.625E+00
Np-237	Am-241	1.000E+00	0.000E+00	1.607E-05	4.743E-05	9.263E-05	1.357E-04	1.767E-04	2.769E-04
U-233	Am-241	1.000E+00	0.000E+00	3.522E-10	3.136E-09	1.235E-08	2.734E-08	4.785E-08	1.275E-07
Th-229	Am-241	1.000E+00	0.000E+00	1.110E-13	2.971E-12	2.347E-11	7.822E-11	1.831E-10	8.202E-10
Cs-137	Cs-137	1.000E+00	5.600E+01	4.445E+01	2.800E+01	1.400E+01	7.000E+00	3.500E+00	5.512E-01
Pu-238	Pu-238	1.000E+00	5.000E-01	4.620E-01	3.945E-01	3.113E-01	2.456E-01	1.838E-01	1.030E-01
U-234	Pu-238	1.000E+00	0.000E+00	1.363E-05	3.786E-05	6.772E-05	9.128E-05	1.099E-04	1.424E-04
Th-230	Pu-238	1.000E+00	0.000E+00	6.215E-10	5.313E-09	1.973E-08	4.131E-08	6.856E-08	1.605E-07
Ra-226	Pu-238	1.000E+00	0.000E+00	9.024E-13	2.339E-11	1.763E-10	5.615E-10	1.259E-09	5.060E-09
Pb-210	Pu-238	1.000E+00	0.000E+00	6.624E-14	4.625E-12	6.013E-11	2.515E-10	6.660E-10	3.394E-09
Pu-239	Pu-239	1.000E+00	1.000E+01	9.997E+00	9.991E+00	9.983E+00	9.974E+00	9.965E+00	9.942E+00
U-235	Pu-239	1.000E+00	0.000E+00	9.847E-08	2.953E-07	5.904E-07	8.852E-07	1.180E-06	1.964E-06
Pa-231	Pu-239	1.000E+00	0.000E+00	1.042E-11	9.372E-11	3.747E-10	8.426E-10	1.497E-09	4.153E-09
Ac-227	Pu-239	1.000E+00	0.000E+00	1.023E-12	2.388E-11	1.574E-10	4.481E-10	9.142E-10	3.054E-09
Sr-90	Sr-90	1.000E+00	1.300E+01	1.025E+01	6.365E+00	3.116E+00	1.526E+00	7.469E-01	1.112E-01

BRF(i) is the branch fraction of the parent nuclide.
§ is used to indicate summation; the Greek sigma is not included in this font.
RESCALC.EXE execution time = 2.33 seconds

DOSE: All Nuclides Summed, All Pathways Summed



TUHME21011kw_remov_500y.RAD 10/18/2002 07:28 Includes All Pathways

Attachment 3

Procedure for Calculating Hot Spot Limits contained in DOE/CH-8901

taken from the "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0."

Category
UC-902

ANL/EAD/LD-2

Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0

Working Draft for Comment

by C. Yu, A.J. Zielen, J.-J. Cheng, Y.C. Yuan,* L.G. Jones,
D.J. LePoire, Y.Y. Wang, C.O. Loureiro,* E. Gnanapragasam,
E. Faillace, A. Wallo III,* W.A. Williams,* and H. Peterson*

Environmental Assessment Division,
Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439

September 1993

Work sponsored by United States Department of Energy,
Assistant Secretary for Environment, Safety and Health, Office of Environmental Guidance,
Assistant Secretary for Environmental Restoration and Waste Management,
Office of Environmental Restoration

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*Yuan is associated with Square Y Consultants, Orchard Park, New York; Loureiro with the School of Engineering of the University of Minas Gerais, Belo Horizonte, Brazil; Wallo with the U.S. Department of Energy, Office of Environmental Guidance, Washington, D.C.; Williams with the U.S. Department of Energy, Office of Environmental Restoration, Washington, D.C.; and Peterson with the U.S. Department of Energy, Office of Environmental Guidance, Washington, D.C.

$G_i(t)$ = single-radionuclide, time-dependent soil guideline for the ith principal radionuclide in a uniformly contaminated zone (pCi/g).

If the area of elevated contamination is inhomogeneous, one of two approaches may be used: (1) the area may be treated as if it were homogeneous with a concentration $\hat{S}_i(0)/3$, where $\hat{S}_i(0)$ is the peak concentration of the ith principal radionuclide in a sample from within the area of elevated contamination, or (2) the area may be divided into subzones by using the same procedure that is used for an inhomogeneous contaminated zone.

When inhomogeneous release criteria are used, Equation 3.12 must be satisfied for every area of inhomogeneous contamination; in addition, Equation 3.3 must be satisfied for any region within the homogeneous portion of the contaminated zone.

3.3.2 Hot Spot Criterion for Field Application

Hot spots are small areas that have levels of residual radioactive material that are considerably above the levels in the surrounding area. The derivation of remedial action criteria generally assumes homogeneous contamination of large areas (several hundred square meters or more), and the derived concentration guide is stated in terms of concentrations averaged over an area of 100 m^2. Because of this averaging process, hot spots can exist within these 100-m^2 areas that contain concentrations of radionuclides that are significantly higher than the authorized limit. Therefore, the presence of hot spots could potentially pose a greater risk of exposure to individuals using the site than the risk associated with homogeneous contamination. To ensure that individuals are adequately protected and to ensure that the ALARA process is satisfied, the following hot spot criterion must be applied, along with the general criterion for homogeneous contamination. The hot spot criterion for field application is

$$M^{**} \equiv \sum_i S_i^{*}/G_i^{**} \leq 1 \; , \tag{3.16}$$

where

M^{**} = hot spot mixture sum for field use (dimensionless),

S_i^{*} = measured concentration of the ith principal radionuclide in the hot spot (pCi/g), and

G_i^{**} = single-radionuclide soil guideline for the ith principal radionuclide in the hot spot (pCi/g).

The measured hot spot concentrations S_i^* are the peak concentrations if the hot spot area is 1 m^2 or less, or the average concentrations if the hot spot area is larger than 1 m^2.

The formula for single-radionuclide, hot spot soil guidelines is

$$G_i^{**} = G_i(t_m) \times (100/A)^{1/2} , \qquad (3.17)$$

where

$G_i(t_m)$ = as defined for Equation 3.4,

A = area of hot spot (m^2), and

$(100/A)^{1/2}$ = hot spot multiplication factor.

Equations 3.15 and 3.16 apply to hot spots with areas of 25 m^2 or less. For larger hot spot areas, the homogeneous release criterion is sufficient. An area of $A = 1$ m^2 is used in Equation 3.16 if the actual hot spot area is less than 1 m^2. The average radionuclide concentrations for any 100-m^2 area must always comply with the homogeneous release criterion, irrespective of hot spot criteria.

For general field applications, it is recommended that the ranges of hot spot multiplication factors provided in Table 3.2 be used. The hot spot guideline for radionuclide i is calculated for each specific site by Equation 3.16. The term $G_i(t_m)$ in Equation 3.16 can be substituted by G_i, the authorized limit at a specific site for the ith principal radionuclide.

TABLE 3.2 Ranges for Hot Spot Multiplication Factors

Range	Factor (multiple of authorized limit)
<1 m^2	10[a]
1 - <3 m^2	6
3 - <10 m^2	3
10 - 25 m^2	2

[a] Areas less than 1 m^2 are to be averaged over a 1-m^2 area, and that average shall not exceed 10 times the authorized limit.

The authorized limit is considered adequate to protect the public for areas larger than 25 m^2; hence, no special hot spot limits are required for areas larger than 25 m^2.

Averaging of hot spots less than or equal to 25 m^2 should be done only over the local hot spot area.

Every reasonable effort should be made to identify and remove any source that has a radionuclide concentration exceeding 30 times the authorized limit, irrespective of area.

Los Alamos National Laboratory/University of California
Risk Reduction & Environmental Stewardship (RRES)
Remediation (R) Program, MS M992
Los Alamos, New Mexico 87545
(505) 667-0808/FAX (505) 665-4747

National Nuclear Security Administration
Los Alamos Site Operations, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-7203/FAX (505) 665-4504

Date: February 18, 2003
Refer to: ER2003-0151

Mr. Steve Yanicak
NMED, DOE OB
Post Office Box 1663 MS J993
Los Alamos, NM 87545

SUBJECT: RESPONSE TO RECOMMENDATIONS FOR ENHANCED STORMWATER CONTROLS AT SOLID WASTE MANAGEMENT UNIT (SWMU) 21-011(K) AT TECHNICAL AREA (TA) 21 LOS ALAMOS NATIONAL LABORATORY (LANL)

Dear Mr. Yanicak:

In response to the walk-around at SWMU 21-011(k) conducted by the Department of Energy Oversight Bureau (DOE-OB) of the New Mexico Environment Department (NMED), a number of enhancements have been made to the Best Management Practices (BMPs) stormwater controls at the site as outlined below. Because the site is currently undergoing remediation, some of the recommendations you provided cannot be implemented at this time. The 21-011(k) Voluntary Corrective Action (VCA) project has developed a Storm Water Pollution Prevention Plan (SWPPP) to address erosion control and contaminant migration concerns at this site. The development and implementation of the SWPPP is coordinated with input from both RRES-R and RRES-WQH as a requirement of the Laboratory's NPDES Multi-Sector General Permit. The contractors responsible for on site activities were also involved in SWPPP development and are required to maintain erosion controls listed in the SWPPP.

NMED DOE OB Comment
The road leading onto the site should have water bars installed to direct any runoff towards low-lying areas, or to areas that are protected with BMP.

LANL Response
On the road leading to the site a run-on/run-off water bar has been installed to prevent storm water from the access road from entering the northeastern corner of the site.

NMED DOE OB Comment
The contaminated materials storage area at the northeast end of the site should have secondary containment.

LANL Response
Stored 5-gallon buckets, bags of investigative derived waste, and excavated pipe in plastic sheeting are currently staged on wooden pallets in the contaminated materials storage area at the northeast end of the site. Waste management activities have been initiated and this material will be removed from the site so that secondary containment is not being installed.

NMED DOE OB Comment
The log/wattle BMPs were not properly installed. The wattles should be set in the ground and soil should be bermed. Refer to EPA 832-R-92-006 "Developing Pollution Prevention Plans and Best Management Practices". The Remediation Project should coordinate with Risk Reduction and Environmental Stewardship-Water Quality and Hydrology (RRES-WQH) representatives responsible for BMP installation activities.

LANL Response
Soil has been placed over the wattles up against the log berms on the northern reach of the site to better secure the wattles in place.

NMED DOE OB Comment
The wattles on the northeast drainage may not be sufficient to withstand storm water flow in DP Canyon. Properly engineered stabilization measures are needed.

LANL Response
The "western drainage" is a historic drainage that was active when the outfall at SWMU 21-011(k) was active and it does not currently receive storm water flow. Site restoration activities will begin shortly and as part of the site restoration the "western drainage" will undergo restoration activities to improve the stabilization of the area against storm water flows in DP Canyon.

NMED DOE OB Comment
The generator should have secondary containment and be located away from the watercourse.

LANL Response
A berm lined with plastic sheeting has been installed around the generator. The generator has not been moved due to the amount of heavy traffic in the area just south of the portable trailer, which is powered by the generator.

NMED DOE OB Comment
The area excavated at the upper site entrance should have run-on controls in place to prevent water from the road and up-gradient parking lot at TA 21 from entering the site.

LANL Response
An earthen berm has been constructed just north of North Perimeter Road to prevent run–on to the excavation area of the site from North Perimeter Road and the up-gradient parking lot at TA-21. The site restoration plan for 21-011(k) designates BMPs that will be installed to protect this area of the site from future erosion.

NMED DOE OB Comment
The fire hydrant at the upper site entrance should have a sign to alert anyone testing the hydrant to divert water away from the site.

LANL Response
RRES-R will evaluate the feasibility of a posting at the fire hydrant at the upper site boundary to alert anyone testing the hydrant to divert water away from the site.

We appreciate the efforts of your staff in helping us improve the storm water BMPs at SWMU 21-011(k). If you have any questions, please contact Steve Veenis (RRES-WQH) at (505) 667-0013 or Mark Thacker (RRES-R) at (505) 665-5342.

Sincerely,

David McInroy, Acting Program Manager
Remediation Program
Los Alamos National Laboratory

Sincerely,

Gene Turner, DOE/AIP/POC
Department of Energy
Los Alamos Site Operations

DM/GT/MT/vn

Cy:
D. McInroy, RRES-R, MS M992
N. Quintana, RRES-R, MS M992
B. Ramsey, RRES-DO, MS J591
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M. Thacker, RRES-R, MS M992
S. Veenis, RRES-WQH, MS K497
G. Turner,LASO, MS A316
L. Woodworth, LASO, MS A316
J. Bearzi, NMED-HWB
V. Maranville, NMED-HWB
J. Parker, NMED-OB
J. Davis, NMED-SWB
L. King, EPA Region 6
RRES-R File, MS M992
CT File, #C883
IM-5, MS A150
RPF MS M707

Mark Thacker

From: Paula Bertino [pmb@lanl.gov]

Sent: Tuesday, March 11, 2003 2:39 PM

To: mthacker@lanl.gov

Subject: FW: 21-011(k)

Hi Mark. As indicated below, NMED stated that we can dispose of all of the excavated material from SWMU 21-011(k) represented by the waste characterization samples collected to date. I need to deliver the writeup we worked on yesterday along with another copy of the analytical results you sent to NMED yesterday. Could you send me the results (or I'll make a copy) and I'll hand-deliver the requested documentation tomorrow. Thanks.

Paula

-----Original Message-----
From: Vickie Maranville [mailto:vickie_maranville@nmenv.state.nm.us]
Sent: Tuesday, March 11, 2003 1:43 PM
To: Paula Bertino
Subject: Re: 21-011(k)

Based on NMED's review of the analytical data for 21-011(k) waste characterization sampling conducted on February 3 and February 6, 2003, NMED has determined the waste piles for which the results were provided (February 3 and 6, 2003) can be disposed of in accordance with the approved contained in determination dated November 25, 2002. In addition, NMED is requesting that LANL formally submit the data and a waste characterization summary to NMED. Please call me if you have any questions or comments regarding this e-mail. Thanks.

Vickie

Paula Bertino wrote:

> OK, one last time! I'll call you in the morning. Paula

Summary of Waste Characterization Results for Contaminated Material Excavated from Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area 21

The organic constituent maximum concentrations listed below were detected in the March 2001 discrete waste characterization samples collected from soil, tuff, and sediment planned for excavation and removal from Solid Waste Management Unit (SWMU) 21-011(k) at Technical Area (TA) 21. The organic constituents, maximum concentrations, proposed Environmental Protection Agency (EPA) Region 6 Medium-Specific Screening Levels (MSSLs), New Mexico Environment Department (NMED) Soil Screening Levels (SSLs), and Land Disposal Restrictions (LDRs) were presented in the no longer contained in request (LANL ER2002-0749), and are shown in the following table in concentrations in micrograms per kilogram (ug/kg) to allow direct comparison with waste characterization analytical results.

Organic Constituent	Maximum Concentration (ug/kg)	MSSL (ug/kg)	SSL (ug/kg)	LDR Treatment Standards (ug/kg)
Acetone	13.0(J)	7,600,000	NA	160,000
Methylene chloride	72.0	25,000	2,700,000	30,000
Toluene	1,000(J)	520,000	180,000	10,000
Trichloroethylene	1,800(J)	7,600	18,000	6,000

NA = no SSL available for this constituent
(J) = estimated value between the method detection limit (MDL) and practical quantification limit (PQL)

Tables 1, 2, and 3 include all of the results for 15 waste characterization samples collected from the 1,500 cubic yards (CY) of low-level radiologically contaminated soil, tuff, and sediment excavated from SWMU 21-011(k) during implementation of the Voluntary Corrective Measure (VCM). The results are presented in the same format used in the no longer contained in request (LANL ER2002-0749), with acetone, methylene chloride, toluene, and trichloroethylene results presented for each waste characterization and quality control (QC) sample. Please note that the characterization results presented in Table 1 on page 3 were provided to the New Mexico Environment Department (NMED) in January 2003 and that the disposal of the excavated material represented by those samples was approved by NMED on January 22, 2003. The data in Table 1 is provided to facilitate the comparison with analytical results from February 2003.

Two additional volatile organic compounds (VOCs), (2-butanone and 4-isopropyltoluene) were detected in waste characterization samples collected in February 2003. The VOC 2-butanone was detected in one sample and 4-isopropyltoluene was detected in two samples. Both VOCs were detected at very low concentrations. Additionally, 2-butanone was previously detected in a single sample, at a concentration of 0.031 (J) milligrams/liter (mg/L – TCLP analyte), during the March 2001 pre-excavation characterization-sampling event. Three other VOCs (chloroform, dibromochloromethane, and bromodichloromethane) were detected in corresponding QC rinsate samples collected from sampling equipment rinsed with deionized water. These compounds were not previously detected in any samples from SWMU 21-011(k) and were likely present in the original deionized water source. These data are presented in Tables 2 and 3.

Attached to this correspondence are the Certificates of Analysis for each sampling event. All results are preliminary and have not undergone data validation.

The following table lists the EPA Region 6 MSSLs, NMED SSLs, and LDRs for all of the VOCs detected in the waste characterization and OC samples collected to date from the material excavated from SWMU 21-011(k).

Organic Constituent	Maximum Concentration (ug/kg)	MSSL (ug/kg)	SSL (ug/kg)	LDR Treatment Standards (ug/kg)
Acetone	26.3(B)	7,600,000	NA	160,000
Methylene chloride	72.0	25,000	2,700,000	30,000
Toluene	1000(J)	520,000	180,000	10,000
Trichloroethylene	1800(J)	7,600	18,000	6,000
Chloroform (detected in rinsate samples only)	0.528(J)	65,000	30	6,000
Dibromochloromethane (detected in rinsate samples only)	0.485(J)	2,900	NA	15,000
2-Butanone (MEK)	6.98	34,000,000	89,000	36,000
4-Isopropyltoluene	0.674(J)	NA	NA	NA
Bromodichloromethane (detected in rinsate samples only)	0.482(J)	2,900	2,200	15,000

NA = no MSSL of SSL, or no LDR value available for this constituent
ND = compound not detected
(B) = compound detected in Trip Blank
(J) = estimated value between the MDL and PQL

Table 1 – VOCs detected in three Waste Characterization samples, representing 300 CY of excavated material from SWMU 21-011(k), samples collected on January 9, 2003

Organic Constituent	Sample ID MD21-03-50314 ug/kg	Rinsate ID MD21-03-50324 ug/L	Sample ID MD21-03-50315 ug/kg	Rinsate ID MD21-03-50325 ug/L
Acetone	ND	**5.12(B)**	ND	**5.95(B)**
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	**0.427(J)**	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.376(J)**	ND	**0.465(J)**
Dibromochloromethane	ND	ND	ND	**0.312(J)**
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

Table 1 - continued

Organic Constituent	Sample ID MD21-03-50316 ug/kg	Rinsate ID MD21-03-50326 ug/L	Trip Blank (sand): MD21-03-50334 ug/kg	Field Blank (sand): MD21-03-50335 ug/kg
Acetone	ND	**5.44(B)**	**3.88(J)**	ND
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.426(J)**	ND	ND
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

ND = compound not detected
(J) = estimated value between the MDL and PQL
(B) = compound detected in the associated Trip Blank

Table 2 – VOCs detected in six Waste Characterization samples, representing 600 CY of excavated material from SWMU 21-011(k), samples collected on February 3, 2003

Organic Constituent	Sample ID MD21-03-50317 ug/kg	Rinsate ID MD21-03-50327 ug/L	Sample ID MD21-03-50318 ug/kg	Rinsate ID MD21-03-50328 ug/L
Acetone	ND	3.51(J)(B)	ND	4.69(J)(B)
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	0.389(J)	ND	ND
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

Table 2 - continued

Organic Constituent	Sample ID MD21-03-50319 ug/kg	Rinsate ID MD21-03-50329 ug/L	Sample ID MD21-03-50320 ug/kg	Rinsate ID MD21-03-50330 ug/L
Acetone	ND	4.15(J)(B)	ND	3.94(J)(B)
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	0.395(J)	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	0.373(J)	ND	0.391(J)
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

Table 2 - continued

Organic Constituent	Sample ID MD21-03-50321 ug/kg	Rinsate ID MD21-03-50331 ug/L	Sample ID MD21-03-50322 ug/kg	Rinsate ID MD21-03-50332 ug/L
Acetone	26.3(B)	3.55(J)(B)	ND	ND
Methylene chloride	ND	ND	ND	ND
Toluene	1.3	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	0.371(J)	ND	0.382(J)
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	6.98*	ND	ND	ND
4-Isopropyltoluene	0.674(J)	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

Table 2 – continued

Organic Constituent	Trip Blank (sand): MD21-03-50336 ug/kg
Acetone	4.63(J)
Methylene chloride	ND
Toluene	ND
Trichloroethylene	ND
Chloroform	ND
Dibromochloromethane	ND
2-Butanone	ND
4-Isopropyltoluene	ND
Bromodichloromethane	ND

(J) = estimated value between the MDL and PQL
(B) = compound detected in the associated Trip Blank
* = compound detected in March 2001 pre-excavation characterization sampling event

Table 3 – VOCs detected in six Waste Characterization samples, representing 600 CY of excavated material from SWMU 21-011(k), samples collected on February 6, 2003

Organic Constituent	Sample ID MD21-03-50323 ug/kg	Rinsate ID MD21-03-50333 ug/L	Sample ID MD21-03-50550 ug/kg	Rinsate ID MD21-03-50560 ug/L
Acetone	ND	6.35(B)	ND	6.27(B)
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	0.528(J)	ND	0.492(J)
Dibromochloromethane	ND	0.480(J)	ND	0.517(J)
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	0.445(J)	ND	0.482(J)

Table 3 - continued

Organic Constituent	Sample ID MD21-03-50551 ug/kg	Rinsate ID MD21-03-50561 ug/L	Sample ID MD21-03-50552 ug/kg	Rinsate ID MD21-03-50562 ug/L
Acetone	ND	5.26(B)	ND	6.51(B)
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	0.476(J)	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	0.478(J)	ND	0.501(J)
Dibromochloromethane	ND	0.485(J)	ND	0.438(J)
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	0.410(J)	ND	0.456(J)

Table 3 - continued

Organic Constituent	Sample ID MD21-03-50553 ug/kg	Rinsate ID MD21-03-50563 ug/L	Sample ID MD21-03-50554 ug/kg	Rinse ID MD21-03-50564 ug/L
Acetone	ND	5.81(B)	ND	6.82(B)
Methylene chloride	ND	ND	ND	ND
Toluene	0.433(J)	ND	0.615(J)	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	0.511(J)	ND	0.501(J)
Dibromochloromethane	ND	0.477(J)	ND	0.495(J)
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	0.353(J)	ND
Bromodichloromethane	ND	0.420(J)	ND	0.406(J)

Table 3 – continued

Organic Constituent	Trip Blank (sand): MD21-03-50338 ug/kg	Field Blank: MD21-03-50337 ug/kg
Acetone	ND	4.07(J)
Methylene chloride	ND	ND
Toluene	ND	ND
Trichloroethylene	ND	ND
Chloroform	ND	ND
Dibromochloromethane	ND	ND
2-Butanone	ND	ND
4-Isopropyltoluene	ND	ND
Bromodichloromethane	ND	ND

(J) = estimated value between the MDL and PQL
(B) = compound detected in the associated Field Blank

Los Alamos National Laboratory/University of California
Risk Reduction & Environmental Stewardship (RRES)
Remediation (R) Program, MS M992
Los Alamos, New Mexico 87545
(505) 667-0808/FAX (505) 665-4747

National Nuclear Security Administration
Los Alamos Site Operations, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-7203/FAX (505) 665-4504

Date: May 7, 2003
Refer to: ER2003-0324

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: RESUBMITTAL OF REVISION 3 OF THE VOLUNTARY CORRECTIVE MEASURES (VCM) PLAN FOR SOLID WASTE MANAGEMENT UNIT (SWMU) 21-011(k), AT TECHNICAL AREA (TA) 21

Dear Mr. Young:

Enclosed please find two copies of the "VCM Plan for SWMU 21-011(k) at TA 21, Revision 3". The revised VCM Plan is submitted in response to the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) letter regarding "Comments and Conditions for Notice of Deficiency Response, SWMU 21-011(k) VCM Plan" (HWB-Facility-02-020). The Los Alamos National Laboratory's (LANL) Risk Reduction and Environmental Stewardship Remediation Program has incorporated comments, where applicable, from the NMED-HWB Notice of Deficiency (NOD) and LANL's Response to the NOD (ER2003-0040) into the revised VCM plan. Attachments 1 through 3 are not included with the revised plan since they have not changed.

If you have any questions, please contact Mark Thacker at (505) 667-5342 or Woody Woodworth at (505) 667-5820.

Sincerely,

David McInroy, Acting Program Manager
Remediation Program
Los Alamos National Laboratory

Sincerely,

David R. Gregory

David Gregory, Project Manager
Department of Energy
Los Alamos Site Operations

DM/ET/PB/vn

Enclosure: VCM Plan for SWMU 21-011(k) at TA-21, Revision 3

Mark Thacker

From: Vickie Maranville [vickie_maranville@nmenv.state.nm.us]

Sent: Monday, June 30, 2003 12:12 PM

To: Mark Thacker

Cc: Vickie Maranville

Subject: Re: Additional waste sampling at SWMU 21-011(k)

Thanks for the clarification. As I stated previously, based on the data presented, the waste can be properly disposed of off site.

Vickie

Mark Thacker wrote:

> I am sorry that nature of the material was unclear.These samples represent additional volume, above the 1500 cy already sampled and reviewed by you.The material however did come from areas that had previously been sampled in the 1500 cy.The samples represent small scattered additional hot spot removal areas that were deemed necessary to assure the clean-up criteria were achieved after the results from final radiological survey were reviewed.
>
> Mark
>
> Mark S. Thacker
> Los Alamos National Laboratory
> Risk Reduction and Environmental Stewardship Division
> (505) 665-5342
> mthacker@LANL.gov
>
> -----Original Message-----
> **From:** Vickie Maranville [mailto:vickie_maranville@nmenv.state.nm.us]
> **Sent:** Monday, June 30, 2003 11:36 AM
> **To:** Mark Thacker
> **Subject:** Re: Additional waste sampling at SWMU 21-011(k)
>
> I have reviewed the April 8, 2003 sample data submitted to NMED. I am unclear as to the origin of the material sampled. Is the material sampled material that was previously sampled but the had additional material added to the waste pile as a result of additional sampling? Please clarify. As for the data, based on my review (and assuming the units are correct) the material can be properly disposed of in accordance with the approved contained in determination letter sent to LANL by NMED. Please call me if you have any questions.
>
> Vickie
>
> Mark Thacker wrote:
>
> Vickie, attached are the results of two additional waste characterization samples collected at SWMU 21-011(k).The table is in the same format as the last 15 samples were transmitted to in.I have labeled it Table 4 to sequentially follow the last 3 tables submitted to you in March 2003.The two samples are representative of material that was previously sampled and submitted to you for review.After the final radiological survey we removed same additional material from areas that still had slightly elevated CPMs, very near what our clean-up goal was, but to be safe we removed additional material from areas at the site and sampled that material again for VOCs.As Table 4 shows we had no unusual detects and only acetone (10.2 ug/Kg) and toluene (0.48 J ug/Kg) were detected in one sample.We will also have two additional samples to transmit to you, one from a final removal area and one from the sediment package removed from DP Canyon.Please give me a call with any questions and I hope you had a good vacation.
>
> Mark

Sent to Vicker 10:00 6/26/03

Table 4 – VOCs detected in two Waste Characterization samples, representing 200 CY of excavated material from SWMU 21-011(k), samples collected on April 8, 2003

Organic Constituent	**Sample ID MD21-03-50555 ug/Kg**	**Sample ID MD21-03-50556 ug/Kg**
Acetone	ND	**10.2**
Methylene chloride	ND	ND
Toluene	ND	**0.48 (J)**
Trichloroethylene	ND	ND
Chloroform	ND	ND
Dibromochloromethane	ND	ND
2-Butanone	ND	ND
4-Isopropyltoluene	ND	ND
Bromodichloromethane	ND	ND

Mark Thacker

From: Vickie Maranville [vickie_maranville@nmenv.state.nm.us]

Sent: Monday, July 21, 2003 9:18 AM

To: Mark Thacker

Subject: Re: Final VOC Sampling Results

The data submitted electronically for DP Canyon area related to 21-011(k) and additional removal from within the 21-011(k) boundary following the final radiological survey has been reviewed by NMED. Based on the information provided for review, the material can be properly disposed of in accordance with the contained in determination and the approved VCM plan. Please contact me if you have any questions.

Vickie Maranville

Mark Thacker wrote:

> Vickie, attached are the final VOC sampling results from the 21-011(k) VCM. The two samples represent the material that was excavated from the DP Canyon Creek bank (approximately 12 cy) that was above the clean-up criteria for 21-011(k) and additional material that was excavated from 21-011(k) after the final radiological survey was conducted and the decision was made to remove a few additional spots that were near the clean-up criteria. Let me know if you have any questions. We are currently working on the report and including you comments on the content of the VCM Completion Report.
> <!--[if !supportEmptyParas]--> <!--[endif]-->
> Mark
> <!--[if !supportEmptyParas]--> <!--[endif]-->
> Mark S. Thacker
> Los Alamos National Laboratory
> Risk Reduction and Environmental Stewardship Division
> (505) 665-5342
> mthacker@LANL.gov
> <!--[if !supportEmptyParas]--> <!--[endif]-->

Sent to Vickie
7/17/03 0740

Table 5 – VOCs detected in two Waste Characterization samples, representing 200 CY of excavated material from SWMU 21-011(k), samples collected on June, 26 2003

Organic Constituent	Sample ID MD21-03-52106 ug/Kg	Sample ID MD21-03-52107 ug/Kg
Acetone	**7.40**	ND
Methylene chloride	**2.03(J)**	**1.58(J)**
Toluene	**0.708(J)**	ND
Trichloroethylene	ND	ND
Chloroform	ND	ND
Dibromochloromethane	ND	ND
2-Butanone	ND	ND
4-Isopropyltoluene	ND	ND
Bromodichloromethane	ND	ND

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
www.nmenv.state.nm.us

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

July 14, 2003

Mr. G. Pete Nanos, Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop A100
Los Alamos, New Mexico 87545

Mr. David Gregory, Project Manager
Office of Los Alamos Site Operations
Department of Energy
528 35th Street, Mail Stop A316
Los Alamos, New Mexico 87544

SUBJECT: COMMENTS AND APPROVAL OF VOLUNTARY CORRECTIVE MEASURES PLAN FOR SOLID WASTE MANAGEMETN UNIT 21-011(k) AT TECHNICAL AREA 21 (REVISION 3).
LOS ALAMOS NATIONAL LABORATORY EPA ID# NM0890010515
NMED HWB TASK NUMBER 02-020

Dear Messrs. Nanos and Gregory:

The New Mexico Environment Department (NMED) is in receipt of Los Alamos National Laboratory and U.S Department of Energy's (Permittees) work plan dated May 2003, titled "Voluntary Corrective Measures Plan for Solid Waste Management Unit 21-011(k) at Technical Area 21 (Revision 3) " referenced by LA-UR-03-3026 (ER2003-0326). NMED hereby approves the aforementioned voluntary corrective measures (VCM) plan with the following conditions:

- NMED requires the Permittees to evaluate risk to human health based on lifetime carcinogenic risk as outlined in the NMED letter dated April 22, 2003 and titled "Comments and Conditions for Notice of Deficiency Response, Solid Management Unit (SWMU) 21-011(k) VCM Plan". In order to determine if the proposed remedy may be considered as a final remedy for SWMU 21-011(k), the risk assessment must contain an estimate of dose and risk over time for a residential receptor. NMED evaluates risk in accordance with published EPA literature, including *"Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (RAGS)"*. NMED is requiring the Permittees to provide information on radionuclides in a format that is consistent with EPA guidance (i.e. RAGS).

- All deviations from the approved VCM plan must be detailed in the VCM Completion Report.

In addition to the conditions for approval outlined above, NMED has the following comments on the VCM plan:

- Although a dose of 15 mrem/year may be deemed acceptable to the Permittees, NMED evaluates risk, not dose and therefore a dose of 15 mrem/year may not be acceptable to NMED.

- The Permittees assert the remedial approach selected (removal and off-site disposal) is a cost-effective and proactive remedial alternative, and is preferred over no action, fencing the site, and/or onsite stabilization. This assertion by the Permittees does not reflect the opinion of NMED.

As outlined in the VCM plan, the VCM Completion Report for SWMU 21-011(k) shall be submitted to NMED for review and approval on or before October 30, 2003. Should you have any questions regarding this approval letter or the deadline for submittal of the VCM Completion Report, please feel free to contact me at (505) 428-2546.

Sincerely,

Vickie Maranville
Project Manager
Permits Management Program

cc: D. Cobrain, NMED HWB
J. Young, NMED HWB
M. Leavitt, NMED SWQB
C. Voorhes NMED DOE OB
S. Yanicak, NMED DOE OB, MS J993
L. King, EPA Region 6 (6PD-N)
B. Ramsey, LANL RRES/ER, MS M992
N. Quintana, LANL RRES/ER, MS M992

W. Woodworth, DOE OLASO, MS A316
File: Reading and LANL TA-21 (TA-21-011(k) Outfall)

Appendix K

Stream Bank Remediation

APPENDIX K STREAM BANK REMEDIATION

Table K-1
Sampling Results for DP Canyon Channel Bank Excavation

Sample ID	Location ID	Depth (ft)	Media	Americium –241 (pCi/g)	Cesium-137 (pCi/g)	Plutonium-238 (pCi/g)	Plutonium-239 (pCi/g)	Strontium-90 (pCi/g)
Sediment Background Value*				0.04	0.9	0.006	0.68	1.04
CADP-03-51799	DP-22335	0.50–1.00	Sediment	18.4	30.2	0.951	3.8	2.49
CADP-03-51800	DP-22336	1.00–1.50	Sediment	13.4	80.5	0.477	6.73	20.2
CADP-03-51801	DP-22337	2.00–2.50	Sediment	5.69	182	0.625	7.61	23.2

*Background values in pCi/g from LANL (1998, 59730.2).

Table K-2
Frequency of Detects in Samples from DP Canyon Channel Bank Excavation

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Sediment	3	3	5.69 to 18.4	0.04	3/3
Cesium-134	Sediment	3	0	[-0.0136 to 0.0205]	NA*	0/3
Cesium-137	Sediment	3	3	30.2 to 182	0.9	3/3
Cobalt-60	Sediment	3	0	[-0.0223 to -0.00716]	NA	0/3
Europium-152	Sediment	3	0	[-0.00287 to 0.0229	NA	0/3
Plutonium-238	Sediment	3	3	0.477 to 0.951	0.006	3/3
Plutonium-239	Sediment	3	3	3.8 to 7.61	0.068	3/3
Ruthenium-106	Sediment	3	0	[-0.231 to 0.166]	NA	0/3
Sodium-22	Sediment	3	0	[-0.0101 to 0.0301]	NA	0/3
Strontium-90	Sediment	3	3	2.49 to 23.2	1.04	3/3
Uranium-235	Sediment	3	0	[-0.0141 to 0.47]	0.2	0/3

*NA = Not available.

Appendix L

Technical Area 21
VOC Results of Contaminated Soil and Tuff
and Technical Area 54 Waste Characterization Results

APPENDIX L TECHNICAL AREA 21 VOC RESULTS OF CONTAMINATED SOIL AND TUFF AND TECHNICAL AREA 54 WASTE CHARACTERIZATION RESULTS

L-1.0 TECHNICAL AREA 21 VOC RESULTS OF CONTAMINATED SOIL AND TUFF AND TA-54 WASTE CHARACTERIZATION RESULTS

Tables L-1 through L-5 summarize the volatile organic compounds (VOCs) analytical results from 19 waste characterization samples from Solid Waste Management Unit (SWMU) 21-011(k). These tables were transmitted to the New Mexico Environment Department during the course of the voluntary corrective measure.

Table L-1
VOCs Detected in Three Waste Characterization Samples, Representing 300 CY of Excavated Material from SWMU 21-011(k), Samples Collected on January 9, 2003

Organic Constituent	Sample ID MD21-03-50314 (µg/kg)	Rinse ID MD21-03-50324 (µg/L)	Sample ID MD21-03-50315 (µg/kg)	Rinse ID MD21-03-50325 (µg/L)
Acetone	ND[a]	**5.12 (B)**[b]	ND	**5.95 (B)**
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	**0.427 (J)**[c]	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.376 (J)**	ND	**0.465 (J)**
Dibromochloromethane	ND	ND	ND	**0.312(J)**
2-Butanone	ND	ND	ND	ND
4 Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
Part 2				
Organic Constituent	**Sample ID MD21-03-50316 (µg/kg)**	**Rinse ID MD21-03-50326 (µg/L)**	**Trip Blank (sand): MD21-03-50334 (µg/L)**	**Field Blank (sand): MD21-03-50335 (µg/L)**
Acetone	ND	**5.44 (B)**	**3.88 (J)**	ND
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.426 (J)**	ND	ND
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

[a] ND = Not detected.

[b] B = Compound detected in the associated Trip Blank.

[c] J = Estimated value between the MDL and PQL.

Table L-2
VOCs Detected in Six Waste Characterization Samples, Representing 600 CY of Excavated Material from SWMU 21-011(k), Samples Collected on February 3, 2003

Organic Constituent	Sample ID MD21-03-50317 (µg/kg)	Rinse ID MD21-03-50327 (µg/L)	Sample ID MD21-03-50318 (µg/kg)	Rinse ID MD21-03-50328 (µg/L)
Acetone	ND[a]	**0.351(J)[b] (B)[c]**	ND	**4.69 (J)(B)**
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.389 (J)**	ND	ND
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

Part 2

Organic Constituent	Sample ID MD21-03-50319 (µg/kg)	Rinse ID MD21-03-50329 (µg/L)	Sample ID MD21-03-50320 (µg/kg)	Rinse ID MD21-03-50330 (µg/L)
Acetone	ND	**4.15 (J)(B)**	ND	**3.94 (J)(B)**
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	**0.395 (J)**	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.373 (J)**	ND	**0.391 (J)**
Dibromochloromethane	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND

Part 3

Organic Constituent	Sample ID MD21-03-50321 (µg/kg)	Rinse ID MD21-03-50331 (µg/L)	Sample ID MD21-03-50322 (µg/kg)	Rinse ID MD21-03-50332 (µg/L)	Trip Blank (sand): MD21-03-50336 (µg/kg)
Acetone	**26.3 (B)**	**3.55 (J)(B)**	ND	ND	**4.63 (J)**
Methylene chloride	ND	ND	ND	ND	ND
Toluene	**1.3**	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND
Chloroform	ND	**0.371 (J)**	ND	**0.382 (J)**	ND
Dibromochloromethane	ND	ND	ND	ND	ND
2-Butanone	**6.98**[d]	ND	ND	ND	ND
4-Isopropyltoluene	**0.674 (J)**	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND

[a] ND = Not detected.
[b] J = Estimated value between the MDL and PQL.
[c] B = Compound detected in the associated Trip Blank.
[d] Compound detected in March 2001 pre-excavation characterization sampling event.

Table L-3
VOCs Detected in Six Waste Characterization Samples, Representing 600 CY of Excavated Material from SWMU 21-011(k), Samples Collected on February 6, 2003

Organic Constituent	Sample ID MD21-03-50323 (µg/kg)	Rinse ID MD21-03-50333 (µg/L)	Sample ID MD21-03-50550 (µg/kg)	Rinse ID MD21-03-50560 (µg/L)
Acetone	ND[a]	**6.35 (B)**[b]	ND	**6.27 (B)**
Methylene chloride	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Chloroform	ND	**0.528 (J)**[c]	ND	**0.492 (J)**
Dibromochloromethane	ND	**0.480 (J)**	ND	**0.517 (J)**
2-Butanone	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND
Bromodichloromethane	ND	**0.445 (J)**	ND	**0.482 (J)**

Part 2

Organic Constituent	Sample ID MD21-03-50551 (µg/kg)	Rinse ID MD21-03-50561 (µg/L)	Sample ID MD21-03-50552 (µg/kg)	Rinse ID MD21-03-50562 (µg/L)	Sample ID MD21-03-50553 (µg/kg)
Acetone	ND	**5.26 (B)**	ND	**6.51(B)**	ND
Methylene chloride	ND	ND	ND	ND	ND
Toluene	ND	ND	**0.476 (J)**	ND	**0.433 (J)**
Trichloroethylene	ND	ND	ND	ND	ND
Chloroform	ND	**0.478 (J)**	ND	**0.501 (J)**	ND
Dibromochloromethane	ND	**0.485 (J)**	ND	**0.438 (J)**	ND
2-Butanone	ND	ND	ND	ND	ND
4-Isopropyltoluene	ND	ND	ND	ND	ND
Bromodichloromethane	ND	**0.410 (J)**	ND	**0.456 (J)**	ND

Part 3

Organic Constituent	Rinse ID MD21-03-50563 (µg/L)	Sample ID MD21-03-50554 (µg/kg)	Rinse ID MD21-03-50564 (µg/L)	Trip Blank (sand): MD21-03-50338 (µg/kg)	Field Blank: MD21-03-50337 (µg/kg)
Acetone	**5.81 (B)**	ND	**6.82 (B)**	ND	**4.07 (J)**
Methylene chloride	ND	ND	ND	ND	ND
Toluene	ND	**0.615 (J)**	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	ND
Chloroform	**0.511 (J)**	ND	**0.501 (J)**	ND	ND
Dibromochloromethane	**0.477 (J)**	ND	**0.495 (J)**	ND	ND
2-Butanone	ND	ND	ND	ND	ND
4-Isopropyltoluene	ND	**0.353 (J)**	ND	ND	ND
Bromodichloromethane	**0.420 (J)**	ND	**0.406 (J)**	ND	ND

[a] ND = Not detected.
[b] B = Compound detected in the associated Field Blank.
[c] J = Estimated value between the MDL and PQL.

Table L-4
VOCs Detected in Two Waste Characterization Samples, Representing 200 CY of Excavated Material from SWMU 21-011(k), Samples Collected on April 8, 2003

Organic Constituent	Sample ID MD21-03-50555 (µg/kg)	Sample ID MD21-03-50556 (µg/kg)
Acetone	ND[a]	**10.2**
Methylene chloride	ND	ND
Toluene	ND	**0.48 (J)**[b]
Trichloroethylene	ND	ND
Chloroform	ND	ND
Dibromochloromethane	ND	ND
2-Butanone	ND	ND
4-Isopropyltoluene	ND	ND
Bromodichloromethane	ND	ND

[a] ND = Not detected.
[b] J = Estimated value between the MDL and PQL.

Table L-5
VOCs Detected in Two Waste Characterization Samples, Representing 200 CY of Excavated Material from SWMU 21-011(k), Samples Collected on June 26, 2003

Organic Constituent	Sample ID MD21-03-52106 (µg/kg)	Sample ID MD21-03-52107 (µg/kg)
Acetone	**7.40**	ND[a]
Methylene chloride	**2.03 (J)**	**1.58 (J)**[b]
Toluene	**0.708 (J)**	ND
Trichloroethylene	ND	ND
Chloroform	ND	ND
Dibromochloromethane	ND	ND
2-Butanone	ND	ND
4-Isopropyltoluene	ND	ND
Bromodichloromethane	ND	ND

[a] ND = Not detected.
[b] J = Estimated value between the MDL and PQL.

Attachment 1

VOC Results

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50550_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706001

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W118

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 6   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.3	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
95-47-6	o-Xylene	1.1	U
----------------	m,p-Xylenes	2.1	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

FORM I VOA   OLM03.0

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50550_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W118

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 6 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 1

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN SILOXANE	11.23	6.7	J
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FORM I VOA-TIC OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-
50551_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706002

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W119

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 6   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	5.3	U
76-13-1	112Trichloro122trifluoroetha	5.3	U
74-88-4	Iodomethane	5.3	U
75-15-0	Carbon disulfide	5.3	U
75-09-2	Methylene chloride	5.3	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.3	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.3	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50551_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W119

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 6 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.3	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
----------------	m,p-Xylenes	2.1	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

FORM I VOA OLM03.0

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50551_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W119

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 6 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 0

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.
MD21-03-
50552_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W120

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 9   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:_______(uL)   Soil Aliquot Volume: _______(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.5	U
76-13-1	112Trichloro122trifluoroetha	5.5	U
74-88-4	Iodomethane	5.5	U
75-15-0	Carbon disulfide	5.5	U
75-09-2	Methylene chloride	5.5	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.5	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.5	U
108-88-3	Toluene	0.48	J
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50552_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W120

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 9   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:_______(uL)   Soil Aliquot Volume: _______(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.5	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
95-47-6	o-Xylene	1.1	U
----------------	m,p-Xylenes	2.2	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50552_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706003

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W120

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 9 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50553_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706004

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W121

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 10 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.6	U
76-13-1	112Trichloro122trifluoroetha	5.6	U
74-88-4	Iodomethane	5.6	U
75-15-0	Carbon disulfide	5.6	U
75-09-2	Methylene chloride	5.6	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.6	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.6	U
108-88-3	Toluene	0.43	J
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50553_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706004

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W121

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 10   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	CONCENTRATION	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.6	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
95-47-6	o-Xylene	1.1	U
----------	m,p-Xylenes	2.2	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50553_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706004

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W121

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 10 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN SILOXANE	11.23	8.6	J
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50554_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706005

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W122

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 9   Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.5	U
76-13-1	112Trichloro122trifluoroetha	5.5	U
74-88-4	Iodomethane	5.5	U
75-15-0	Carbon disulfide	5.5	U
75-09-2	Methylene chloride	5.5	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.5	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.5	U
108-88-3	Toluene	0.64	J
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

FORM I VOA   OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-
50554_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706005

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W122

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 9   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.5	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
95-47-6	o-Xylene	1.1	U
----------	m,p-Xylenes	2.2	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	0.35	J
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50554_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1570S

Matrix: (soil/water) SOIL Lab Sample ID: 74706005

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W122

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 9 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______(uL) Soil Aliquot Volume: _______(uL)

CONCENTRATION UNITS:

Number TICs found: 3 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN ALKENE	9.26	11.5	J
2. 13466-78-9	3-CARENE	10.48	9.6	NJ
3.	UNKNOWN SILOXANE	11.23	7.9	J
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FORM I VOA-TIC OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-
50550_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1570S

Matrix: (soil/water) SOIL   Lab Sample ID: 74706001

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W118

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 6   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	CONCENTRATION (UG/KG)	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.3	U
76-13-1	112Trichloro122trifluoroetha	5.3	U
74-88-4	Iodomethane	5.3	U
75-15-0	Carbon disulfide	5.3	U
75-09-2	Methylene chloride	5.3	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.3	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.3	U
108-88-3	Toluene	1.1	U
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50555

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1701S

Matrix: (soil/water) SOIL Lab Sample ID: 78066001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 5F409

Level: (low/med) LOW Date Received: 04/10/03

% Moisture: not dec. 5 Date Analyzed: 04/17/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	CONCENTRATION (UG/KG)	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	5.3	U
76-13-1	112Trichloro122trifluoroetha	5.3	U
74-88-4	Iodomethane	5.3	U
75-15-0	Carbon disulfide	5.3	U
75-09-2	Methylene chloride	5.3	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.3	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.3	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

FORM I VOA OLM03.0

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50555

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1701S

Matrix: (soil/water) SOIL Lab Sample ID: 78066001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 5F409

Level: (low/med) LOW Date Received: 04/10/03

% Moisture: not dec. 5 Date Analyzed: 04/17/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.3	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
----------------	m,p-Xylenes	2.1	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50555

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1701S

Matrix: (soil/water) SOIL Lab Sample ID: 78066001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 5F409

Level: (low/med) LOW Date Received: 04/10/03

% Moisture: not dec. 5 Date Analyzed: 04/17/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______(uL) Soil Aliquot Volume: _______(uL)

CONCENTRATION UNITS:
Number TICs found: 1 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	4.09	6.9	J
2.				
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50556

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1701S

Matrix: (soil/water) SOIL Lab Sample ID: 78066002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 5F415

Level: (low/med) LOW Date Received: 04/10/03

% Moisture: not dec. 1 Date Analyzed: 04/17/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	10.2	
76-13-1	112Trichloro122trifluoroetha	5.1	U
74-88-4	Iodomethane	5.1	U
75-15-0	Carbon disulfide	5.1	U
75-09-2	Methylene chloride	5.1	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.1	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.1	U
108-88-3	Toluene	0.48	J
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50556

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1701S

Matrix: (soil/water) SOIL Lab Sample ID: 78066002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 5F415

Level: (low/med) LOW Date Received: 04/10/03

% Moisture: not dec. 1 Date Analyzed: 04/17/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.1	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
----------------	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50556

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1701S

Matrix: (soil/water) SOIL Lab Sample ID: 78066002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 5F415

Level: (low/med) LOW Date Received: 04/10/03

% Moisture: not dec. 1 Date Analyzed: 04/17/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:

Number TICs found: 0 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-52106

Lab Name: GEL, LLC. Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1797S

Matrix: (soil/water) SOIL Lab Sample ID: 83144001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Q112

Level: (low/med) LOW Date Received: 06/28/03

% Moisture: not dec. 2 Date Analyzed: 06/30/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	7.4	
76-13-1	112Trichloro122trifluoroetha	5.1	U
74-88-4	Iodomethane	5.1	U
75-15-0	Carbon disulfide	5.1	U
75-09-2	Methylene chloride	2.0	J
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.1	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.1	U
108-88-3	Toluene	0.71	J
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

FORM I VOA OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-52106

Lab Name: GEL, LLC. Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1797S

Matrix: (soil/water) SOIL Lab Sample ID: 83144001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Q112

Level: (low/med) LOW Date Received: 06/28/03

% Moisture: not dec. 2 Date Analyzed: 06/30/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.1	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
----------------	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-52106

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1797S

Matrix: (soil/water) SOIL Lab Sample ID: 83144001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Q112

Level: (low/med) LOW Date Received: 06/28/03

% Moisture: not dec. 2 Date Analyzed: 06/30/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
Number TICs found: 0 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-52107

Lab Name: GEL, LLC. Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1797S

Matrix: (soil/water) SOIL Lab Sample ID: 83144002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Q113

Level: (low/med) LOW Date Received: 06/28/03

% Moisture: not dec. 4 Date Analyzed: 06/30/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	5.2	U
76-13-1	112Trichloro122trifluoroetha	5.2	U
74-88-4	Iodomethane	5.2	U
75-15-0	Carbon disulfide	5.2	U
75-09-2	Methylene chloride	1.6	J
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.2	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.2	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

FORM I VOA OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-52107

Lab Name: GEL, LLC. Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1797S

Matrix: (soil/water) SOIL Lab Sample ID: 83144002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Q113

Level: (low/med) LOW Date Received: 06/28/03

% Moisture: not dec. 4 Date Analyzed: 06/30/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.2	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
--------	m,p-Xylenes	2.1	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-52107

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1797S

Matrix: (soil/water) SOIL Lab Sample ID: 83144002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 1Q113

Level: (low/med) LOW Date Received: 06/28/03

% Moisture: not dec. 4 Date Analyzed: 06/30/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 0

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50317_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529001

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W108

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 8   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.4	U
76-13-1	Trichlorotrifluoroethane	5.4	U
74-88-4	Iodomethane	5.4	U
75-15-0	Carbon disulfide	5.4	U
75-09-2	Methylene chloride	5.4	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.4	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.4	U
108-88-3	Toluene	1.1	U
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50317_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W108

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 8 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.4	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
----------------	m,p-Xylenes	2.2	U
95-47-6	o-Xylene	1.1	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50317_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W108

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 8 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 2

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN ORGANIC ACID	11.88	10.2	J
2.	UNKNOWN ALKANE	12.64	9.8	J
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-
50318_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W110

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 7 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.4	U
76-13-1	Trichlorotrifluoroethane	5.4	U
74-88-4	Iodomethane	5.4	U
75-15-0	Carbon disulfide	5.4	U
75-09-2	Methylene chloride	5.4	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.4	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.4	U
108-88-3	Toluene	1.1	U
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

FORM I VOA OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50318_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W110

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 7 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______ (uL) Soil Aliquot Volume: _______ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.4	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
----------------	m,p-Xylenes	2.2	U
95-47-6	o-Xylene	1.1	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50318_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529002

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W110

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 7 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 1

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN ALKENE	9.26	20.4	J
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50319_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W111

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 10   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:_______(uL)   Soil Aliquot Volume: _______(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.6	U
76-13-1	Trichlorotrifluoroethane	5.6	U
74-88-4	Iodomethane	5.6	U
75-15-0	Carbon disulfide	5.6	U
75-09-2	Methylene chloride	5.6	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.6	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.6	U
108-88-3	Toluene	1.1	U
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50319_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W111

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 10   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.6	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
----------------	m,p-Xylenes	2.2	U
95-47-6	o-Xylene	1.1	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50319_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529003

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W111

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 10 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______(uL) Soil Aliquot Volume: _______(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50320_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529004

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W123

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 14   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.2	U
74-87-3	Chloromethane	1.2	U
75-01-4	Vinyl chloride	1.2	U
74-83-9	Bromomethane	1.2	U
75-00-3	Chloroethane	1.2	U
75-69-4	Trichlorofluoromethane	1.2	U
75-35-4	1,1-Dichloroethylene	1.2	U
67-64-1	Acetone	5.8	U
76-13-1	Trichlorotrifluoroethane	5.8	U
74-88-4	Iodomethane	5.8	U
75-15-0	Carbon disulfide	5.8	U
75-09-2	Methylene chloride	5.8	U
156-60-5	trans-1,2-Dichloroethylene	1.2	U
75-34-3	1,1-Dichloroethane	1.2	U
78-93-3	2-Butanone	5.8	U
156-59-2	cis-1,2-Dichloroethylene	1.2	U
594-20-7	2,2-Dichloropropane	1.2	U
74-97-5	Bromochloromethane	1.2	U
67-66-3	Chloroform	1.2	U
71-55-6	1,1,1-Trichloroethane	1.2	U
563-58-6	1,1-Dichloropropene	1.2	U
56-23-5	Carbon tetrachloride	1.2	U
107-06-2	1,2-Dichloroethane	1.2	U
71-43-2	Benzene	1.2	U
79-01-6	Trichloroethylene	1.2	U
78-87-5	1,2-Dichloropropane	1.2	U
74-95-3	Dibromomethane	1.2	U
75-27-4	Bromodichloromethane	1.2	U
10061-01-5	cis-1,3-Dichloropropylene	1.2	U
108-10-1	4-Methyl-2-pentanone	5.8	U
108-88-3	Toluene	0.39	J
10061-02-6	trans-1,3-Dichloropropylene	1.2	U
79-00-5	1,1,2-Trichloroethane	1.2	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50320_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529004

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W123

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 14 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.2	U
591-78-6	2-Hexanone	5.8	U
127-18-4	Tetrachloroethylene	1.2	U
124-48-1	Dibromochloromethane	1.2	U
106-93-4	1,2-Dibromoethane	1.2	U
108-90-7	Chlorobenzene	1.2	U
630-20-6	1,1,1,2-Tetrachloroethane	1.2	U
100-41-4	Ethylbenzene	1.2	U
----------------	m,p-Xylenes	2.3	U
95-47-6	o-Xylene	1.2	U
100-42-5	Styrene	1.2	U
75-25-2	Bromoform	1.2	U
98-82-8	Isopropylbenzene	1.2	U
79-34-5	1,1,2,2-Tetrachloroethane	1.2	U
96-18-4	1,2,3-Trichloropropane	1.2	U
108-86-1	Bromobenzene	1.2	U
103-65-1	n-Propylbenzene	1.2	U
95-49-8	2-Chlorotoluene	1.2	U
108-67-8	1,3,5-Trimethylbenzene	1.2	U
95-63-6	1,2,4-Trimethylbenzene	1.2	U
106-43-4	4-Chlorotoluene	1.2	U
98-06-6	tert-Butylbenzene	1.2	U
135-98-8	sec-Butylbenzene	1.2	U
99-87-6	4-Isopropyltoluene	1.2	U
541-73-1	1,3-Dichlorobenzene	1.2	U
106-46-7	1,4-Dichlorobenzene	1.2	U
104-51-8	n-Butylbenzene	1.2	U
95-50-1	1,2-Dichlorobenzene	1.2	U
96-12-8	1,2-Dibromo-3-chloropropane	1.2	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50320_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529004

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W123

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 14 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:

Number TICs found: 1 (ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN ALKENE	11.40	6.7	J
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50321_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529005

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W113

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 1   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:_______(uL)   Soil Aliquot Volume: _______(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	26.2	
76-13-1	Trichlorotrifluoroethane	5.1	U
74-88-4	Iodomethane	5.1	U
75-15-0	Carbon disulfide	5.1	U
75-09-2	Methylene chloride	5.1	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	7.0	
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.1	U
108-88-3	Toluene	1.3	
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-
50321_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529005

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W113

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 1   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.1	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
----------------	m,p-Xylenes	2.0	U
95-47-6	o-Xylene	1.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	0.67	J
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-
50321_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529005

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W113

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 1 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 1

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN ALKENE	9.26	7.8	J
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50322_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529006

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W114

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 10 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	CONCENTRATION	Q
75-71-8	Dichlorodifluoromethane	1.1	U
74-87-3	Chloromethane	1.1	U
75-01-4	Vinyl chloride	1.1	U
74-83-9	Bromomethane	1.1	U
75-00-3	Chloroethane	1.1	U
75-69-4	Trichlorofluoromethane	1.1	U
75-35-4	1,1-Dichloroethylene	1.1	U
67-64-1	Acetone	5.5	U
76-13-1	Trichlorotrifluoroethane	5.5	U
74-88-4	Iodomethane	5.5	U
75-15-0	Carbon disulfide	5.5	U
75-09-2	Methylene chloride	5.5	U
156-60-5	trans-1,2-Dichloroethylene	1.1	U
75-34-3	1,1-Dichloroethane	1.1	U
78-93-3	2-Butanone	5.5	U
156-59-2	cis-1,2-Dichloroethylene	1.1	U
594-20-7	2,2-Dichloropropane	1.1	U
74-97-5	Bromochloromethane	1.1	U
67-66-3	Chloroform	1.1	U
71-55-6	1,1,1-Trichloroethane	1.1	U
563-58-6	1,1-Dichloropropene	1.1	U
56-23-5	Carbon tetrachloride	1.1	U
107-06-2	1,2-Dichloroethane	1.1	U
71-43-2	Benzene	1.1	U
79-01-6	Trichloroethylene	1.1	U
78-87-5	1,2-Dichloropropane	1.1	U
74-95-3	Dibromomethane	1.1	U
75-27-4	Bromodichloromethane	1.1	U
10061-01-5	cis-1,3-Dichloropropylene	1.1	U
108-10-1	4-Methyl-2-pentanone	5.5	U
108-88-3	Toluene	1.1	U
10061-02-6	trans-1,3-Dichloropropylene	1.1	U
79-00-5	1,1,2-Trichloroethane	1.1	U

FORM I VOA OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50322_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529006

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W114

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 10 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______ (uL) Soil Aliquot Volume: _______ (uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.1	U
591-78-6	2-Hexanone	5.5	U
127-18-4	Tetrachloroethylene	1.1	U
124-48-1	Dibromochloromethane	1.1	U
106-93-4	1,2-Dibromoethane	1.1	U
108-90-7	Chlorobenzene	1.1	U
630-20-6	1,1,1,2-Tetrachloroethane	1.1	U
100-41-4	Ethylbenzene	1.1	U
----------------	m,p-Xylenes	2.2	U
95-47-6	o-Xylene	1.1	U
100-42-5	Styrene	1.1	U
75-25-2	Bromoform	1.1	U
98-82-8	Isopropylbenzene	1.1	U
79-34-5	1,1,2,2-Tetrachloroethane	1.1	U
96-18-4	1,2,3-Trichloropropane	1.1	U
108-86-1	Bromobenzene	1.1	U
103-65-1	n-Propylbenzene	1.1	U
95-49-8	2-Chlorotoluene	1.1	U
108-67-8	1,3,5-Trimethylbenzene	1.1	U
95-63-6	1,2,4-Trimethylbenzene	1.1	U
106-43-4	4-Chlorotoluene	1.1	U
98-06-6	tert-Butylbenzene	1.1	U
135-98-8	sec-Butylbenzene	1.1	U
99-87-6	4-Isopropyltoluene	1.1	U
541-73-1	1,3-Dichlorobenzene	1.1	U
106-46-7	1,4-Dichlorobenzene	1.1	U
104-51-8	n-Butylbenzene	1.1	U
95-50-1	1,2-Dichlorobenzene	1.1	U
96-12-8	1,2-Dibromo-3-chloropropane	1.1	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50322_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529006

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W114

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 10 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 0

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50336_01

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1566S

Matrix: (soil/water) SOIL   Lab Sample ID: 74529007

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W109

Level: (low/med) LOW   Date Received: 02/05/03

% Moisture: not dec. 0   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	4.6	J
76-13-1	Trichlorotrifluoroethane	5.0	U
74-88-4	Iodomethane	5.0	U
75-15-0	Carbon disulfide	5.0	U
75-09-2	Methylene chloride	5.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.0	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50336_01

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529007

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W109

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 0 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
----------------	m,p-Xylenes	2.0	U
95-47-6	o-Xylene	1.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

FORM I VOA OLM03.0

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50336_01

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1566S

Matrix: (soil/water) SOIL Lab Sample ID: 74529007

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W109

Level: (low/med) LOW Date Received: 02/05/03

% Moisture: not dec. 0 Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______(uL) Soil Aliquot Volume: _______(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 0

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50323_1

Lab Name: GENERAL ENGINEERING LABS Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1569S

Matrix: (soil/water) SOIL Lab Sample ID: 74702001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W207

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 5 Date Analyzed: 02/11/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_______(uL) Soil Aliquot Volume: _______(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	5.3	U
76-13-1	112Trichloro122trifluoroetha	5.3	U
74-88-4	Iodomethane	5.3	U
75-15-0	Carbon disulfide	5.3	U
75-09-2	Methylene chloride	5.3	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.3	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.3	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50323_1

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702001

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W207

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 5   Date Analyzed: 02/11/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.3	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
---------	m,p-Xylenes	2.1	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50323_1

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 1569S

Matrix: (soil/water) SOIL Lab Sample ID: 74702001

Sample wt/vol: 5.0 (g/mL) G Lab File ID: 9W207

Level: (low/med) LOW Date Received: 02/07/03

% Moisture: not dec. 5 Date Analyzed: 02/11/03

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:________(uL) Soil Aliquot Volume: ________(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN SILOXANE.	11.23	7.0	J
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50337_1

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702002

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W115

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 1   Date Analyzed: 02/10/03

GC Column: DB-624 ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	4.1	J
76-13-1	112Trichloro122trifluoroetha	5.0	U
74-88-4	Iodomethane	5.0	U
75-15-0	Carbon disulfide	5.0	U
75-09-2	Methylene chloride	5.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.0	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

FORM I VOA   OLM03.0

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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50337_1

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702002

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W115

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 1   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
----------	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50337_1

Lab Name: GENERAL ENGINEERING LABOR   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702002

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W115

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 1   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 0

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50338_1

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W116

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 0   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethylene	1.0	U
67-64-1	Acetone	5.0	U
76-13-1	112Trichloro122trifluoroetha	5.0	U
74-88-4	Iodomethane	5.0	U
75-15-0	Carbon disulfide	5.0	U
75-09-2	Methylene chloride	5.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
594-20-7	2,2-Dichloropropane	1.0	U
74-97-5	Bromochloromethane	1.0	U
67-66-3	Chloroform	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
563-58-6	1,1-Dichloropropene	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-43-2	Benzene	1.0	U
79-01-6	Trichloroethylene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
74-95-3	Dibromomethane	1.0	U
75-27-4	Bromodichloromethane	1.0	U
10061-01-5	cis-1,3-Dichloropropylene	1.0	U
108-10-1	4-Methyl-2-pentanone	5.0	U
108-88-3	Toluene	1.0	U
10061-02-6	trans-1,3-Dichloropropylene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

MD21-03-50338_1

Lab Name: GENERAL ENGINEERING LABS   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W116

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 0   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
142-28-9	1,3-Dichloropropane	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethylene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
108-90-7	Chlorobenzene	1.0	U
630-20-6	1,1,1,2-Tetrachloroethane	1.0	U
100-41-4	Ethylbenzene	1.0	U
95-47-6	o-Xylene	1.0	U
---------	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
75-25-2	Bromoform	1.0	U
98-82-8	Isopropylbenzene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
96-18-4	1,2,3-Trichloropropane	1.0	U
108-86-1	Bromobenzene	1.0	U
103-65-1	n-Propylbenzene	1.0	U
95-49-8	2-Chlorotoluene	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
106-43-4	4-Chlorotoluene	1.0	U
98-06-6	tert-Butylbenzene	1.0	U
135-98-8	sec-Butylbenzene	1.0	U
99-87-6	4-Isopropyltoluene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
104-51-8	n-Butylbenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
96-12-8	1,2-Dibromo-3-chloropropane	1.0	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

MD21-03-50338_1

Lab Name: GENERAL ENGINEERING LABOR   Contract: N/A

Lab Code: N/A   Case No.: N/A   SAS No.: N/A   SDG No.: 1569S

Matrix: (soil/water) SOIL   Lab Sample ID: 74702003

Sample wt/vol: 5.0 (g/mL) G   Lab File ID: 9W116

Level: (low/med) LOW   Date Received: 02/07/03

% Moisture: not dec. 0   Date Analyzed: 02/10/03

GC Column: DB-624   ID: 0.25 (mm)   Dilution Factor: 1.0

Soil Extract Volume:________(uL)   Soil Aliquot Volume: ________(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
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27.				
28.				
29.				
30.				

Attachment 2

TA-54 Waste Characterization Results

LWP#35709
ROLL-OFF BIN

WS 38
HAZ Results
L03158042

ASSAIGAI ANALYTICAL LABORATORIES, INC.

P.O. Box 90430 • Albuquerque, New Mexico 87199 • (505) 345-8964 • FAX (505) 345-7259

3332 Wedgewood, Ste. N • El Paso, Texas 79925 • (915) 593-6000 • FAX (915) 593-7820

127 Eastgate Drive, 212-C • Los Alamos, New Mexico 87544 • (505) 662-2558

Waste Verification Results.

LOS ALAMOS NATIONAL LABS
attn: LOUIS JALBERT
PO BOX 1663 ESH-5 K-494
LOS ALAMOS NM 87545

Explanation of codes

B	analyte detected in Method Blank
E	result is estimated
H	analyzed out of hold time
N	tentatively identified compound
S	subcontracted
1-9	see footnote

STANDARD

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

COPY

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28 Receipt: 03-18-03

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Sample: *L03158042V1* Collected: *03-15-03 9:45:00* By: *LJ*
Matrix: **S**

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303322-01A		SW846 8260B Purgeable VOCs by GC/MS					By:	JAA		
X03135	XG.2003.533.7	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05	1	03-26-03	03-26-03
X03135	XG.2003.533.7	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025	1	03-26-03	03-26-03
X03135	XG.2003.533.7	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025	1	03-26-03	03-26-03
X03135	XG.2003.533.7	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025	1	03-26-03	03-26-03
X03135	XG.2003.533.7	67-64-1	Acetone	ND	mg / Kg	1	0.05	1	03-26-03	03-26-03
X03135	XG.2003.533.7	107-02-8	Acrolein	ND	mg / Kg	1	0.1	1	03-26-03	03-26-03
X03135	XG.2003.533.7	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1	1	03-26-03	03-26-03
X03135	XG.2003.533.7	71-43-2	Benzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03
X03135	XG.2003.533.7	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28 Receipt: 03-18-03

Sample: *L03158042V1* Collected: *03-15-03 9:45:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303322-01A		**SW846 8260B Purgeable VOCs by GC/MS**					By:	JAA		
X03135	XG.2003.533.7	75-25-2	Bromoform	ND	mg / Kg	1	0.005	1	03-26-03	03-26
X03135	XG.2003.533.7	74-83-9	Bromomethane	ND	mg / Kg	1	0.025	1	03-26-03	03-26
X03135	XG.2003.533.7	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025	1	03-26-03	03-26
X03135	XG.2003.533.7	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005	1	03-26-03	03-26
X03135	XG.2003.533.7	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-26
X03135	XG.2003.533.7	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005	1	03-26-03	03-26
X03135	XG.2003.533.7	75-00-3	Chloroethane	ND	mg / Kg	1	0.025	1	03-26-03	03-26
X03135	XG.2003.533.7	67-66-3	Chloroform	ND	mg / Kg	1	0.005	1	03-26-03	03-26
X03135	XG.2003.533.7	74-87-3	Chloromethane	ND	mg / Kg	1	0.025	1	03-26-03	03-2
X03135	XG.2003.533.7	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025	1	03-26-03	03-2
X03135	XG.2003.533.7	100-41-4	Ethylbenzene	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7		Freon 113	ND	mg / Kg	1	0.035	1	03-26-03	03-2
X03135	XG.2003.533.7	75-71-8	Freon 12	ND	mg / Kg	1	0.05	1	03-26-03	03-2
X03135	XG.2003.533.7	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05	1	03-26-03	03-2
X03135	XG.2003.533.7	91-20-3	Naphthalene	ND	mg / Kg	1	0.025	1	03-26-03	03-2
X03135	XG.2003.533.7	95-47-6	o-Xylene	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg	1	0.01	1	03-26-03	03-2
X03135	XG.2003.533.7	100-42-5	Styrene	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005	1	03-26-03	03-2
X03135	XG.2003.533.7	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005	1	03-26-03	03-
X03135	XG.2003.533.7	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005	1	03-26-03	03-
X03135	XG.2003.533.7	108-88-3	Toluene	ND	mg / Kg	1	0.005	1	03-26-03	03-
X03135	XG.2003.533.7	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005	1	03-26-03	03-
X03135	XG.2003.533.7	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025	1	03-26-03	03-
X03135	XG.2003.533.7	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025	1	03-26-03	03-
X03135	XG.2003.533.7	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01	1	03-26-03	03-

Sample: *L03158042V2* Collected: *03-15-03 9:45:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303322-02A		**SW846 8260B Purgeable VOCs by GC/MS**					By:	JAA		
X03135	XG.2003.533.8	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03
X03135	XG.2003.533.8	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005	1	03-26-03	03
X03135	XG.2003.533.8	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03
X03135	XG.2003.533.8	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03
X03135	XG.2003.533.8	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005	1	03-26-03	03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28 Receipt: 03-18-03

Sample: *L03158042SV* Collected: *03-15-03 9:45:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303322-04A		SW846 3550A/8270B SVOCs by GC/MS					By:	DS		
X03111	XG.2003.486.11	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	91-58-7	2-Chloronaphthalene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	95-57-8	2-Chlorophenol	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	91-57-6	2-Methylnaphthalene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	95-48-7	2-Methylphenol	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	88-74-4	2-Nitroaniline	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	88-75-5	2-Nitrophenol	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11		3+4 Methylphenol	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	99-09-2	3-Nitroaniline	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	106-47-8	4-Chloroaniline	ND	mg / Kg	1	0.3		03-20-03	[illegible]
X03111	XG.2003.486.11	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg	1	0.03		03-20-03	[illegible]
X03111	XG.2003.486.11	100-01-6	4-Nitroaniline	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	100-02-7	4-Nitrophenol	ND	mg / Kg	1	0.6		03-20-03	03-20-03
X03111	XG.2003.486.11	83-32-9	Acenaphthene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	208-96-8	Acenaphthylene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	62-53-3	Aniline	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	120-12-7	Anthracene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	56-55-3	Benzo (a) anthracene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	50-32-8	Benzo(a)pyrene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11		Benzo(b & k)fluoranthene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	64-85-0	Benzoic acid	ND	mg / Kg	1	3		03-20-03	03-20-03
X03111	XG.2003.486.11	100-51-6	Benzyl alcohol	ND	mg / Kg	1	1.5		03-20-03	03-20-03
X03111	XG.2003.486.11	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	85-68-7	Butylbenzylphthalate	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	218-01-9	Chrysene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	132-64-9	Dibenzofuran	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	84-66-2	Diethylphthalate	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	131-11-3	Dimethylphthalate	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	84-74-2	di-n-Butylphthalate	ND	mg / Kg	1	0.3		03-20-03	[illegible]
X03111	XG.2003.486.11	117-84-0	di-n-Octylphthalate	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	206-44-0	Fluoranthene	ND	mg / Kg	1	0.03		03-20-03	03-20-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28 Receipt: 03-18-03

Sample: *L03158042SV* Collected: *03-15-03 9:45:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303322-04A		SW846 3550A/8270B SVOCs by GC/MS					By:	DS		
X03111	XG.2003.486.11	86737	Fluorene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	118-74-1	Hexachlorobenzene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	87-68-3	Hexachlorobutadiene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg	1	1.5		03-20-03	03-20-03
X03111	XG.2003.486.11	67-72-1	Hexachloroethane	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	78-59-1	Isophorone	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	91-20-3	Naphthalene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	98-95-3	Nitrobenzene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	87-86-5	Pentachlorophenol	ND	mg / Kg	1	0.3		03-20-03	03-20-03
X03111	XG.2003.486.11	85-01-8	Phenanthrene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
[illegible]11	XG.2003.486.11	108-95-2	Phenol	ND	mg / Kg	1	0.3		03-20-03	03-20-03
[illegible]11	XG.2003.486.11	129-00-0	Pyrene	ND	mg / Kg	1	0.03		03-20-03	03-20-03
X03111	XG.2003.486.11	110-86-1	Pyridine	ND	mg / Kg	1	0.3		03-20-03	03-20-03

Unless otherwise noted, all samples were received in acceptable condition and all sampling was performed by client or client representative. Sample result of ND indicates Not Detected, ie result is less than the sample specific Detection Limit. Sample specific Detection Limit is determined by multiplying the sample Dilution Factor by the listed Reporting Detection Limit. All results relate only to the items tested. Any miscellaneous workorder information or foonotes will appear below.

1 Sample was received with headspace.

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *LCS: Lab Control Spike* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-002**		
XG.2003.486.2	120-82-1	1,2,4-Trichlorobenzene	80	% Recovery	64 - 103	1	NA		03-12-03
XG.2003.486.2	106-46-7	1,4-Dichlorobenzene	79	% Recovery	66 - 97	1	NA		03-12-03
XG.2003.486.2	121-14-2	2,4-Dinitrotoluene	84	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.2	95-57-8	2-Chlorophenol	82	% Recovery	72 - 102	1	NA		03-12-03
XG.2003.486.2	59-50-7	4-Chloro-3-methylphenol	88	% Recovery	67 - 110	1	NA		03-12-03
XG.2003.486.2	100-02-7	4-Nitrophenol	84	% Recovery	56 - 122	1	NA		03-12-03
XG.2003.486.2	83-32-9	Acenaphthene	81	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.2	117-84-0	di-n-Octylphthalate	93	% Recovery	69 - 127	1	NA		03-12-03
XG.2003.486.2	621-64-7	n-Nitroso-di-n-propylamine	83	% Recovery	64 - 111	1	NA		03-12-03
XG.2003.486.2	87-86-5	Pentachlorophenol	85	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.2	108-95-2	Phenol	81	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.2	129-00-0	Pyrene	91	% Recovery	69 - 117	1	NA		03-12-03
X03135		**SW846 8260B Purgeable VOCs by GC/MS**					**X03135-002**		
XG.2003.533.5	75-35-4	1,1 Dichloroethene	124	% Recovery	59 - 172	1	NA		03-26-03
XG.2003.533.5	106-46-7	1,4 Dichlorobenzene	109	% Recovery	60 - 133	1	NA		03-26-03
XG.2003.533.5	71-43-2	Benzene	112	% Recovery	66 - 142	1	NA		[illegible]3
XG.2003.533.5	108-90-7	Chlorobenzene	115	% Recovery	60 - 133	1	NA		03-26-03
XG.2003.533.5	108-88-3	Toluene	112	% Recovery	59 - 139	1	NA		03-28-03
XG.2003.533.5	79-01-6	Trichloroethene	112	% Recovery	62 - 137	1	NA		03-26-03

Type: *LCS: Lab Control Spike* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-003**		
MT.2003.351.35	7440-38-2	Arsenic	85	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.35	7440-39-3	Barium	99	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.35	7440-43-9	Cadmium	102	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.35	7440-47-3	Chromium	105	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.35	7439-92-1	Lead	105	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.35	7782-49-2	Selenium	86	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.35	7440-22-4	Silver	97	% Recovery	80 - 120	1	NA		03-26-03
M03385		**SW846 1311/7470 CVAA TCLP**					**M03385-002**		
MT.2003.360.28	7439-97-6	Mercury	109	% Recovery	80 - 120	1	NA		03-28-03

Type: *LCSD: Lab Control Spike Duplicate Precision* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-003**		
XG.2003.486.3	120-82-1	1,2,4-Trichlorobenzene	2	RPD	0 - 11	1	NA		[illegible]2-03
XG.2003.486.3	106-46-7	1,4-Dichlorobenzene	2	RPD	0 - 73	1	NA		03-12-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

nt: LOS ALAMOS NATIONAL LABS
ject: 7D38 C351 0606 0400
Order. 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *LCSD: Lab Control Spike Duplicate Precision* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-003**		
XG.2003.486.3	121-14-2	2,4-Dinitrotoluene	5	RPD	0 - 17	1	NA		03-12-03
XG.2003.486.3	95-57-8	2-Chlorophenol	< 1	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.3	59-50-7	4-Chloro-3-methylphenol	< 1	RPD	0 - 13	1	NA		03-12-03
XG.2003.486.3	100-02-7	4-Nitrophenol	4	RPD	0 - 12	1	NA		03-12-03
XG.2003.486.3	83-32-9	Acenaphthene	< 1	RPD	0 - 12	1	NA		03-12-03
XG.2003.486.3	117-84-0	di-n-Octylphthalate	4	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.3	621-64-7	n-Nitroso-di-n-propylamine	1	RPD	0 - 10	1	NA		03-12-03
XG.2003.486.3	87-86-5	Pentachlorophenol	5	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.3	108-95-2	Phenol	< 1	RPD	0 - 9	1	NA		03-12-03
XG.2003.486.3	129-00-0	Pyrene	4	RPD	0 - 11	1	NA		03-12-03
X03135		**SW846 8260B Purgeable VOCs by GC/MS**					**X03135-003**		
XG.2003.533.6	75-35-4	1,1 Dichloroethene	7	RPD	0 - 22	1	NA		03-26-03
XG.2003.533.6	106-46-7	1,4 Dichlorobenzene	8	RPD	0 - 21	1	NA		03-26-03
XG.2003.533.6	71-43-2	Benzene	6	RPD	0 - 21	1	NA		03-26-03
XG.2003.533.6	108-90-7	Chlorobenzene	2	RPD	0 - 21	1	NA		03-26-03
2003.533.6	108-88-3	Toluene	3	RPD	0 - 21	1	NA		03-26-03
2003.533.6	79-01-6	Trichloroethene	6	RPD	0 - 24	1	NA		03-26-03

Type: *LCSD: Lab Control Spike Duplicate Precision* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-004**		
MT.2003.351.36	7440-38-2	Arsenic	2	RPD	0 - 20	1	NA		03-26-03
MT.2003.351.36	7440-39-3	Barium	2	RPD	0 - 20	1	NA		03-26-03
MT.2003.351.36	7440-43-9	Cadmium	4	RPD	0 - 20	1	NA		03-26-03
MT.2003.351.36	7440-47-3	Chromium	4	RPD	0 - 20	1	NA		03-26-03
MT.2003.351.36	7439-92-1	Lead	5	RPD	0 - 20	1	NA		03-26-03
MT.2003.351.36	7782-49-2	Selenium	4	RPD	0 - 20	1	NA		03-26-03
MT.2003.351.36	7440-22-4	Silver	1	RPD	0 - 20	1	NA		03-26-03
M03385		**SW846 1311/7470 CVAA TCLP**					**M03385-003**		
MT.2003.360.29	7439-97-6	Mercury	< 1	RPD	0 - 20	1	NA		03-28-03

Type: *LCSD: Lab Control Spike Duplicate Accuracy* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-003**		
XG.2003.486.3	120-82-1	1,2,4-Trichlorobenzene	82	% Recovery	64 - 103	1	NA		03-12-03
2003.486.3	106-46-7	1,4-Dichlorobenzene	78	% Recovery	66 - 97	1	NA		03-12-03
2003.486.3	121-14-2	2,4-Dinitrotoluene	89	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.3	95-57-8	2-Chlorophenol	82	% Recovery	72 - 102	1	NA		03-12-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes
D Not applicable due to sample dilution
L Not applicable due to MDL proximity

Type: *LCSD: Lab Control Spike Duplicate Accuracy* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-003		
XG.2003.486.3	59-50-7	4-Chloro-3-methylphenol	88	% Recovery	67 - 110	1	NA		03-12-03
XG.2003.486.3	100-02-7	4-Nitrophenol	88	% Recovery	56 - 122	1	NA		03-12-03
XG.2003.486.3	83-32-9	Acenaphthene	82	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.3	117-84-0	di-n-Octylphthalate	97	% Recovery	69 - 127	1	NA		03-12-03
XG.2003.486.3	621-64-7	n-Nitroso-di-n-propylamine	84	% Recovery	64 - 111	1	NA		03-12-03
XG.2003.486.3	87-86-5	Pentachlorophenol	89	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.3	108-95-2	Phenol	80	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.3	129-00-0	Pyrene	95	% Recovery	69 - 117	1	NA		03-12-03
X03135		SW846 8260B Purgeable VOCs by GC/MS					X03135-003		
XG.2003.533.6	75-35-4	1,1 Dichloroethene	116	% Recovery	59 - 172	1	NA		03-26-03
XG.2003.533.6	106-46-7	1,4 Dichlorobenzene	101	% Recovery	60 - 133	1	NA		03-26-03
XG.2003.533.6	71-43-2	Benzene	105	% Recovery	66 - 142	1	NA		03-26-03
XG.2003.533.6	108-90-7	Chlorobenzene	112	% Recovery	60 - 133	1	NA		03-26-03
XG.2003.533.6	108-88-3	Toluene	109	% Recovery	59 - 139	1	NA		03-26-03
XG.2003.533.6	79-01-6	Trichloroethene	106	% Recovery	62 - 137	1	NA		03-26-03

Type: *LCSD: Lab Control Spike Duplicate Accuracy* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		SW846 1311/3010A/6010A ICP TCLP					M03371-004		
MT.2003.351.36	7440-38-2	Arsenic	86	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.36	7440-39-3	Barium	101	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.36	7440-43-9	Cadmium	107	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.36	7440-47-3	Chromium	109	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.36	7439-92-1	Lead	111	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.36	7782-49-2	Selenium	90	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.36	7440-22-4	Silver	99	% Recovery	80 - 120	1	NA		03-26-03
M03385		SW846 1311/7470 CVAA TCLP					M03385-003		
MT.2003.360.29	7439-97-6	Mercury	109	% Recovery	80 - 120	1	NA		03-28-03

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-001		
XG.2003.486.1	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		[illegible]03
XG.2003.486.1	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		[illegible]2-03
XG.2003.486.1	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-12-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order. 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-001		
XG.2003.486.1	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-12-03
XG.2003.486.1	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-12-03
XG.2003.486.1	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-12-03
XG.2003.486.1	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-12-03
XG.2003.486.1	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		03-12-03

STANDARD

Assaigal Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-001		
XG.2003.486.1	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	86737	Fluorene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-12-03
XG.2003.486.1	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		[illegible]3
XG.2003.486.1	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		[illegible]-03
XG.2003.486.1	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-12-03
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-007		
XG.2003.486.7	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-19-03
XG.2003.486.7	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-19-03
XG.2003.486.7	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		[illegible]-03
XG.2003.486.7	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		[illegible]9-03
XG.2003.486.7		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-19-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

t: LOS ALAMOS NATIONAL LABS
roject: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-007**		
XG.2003.486.7	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-19-03
XG.2003.486.7	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		03-19-03
2003.486.7	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-19-03
003.486.7		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-19-03
XG.2003.486.7	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-19-03
XG.2003.486.7	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	86737	Fluorene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-19-03
XG.2003.486.7	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-19-03
2003.486.7	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-19-03
2003.486.7	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-19-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes

D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-007**		
XG.2003.486.7	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-19-03
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-010**		
XG.2003.486.10	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-20-03
XG.2003.486.10	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		[illegible]3
XG.2003.486.10	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-20-03
XG.2003.486.10	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-20-03
XG.2003.486.10	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		[illegible]03
XG.2003.486.10	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		03-20-03

Assaigal Analytical Laboratories, Inc.

Quality Control Summary

t:	LOS ALAMOS NATIONAL LABS
roject:	7D38 C351 0606 0400
Order.	0303322 LOS28

Explanation of codes

D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-010**		
XG.2003.486.10	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-20-03
XG.2003.486.10	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-20-03
XG.2003.486.10	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-20-03
003.486.10	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-20-03
003.486.10	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	86737	Fluorene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-20-03
XG.2003.486.10	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-20-03
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-012**		
XG.2003.499.1	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		03-25-03
003.499.1	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		03-25-03
.2003.499.1	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-25-03
XG.2003.499.1	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-25-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-012		
XG.2003.499.1	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-25-03
XG.2003.499.1	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		[illegible]-03
XG.2003.499.1	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		[illegible]03
XG.2003.499.1	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-25-03
XG.2003.499.1	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-25-03
XG.2003.499.1	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-25-03
XG.2003.499.1	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-25-03
XG.2003.499.1	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-25-03
XG.2003.499.1	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		[illegible]-03
XG.2003.499.1	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		[illegible]-25-03
XG.2003.499.1	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-25-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes

D	Not applicable due to sample dilutior
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-012		
XG.2003.499.1	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-25
XG.2003.499.1	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-25
XG.2003.499.1	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-25
XG.2003.499.1	86737	Fluorene	ND	mg / Kg		1	0.03		03-25
XG.2003.499.1	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-25
XG.2003.499.1	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-2
XG.2003.499.1	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-2
XG.2003.499.1	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-2
XG.2003.499.1	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		03-2
XG.2003.499.1	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-2
XG.2003.499.1	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-2
XG.2003.499.1	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-2
X03135		SW846 8260B Purgeable VOCs by GC/MS					X03135-001		
XG.2003.533.4	75-34-3	1,1 Dichloroethane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	75-35-4	1,1 Dichloroethene	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	78-87-5	1,2 Dichloropropane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg		1	0.005		03-
XG.2003.533.4	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg		1	0.005		03
XG.2003.533.4	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg		1	0.005		03
XG.2003.533.4	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg		1	0.05		03
XG.2003.533.4	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg		1	0.005		03
XG.2003.533.4	78-93-3	2-Butanone (MEK)	ND	mg / Kg		1	0.025		03
XG.2003.533.4	591-78-6	2-Hexanone (MBK)	ND	mg / Kg		1	0.025		03
XG.2003.533.4	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg		1	0.025		03
XG.2003.533.4	67-64-1	Acetone	ND	mg / Kg		1	0.05		03
XG.2003.533.4	107-02-8	Acrolein	ND	mg / Kg		1	0.1		03
XG.2003.533.4	107-13-1	Acrylonitrile	ND	mg / Kg		1	0.1		03

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303322 LOS28

Explanation of codes

D Not applicable due to sampl[illegible]on

L Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

X03135 SW846 8260B Purgeable VOCs by GC/MS **X03135-001**

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
XG.2003.533.4	71-43-2	Benzene	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	75-27-4	Bromodichloromethane	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	75-25-2	Bromoform	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	74-83-9	Bromomethane	ND	mg / Kg		1	0.025		03-26-
XG.2003.533.4	75-15-0	Carbon disulfide	ND	mg / Kg		1	0.025		03-26-
XG.2003.533.4	56-23-5	Carbon tetrachloride	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	108-90-7	Chlorobenzene	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	124-48-1	Chlorodibromomethane	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	75-00-3	Chloroethane	ND	mg / Kg		1	0.025		03-26-
XG.2003.533.4	67-66-3	Chloroform	ND	mg / Kg		1	0.005		03-26-
XG.2003.533.4	74-87-3	Chloromethane	ND	mg / Kg		1	0.025		03-26-
XG.2003.533.4	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg		1	0.005		03-26
XG.2003.533.4		cis-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-26
XG.2003.533.4	74-95-3	Dibromomethane	ND	mg / Kg		1	0.005		03-26
XG.2003.533.4	97-63-2	Ethyl methacrylate	ND	mg / Kg		1	0.025		03-26
XG.2003.533.4	100-41-4	Ethylbenzene	ND	mg / Kg		1	0.005		03-26
XG.2003.533.4		Freon 113	ND	mg / Kg		1	0.035		03-26
XG.2003.533.4	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg		1	0.005		-26
XG.2003.533.4	75-09-2	Methylene chloride	ND	mg / Kg		1	0.05		03-26
XG.2003.533.4	91-20-3	Naphthalene	ND	mg / Kg		1	0.025		03-26
XG.2003.533.4	95-47-6	o-Xylene	ND	mg / Kg		1	0.005		03-26
XG.2003.533.4	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg		1	0.01		03-26
XG.2003.533.4	100-42-5	Styrene	ND	mg / Kg		1	0.005		03-26
XG.2003.533.4	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.4	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.4	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg		1	0.005		03-2
XG.2003.533.4	108-88-3	Toluene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.4	79-01-6	Trichloroethene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.4	75-69-4	Trichlorofluoromethane	ND	mg / Kg		1	0.025		03-2
XG.2003.533.4	108-05-4	Vinyl acetate	ND	mg / Kg		1	0.025		03-2
XG.2003.533.4	75-01-4	Vinyl chloride	ND	mg / Kg		1	0.01		03-2

X03135 SW846 8260B Purgeable VOCs by GC/MS **X03135-012**

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
XG.2003.533.24	75-34-3	1,1 Dichloroethane	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	75-35-4	1,1 Dichloroethene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	78-87-5	1,2 Dichloropropane	ND	mg / Kg		1	0.005		03-2
XG.2003.533.24	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg		1	0.005		03-2

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		SW846 8260B Purgeable VOCs by GC/MS					X03135-012		
XG.2003.533.24	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg		1	0.005		03-27-0:
XG.2003.533.24	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg		1	0.005		03-27-0:
XG.2003.533.24	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg		1	0.005		03-27-0
XG.2003.533.24	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg		1	0.05		03-27-0
XG.2003.533.24	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg		1	0.005		03-27-0
XG.2003.533.24	78-93-3	2-Butanone (MEK)	ND	mg / Kg		1	0.025		03-27-0
XG.2003.533.24	591-78-6	2-Hexanone (MBK)	ND	mg / Kg		1	0.025		03-27-0
XG.2003.533.24	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg		1	0.025		03-27-0
XG.2003.533.24	67-64-1	Acetone	ND	mg / Kg		1	0.05		03-27-C
XG.2003.533.24	107-02-8	Acrolein	ND	mg / Kg		1	0.1		03-27-C
XG.2003.533.24	107-13-1	Acrylonitrile	ND	mg / Kg		1	0.1		03-27-C
XG.2003.533.24	71-43-2	Benzene	ND	mg / Kg		1	0.005		03-27-C
XG.2003.533.24	75-27-4	Bromodichloromethane	ND	mg / Kg		1	0.005		03-27-(
XG.2003.533.24	75-25-2	Bromoform	ND	mg / Kg		1	0.005		03-27-(
XG.2003.533.24	74-83-9	Bromomethane	ND	mg / Kg		1	0.025		03-27-(
XG.2003.533.24	75-15-0	Carbon disulfide	ND	mg / Kg		1	0.025		03-27-(
XG.2003.533.24	56-23-5	Carbon tetrachloride	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24	108-90-7	Chlorobenzene	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24	124-48-1	Chlorodibromomethane	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24	75-00-3	Chloroethane	ND	mg / Kg		1	0.025		03-27-
XG.2003.533.24	67-66-3	Chloroform	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24	74-87-3	Chloromethane	ND	mg / Kg		1	0.025		03-27-
XG.2003.533.24	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24		cis-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24	74-95-3	Dibromomethane	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24	97-63-2	Ethyl methacrylate	ND	mg / Kg		1	0.025		03-27-
XG.2003.533.24	100-41-4	Ethylbenzene	ND	mg / Kg		1	0.005		03-27-
XG.2003.533.24		Freon 113	ND	mg / Kg		1	0.035		03-27-
XG.2003.533.24	75-71-8	Freon 12	ND	mg / Kg		1	0.05		03-27-
XG.2003.533.24	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	75-09-2	Methylene chloride	ND	mg / Kg		1	0.05		03-27
XG.2003.533.24	91-20-3	Naphthalene	ND	mg / Kg		1	0.025		03-27
XG.2003.533.24	95-47-6	o-Xylene	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg		1	0.01		03-27
XG.2003.533.24	100-42-5	Styrene	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	108-88-3	Toluene	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	79-01-6	Trichloroethene	ND	mg / Kg		1	0.005		03-27
XG.2003.533.24	75-69-4	Trichlorofluoromethane	ND	mg / Kg		1	0.025		03-27
XG.2003.533.24	108-05-4	Vinyl acetate	ND	mg / Kg		1	0.025		03-27
XG.2003.533.24	75-01-4	Vinyl chloride	ND	mg / Kg		1	0.01		03-27

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

X03135 SW846 8260B Purgeable VOCs by GC/MS X03135-022

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
XG.2003.533.37	75-34-3	1,1 Dichloroethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	75-35-4	1,1 Dichloroethene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	78-87-5	1,2 Dichloropropane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg		1	0.05		03-28-03
XG.2003.533.37	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg		1	0.005		[illegible]8-03
XG.2003.533.37	78-93-3	2-Butanone (MEK)	ND	mg / Kg		1	0.025		[illegible]-03
XG.2003.533.37	591-78-6	2-Hexanone (MBK)	ND	mg / Kg		1	0.025		03-28-03
XG.2003.533.37	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg		1	0.025		03-28-03
XG.2003.533.37	67-64-1	Acetone	ND	mg / Kg		1	0.05		03-28-03
XG.2003.533.37	107-02-8	Acrolein	ND	mg / Kg		1	0.1		03-28-03
XG.2003.533.37	107-13-1	Acrylonitrile	ND	mg / Kg		1	0.1		03-28-03
XG.2003.533.37	71-43-2	Benzene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	75-27-4	Bromodichloromethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	75-25-2	Bromoform	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	74-83-9	Bromomethane	ND	mg / Kg		1	0.025		03-28-03
XG.2003.533.37	75-15-0	Carbon disulfide	ND	mg / Kg		1	0.025		03-28-03
XG.2003.533.37	56-23-5	Carbon tetrachloride	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	108-90-7	Chlorobenzene	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	124-48-1	Chlorodibromomethane	ND	mg / Kg		1	0.005		03-28-03
XG.2003.533.37	75-00-3	Chloroethane	ND	mg / Kg		1	0.025		03-28-0
XG.2003.533.37	67-66-3	Chloroform	ND	mg / Kg		1	0.005		03-28-0
XG.2003.533.37	74-87-3	Chloromethane	ND	mg / Kg		1	0.025		03-28-0
XG.2003.533.37	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg		1	0.005		03-28-0
XG.2003.533.37		cis-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-28-0
XG.2003.533.37	74-95-3	Dibromomethane	ND	mg / Kg		1	0.005		03-28-0
XG.2003.533.37	97-63-2	Ethyl methacrylate	ND	mg / Kg		1	0.025		03-28-0
XG.2003.533.37	100-41-4	Ethylbenzene	ND	mg / Kg		1	0.005		03-28-0
XG.2003.533.37		Freon 113	ND	mg / Kg		1	0.035		03-28-0
XG.2003.533.37	75-71-8	Freon 12	ND	mg / Kg		1	0.05		03-28-0
XG.2003.533.37	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg		1	0.005		03-28-0
XG.2003.533.37	75-09-2	Methylene chloride	ND	mg / Kg		1	0.05		[illegible]28-0
XG.2003.533.37	91-20-3	Naphthalene	ND	mg / Kg		1	0.025		03-28-0
XG.2003.533.37	95-47-6	o-Xylene	ND	mg / Kg		1	0.005		03-28-0

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes

D	Not applicable due to sample dilutio
L	Not applicable due to MDL proximit

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**SW846 8260B Purgeable VOCs by GC/MS**					**X03135-022**		
XG.2003.533.37	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg		1	0.01		03-2
XG.2003.533.37	100-42-5	Styrene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.37	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.37	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.37	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg		1	0.005		03-2
XG.2003.533.37	108-88-3	Toluene	0.005	mg / Kg		1	0.005		03-2
XG.2003.533.37	79-01-6	Trichloroethene	ND	mg / Kg		1	0.005		03-2
XG.2003.533.37	75-69-4	Trichlorofluoromethane	ND	mg / Kg		1	0.025		03-2
XG.2003.533.37	108-05-4	Vinyl acetate	ND	mg / Kg		1	0.025		03-2
XG.2003.533.37	75-01-4	Vinyl chloride	ND	mg / Kg		1	0.01		03-2
X03135		**SW846 8260B Purgeable VOCs by GC/MS**					**X03135-028**		
XG.2003.533.43	108-88-3	Toluene	ND	mg / Kg		40	0.005		03-2

Type: *MB: Method Blank* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-001**		
MT.2003.351.33	7440-38-2	Arsenic	ND	mg / L		1	0.1		03-
MT.2003.351.33	7440-39-3	Barium	ND	mg / L		1	0.1		03-
MT.2003.351.33	7440-43-9	Cadmium	ND	mg / L		1	0.02		03-
MT.2003.351.33	7440-47-3	Chromium	ND	mg / L		1	0.02		03-
MT.2003.351.33	7439-92-1	Lead	ND	mg / L		1	0.05		03-
MT.2003.351.33	7782-49-2	Selenium	ND	mg / L		1	0.05		03-
MT.2003.351.33	7440-22-4	Silver	ND	mg / L		1	0.04		03-
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-002**		
MT.2003.351.34	7440-38-2	Arsenic	ND	mg / L		1	0.1		03-
MT.2003.351.34	7440-39-3	Barium	ND	mg / L		1	0.1		03-
MT.2003.351.34	7440-43-9	Cadmium	ND	mg / L		1	0.02		03-
MT.2003.351.34	7440-47-3	Chromium	ND	mg / L		1	0.02		03-
MT.2003.351.34	7439-92-1	Lead	ND	mg / L		1	0.05		03-
MT.2003.351.34	7782-49-2	Selenium	ND	mg / L		1	0.05		03-
MT.2003.351.34	7440-22-4	Silver	ND	mg / L		1	0.04		03-
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-013**		
MT.2003.351.47	7440-38-2	Arsenic	ND	mg / L		1	0.1		03
MT.2003.351.47	7440-39-3	Barium	ND	mg / L		1	0.1		03
MT.2003.351.47	7440-43-9	Cadmium	ND	mg / L		1	0.02		03
MT.2003.351.47	7440-47-3	Chromium	ND	mg / L		1	0.02		03
MT.2003.351.47	7439-92-1	Lead	ND	mg / L		1	0.05		03
MT.2003.351.47	7782-49-2	Selenium	ND	mg / L		1	0.05		03
MT.2003.351.47	7440-22-4	Silver	ND	mg / L		1	0.04		03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to samp[illegible]tion
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03385		SW846 1311/7470 CVAA TCLP					M03385-001		
MT.2003.360.58	7439-97-6	Mercury	ND	mg / L		1	0.0002		03-28-
M03385		SW846 1311/7470 CVAA TCLP					M03385-014		
MT.2003.360.42	7439-97-6	Mercury	ND	mg / L		1	0.0002		03-28-
M03385		SW846 1311/7470 CVAA TCLP					M03385-021		
MT.2003.360.51	7439-97-6	Mercury	ND	mg / L		1	0.0002		03-28-

Type: *MS: Matrix Spike* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-005		
XG.2003.486.5	120-82-1	1,2,4-Trichlorobenzene	90	% Recovery	64 - 103	1	NA		03-12
XG.2003.486.5	106-46-7	1,4-Dichlorobenzene	89	% Recovery	66 - 97	1	NA		03-12
XG.2003.486.5	121-14-2	2,4-Dinitrotoluene	95	% Recovery	61 - 118	1	NA		03-12
XG.2003.486.5	95-57-8	2-Chlorophenol	91	% Recovery	72 - 102	1	NA		03-12
XG.2003.486.5	59-50-7	4-Chloro-3-methylphenol	94	% Recovery	67 - 110	1	NA		3-12
XG.2003.486.5	100-02-7	4-Nitrophenol	81	% Recovery	56 - 122	1	NA		03-12
XG.2003.486.5	83-32-9	Acenaphthene	84	% Recovery	72 - 109	1	NA		03-12
XG.2003.486.5	117-84-0	di-n-Octylphthalate	132	% Recovery	69 - 127	1	NA		03-12
XG.2003.486.5	621-64-7	n-Nitroso-di-n-propylamine	90	% Recovery	64 - 111	1	NA		03-12
XG.2003.486.5	87-86-5	Pentachlorophenol	80	% Recovery	64 - 105	1	NA		03-12
XG.2003.486.5	108-95-2	Phenol	88	% Recovery	66 - 98	1	NA		03-12
XG.2003.486.5	129-00-0	Pyrene	116	% Recovery	69 - 117	1	NA		03-12
X03135		SW846 8260B Purgeable VOCs by GC/MS					X03135-006		
XG.2003.533.9	75-35-4	1,1 Dichloroethene	119	% Recovery	59 - 172	1	NA		03-20
XG.2003.533.9	106-46-7	1,4 Dichlorobenzene	94	% Recovery	60 - 133	1	NA		03-20
XG.2003.533.9	71-43-2	Benzene	110	% Recovery	66 - 142	1	NA		03-2
XG.2003.533.9	108-90-7	Chlorobenzene	106	% Recovery	60 - 133	1	NA		03-2
XG.2003.533.9	108-88-3	Toluene	110	% Recovery	59 - 139	1	NA		03-2
XG.2003.533.9	79-01-6	Trichloroethene	106	% Recovery	62 - 137	1	NA		03-2

Type: *MS: Matrix Spike* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		SW846 1311/3010A/6010A ICP TCLP					M03371-006		
MT.2003.351.38	7440-38-2	Arsenic	96	% Recovery	80 - 120	1	NA		03-2
MT.2003.351.38	7440-39-3	Barium	106	% Recovery	80 - 120	1	NA		03-2
MT.2003.351.38	7440-43-9	Cadmium	110	% Recovery	80 - 120	1	NA		03-2
MT.2003.351.38	7440-47-3	Chromium	114	% Recovery	80 - 120	1	NA		03-2
MT.2003.351.38	7439-92-1	Lead	116	% Recovery	80 - 120	1	NA		03-2
MT.2003.351.38	7782-49-2	Selenium	83	% Recovery	80 - 120	1	NA		03-2

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: **MS: Matrix Spike** Matrix: **TCLP**

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-006**		
MT.2003.351.38	7440-22-4	Silver	102	% Recovery	80 - 120	1	NA		03-26
M03385		**SW846 1311/7470 CVAA TCLP**					**M03385-005**		
MT.2003.360.33	7439-97-6	Mercury	97	% Recovery	80 - 120	1	NA		03-28

Type: **MSD: Matrix Spike Duplicate Precision** Matrix: **SOLID**

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-006**		
XG.2003.486.6	120-82-1	1,2,4-Trichlorobenzene	7	RPD	0 - 16	1	NA		03-12
XG.2003.486.6	106-46-7	1,4-Dichlorobenzene	12	RPD	0 - 15	1	NA		03-12
XG.2003.486.6	121-14-2	2,4-Dinitrotoluene	6	RPD	0 - 12	1	NA		03-1:
XG.2003.486.6	95-57-8	2-Chlorophenol	9	RPD	0 - 11	1	NA		03-1:
XG.2003.486.6	59-50-7	4-Chloro-3-methylphenol	4	RPD	0 - 8	1	NA		03-1:
XG.2003.486.6	100-02-7	4-Nitrophenol	34	RPD	0 - 9	1	NA		03-1:
XG.2003.486.6	83-32-9	Acenaphthene	3	RPD	0 - 16	1	NA		03-1:
XG.2003.486.6	117-84-0	di-n-Octylphthalate	11	RPD	0 - 20	1	NA		03-1:
XG.2003.486.6	621-64-7	n-Nitroso-di-n-propylamine	9	RPD	0 - 10	1	NA		03-1
XG.2003.486.6	87-86-5	Pentachlorophenol	8	RPD	0 - 10	1	NA		03-1
XG.2003.486.6	108-95-2	Phenol	13	RPD	0 - 9	1	NA		03-1
XG.2003.486.6	129-00-0	Pyrene	13	RPD	0 - 7	1	NA		03-1
X03135		**SW846 8260B Purgeable VOCs by GC/MS**					**X03135-007**		
XG.2003.533.10	75-35-4	1,1 Dichloroethene	2	RPD	0 - 22	1	NA		03-2
XG.2003.533.10	106-46-7	1,4 Dichlorobenzene	4	RPD	0 - 21	1	NA		03-2
XG.2003.533.10	71-43-2	Benzene	4	RPD	0 - 21	1	NA		03-2
XG.2003.533.10	108-90-7	Chlorobenzene	4	RPD	0 - 21	1	NA		03-2
XG.2003.533.10	108-88-3	Toluene	< 1	RPD	0 - 21	1	NA		03-2
XG.2003.533.10	79-01-6	Trichloroethene	1	RPD	0 - 24	1	NA		03-2

Type: **MSD: Matrix Spike Duplicate Precision** Matrix: **TCLP**

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-007**		
MT.2003.351.39	7440-38-2	Arsenic	7	RPD	0 - 20	1	NA		03-
MT.2003.351.39	7440-39-3	Barium	2	RPD	0 - 20	1	NA		03-
MT.2003.351.39	7440-43-9	Cadmium	1	RPD	0 - 20	1	NA		03-
MT.2003.351.39	7440-47-3	Chromium	1	RPD	0 - 20	1	NA		03-
MT.2003.351.39	7439-92-1	Lead	< 1	RPD	0 - 20	1	NA		03-
MT.2003.351.39	7782-49-2	Selenium	< 1	RPD	0 - 20	1	NA		03-
MT.2003.351.39	7440-22-4	Silver	2	RPD	0 - 20	1	NA		03-

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MSD: Matrix Spike Duplicate Precision* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03385		**SW846 1311/7470 CVAA TCLP**					**M03385-006**		
MT.2003.360.34	7439-97-6	Mercury	2	RPD	0 - 20	1	NA		03-28-03

Type: *MSD: Matrix Spike Duplicate Accuracy* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-006**		
XG.2003.486.6	120-82-1	1,2,4-Trichlorobenzene	84	% Recovery	64 - 103	1	NA		03-12-03
XG.2003.486.6	106-46-7	1,4-Dichlorobenzene	79	% Recovery	66 - 97	1	NA		03-12-03
XG.2003.486.6	121-14-2	2,4-Dinitrotoluene	89	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.6	95-57-8	2-Chlorophenol	83	% Recovery	72 - 102	1	NA		03-12-03
XG.2003.486.6	59-50-7	4-Chloro-3-methylphenol	90	% Recovery	67 - 110	1	NA		03-12-03
XG.2003.486.6	100-02-7	4-Nitrophenol	58	% Recovery	56 - 122	1	NA		03-12-03
XG.2003.486.6	83-32-9	Acenaphthene	82	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.6	117-84-0	di-n-Octylphthalate	119	% Recovery	69 - 127	1	NA		[illegible]-03
XG.2003.486.6	621-64-7	n-Nitroso-di-n-propylamine	83	% Recovery	64 - 111	1	NA		[illegible]03
XG.2003.486.6	87-86-5	Pentachlorophenol	74	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.6	108-95-2	Phenol	77	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.6	129-00-0	Pyrene	102	% Recovery	69 - 117	1	NA		03-12-03
X03135		**SW846 8260B Purgeable VOCs by GC/MS**					**X03135-007**		
XG.2003.533.10	75-35-4	1,1 Dichloroethene	117	% Recovery	59 - 172	1	NA		03-26-03
XG.2003.533.10	106-46-7	1,4 Dichlorobenzene	90	% Recovery	60 - 133	1	NA		03-26-03
XG.2003.533.10	71-43-2	Benzene	106	% Recovery	66 - 142	1	NA		03-26-03
XG.2003.533.10	108-90-7	Chlorobenzene	110	% Recovery	60 - 133	1	NA		03-26-03
XG.2003.533.10	108-88-3	Toluene	111	% Recovery	59 - 139	1	NA		03-26-03
XG.2003.533.10	79-01-6	Trichloroethene	104	% Recovery	62 - 137	1	NA		03-26-03

Type: *MSD: Matrix Spike Duplicate Accuracy* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03371		**SW846 1311/3010A/6010A ICP TCLP**					**M03371-007**		
MT.2003.351.39	7440-38-2	Arsenic	102	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.39	7440-39-3	Barium	109	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.39	7440-43-9	Cadmium	111	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.39	7440-47-3	Chromium	116	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.39	7439-92-1	Lead	116	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.39	7782-49-2	Selenium	84	% Recovery	80 - 120	1	NA		03-26-03
MT.2003.351.39	7440-22-4	Silver	105	% Recovery	80 - 120	1	NA		03-26-03
M03385		**SW846 1311/7470 CVAA TCLP**					**M03385-006**		
MT.2003.360.34	7439-97-6	Mercury	98	% Recovery	80 - 120	1	NA		[illegible]28-03

STANDARD

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *0303322-01A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-004**		
XG.2003.533.7		1,2 Dichloroethane-D4 (SS)	99	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.7		4-Bromofluorobenzene (SS)	96	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.7		Dibromofluoromethane (SS)	102	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.7		Toluene-D8 (SS)	101	% Recovery	81 - 117	1	NA		03-26-03

Sample: *0303322-02A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-005**		
XG.2003.533.8		1,2 Dichloroethane-D4 (SS)	97	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.8		4-Bromofluorobenzene (SS)	96	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.8		Dibromofluoromethane (SS)	100	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.8		Toluene-D8 (SS)	99	% Recovery	81 - 117	1	NA		03-26-03

Sample: *0303322-04A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**8270**					**X03111-011**		
XG.2003.486.11		*2,4,6-TRIBROMOPHENOL	79	% Recovery	24 - 132	1	NA		03-20-03
XG.2003.486.11		*2-FLUOROBIPHENYL	83	% Recovery	53 - 126	1	NA		03-20-03
XG.2003.486.11		*2-FLUOROPHENOL	78	% Recovery	44 - 104	1	NA		03-20-03
XG.2003.486.11		*NITROBENZENE-D5	78	% Recovery	34 - 127	1	NA		03-20-03
XG.2003.486.11		*PHENOL-D6	86	% Recovery	40 - 115	1	NA		03-20-03
XG.2003.486.11		*TERPHENYL-D14	86	% Recovery	47 - 116	1	NA		03-20-03

Sample: *LCS* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-002**		
XG.2003.533.5		1,2 Dichloroethane-D4 (SS)	96	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.5		4-Bromofluorobenzene (SS)	99	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.5		Dibromofluoromethane (SS)	101	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.5		Toluene-D8 (SS)	102	% Recovery	81 - 117	1	NA		03-26-03
X03111		**8270**					**X03111-002**		
XG.2003.486.2		*2,4,6-TRIBROMOPHENOL	88	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.2		*2-FLUOROBIPHENYL	84	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.2		*2-FLUOROPHENOL	77	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.2		*NITROBENZENE-D5	81	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.2		*PHENOL-D6	83	% Recovery	40 - 115	1	NA		03-12-03

STANDARD

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *LCS* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**8270**					**X03111-002**		
XG.2003.486.2		*TERPHENYL-D14	91	% Recovery	47 - 116	1	NA		03-12-03

Sample: *LCSD* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-003**		
XG.2003.533.6		1,2 Dichloroethane-D4 (SS)	100	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.6		4-Bromofluorobenzene (SS)	100	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.6		Dibromofluoromethane (SS)	99	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.6		Toluene-D8 (SS)	101	% Recovery	81 - 117	1	NA		03-26-03
X03111		**8270**					**X03111-003**		
XG.2003.486.3		*2,4,6-TRIBROMOPHENOL	91	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.3		*2-FLUOROBIPHENYL	85	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.3		*2-FLUOROPHENOL	76	% Recovery	44 - 104	1	NA		[illegible]-03
XG.2003.486.3		*NITROBENZENE-D5	82	% Recovery	34 - 127	1	NA		[illegible]03
XG.2003.486.3		*PHENOL-D6	82	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.3		*TERPHENYL-D14	95	% Recovery	47 - 116	1	NA		03-12-03

Sample: *MB* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-001**		
XG.2003.533.4		1,2 Dichloroethane-D4 (SS)	102	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.4		4-Bromofluorobenzene (SS)	98	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.4		Dibromofluoromethane (SS)	100	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.4		Toluene-D8 (SS)	98	% Recovery	81 - 117	1	NA		03-26-03
X03135		**8260**					**X03135-012**		
XG.2003.533.24		1,2 Dichloroethane-D4 (SS)	100	% Recovery	70 - 121	1	NA		03-27-03
XG.2003.533.24		4-Bromofluorobenzene (SS)	100	% Recovery	75 - 125	1	NA		03-27-03
XG.2003.533.24		Dibromofluoromethane (SS)	99	% Recovery	75 - 125	1	NA		03-27-03
XG.2003.533.24		Toluene-D8 (SS)	97	% Recovery	81 - 117	1	NA		03-27-03
X03135		**8260**					**X03135-022**		
XG.2003.533.37		1,2 Dichloroethane-D4 (SS)	90	% Recovery	70 - 121	1	NA		03-28-03
XG.2003.533.37		4-Bromofluorobenzene (SS)	97	% Recovery	75 - 125	1	NA		03-28-03
XG.2003.533.37		Dibromofluoromethane (SS)	95	% Recovery	75 - 125	1	NA		03-28-03
XG.2003.533.37		Toluene-D8 (SS)	98	% Recovery	81 - 117	1	NA		03-28-03
X03135		**8260**					**X03135-028**		
XG.2003.533.43		1,2 Dichloroethane-D4 (SS)	93	% Recovery	70 - 121	40	NA		[illegible]-28-03
XG.2003.533.43		4-Bromofluorobenzene (SS)	99	% Recovery	75 - 125	40	NA		03-28-03

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

:	LOS ALAMOS NATIONAL LABS
roject:	7D38 C351 0606 0400
Order:	0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *MB* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-028**		
XG.2003.533.43		Dibromofluoromethane (SS)	96	% Recovery	75 - 125	40	NA		03-28-03
XG.2003.533.43		Toluene-D8 (SS)	96	% Recovery	81 - 117	40	NA		03-28-03
X03111		**8270**					**X03111-001**		
XG.2003.486.1		*2,4,6-TRIBROMOPHENOL	80	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.1		*2-FLUOROBIPHENYL	78	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.1		*2-FLUOROPHENOL	70	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.1		*NITROBENZENE-D5	73	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.1		*PHENOL-D6	76	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.1		*TERPHENYL-D14	92	% Recovery	47 - 116	1	NA		03-12-03
X03111		**8270**					**X03111-007**		
XG.2003.486.7		*2,4,6-TRIBROMOPHENOL	71	% Recovery	24 - 132	1	NA		03-19-03
XG.2003.486.7		*2-FLUOROBIPHENYL	75	% Recovery	53 - 126	1	NA		03-19-03
XG.2003.486.7		*2-FLUOROPHENOL	70	% Recovery	44 - 104	1	NA		03-19-03
XG.2003.486.7		*NITROBENZENE-D5	70	% Recovery	34 - 127	1	NA		03-19-03
003.486.7		*PHENOL-D6	74	% Recovery	40 - 115	1	NA		03-19-03
003.486.7		*TERPHENYL-D14	78	% Recovery	47 - 116	1	NA		03-19-03
X03111		**8270**					**X03111-010**		
XG.2003.486.10		*2,4,6-TRIBROMOPHENOL	86	% Recovery	24 - 132	1	NA		03-20-03
XG.2003.486.10		*2-FLUOROBIPHENYL	90	% Recovery	53 - 126	1	NA		03-20-03
XG.2003.486.10		*2-FLUOROPHENOL	83	% Recovery	44 - 104	1	NA		03-20-03
XG.2003.486.10		*NITROBENZENE-D5	84	% Recovery	34 - 127	1	NA		03-20-03
XG.2003.486.10		*PHENOL-D6	91	% Recovery	40 - 115	1	NA		03-20-03
XG.2003.486.10		*TERPHENYL-D14	96	% Recovery	47 - 116	1	NA		03-20-03
X03111		**8270**					**X03111-012**		
XG.2003.499.1		*2,4,6-TRIBROMOPHENOL	89	% Recovery	24 - 132	1	NA		03-25-03
XG.2003.499.1		*2-FLUOROBIPHENYL	90	% Recovery	53 - 126	1	NA		03-25-03
XG.2003.499.1		*2-FLUOROPHENOL	85	% Recovery	44 - 104	1	NA		03-25-03
XG.2003.499.1		*NITROBENZENE-D5	86	% Recovery	34 - 127	1	NA		03-25-03
XG.2003.499.1		*PHENOL-D6	94	% Recovery	40 - 115	1	NA		03-25-03
XG.2003.499.1		*TERPHENYL-D14	94	% Recovery	47 - 116	1	NA		03-25-03

Sample: *MS* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		**8260**					**X03135-006**		
XG.2003.533.9		1,2 Dichloroethane-D4 (SS)	96	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.9		4-Bromofluorobenzene (SS)	97	% Recovery	75 - 125	1	NA		03-26-03
003.533.9		Dibromofluoromethane (SS)	101	% Recovery	75 - 125	1	NA		03-26-03
2003.533.9		Toluene-D8 (SS)	99	% Recovery	81 - 117	1	NA		03-26-03

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303322 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: MS Matrix: SOLID

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		8270					X03111-005		
XG.2003.486.5		*2,4,6-TRIBROMOPHENOL	91	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.5		*2-FLUOROBIPHENYL	94	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.5		*2-FLUOROPHENOL	83	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.5		*NITROBENZENE-D5	89	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.5		*PHENOL-D6	90	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.5		*TERPHENYL-D14	103	% Recovery	47 - 116	1	NA		03-12-03

Sample: MSD Matrix: SOLID

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03135		8260					X03135-007		
XG.2003.533.10		1,2 Dichloroethane-D4 (SS)	102	% Recovery	70 - 121	1	NA		03-26-03
XG.2003.533.10		4-Bromofluorobenzene (SS)	99	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.10		Dibromofluoromethane (SS)	98	% Recovery	75 - 125	1	NA		03-26-03
XG.2003.533.10		Toluene-D8 (SS)	96	% Recovery	81 - 117	1	NA		[illegible]-03
X03111		8270					X03111-006		
XG.2003.486.6		*2,4,6-TRIBROMOPHENOL	86	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.6		*2-FLUOROBIPHENYL	87	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.6		*2-FLUOROPHENOL	72	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.6		*NITROBENZENE-D5	80	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.6		*PHENOL-D6	80	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.6		*TERPHENYL-D14	96	% Recovery	47 - 116	1	NA		03-12-03

L03158012
L03158002

ASSAIGAI ANALYTICAL LABORATORIES, INC.
P.O. Box 90430 • Albuquerque, New Mexico 87199 • (505) 345-8964 • FAX (505) 345-7259
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127 Eastgate Drive, 212-C • Los Alamos, New Mexico 87544 • (505) 662-2558

Explanation of codes	
B	analyte detected in Method Blank
E	result is estimated
H	analyzed out of hold time
N	tentatively identified compound
S	subcontracted
1-9	see footnote

LOS ALAMOS NATIONAL LABS
attn: **LOUIS JALBERT**
PO BOX 1663 ESH-5 K-494
LOS ALAMOS NM 87545

STANDARD

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: **LOS ALAMOS NATIONAL LABS**
Project: **7D38 C351 0606 0400**
Order: **0303260 LOS28** Receipt: **03-12-03**

William P. Biava: President of Assaigai Analytical Laboratories, Inc.

Sample: *L03158012V1* WP# 35709 Collected: *03-10-03 9:15:00* By: *LJ*
Matrix: **S**

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-01A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.4	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.4	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	67-64-1	Acetone	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.4	107-02-8	Acrolein	ND	mg / Kg	1	0.1		03-20-03	03-20-03
[illegible]14	XG.2003.481.4	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.4	71-43-2	Benzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158012V1* Collected: *03-10-03 9:15:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-01A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.4	75-25-2	Bromoform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	74-83-9	Bromomethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	75-00-3	Chloroethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	67-66-3	Chloroform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	74-87-3	Chloromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	100-41-4	Ethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4		Freon 113	ND	mg / Kg	1	0.035		03-20-03	03-20-03
X03114	XG.2003.481.4	75-71-8	Freon 12	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.4	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.4	91-20-3	Naphthalene	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	95-47-6	o-Xylene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg	1	0.01		03-20-03	03-20-03
X03114	XG.2003.481.4	100-42-5	Styrene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	108-88-3	Toluene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.4	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.4	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01		03-20-03	03-20-03

Sample: *L03158012V2* Collected: *03-10-03 9:15:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-02A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.5	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-0
X03114	XG.2003.481.5	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-0
X03114	XG.2003.481.5	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-0
X03114	XG.2003.481.5	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-0
X03114	XG.2003.481.5	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-0

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Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158012V2* Collected: *03-10-03 9:15:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-02A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.5	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.5	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	67-64-1	Acetone	ND	mg / Kg	1	0.05		03-20-03	-03
X03114	XG.2003.481.5	107-02-8	Acrolein	ND	mg / Kg	1	0.1		03-20-03	-03
X03114	XG.2003.481.5	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.5	71-43-2	Benzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	75-25-2	Bromoform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	74-83-9	Bromomethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	75-00-3	Chloroethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	67-66-3	Chloroform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	74-87-3	Chloromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	100-41-4	Ethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5		Freon 113	ND	mg / Kg	1	0.035		03-20-03	03-20-03
X03114	XG.2003.481.5	75-71-8	Freon 12	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.5	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.5	91-20-3	Naphthalene	ND	mg / Kg	1	0.025		03-20-03	03-20-0
X03114	XG.2003.481.5	95-47-6	o-Xylene	ND	mg / Kg	1	0.005		03-20-03	03-20-0
X03114	XG.2003.481.5	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg	1	0.01		03-20-03	03-20-0
X03114	XG.2003.481.5	100-42-5	Styrene	ND	mg / Kg	1	0.005		03-20-03	20-0
X03114	XG.2003.481.5	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-0

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158012V2* Collected: *03-10-03 9:15:00* By: *LJ*

Matrix: *S*

0303260-02A — SW846 8260B Purgeable VOCs by GC/MS — By: JDR

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
X03114	XG.2003.481.5	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	108-88-3	Toluene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.5	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.5	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01		03-20-03	03-20-03

Sample: *L03158012SV* Collected: *03-10-03 9:15:00* By: *LJ*

Matrix: *S*

0303260-03A — SW846 3550A/8270B SVOCs by GC/MS — By: DS

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
X03111	XG.2003.486.8	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	90-12-0	1-Methylnaphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg	1	1.5		03-18-03	03-19-03
X03111	XG.2003.486.8	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	120-83-2	2,4-Dichlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	105-67-9	2,4-Dimethylphenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	51-28-5	2,4-Dinitrophenol	ND	mg / Kg	1	0.67		03-18-03	03-19-03
X03111	XG.2003.486.8	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	91-58-7	2-Chloronaphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	95-57-8	2-Chlorophenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	91-57-6	2-Methylnaphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	95-48-7	2-Methylphenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	88-74-4	2-Nitroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	88-75-5	2-Nitrophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8		3+4 Methylphenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	99-09-2	3-Nitroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	106-47-8	4-Chloroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	100-01-6	4-Nitroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03

Assaigai Analytical Laboratories, Inc.

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Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158012SV* Collected: *03-10-03 9:15:00* By: *LJ*

Matrix: *S*

0303260-03A SW846 3550A/8270B SVOCs by GC/MS By: DS

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
X03111	XG.2003.486.8	100-02-7	4-Nitrophenol	ND	mg / Kg	1	0.6		03-18-03	03-19-03
X03111	XG.2003.486.8	83-32-9	Acenaphthene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	208-96-8	Acenaphthylene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	62-53-3	Aniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	120-12-7	Anthracene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	56-55-3	Benzo (a) anthracene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	50-32-8	Benzo(a)pyrene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8		Benzo(b & k)fluoranthene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	64-85-0	Benzoic acid	ND	mg / Kg	1	3		03-18-03	03-19-03
X03111	XG.2003.486.8	100-51-6	Benzyl alcohol	ND	mg / Kg	1	1.5		03-18-03	03-19-03
X03111	XG.2003.486.8	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg	1	0.03		03-18-03	[illegible]03
X03111	XG.2003.486.8	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg	1	0.03		03-18-03	[illegible]03
X03111	XG.2003.486.8	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	85-68-7	Butylbenzylphthalate	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	218-01-9	Chrysene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	132-64-9	Dibenzofuran	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	84-66-2	Diethylphthalate	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	131-11-3	Dimethylphthalate	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	84-74-2	di-n-Butylphthalate	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	117-84-0	di-n-Octylphthalate	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	206-44-0	Fluoranthene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	86737	Fluorene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	118-74-1	Hexachlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	87-68-3	Hexachlorobutadiene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg	1	1.5		03-18-03	03-19-03
X03111	XG.2003.486.8	67-72-1	Hexachloroethane	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	78-59-1	Isophorone	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	91-20-3	Naphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	98-95-3	Nitrobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	87-86-5	Pentachlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.8	85-01-8	Phenanthrene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	108-95-2	Phenol	ND	mg / Kg	1	0.3		03-18-03	[illegible]-03
X03111	XG.2003.486.8	129-00-0	Pyrene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.8	110-86-1	Pyridine	ND	mg / Kg	1	0.3		03-18-03	03-19-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158012SV* Collected: *03-10-03 9:15:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date

Sample: *L03158012M* Collected: *03-10-03 9:15:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-04B		SW846 1311/3010A/6010A ICP TCLP						By: JRE		
M03337	MT.2003.316.54	7440-38-2	Arsenic	ND	mg / L	1	0.1		03-18-03	03-19-03
M03337	MT.2003.316.54	7440-39-3	Barium	0.8	mg / L	1	0.1		03-18-03	03-19-03
M03337	MT.2003.316.54	7440-43-9	Cadmium	ND	mg / L	1	0.02		03-18-03	03-19-03
M03337	MT.2003.316.54	7440-47-3	Chromium	ND	mg / L	1	0.02		03-18-03	03-19-03
M03337	MT.2003.316.54	7439-92-1	Lead	ND	mg / L	1	0.05		03-18-03	03-19-03
M03337	MT.2003.316.54	7782-49-2	Selenium	ND	mg / L	1	0.05		03-18-03	03-19-03
M03337	MT.2003.316.54	7440-22-4	Silver	ND	mg / L	1	0.04		03-18-03	03-19-03
0303260-04B		SW846 1311/7470 CVAA TCLP						By: KLT		
M03341	MT.2003.315.39	7439-97-6	Mercury	0.0002	mg / L	1	0.0002		03-19-03	03-19-03

Sample: *L03158002V1* Collected: *03-10-03 9:27:00* By: *LJ*

Matrix: *S* WP# 35709

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-05A		SW846 8260B Purgeable VOCs by GC/MS						By: JDR		
X03114	XG.2003.481.6	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.6	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	67-64-1	Acetone	ND	mg / Kg	1	0.05		03-20-03	03-20-03

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Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158002V1* Collected: *03-10-03 9:27:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-05A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.6	107-02-8	Acrolein	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.6	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.6	71-43-2	Benzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	75-25-2	Bromoform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	74-83-9	Bromomethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	75-00-3	Chloroethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	67-66-3	Chloroform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	74-87-3	Chloromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	[illegible]-03
X03114	XG.2003.481.6	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005		03-20-03	[illegible]-03
X03114	XG.2003.481.6	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	100-41-4	Ethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6		Freon 113	ND	mg / Kg	1	0.035		03-20-03	03-20-03
X03114	XG.2003.481.6	75-71-8	Freon 12	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.6	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.6	91-20-3	Naphthalene	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	95-47-6	o-Xylene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg	1	0.01		03-20-03	03-20-03
X03114	XG.2003.481.6	100-42-5	Styrene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	108-88-3	Toluene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.6	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.6	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01		03-20-03	03-20-03

Sample: *L03158002V2* Collected: *03-10-03 9:27:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-06A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.7	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-0

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[illegible]t: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158002V2* Collected: *03-10-03 9:27:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-06A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.7	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05		03-20-03	03-20-03
[illegible]14	XG.2003.481.7	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
[illegible]14	XG.2003.481.7	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	67-64-1	Acetone	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.7	107-02-8	Acrolein	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.7	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.7	71-43-2	Benzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	75-25-2	Bromoform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	74-83-9	Bromomethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	75-00-3	Chloroethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	67-66-3	Chloroform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	74-87-3	Chloromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	100-41-4	Ethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7		Freon 113	ND	mg / Kg	1	0.035		03-20-03	03-20-03
X03114	XG.2003.481.7	75-71-8	Freon 12	ND	mg / Kg	1	0.05		03-20-03	03-20-03
[illegible]114	XG.2003.481.7	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
[illegible]14	XG.2003.481.7	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.7	91-20-3	Naphthalene	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	95-47-6	o-Xylene	ND	mg / Kg	1	0.005		03-20-03	03-20-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158002V2* Collected: *03-10-03 9:27:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-06A		SW846 8260B Purgeable VOCs by GC/MS					By: JDR			
X03114	XG.2003.481.7	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg	1	0.01		03-20-03	03-20-03
X03114	XG.2003.481.7	100-42-5	Styrene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	108-88-3	Toluene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.7	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.7	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01		03-20-03	03-20-03

Sample: *L03158002SV* Collected: *03-10-03 9:27:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-07A		SW846 3550A/8270B SVOCs by GC/MS					By: DS			
X03111	XG.2003.486.9	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	90-12-0	1-Methylnaphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg	1	1.5		03-18-03	03-19-03
X03111	XG.2003.486.9	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	120-83-2	2,4-Dichlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	105-67-9	2,4-Dimethylphenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	51-28-5	2,4-Dinitrophenol	ND	mg / Kg	1	0.67		03-18-03	03-19-03
X03111	XG.2003.486.9	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	91-58-7	2-Chloronaphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	95-57-8	2-Chlorophenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	91-57-6	2-Methylnaphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	95-48-7	2-Methylphenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	88-74-4	2-Nitroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	88-75-5	2-Nitrophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9		3+4 Methylphenol	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	99-09-2	3-Nitroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg	1	0.3		03-18-03	[illegible]-03
X03111	XG.2003.486.9	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg	1	0.03		03-18-03	[illegible]-19-03
X03111	XG.2003.486.9	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158002SV* Collected: *03-10-03 9:27:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-07A			SW846 3550A/8270B SVOCs by GC/MS				By:	DS		
X03111	XG.2003.486.9	106-47-8	4-Chloroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	100-01-6	4-Nitroaniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	100-02-7	4-Nitrophenol	ND	mg / Kg	1	0.6		03-18-03	03-19-03
X03111	XG.2003.486.9	83-32-9	Acenaphthene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	208-96-8	Acenaphthylene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	62-53-3	Aniline	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	120-12-7	Anthracene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	56-55-3	Benzo (a) anthracene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	50-32-8	Benzo(a)pyrene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9		Benzo(b & k)fluoranthene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	64-85-0	Benzoic acid	ND	mg / Kg	1	3		03-18-03	03-19-03
X03111	XG.2003.486.9	100-51-6	Benzyl alcohol	ND	mg / Kg	1	1.5		03-18-03	03-19-03
X03111	XG.2003.486.9	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	85-68-7	Butylbenzylphthalate	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	218-01-9	Chrysene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	132-64-9	Dibenzofuran	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	84-66-2	Diethylphthalate	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	131-11-3	Dimethylphthalate	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	84-74-2	di-n-Butylphthalate	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	117-84-0	di-n-Octylphthalate	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	206-44-0	Fluoranthene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	86737	Fluorene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	118-74-1	Hexachlorobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	87-68-3	Hexachlorobutadiene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg	1	1.5		03-18-03	03-19-03
X03111	XG.2003.486.9	67-72-1	Hexachloroethane	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	78-59-1	Isophorone	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	91-20-3	Naphthalene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	98-95-3	Nitrobenzene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	87-86-5	Pentachlorophenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	85-01-8	Phenanthrene	ND	mg / Kg	1	0.03		03-18-03	03-19-03

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Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158002SV* Collected: *03-10-03 9:27:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-07A		SW846 3550A/8270B SVOCs by GC/MS					By: DS			
X03111	XG.2003.486.9	108-95-2	Phenol	ND	mg / Kg	1	0.3		03-18-03	03-19-03
X03111	XG.2003.486.9	129-00-0	Pyrene	ND	mg / Kg	1	0.03		03-18-03	03-19-03
X03111	XG.2003.486.9	110-86-1	Pyridine	ND	mg / Kg	1	0.3		03-18-03	03-19-03

Sample: *L03158002M* Collected: *03-10-03 9:27:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-08B		SW846 1311/3010A/6010A ICP TCLP					By: JRE			
M03337	MT.2003.316.55	7440-38-2	Arsenic	ND	mg / L	1	0.1		03-18-03	03-19-03
M03337	MT.2003.316.55	7440-39-3	Barium	0.6	mg / L	1	0.1		03-18-03	03-19-03
M03337	MT.2003.316.55	7440-43-9	Cadmium	ND	mg / L	1	0.02		03-18-03	03-19-03
M03337	MT.2003.316.55	7440-47-3	Chromium	ND	mg / L	1	0.02		03-18-03	03-19-03
M03337	MT.2003.316.55	7439-92-1	Lead	ND	mg / L	1	0.05		03-18-03	[illegible]03
M03337	MT.2003.316.55	7782-49-2	Selenium	ND	mg / L	1	0.05		03-18-03	[illegible]-03
M03337	MT.2003.316.55	7440-22-4	Silver	ND	mg / L	1	0.04		03-18-03	03-19-03
0303260-08B		SW846 1311/7470 CVAA TCLP					By: KLT			
M03341	MT.2003.315.40	7439-97-6	Mercury	ND	mg / L	1	0.0002		03-19-03	03-19-03

Sample: *L03158666V1* Collected: *03-10-03 9:37:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-09A		SW846 8260B Purgeable VOCs by GC/MS					By: JDR			
X03114	XG.2003.481.8	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	95-63-6	1,2,4-Trimethylbenzene	0.008	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	[illegible]0-03
X03114	XG.2003.481.8	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	[illegible]0-03
X03114	XG.2003.481.8	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05		03-20-03	03-20-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158666V1* Collected: *03-10-03 9:37:00* By: *LJ*

Matrix: *S*

0303260-09A — SW846 8260B Purgeable VOCs by GC/MS — By: JDR

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
X03114	XG.2003.481.8	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	67-64-1	Acetone	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.8	107-02-8	Acrolein	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.8	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.8	71-43-2	Benzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	75-25-2	Bromoform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	74-83-9	Bromomethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	75-00-3	Chloroethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	67-66-3	Chloroform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	74-87-3	Chloromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	100-41-4	Ethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8		Freon 113	ND	mg / Kg	1	0.035		03-20-03	03-20-03
X03114	XG.2003.481.8	75-71-8	Freon 12	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.8	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.8	91-20-3	Naphthalene	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	95-47-6	o-Xylene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	108-38-3/106-42	p/m-Xylenes	0.010	mg / Kg	1	0.01		03-20-03	03-20-03
X03114	XG.2003.481.8	100-42-5	Styrene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	108-88-3	Toluene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.8	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.8	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01		03-20-03	03-20-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158666V2* Collected: *03-10-03 9:37:00* By: *LJ*

Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-10A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.9	75-34-3	1,1 Dichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	75-35-4	1,1 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	78-87-5	1,2 Dichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	95-63-6	1,2,4-Trimethylbenzene	0.015	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg	1	0.05		03-20-03	[illegible]
X03114	XG.2003.481.9	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg	1	0.005		03-20-03	[illegible]
X03114	XG.2003.481.9	78-93-3	2-Butanone (MEK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	591-78-6	2-Hexanone (MBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	67-64-1	Acetone	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.9	107-02-8	Acrolein	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.9	107-13-1	Acrylonitrile	ND	mg / Kg	1	0.1		03-20-03	03-20-03
X03114	XG.2003.481.9	71-43-2	Benzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	75-27-4	Bromodichloromethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	75-25-2	Bromoform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	74-83-9	Bromomethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	75-15-0	Carbon disulfide	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	56-23-5	Carbon tetrachloride	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	108-90-7	Chlorobenzene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	124-48-1	Chlorodibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	75-00-3	Chloroethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	67-66-3	Chloroform	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	74-87-3	Chloromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9		cis-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	74-95-3	Dibromomethane	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	97-63-2	Ethyl methacrylate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	100-41-4	Ethylbenzene	0.005	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9		Freon 113	ND	mg / Kg	1	0.035		03-20-03	03-20-03
X03114	XG.2003.481.9	75-71-8	Freon 12	ND	mg / Kg	1	0.05		03-20-03	03-20-03
X03114	XG.2003.481.9	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg	1	0.005		03-20-03	[illegible]
X03114	XG.2003.481.9	75-09-2	Methylene chloride	ND	mg / Kg	1	0.05		03-20-03	[illegible]
X03114	XG.2003.481.9	91-20-3	Naphthalene	ND	mg / Kg	1	0.025		03-20-03	03-20-03

Assaigai Analytical Laboratories, Inc.

Certificate of Analysis

ent: LOS ALAMOS NATIONAL LABS
oject: 7D38 C351 0606 0400
Order: 0303260 LOS28 Receipt: 03-12-03

Sample: *L03158666V2* Collected: *03-10-03 9:37:00* By: *LJ*
Matrix: *S*

QC Group	Run Sequence	CAS #	Analyte	Result	Units	Dilution Factor	Detection Limit	Code	Prep Date	Run Date
0303260-10A		SW846 8260B Purgeable VOCs by GC/MS					By:	JDR		
X03114	XG.2003.481.9	95-47-6	o-Xylene	0.006	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	108-38-3/106-42	p/m-Xylenes	0.020	mg / Kg	1	0.01		03-20-03	03-20-03
X03114	XG.2003.481.9	100-42-5	Styrene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	108-88-3	Toluene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	79-01-6	Trichloroethene	ND	mg / Kg	1	0.005		03-20-03	03-20-03
X03114	XG.2003.481.9	75-69-4	Trichlorofluoromethane	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	108-05-4	Vinyl acetate	ND	mg / Kg	1	0.025		03-20-03	03-20-03
X03114	XG.2003.481.9	75-01-4	Vinyl chloride	ND	mg / Kg	1	0.01		03-20-03	03-20-03

Unless otherwise noted, all samples were received in acceptable condition and all sampling was performed by client or client representative. Sample result of ND indicates Not Detected, ie result is less than the sample specific Detection Limit. Sample specific Detection Limit is determined by multiplying the sample Dilution Factor by the listed Reporting Detection Limit. All results relate only to the items tested. Any miscellaneous workorder information or foonotes will appear below.

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *LCS: Lab Control Spike* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-002		
XG.2003.486.2	120-82-1	1,2,4-Trichlorobenzene	80	% Recovery	64 - 103	1	NA		03-12-03
XG.2003.486.2	106-46-7	1,4-Dichlorobenzene	79	% Recovery	66 - 97	1	NA		03-12-03
XG.2003.486.2	121-14-2	2,4-Dinitrotoluene	84	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.2	95-57-8	2-Chlorophenol	82	% Recovery	72 - 102	1	NA		03-12-03
XG.2003.486.2	59-50-7	4-Chloro-3-methylphenol	88	% Recovery	67 - 110	1	NA		03-12-03
XG.2003.486.2	100-02-7	4-Nitrophenol	84	% Recovery	56 - 122	1	NA		03-12-03
XG.2003.486.2	83-32-9	Acenaphthene	81	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.2	117-84-0	di-n-Octylphthalate	93	% Recovery	69 - 127	1	NA		03-12-03
XG.2003.486.2	621-64-7	n-Nitroso-di-n-propylamine	83	% Recovery	64 - 111	1	NA		03-12-03
XG.2003.486.2	87-86-5	Pentachlorophenol	85	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.2	108-95-2	Phenol	81	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.2	129-00-0	Pyrene	91	% Recovery	69 - 117	1	NA		03-12-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-002		
XG.2003.451.4	75-35-4	1,1 Dichloroethene	116	% Recovery	59 - 172	1	NA		03-14-03
XG.2003.451.4	106-46-7	1,4 Dichlorobenzene	105	% Recovery	60 - 133	1	NA		03-[illegible]4-03
XG.2003.451.4	71-43-2	Benzene	106	% Recovery	66 - 142	1	NA		[illegible]03
XG.2003.451.4	108-90-7	Chlorobenzene	110	% Recovery	60 - 133	1	NA		[illegible]14-03
XG.2003.451.4	108-88-3	Toluene	110	% Recovery	59 - 139	1	NA		03-14-03
XG.2003.451.4	79-01-6	Trichloroethene	108	% Recovery	62 - 137	1	NA		03-14-03

Type: *LCS: Lab Control Spike* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-003		
MT.2003.316.40	7440-38-2	Arsenic	89	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.40	7440-39-3	Barium	88	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.40	7440-43-9	Cadmium	110	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.40	7440-47-3	Chromium	101	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.40	7439-92-1	Lead	100	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.40	7782-49-2	Selenium	95	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.40	7440-22-4	Silver	89	% Recovery	80 - 120	1	NA		03-19-03
M03341		SW846 1311/7470 CVAA TCLP					M03341-002		
MT.2003.315.23	7439-97-6	Mercury	108	% Recovery	80 - 120	1	NA		03-19-03

Type: *LCSD: Lab Control Spike Duplicate Precision* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-003		
XG.2003.486.3	120-82-1	1,2,4-Trichlorobenzene	2	RPD	0 - 11	1	NA		[illegible]2-03
XG.2003.486.3	106-46-7	1,4-Dichlorobenzene	2	RPD	0 - 73	1	NA		03-12-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

[illegible]t: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *LCSD: Lab Control Spike Duplicate Precision* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-003		
XG.2003.486.3	121-14-2	2,4-Dinitrotoluene	5	RPD	0 - 17	1	NA		03-12-03
XG.2003.486.3	95-57-8	2-Chlorophenol	< 1	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.3	59-50-7	4-Chloro-3-methylphenol	< 1	RPD	0 - 13	1	NA		03-12-03
XG.2003.486.3	100-02-7	4-Nitrophenol	4	RPD	0 - 12	1	NA		03-12-03
XG.2003.486.3	83-32-9	Acenaphthene	< 1	RPD	0 - 12	1	NA		03-12-03
XG.2003.486.3	117-84-0	di-n-Octylphthalate	4	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.3	621-64-7	n-Nitroso-di-n-propylamine	1	RPD	0 - 10	1	NA		03-12-03
XG.2003.486.3	87-86-5	Pentachlorophenol	5	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.3	108-95-2	Phenol	< 1	RPD	0 - 9	1	NA		03-12-03
XG.2003.486.3	129-00-0	Pyrene	4	RPD	0 - 11	1	NA		03-12-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-003		
XG.2003.451.5	75-35-4	1,1 Dichloroethene	1	RPD	0 - 22	1	NA		03-14-03
XG.2003.451.5	106-46-7	1,4 Dichlorobenzene	< 1	RPD	0 - 21	1	NA		03-14-03
XG.2003.451.5	71-43-2	Benzene	2	RPD	0 - 21	1	NA		03-14-03
[illegible]2003.451.5	108-90-7	Chlorobenzene	< 1	RPD	0 - 21	1	NA		03-14-03
[illegible]003.451.5	108-88-3	Toluene	< 1	RPD	0 - 21	1	NA		03-14-03
XG.2003.451.5	79-01-6	Trichloroethene	< 1	RPD	0 - 24	1	NA		03-14-03

Type: *LCSD: Lab Control Spike Duplicate Precision* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-004		
MT.2003.316.41	7440-38-2	Arsenic	5	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.41	7440-39-3	Barium	6	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.41	7440-43-9	Cadmium	8	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.41	7440-47-3	Chromium	11	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.41	7439-92-1	Lead	21	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.41	7782-49-2	Selenium	1	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.41	7440-22-4	Silver	7	RPD	0 - 20	1	NA		03-19-03
M03341		SW846 1311/7470 CVAA TCLP					M03341-003		
MT.2003.315.24	7439-97-6	Mercury	8	RPD	0 - 20	1	NA		03-19-03

Type: *LCSD: Lab Control Spike Duplicate Accuracy* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-003		
XG.2003.486.3	120-82-1	1,2,4-Trichlorobenzene	82	% Recovery	64 - 103	1	NA		03-12-03
[illegible]2003.486.3	106-46-7	1,4-Dichlorobenzene	78	% Recovery	66 - 97	1	NA		03-12-03
[illegible]G.2003.486.3	121-14-2	2,4-Dinitrotoluene	89	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.3	95-57-8	2-Chlorophenol	82	% Recovery	72 - 102	1	NA		03-12-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes
D : Not applicable due to sample dilution
L : Not applicable due to MDL proximity

Type: *LCSD: Lab Control Spike Duplicate Accuracy* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-003		
XG.2003.486.3	59-50-7	4-Chloro-3-methylphenol	88	% Recovery	67 - 110	1	NA		03-12-03
XG.2003.486.3	100-02-7	4-Nitrophenol	88	% Recovery	56 - 122	1	NA		03-12-03
XG.2003.486.3	83-32-9	Acenaphthene	82	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.3	117-84-0	di-n-Octylphthalate	97	% Recovery	69 - 127	1	NA		03-12-03
XG.2003.486.3	621-64-7	n-Nitroso-di-n-propylamine	84	% Recovery	64 - 111	1	NA		03-12-03
XG.2003.486.3	87-86-5	Pentachlorophenol	89	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.3	108-95-2	Phenol	80	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.3	129-00-0	Pyrene	95	% Recovery	69 - 117	1	NA		03-12-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-003		
XG.2003.451.5	75-35-4	1,1 Dichloroethene	114	% Recovery	59 - 172	1	NA		03-14-03
XG.2003.451.5	106-46-7	1,4 Dichlorobenzene	104	% Recovery	60 - 133	1	NA		03-14-03
XG.2003.451.5	71-43-2	Benzene	109	% Recovery	66 - 142	1	NA		03-14-03
XG.2003.451.5	108-90-7	Chlorobenzene	111	% Recovery	60 - 133	1	NA		03-14-03
XG.2003.451.5	108-88-3	Toluene	110	% Recovery	59 - 139	1	NA		03-14-03
XG.2003.451.5	79-01-6	Trichloroethene	108	% Recovery	62 - 137	1	NA		03-14-03

Type: *LCSD: Lab Control Spike Duplicate Accuracy* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-004		
MT.2003.316.41	7440-38-2	Arsenic	94	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.41	7440-39-3	Barium	94	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.41	7440-43-9	Cadmium	120	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.41	7440-47-3	Chromium	113	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.41	7439-92-1	Lead	124	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.41	7782-49-2	Selenium	94	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.41	7440-22-4	Silver	96	% Recovery	80 - 120	1	NA		03-19-03
M03341		SW846 1311/7470 CVAA TCLP					M03341-003		
MT.2003.315.24	7439-97-6	Mercury	100	% Recovery	80 - 120	1	NA		03-19-0

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-001		
XG.2003.486.1	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-12-(
XG.2003.486.1	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-12-(
XG.2003.486.1	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-12-(
XG.2003.486.1	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		-12-
XG.2003.486.1	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		12-
XG.2003.486.1	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-12-

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-001		
XG.2003.486.1	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-12-03
XG.2003.486.1	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-12-03
XG.2003.486.1	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-12-03
XG.2003.486.1	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-12-0
XG.2003.486.1	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-12-0
XG.2003.486.1	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-12-0
XG.2003.486.1	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-12-0
XG.2003.486.1	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-12-0
XG.2003.486.1	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-12-0
XG.2003.486.1	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-12-C
XG.2003.486.1	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-12-C
XG.2003.486.1	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-12-C
XG.2003.486.1	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-12-C
XG.2003.486.1	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-12-(
XG.2003.486.1	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-12-(
XG.2003.486.1	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-12-(
XG.2003.486.1	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		03-12-(
XG.2003.486.1	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		03-12-(

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28

Explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-001		
XG.2003486.1	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-12-03
XG.2003486.1	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-12-03
XG.2003486.1	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	86737	Fluorene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-12-03
XG.2003486.1	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-12-03
XG.2003486.1	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-12-03
XG.2003486.1	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		12-03
XG.2003486.1	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		2-03
XG.2003486.1	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-12-03
XG.2003486.1	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-12-0
XG.2003486.1	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-12-0
XG.2003486.1	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-12-0
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-007		
XG.2003486.7	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-19-0
XG.2003486.7	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-19-0
XG.2003486.7	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-19-0
XG.2003486.7	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		03-19-0
XG.2003486.7	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		03-19-0
XG.2003486.7	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-19-0
XG.2003486.7	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-19-0
XG.2003486.7	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-19-0
XG.2003486.7	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		03-19-0
XG.2003486.7	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		03-19-0
XG.2003486.7	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-19-0
XG.2003486.7	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-19-0
XG.2003486.7	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-19-0
XG.2003486.7	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-19-
XG.2003486.7	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-19-
XG.2003486.7	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-19-
XG.2003486.7	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-19-
XG.2003486.7	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-19-
XG.2003486.7	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		-19-
XG.2003486.7	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		-19-
XG.2003486.7		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-19-

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

:	LOS ALAMOS NATIONAL LABS
ct:	7D38 C351 0606 0400
Order:	0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS	-				X03111-007		
XG.2003.486.7	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-19-03
XG.2003.486.7	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		03-19-03
2003.486.7	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-19-03
03.486.7		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-19-03
XG.2003.486.7	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-19-03
XG.2003.486.7	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	86737	Fluorene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-19-03
XG.2003.486.7	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-19-03
003.486.7	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-19-03
003.486.7	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-19-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-007		
XG.2003.486.7	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-19-03
XG.2003.486.7	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-19-03
XG.2003.486.7	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-19-03
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-010		
XG.2003.486.10	120-82-1	1,2,4-Trichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	95-50-1	1,2-Dichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	541-73-1	1,3-Dichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	106-46-7	1,4-Dichlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	90-12-0	1-Methylnaphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	58-90-2	2,3,4,6-Tetrachlorophenol	ND	mg / Kg		1	1.5		03-20-03
XG.2003.486.10	95-95-4	2,4,5-Trichlorophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	88-06-2	2,4,6-Trichlorophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	120-83-2	2,4-Dichlorophenol	ND	mg / Kg		1	0.3		[illegible]03
XG.2003.486.10	105-67-9	2,4-Dimethylphenol	ND	mg / Kg		1	0.03		[illegible]03
XG.2003.486.10	51-28-5	2,4-Dinitrophenol	ND	mg / Kg		1	0.67		03-20-03
XG.2003.486.10	121-14-2	2,4-Dinitrotoluene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	606-20-2	2,6-Dinitrotoluene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	91-58-7	2-Chloronaphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	95-57-8	2-Chlorophenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	91-57-6	2-Methylnaphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	95-48-7	2-Methylphenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	88-74-4	2-Nitroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	88-75-5	2-Nitrophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	91-94-1	3,3-Dichlorobenzidine	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10		3+4 Methylphenol	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	99-09-2	3-Nitroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	534-52-1	4,6-Dinitro-2-methylphenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	101-55-3	4-Bromophenyl-phenylether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	59-50-7	4-Chloro-3-methylphenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	106-47-8	4-Chloroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	7005-72-3	4-Chlorophenyl-phenylether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	100-01-6	4-Nitroaniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	100-02-7	4-Nitrophenol	ND	mg / Kg		1	0.6		03-20-03
XG.2003.486.10	83-32-9	Acenaphthene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	208-96-8	Acenaphthylene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	62-53-3	Aniline	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	120-12-7	Anthracene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10		Azobenzene&1,2-Diphenylhydrazine	ND	mg / Kg		1	0.03		[illegible]20-03
XG.2003.486.10	56-55-3	Benzo (a) anthracene	ND	mg / Kg		1	0.03		[illegible]-20-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**SW846 3550A/8270B SVOCs by GC/MS**					**X03111-010**		
XG.2003.486.10	50-32-8	Benzo(a)pyrene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10		Benzo(b & k)fluoranthene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	191-24-2	Benzo(g,h,i)perylene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	64-85-0	Benzoic acid	ND	mg / Kg		1	3		03-20-03
XG.2003.486.10	100-51-6	Benzyl alcohol	ND	mg / Kg		1	1.5		03-20-03
XG.2003.486.10	111-44-4	bis (2-Chloroethyl) ether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	111-91-1	bis(2-Chloroethoxy)methane	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	108-60-1	bis(2-Chloroisopropyl)ether	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	117-81-7	bis(2-Ethylhexyl)phthalate	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	85-68-7	Butylbenzylphthalate	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	218-01-9	Chrysene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	53-70-3	Dibenz(a,h)anthracene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	132-64-9	Dibenzofuran	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	84-66-2	Diethylphthalate	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	131-11-3	Dimethylphthalate	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	84-74-2	di-n-Butylphthalate	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	117-84-0	di-n-Octylphthalate	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	206-44-0	Fluoranthene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	86737	Fluorene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	118-74-1	Hexachlorobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	87-68-3	Hexachlorobutadiene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	77-47-4	Hexachlorocyclopentadiene	ND	mg / Kg		1	1.5		03-20-03
XG.2003.486.10	67-72-1	Hexachloroethane	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	193-39-5	Indeno(1,2,3-cd)pyrene	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	78-59-1	Isophorone	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	91-20-3	Naphthalene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	98-95-3	Nitrobenzene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	62-75-9	n-Nitroso-dimethyl-amine	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	621-64-7	n-Nitroso-di-n-propylamine	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	86-30-6	n-Nitrosodiphenylamine	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	87-86-5	Pentachlorophenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	85-01-8	Phenanthrene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	108-95-2	Phenol	ND	mg / Kg		1	0.3		03-20-03
XG.2003.486.10	129-00-0	Pyrene	ND	mg / Kg		1	0.03		03-20-03
XG.2003.486.10	110-86-1	Pyridine	ND	mg / Kg		1	0.3		03-20-03
X03114		**SW846 8260B Purgeable VOCs by GC/MS**					**X03114-001**		
XG.2003.451.3	75-34-3	1,1 Dichloroethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	75-35-4	1,1 Dichloroethene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg		1	0.005		03-14-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-001		
XG.2003.451.3	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	78-87-5	1,2 Dichloropropane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg		1	0.05		03-14-03
XG.2003.451.3	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	78-93-3	2-Butanone (MEK)	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	591-78-6	2-Hexanone (MBK)	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	67-64-1	Acetone	ND	mg / Kg		1	0.05		03-14-03
XG.2003.451.3	107-02-8	Acrolein	ND	mg / Kg		1	0.1		03-14-03
XG.2003.451.3	107-13-1	Acrylonitrile	ND	mg / Kg		1	0.1		03-14-03
XG.2003.451.3	71-43-2	Benzene	ND	mg / Kg		1	0.005		[illegible]03
XG.2003.451.3	75-27-4	Bromodichloromethane	ND	mg / Kg		1	0.005		[illegible]3
XG.2003.451.3	75-25-2	Bromoform	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	74-83-9	Bromomethane	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	75-15-0	Carbon disulfide	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	56-23-5	Carbon tetrachloride	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	108-90-7	Chlorobenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	124-48-1	Chlorodibromomethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	75-00-3	Chloroethane	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	67-66-3	Chloroform	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	74-87-3	Chloromethane	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3		cis-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	74-95-3	Dibromomethane	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	97-63-2	Ethyl methacrylate	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	100-41-4	Ethylbenzene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3		Freon 113	ND	mg / Kg		1	0.035		03-14-03
XG.2003.451.3	75-71-8	Freon 12	ND	mg / Kg		1	0.05		03-14-03
XG.2003.451.3	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	75-09-2	Methylene chloride	ND	mg / Kg		1	0.05		03-14-03
XG.2003.451.3	91-20-3	Naphthalene	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	95-47-6	o-Xylene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg		1	0.01		03-14-03
XG.2003.451.3	100-42-5	Styrene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg		1	0.005		[illegible]-03
XG.2003.451.3	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg		1	0.005		[illegible]-03
XG.2003.451.3	108-88-3	Toluene	ND	mg / Kg		1	0.005		03-14-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

t: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-001		
XG.2003.451.3	79-01-6	Trichloroethene	ND	mg / Kg		1	0.005		03-14-03
XG.2003.451.3	75-69-4	Trichlorofluoromethane	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	108-05-4	Vinyl acetate	ND	mg / Kg		1	0.025		03-14-03
XG.2003.451.3	75-01-4	Vinyl chloride	ND	mg / Kg		1	0.01		03-14-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-014		
XG.2003.472.3	75-34-3	1,1 Dichloroethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	75-35-4	1,1 Dichloroethene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg		1	0.005		03-19-03
2003.472.3	78-87-5	1,2 Dichloropropane	ND	mg / Kg		1	0.005		03-19-03
003.472.3	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg		1	0.05		03-19-03
XG.2003.472.3	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	78-93-3	2-Butanone (MEK)	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	591-78-6	2-Hexanone (MBK)	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	67-64-1	Acetone	ND	mg / Kg		1	0.05		03-19-03
XG.2003.472.3	107-02-8	Acrolein	ND	mg / Kg		1	0.1		03-19-03
XG.2003.472.3	107-13-1	Acrylonitrile	ND	mg / Kg		1	0.1		03-19-03
XG.2003.472.3	71-43-2	Benzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	75-27-4	Bromodichloromethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	75-25-2	Bromoform	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	74-83-9	Bromomethane	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	75-15-0	Carbon disulfide	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	56-23-5	Carbon tetrachloride	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	108-90-7	Chlorobenzene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	124-48-1	Chlorodibromomethane	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	75-00-3	Chloroethane	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	67-66-3	Chloroform	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3	74-87-3	Chloromethane	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg		1	0.005		03-19-03
XG.2003.472.3		cis-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-19-03
003.472.3	74-95-3	Dibromomethane	ND	mg / Kg		1	0.005		03-19-03
.2003.472.3	97-63-2	Ethyl methacrylate	ND	mg / Kg		1	0.025		03-19-03
XG.2003.472.3	100-41-4	Ethylbenzene	ND	mg / Kg		1	0.005		03-19-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-014		
XG.2003 472.3		Freon 113	ND	mg / Kg		1	0.035		03-19-03
XG.2003 472.3	75-71-8	Freon 12	ND	mg / Kg		1	0.05		03-19-03
XG.2003 472.3	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	75-09-2	Methylene chloride	ND	mg / Kg		1	0.05		03-19-03
XG.2003 472.3	91-20-3	Naphthalene	ND	mg / Kg		1	0.025		03-19-03
XG.2003 472.3	95-47-6	o-Xylene	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg		1	0.01		03-19-03
XG.2003 472.3	100-42-5	Styrene	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	108-88-3	Toluene	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	79-01-6	Trichloroethene	ND	mg / Kg		1	0.005		03-19-03
XG.2003 472.3	75-69-4	Trichlorofluoromethane	ND	mg / Kg		1	0.025		03-19-03
XG.2003 472.3	108-05-4	Vinyl acetate	ND	mg / Kg		1	0.025		03-19-03
XG.2003 472.3	75-01-4	Vinyl chloride	ND	mg / Kg		1	0.01		9-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-018		
XG.2003 481.3	75-34-3	1,1 Dichloroethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	75-35-4	1,1 Dichloroethene	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	71-55-6	1,1,1 Trichloroethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	630-20-6	1,1,1,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	79-00-5	1,1,2 Trichloroethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	79-34-5	1,1,2,2 Tetrachloroethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	106-93-4	1,2 Dibromoethane (EDB)	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	95-50-1	1,2 Dichlorobenzene	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	107-06-2	1,2 Dichloroethane (EDC)	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	78-87-5	1,2 Dichloropropane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	96-18-4	1,2,3 Trichloropropane	ND	mg / Kg		1	0.005		03-20-03
XG.2003 481.3	95-63-6	1,2,4-Trimethylbenzene	ND	mg / Kg		1	0.005		03-20-0
XG.2003 481.3	541-73-1	1,3 Dichlorobenzene	ND	mg / Kg		1	0.005		03-20-0
XG.2003 481.3	108-67-8	1,3,5-Trimethylbenzene	ND	mg / Kg		1	0.005		03-20-0
XG.2003 481.3	764-41-0	1,4 Dichloro-2-butene	ND	mg / Kg		1	0.05		03-20-0
XG.2003 481.3	106-46-7	1,4 Dichlorobenzene	ND	mg / Kg		1	0.005		03-20-0
XG.2003 481.3	78-93-3	2-Butanone (MEK)	ND	mg / Kg		1	0.025		03-20-0
XG.2003 481.3	591-78-6	2-Hexanone (MBK)	ND	mg / Kg		1	0.025		03-20-0
XG.2003 481.3	108-10-1	4-Methyl-2-pentanone (MIBK)	ND	mg / Kg		1	0.025		03-20-0
XG.2003 481.3	67-64-1	Acetone	ND	mg / Kg		1	0.05		03-20-0
XG.2003 481.3	107-02-8	Acrolein	ND	mg / Kg		1	0.1		03-20-0
XG.2003 481.3	107-13-1	Acrylonitrile	ND	mg / Kg		1	0.1		03-20-0
XG.2003 481.3	71-43-2	Benzene	ND	mg / Kg		1	0.005		3-20-0
XG.2003 481.3	75-27-4	Bromodichloromethane	ND	mg / Kg		1	0.005		20-0
XG.2003 481.3	75-25-2	Bromoform	ND	mg / Kg		1	0.005		03-20-0
XG.2003 481.3	74-83-9	Bromomethane	ND	mg / Kg		1	0.025		03-20-0

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

nt:	LOS ALAMOS NATIONAL LABS
Project:	7D38 C351 0606 0400
Order:	0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-018		
XG.2003.481.3	75-15-0	Carbon disulfide	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	56-23-5	Carbon tetrachloride	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	108-90-7	Chlorobenzene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	124-48-1	Chlorodibromomethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	75-00-3	Chloroethane	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	67-66-3	Chloroform	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	74-87-3	Chloromethane	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	156-59-2	cis-1,2 dichloroethene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3		cis-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	74-95-3	Dibromomethane	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	97-63-2	Ethyl methacrylate	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	100-41-4	Ethylbenzene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3		Freon 113	ND	mg / Kg		1	0.035		03-20-03
XG.2003.481.3	75-71-8	Freon 12	ND	mg / Kg		1	0.05		03-20-03
XG.2003.481.3	1634-04-4	Methyl t-butyl ether (MTBE)	ND	mg / Kg		1	0.005		03-20-03
2003.481.3	75-09-2	Methylene chloride	ND	mg / Kg		1	0.05		03-20-03
2003.481.3	91-20-3	Naphthalene	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	95-47-6	o-Xylene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	108-38-3/106-42	p/m-Xylenes	ND	mg / Kg		1	0.01		03-20-03
XG.2003.481.3	100-42-5	Styrene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	156-60-5	t-1,2 Dichloroethene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	10061-02-6	t-1,3 Dichloropropene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	127-18-4	Tetrachloroethene (PCE)	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	108-88-3	Toluene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	79-01-6	Trichloroethene	ND	mg / Kg		1	0.005		03-20-03
XG.2003.481.3	75-69-4	Trichlorofluoromethane	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	108-05-4	Vinyl acetate	ND	mg / Kg		1	0.025		03-20-03
XG.2003.481.3	75-01-4	Vinyl chloride	ND	mg / Kg		1	0.01		03-20-03

Type: *MB: Method Blank* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-001		
MT.2003.316.38	7440-38-2	Arsenic	ND	mg / L		1	0.1		03-19-03
MT.2003.316.38	7440-39-3	Barium	ND	mg / L		1	0.1		03-19-03
MT.2003.316.38	7440-43-9	Cadmium	ND	mg / L		1	0.02		03-19-03
MT.2003.316.38	7440-47-3	Chromium	ND	mg / L		1	0.02		03-19-03
MT.2003.316.38	7439-92-1	Lead	ND	mg / L		1	0.05		03-19-03
MT.2003.316.38	7782-49-2	Selenium	0.05	mg / L		1	0.05		03-19-03
2003.316.38	7440-22-4	Silver	ND	mg / L		1	0.04		03-19-03
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-002		
MT.2003.316.39	7440-38-2	Arsenic	ND	mg / L		1	0.1		03-19-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MB: Method Blank* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337	SW846 1311/3010A/6010A ICP TCLP						M03337-002		
MT.2003.316.39	7440-39-3	Barium	ND	mg / L		1	0.1		03-19-03
MT.2003.316.39	7440-43-9	Cadmium	ND	mg / L		1	0.02		03-19-03
MT.2003.316.39	7440-47-3	Chromium	ND	mg / L		1	0.02		03-19-03
MT.2003.316.39	7439-92-1	Lead	ND	mg / L		1	0.05		03-19-03
MT.2003.316.39	7782-49-2	Selenium	ND	mg / L		1	0.05		03-19-03
MT.2003.316.39	7440-22-4	Silver	ND	mg / L		1	0.04		03-19-03
M03341	SW846 1311/7470 CVAA TCLP						M03341-001		
MT.2003.315.22	7439-97-6	Mercury	ND	mg / L		1	0.0002		03-19-03

Type: *MS: Matrix Spike* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111	SW846 3550A/8270B SVOCs by GC/MS						X03111-005		
XG.2003.486.5	120-82-1	1,2,4-Trichlorobenzene	90	% Recovery	64 - 103	1	NA		[illegible]03
XG.2003.486.5	106-46-7	1,4-Dichlorobenzene	89	% Recovery	66 - 97	1	NA		[illegible]03
XG.2003.486.5	121-14-2	2,4-Dinitrotoluene	95	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.5	95-57-8	2-Chlorophenol	91	% Recovery	72 - 102	1	NA		03-12-03
XG.2003.486.5	59-50-7	4-Chloro-3-methylphenol	94	% Recovery	67 - 110	1	NA		03-12-03
XG.2003.486.5	100-02-7	4-Nitrophenol	81	% Recovery	56 - 122	1	NA		03-12-03
XG.2003.486.5	83-32-9	Acenaphthene	84	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.5	117-84-0	di-n-Octylphthalate	132	% Recovery	69 - 127	1	NA		03-12-03
XG.2003.486.5	621-64-7	n-Nitroso-di-n-propylamine	90	% Recovery	64 - 111	1	NA		03-12-03
XG.2003.486.5	87-86-5	Pentachlorophenol	80	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.5	108-95-2	Phenol	88	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.5	129-00-0	Pyrene	116	% Recovery	69 - 117	1	NA		03-12-03
X03114	SW846 8260B Purgeable VOCs by GC/MS						X03114-005		
XG.2003.451.7	75-35-4	1,1 Dichloroethene	117	% Recovery	59 - 172	1	NA		03-14-03
XG.2003.451.7	106-46-7	1,4 Dichlorobenzene	98	% Recovery	60 - 133	1	NA		03-14-03
XG.2003.451.7	71-43-2	Benzene	107	% Recovery	66 - 142	1	NA		03-14-03
XG.2003.451.7	108-90-7	Chlorobenzene	107	% Recovery	60 - 133	1	NA		03-14-03
XG.2003.451.7	108-88-3	Toluene	107	% Recovery	59 - 139	1	NA		03-14-03
XG.2003.451.7	79-01-6	Trichloroethene	104	% Recovery	62 - 137	1	NA		03-14-03

Type: *MS: Matrix Spike* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337	SW846 1311/3010A/6010A ICP TCLP						M03337-006		
MT.2003.316.43	7440-38-2	Arsenic	97	% Recovery	80 - 120	1	NA		[illegible]9-03
MT.2003.316.43	7440-39-3	Barium	89	% Recovery	80 - 120	1	NA		[illegible]19-03
MT.2003.316.43	7440-43-9	Cadmium	85	% Recovery	80 - 120	1	NA		03-19-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

nt: LOS ALAMOS NATIONAL LABS
roject: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MS: Matrix Spike* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-006		
MT.2003.316.43	7440-47-3	Chromium	95	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.43	7439-92-1	Lead	96	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.43	7782-49-2	Selenium	93	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.43	7440-22-4	Silver	87	% Recovery	80 - 120	1	NA		03-19-03
M03341		SW846 1311/7470 CVAA TCLP					M03341-005		
MT.2003.315.45	7439-97-6	Mercury	67	% Recovery	80 - 120	1	NA		03-19-03

Type: *MSD: Matrix Spike Duplicate Precision* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-006		
XG.2003.486.6	120-82-1	1,2,4-Trichlorobenzene	7	RPD	0 - 16	1	NA		03-12-03
XG.2003.486.6	106-46-7	1,4-Dichlorobenzene	12	RPD	0 - 15	1	NA		03-12-03
2003.486.6	121-14-2	2,4-Dinitrotoluene	6	RPD	0 - 12	1	NA		03-12-03
2003.486.6	95-57-8	2-Chlorophenol	9	RPD	0 - 11	1	NA		03-12-03
XG.2003.486.6	59-50-7	4-Chloro-3-methylphenol	4	RPD	0 - 8	1	NA		03-12-03
XG.2003.486.6	100-02-7	4-Nitrophenol	34	RPD	0 - 9	1	NA		03-12-03
XG.2003.486.6	83-32-9	Acenaphthene	3	RPD	0 - 16	1	NA		03-12-03
XG.2003.486.6	117-84-0	di-n-Octylphthalate	11	RPD	0 - 20	1	NA		03-12-03
XG.2003.486.6	621-64-7	n-Nitroso-di-n-propylamine	9	RPD	0 - 10	1	NA		03-12-03
XG.2003.486.6	87-86-5	Pentachlorophenol	8	RPD	0 - 10	1	NA		03-12-03
XG.2003.486.6	108-95-2	Phenol	13	RPD	0 - 9	1	NA		03-12-03
XG.2003.486.6	129-00-0	Pyrene	13	RPD	0 - 7	1	NA		03-12-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-006		
XG.2003.451.8	75-35-4	1,1 Dichloroethene	1	RPD	0 - 22	1	NA		03-14-03
XG.2003.451.8	106-46-7	1,4 Dichlorobenzene	1	RPD	0 - 21	1	NA		03-14-03
XG.2003.451.8	71-43-2	Benzene	< 1	RPD	0 - 21	1	NA		03-14-03
XG.2003.451.8	108-90-7	Chlorobenzene	< 1	RPD	0 - 21	1	NA		03-14-03
XG.2003.451.8	108-88-3	Toluene	< 1	RPD	0 - 21	1	NA		03-14-03
XG.2003.451.8	79-01-6	Trichloroethene	4	RPD	0 - 24	1	NA		03-14-03

Type: *MSD: Matrix Spike Duplicate Precision* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-007		
MT.2003.316.44	7440-38-2	Arsenic	8	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.44	7440-39-3	Barium	4	RPD	0 - 20	1	NA		03-19-03
2003.316.44	7440-43-9	Cadmium	22	RPD	0 - 20	1	NA		03-19-03
2003.316.44	7440-47-3	Chromium	4	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.44	7439-92-1	Lead	3	RPD	0 - 20	1	NA		03-19-03

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Type: *MSD: Matrix Spike Duplicate Precision* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-007		
MT.2003.316.44	7782-49-2	Selenium	6	RPD	0 - 20	1	NA		03-19-03
MT.2003.316.44	7440-22-4	Silver	3	RPD	0 - 20	1	NA		03-19-03
M03341		SW846 1311/7470 CVAA TCLP					M03341-006		
MT.2003.315.46	7439-97-6	Mercury	24	RPD	0 - 20	1	NA		03-19-03

Type: *MSD: Matrix Spike Duplicate Accuracy* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		SW846 3550A/8270B SVOCs by GC/MS					X03111-006		
XG.2003.486.6	120-82-1	1,2,4-Trichlorobenzene	84	% Recovery	64 - 103	1	NA		03-12-03
XG.2003.486.6	106-46-7	1,4-Dichlorobenzene	79	% Recovery	66 - 97	1	NA		03-12-03
XG.2003.486.6	121-14-2	2,4-Dinitrotoluene	89	% Recovery	61 - 118	1	NA		03-12-03
XG.2003.486.6	95-57-8	2-Chlorophenol	83	% Recovery	72 - 102	1	NA		03-12-03
XG.2003.486.6	59-50-7	4-Chloro-3-methylphenol	90	% Recovery	67 - 110	1	NA		[illegible]03
XG.2003.486.6	100-02-7	4-Nitrophenol	58	% Recovery	56 - 122	1	NA		[illegible]03
XG.2003.486.6	83-32-9	Acenaphthene	82	% Recovery	72 - 109	1	NA		03-12-03
XG.2003.486.6	117-84-0	di-n-Octylphthalate	119	% Recovery	69 - 127	1	NA		03-12-03
XG.2003.486.6	621-64-7	n-Nitroso-di-n-propylamine	83	% Recovery	64 - 111	1	NA		03-12-03
XG.2003.486.6	87-86-5	Pentachlorophenol	74	% Recovery	64 - 105	1	NA		03-12-03
XG.2003.486.6	108-95-2	Phenol	77	% Recovery	66 - 98	1	NA		03-12-03
XG.2003.486.6	129-00-0	Pyrene	102	% Recovery	69 - 117	1	NA		03-12-03
X03114		SW846 8260B Purgeable VOCs by GC/MS					X03114-006		
XG.2003.451.8	75-35-4	1,1 Dichloroethene	119	% Recovery	59 - 172	1	NA		03-14-03
XG.2003.451.8	106-46-7	1,4 Dichlorobenzene	100	% Recovery	60 - 133	1	NA		03-14-03
XG.2003.451.8	71-43-2	Benzene	107	% Recovery	66 - 142	1	NA		03-14-03
XG.2003.451.8	108-90-7	Chlorobenzene	107	% Recovery	60 - 133	1	NA		03-14-03
XG.2003.451.8	108-88-3	Toluene	108	% Recovery	59 - 139	1	NA		03-14-03
XG.2003.451.8	79-01-6	Trichloroethene	108	% Recovery	62 - 137	1	NA		03-14-03

Type: *MSD: Matrix Spike Duplicate Accuracy* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03337		SW846 1311/3010A/6010A ICP TCLP					M03337-007		
MT.2003.316.44	7440-38-2	Arsenic	106	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.44	7440-39-3	Barium	94	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.44	7440-43-9	Cadmium	106	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.44	7440-47-3	Chromium	100	% Recovery	80 - 120	1	NA		03-19-03
MT.2003.316.44	7439-92-1	Lead	100	% Recovery	80 - 120	1	NA		[illegible]-03
MT.2003.316.44	7782-49-2	Selenium	99	% Recovery	80 - 120	1	NA		[illegible]-03
MT.2003.316.44	7440-22-4	Silver	90	% Recovery	80 - 120	1	NA		03-19-03

STANDARD

Assaigai Analytical Laboratories, Inc.

Quality Control Summary

nt: LOS ALAMOS NATIONAL LABS
oject: 7D38 C351 0606 0400
Order 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Type: *MSD: Matrix Spike Duplicate Accuracy* Matrix: *TCLP*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
M03341		SW846 1311/7470 CVAA TCLP					M03341-006		
MT.2003.315.46	7439-97-6	Mercury	85	% Recovery	80 - 120	1	NA		03-19-03

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *0303260-01A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114	8260						X03114-019		
XG.2003.481.4		1,2 Dichloroethane-D4 (SS)	93	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.4		4-Bromofluorobenzene (SS)	96	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.4		Dibromofluoromethane (SS)	95	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.4		Toluene-D8 (SS)	95	% Recovery	81 - 117	1	NA		03-20-03

Sample: *0303260-02A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114	8260						X03114-020		
XG.2003.481.5		1,2 Dichloroethane-D4 (SS)	96	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.5		4-Bromofluorobenzene (SS)	94	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.5		Dibromofluoromethane (SS)	100	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.5		Toluene-D8 (SS)	95	% Recovery	81 - 117	1	NA		03-20-03

Sample: *0303260-03A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111	8270						X03111-008		
XG.2003.486.8		*2,4,6-TRIBROMOPHENOL	72	% Recovery	24 - 132	1	NA		03-19-03
XG.2003.486.8		*2-FLUOROBIPHENYL	78	% Recovery	53 - 126	1	NA		03-19-03
XG.2003.486.8		*2-FLUOROPHENOL	72	% Recovery	44 - 104	1	NA		03-19-03
XG.2003.486.8		*NITROBENZENE-D5	71	% Recovery	34 - 127	1	NA		03-19-03
XG.2003.486.8		*PHENOL-D6	78	% Recovery	40 - 115	1	NA		03-19-03
XG.2003.486.8		*TERPHENYL-D14	84	% Recovery	47 - 116	1	NA		03-19-03

Sample: *0303260-05A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114	8260						X03114-021		
XG.2003.481.6		1,2 Dichloroethane-D4 (SS)	94	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.6		4-Bromofluorobenzene (SS)	96	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.6		Dibromofluoromethane (SS)	97	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.6		Toluene-D8 (SS)	99	% Recovery	81 - 117	1	NA		03-20-03

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *0303260-06A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		8260					X03114-022		
XG.2003.481.7		1,2 Dichloroethane-D4 (SS)	96	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.7		4-Bromofluorobenzene (SS)	96	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.7		Dibromofluoromethane (SS)	97	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.7		Toluene-D8 (SS)	101	% Recovery	81 - 117	1	NA		03-20-03

Sample: *0303260-07A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		8270					X03111-009		
XG.2003.486.9		*2,4,6-TRIBROMOPHENOL	75	% Recovery	24 - 132	1	NA		03-19-03
XG.2003.486.9		*2-FLUOROBIPHENYL	80	% Recovery	53 - 126	1	NA		03-19-03
XG.2003.486.9		*2-FLUOROPHENOL	74	% Recovery	44 - 104	1	NA		03-19-03
XG.2003.486.9		*NITROBENZENE-D5	74	% Recovery	34 - 127	1	NA		03-19-03
XG.2003.486.9		*PHENOL-D6	82	% Recovery	40 - 115	1	NA		03-19-03
XG.2003.486.9		*TERPHENYL-D14	87	% Recovery	47 - 116	1	NA		03-19-03

Sample: *0303260-09A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		8260					X03114-023		
XG.2003.481.8		1,2 Dichloroethane-D4 (SS)	98	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.8		4-Bromofluorobenzene (SS)	96	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.8		Dibromofluoromethane (SS)	97	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.8		Toluene-D8 (SS)	99	% Recovery	81 - 117	1	NA		03-20-03

Sample: *0303260-10A* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		8260					X03114-024		
XG.2003.481.9		1,2 Dichloroethane-D4 (SS)	96	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.9		4-Bromofluorobenzene (SS)	95	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.9		Dibromofluoromethane (SS)	96	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.9		Toluene-D8 (SS)	96	% Recovery	81 - 117	1	NA		03-20-03

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *LCS* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		**8260**						**X03114-002**	
XG.2003.451.4		1,2 Dichloroethane-D4 (SS)	95	% Recovery	70 - 121	1	NA		03-14-03
XG.2003.451.4		4-Bromofluorobenzene (SS)	97	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.4		Dibromofluoromethane (SS)	97	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.4		Toluene-D8 (SS)	98	% Recovery	81 - 117	1	NA		03-14-03
X03111		**8270**						**X03111-002**	
XG.2003.486.2		*2,4,6-TRIBROMOPHENOL	88	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.2		*2-FLUOROBIPHENYL	84	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.2		*2-FLUOROPHENOL	77	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.2		*NITROBENZENE-D5	81	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.2		*PHENOL-D6	83	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.2		*TERPHENYL-D14	91	% Recovery	47 - 116	1	NA		03-12-03

Sample: *LCSD* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run D
X03114		**8260**						**X03114-003**	
XG.2003.451.5		1,2 Dichloroethane-D4 (SS)	98	% Recovery	70 - 121	1	NA		03-14-03
XG.2003.451.5		4-Bromofluorobenzene (SS)	98	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.5		Dibromofluoromethane (SS)	99	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.5		Toluene-D8 (SS)	101	% Recovery	81 - 117	1	NA		03-14-03
X03111		**8270**						**X03111-003**	
XG.2003.486.3		*2,4,6-TRIBROMOPHENOL	91	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.3		*2-FLUOROBIPHENYL	85	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.3		*2-FLUOROPHENOL	76	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.3		*NITROBENZENE-D5	82	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.3		*PHENOL-D6	82	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.3		*TERPHENYL-D14	95	% Recovery	47 - 116	1	NA		03-12-03

Sample: *MB* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		**8260**						**X03114-001**	
XG.2003.451.3		1,2 Dichloroethane-D4 (SS)	99	% Recovery	70 - 121	1	NA		03-14-03
XG.2003.451.3		4-Bromofluorobenzene (SS)	100	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.3		Dibromofluoromethane (SS)	96	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.3		Toluene-D8 (SS)	99	% Recovery	81 - 117	1	NA		03-14-03
X03114		**8260**						**X03114-014**	
XG.2003.472.3		1,2 Dichloroethane-D4 (SS)	91	% Recovery	70 - 121	1	NA		9-03
XG.2003.472.3		4-Bromofluorobenzene (SS)	99	% Recovery	75 - 125	1	NA		03-19-03

STANDARD

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS
Project: 7D38 C351 0606 0400
Order: 0303260 LOS28

Explanation of codes

D	*Not applicable due to sample dilution*
L	*Not applicable due to MDL proximity*

Sample: *MB* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		**8260**						**X03114-014**	
XG.2003.472.3		Dibromofluoromethane (SS)	100	% Recovery	75 - 125	1	NA		03-19-03
XG.2003.472.3		Toluene-D8 (SS)	96	% Recovery	81 - 117	1	NA		03-19-03
X03114		**8260**						**X03114-018**	
XG.2003.481.3		1,2 Dichloroethane-D4 (SS)	95	% Recovery	70 - 121	1	NA		03-20-03
XG.2003.481.3		4-Bromofluorobenzene (SS)	98	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.3		Dibromofluoromethane (SS)	98	% Recovery	75 - 125	1	NA		03-20-03
XG.2003.481.3		Toluene-D8 (SS)	96	% Recovery	81 - 117	1	NA		03-20-03
X03111		**8270**						**X03111-001**	
XG.2003.486.1		*2,4,6-TRIBROMOPHENOL	80	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.1		*2-FLUOROBIPHENYL	78	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.1		*2-FLUOROPHENOL	70	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.1		*NITROBENZENE-D5	73	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.1		*PHENOL-D6	76	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.1		*TERPHENYL-D14	92	% Recovery	47 - 116	1	NA		03-12-03
X03111		**8270**						**X03111-007**	
XG.2003.486.7		*2,4,6-TRIBROMOPHENOL	71	% Recovery	24 - 132	1	NA		03-19-03
XG.2003.486.7		*2-FLUOROBIPHENYL	75	% Recovery	53 - 126	1	NA		03-19-03
XG.2003.486.7		*2-FLUOROPHENOL	70	% Recovery	44 - 104	1	NA		03-19-03
XG.2003.486.7		*NITROBENZENE-D5	70	% Recovery	34 - 127	1	NA		03-19-03
XG.2003.486.7		*PHENOL-D6	74	% Recovery	40 - 115	1	NA		03-19-03
XG.2003.486.7		*TERPHENYL-D14	78	% Recovery	47 - 116	1	NA		03-19-03
X03111		**8270**						**X03111-010**	
XG.2003.486.10		*2,4,6-TRIBROMOPHENOL	86	% Recovery	24 - 132	1	NA		03-20-03
XG.2003.486.10		*2-FLUOROBIPHENYL	90	% Recovery	53 - 126	1	NA		03-20-03
XG.2003.486.10		*2-FLUOROPHENOL	83	% Recovery	44 - 104	1	NA		03-20-03
XG.2003.486.10		*NITROBENZENE-D5	84	% Recovery	34 - 127	1	NA		03-20-03
XG.2003.486.10		*PHENOL-D6	91	% Recovery	40 - 115	1	NA		03-20-03
XG.2003.486.10		*TERPHENYL-D14	96	% Recovery	47 - 116	1	NA		03-20-03

Sample: *MS* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		**8260**						**X03114-005**	
XG.2003.451.7		1,2 Dichloroethane-D4 (SS)	106	% Recovery	70 - 121	1	NA		03-14-03
XG.2003.451.7		4-Bromofluorobenzene (SS)	98	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.7		Dibromofluoromethane (SS)	98	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.7		Toluene-D8 (SS)	101	% Recovery	81 - 117	1	NA		03-14-03
X03111		**8270**						**X03111-005**	
XG.2003.486.5		*2,4,6-TRIBROMOPHENOL	91	% Recovery	24 - 132	1	NA		03-12-03
XG.2003.486.5		*2-FLUOROBIPHENYL	94	% Recovery	53 - 126	1	NA		03-12-03

Assaigai Analytical Laboratories, Inc.

QC Surrogate Summary

Client: LOS ALAMOS NATIONAL LABS

Project: 7D38 C351 0606 0400

Order: 0303260 LOS28

Explanation of codes	
D	Not applicable due to sample dilution
L	Not applicable due to MDL proximity

Sample: *MS* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03111		**8270**					**X03111-005**		
XG.2003.486.5		*2-FLUOROPHENOL	83	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.5		*NITROBENZENE-D5	89	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.5		*PHENOL-D6	90	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.5		*TERPHENYL-D14	103	% Recovery	47 - 116	1	NA		03-12-03

Sample: *MSD* Matrix: *SOLID*

Run Sequence	CAS #	Analyte	Result	Units	Range	Dilution Factor	Detection Limit	Code	Run Date
X03114		**8260**					**X03114-006**		
XG.2003.451.8		1,2 Dichloroethane-D4 (SS)	104	% Recovery	70 - 121	1	NA		03-14-03
XG.2003.451.8		4-Bromofluorobenzene (SS)	101	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.8		Dibromofluoromethane (SS)	99	% Recovery	75 - 125	1	NA		03-14-03
XG.2003.451.8		Toluene-D8 (SS)	99	% Recovery	81 - 117	1	NA		03-14-03
X03111		**8270**					**X03111-006**		
XG.2003.486.6		*2,4,6-TRIBROMOPHENOL	86	% Recovery	24 - 132	1	NA		[illegible]3
XG.2003.486.6		*2-FLUOROBIPHENYL	87	% Recovery	53 - 126	1	NA		03-12-03
XG.2003.486.6		*2-FLUOROPHENOL	72	% Recovery	44 - 104	1	NA		03-12-03
XG.2003.486.6		*NITROBENZENE-D5	80	% Recovery	34 - 127	1	NA		03-12-03
XG.2003.486.6		*PHENOL-D6	80	% Recovery	40 - 115	1	NA		03-12-03
XG.2003.486.6		*TERPHENYL-D14	96	% Recovery	47 - 116	1	NA		03-12-03

Appendix M

Ambient Air Radionuclide Concentrations
At and Near TA-21 from 2000 through the First Half of 2003

APPENDIX M AMBIENT AIR RADIONUCLIDE CONCENTRATIONS AT AND NEAR TA-21 FROM 2000 THROUGH THE FIRST HALF OF 2003

M-1.0 INTRODUCTION

The radiological air-sampling network, referred to as AIRNET, at Los Alamos National Laboratory (LANL or the Laboratory) is operated by the Air Quality Monitoring Team in the Meteorology and Air Quality Group (RRES-MAQ). AIRNET is designed to measure environmental levels of airborne radionuclides that may be released from Laboratory operations. These emissions include plutonium, americium, uranium, tritium, and activation products. The Laboratory currently operates about 50 environmental air samplers to sample radionuclides by collecting water vapor and particulate matter. This data analysis is a review of particulate matter AIRNET data near TA-21 from the beginning of 2000 through the second quarter of 2003 to evaluate the potential impact of the remediation activities conducted at PRS-21-011(k) during 2002 and 2003. Several radionuclides were determined to be present at levels above background values in the soils for this site. These radionuclides included cesium-137, americium-241, strontium-90, plutonium-238, and plutonium-239 (which includes plutonium-240). The sites and groups of sites (identified as clumps) included in this review are listed below in Table M-1.0-1 and are identified in Figure M-1.0-1.

Table M-1.0-1
Sites Included in TA-21 Ambient Air Radionuclide Study

Site Number	Site Name
09	Los Alamos Airport
10	Eastgate
20	TA-21 Area B
62	Crossroads Bible Church
68	Los Alamos Airport Road
69	DP Road - West entrance
71	TA-21.01 (NW Bldg 344)
72	TA-21.02 (N Bldg 344)
73	TA-21.03 (NE Bldg 344)
74	TA-21.04 (SE Bldg 344)
75	TA-21.05 (S Bldg 344)
90	Eastgate - backup
CB	TA-21 Station Clump
CD	LA East Station Clump
CH	On-site Station Clump

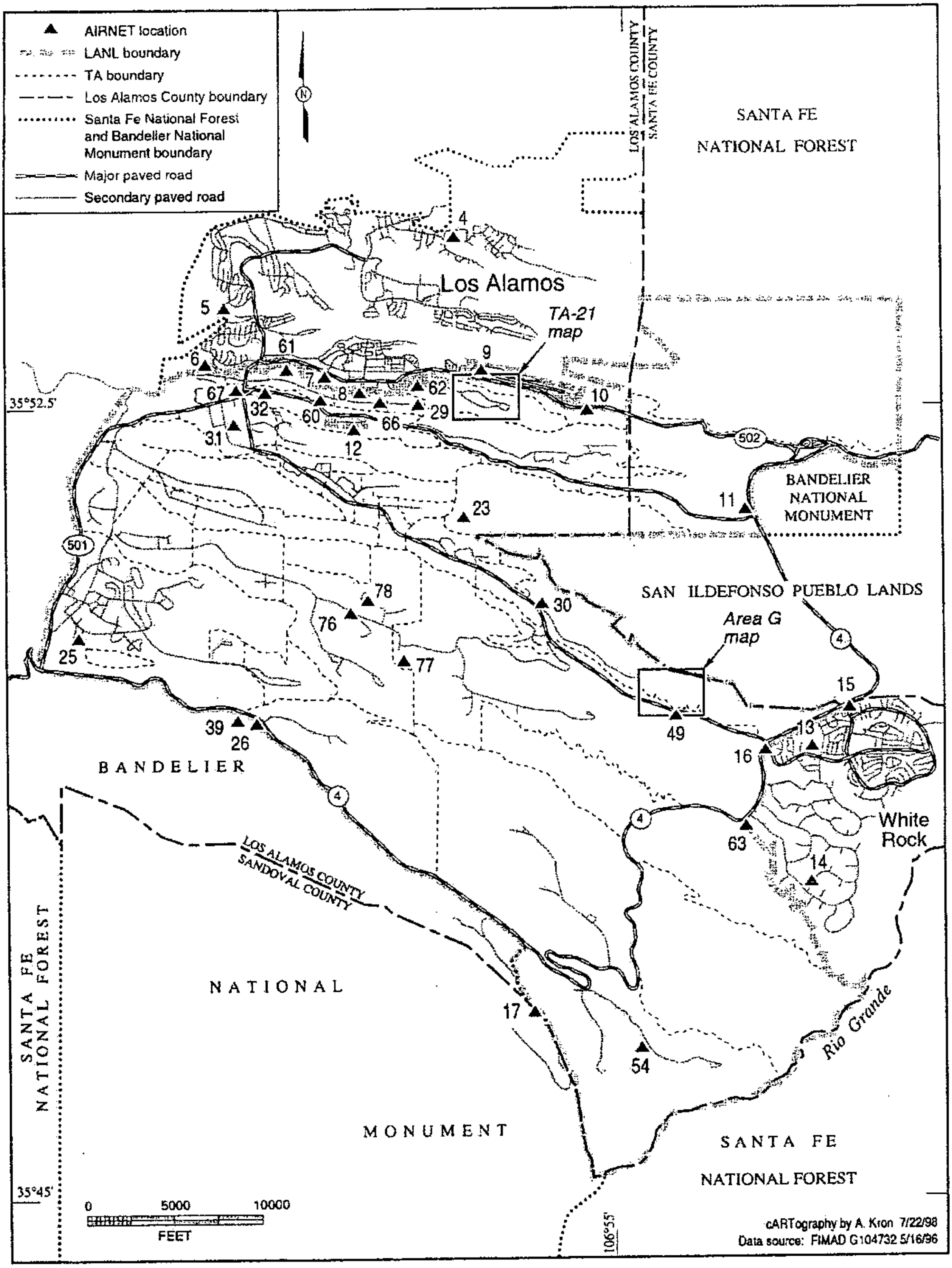

Figure M-1.0-1. AIRNET sample locations

Generally, each AIRNET sampler continuously collects particulate matter for approximately two weeks per sample. Particulate matter is collected on 47-mm polypropylene filters at airflow rates of about 0.11 m^3/min. Individual particulate matter filters are analyzed for gross alpha and gross beta activities. These filters are also grouped across sites, designated as "clumps", and analyzed for gamma-emitting radionuclides. Clumps typically consist of five to ten filters. Gamma-emitting radionuclides have also been measured at individual stations by grouping the filters collected each quarter. Also, each quarter, half-filters from the six or seven sampling periods at each site during the quarter are combined to prepare a quarterly composite for isotopic analyses for each AIRNET station. These composites are dissolved, separated chemically, and then analyzed for isotopes of americium, plutonium, and uranium using alpha spectroscopy. A limited subset of these samples is also analyzed for strontium-90. All analytical procedures meet the requirements of 40 Code of Federal Regulations (CFR) 61, Appendix B, Method 114. The AIRNET project plan provides a summary of the target minimum detectable activity (MDA) for the biweekly and quarterly samples.

All AIRNET concentrations and doses are total measurements without any type of regional background subtractions. The AIRNET air concentrations are blank-corrected to include corrections for the radioactivity from the filter material and the analytical process.

RRES-MAQ compares ambient air concentrations, as calculated from the AIRNET sample measurements, with environmental compliance standards or workplace exposure standards, depending on the location of the sampler. For this analysis, annual concentrations are compared with the 10-mrem equivalent concentration established by the U.S. Environmental Protection Agency (EPA 1989) and published in 40 CFR Part 61, Appendix E, Table 2—"Concentration Levels for Environmental Compliance". All radiation doses were calculated using this 10-mrem concentration as the conversion factor.

M-2.0 AMBIENT AIR CONCENTRATIONS

As previously noted, the radionuclides that could potentially be present at levels above background values include cesium-137, americium-241, strontium-90, plutonium-238, and plutonium-239. Air concentrations from individual samples are shown in Table M-2.0-1 for all these radionuclides, with the exception of cesium-137, and for the three uranium isotopes (uranium-234, uranium-235, and uranium-238). Radionuclide concentrations among sites are graphically compared in Figures M-2.0-1 through M-2.0-7. As shown in Table M-2.0-1, many of these measurements are less than their 2s uncertainties; however, the measurements are estimated concentrations rather than "less than" values. Annual isotopic concentrations were calculated from these results and are presented in Table M-2.0-2.

No detectable concentrations of cesium-137 were measured in any of the quarterly samples or in any of the clumped filters. Because these concentrations were measured by gamma spectroscopy, all cesium-137 values are expressed as "less than" values. Annual averages of these values are shown in Table M-2.0-3. The maximum "less than" value was 1.42 fCi/m^3, a value which, if it were an actual concentration, would result in a dose of about 0.75 mrem. However, because all measurements were "less than" values, the actual concentration would be much lower.

Particulate matter samples in and around TA-21 occasionally contain measurable concentrations of plutonium and americium that have been related to previous remediation activities and to soil disturbances including dirt roads. As shown in Figures M-2.0-2 through M-2.0-4, there were no major increases at any site during the latter half of 2002 and the first half of 2003. Concentrations of plutonium and americium did increase slightly during the second quarter of 2003 at site 72, just south of SWMU 21-011(k); the plutonium-239 concentration was above its 2s uncertainty. As shown in Figure M-2.0-1, none of the strontium measurements exceeded their 2s uncertainties.

Table M-2.0-1
AIRNET Sample Analytical Results

Analyte	Site Number	Site Name	Period ID	Net Air Concentration (aCi/m³) Measurement	2s Uncertainty	Start Date	End Date
Americium-241	09	Los Alamos Airport	00Q1	0.0	2.3	12/20/99	3/27/00
Americium-241	09	Los Alamos Airport	00Q2	2.1	6.3	3/27/00	6/19/00
Americium-241	09	Los Alamos Airport	00Q3	-0.3	2.2	6/19/00	9/25/00
Americium-241	09	Los Alamos Airport	00Q4	1.0	2.5	9/25/00	12/18/00
Americium-241	09	Los Alamos Airport	01Q1	0.7	3.0	12/18/00	3/26/01
Americium-241	09	Los Alamos Airport	01Q2	1.1	4.0	3/26/01	6/18/01
Americium-241	09	Los Alamos Airport	01Q3	0.8	2.7	6/18/01	9/24/01
Americium-241	09	Los Alamos Airport	01Q4	-0.9	2.1	9/24/01	12/17/01
Americium-241	09	Los Alamos Airport	02Q1	0.3	2.5	12/17/01	3/18/02
Americium-241	09	Los Alamos Airport	02Q2	0.1	1.8	3/18/02	6/24/02
Americium-241	09	Los Alamos Airport	02Q3	0.7	1.9	6/24/02	9/30/02
Americium-241	09	Los Alamos Airport	02Q4	-0.9	2.4	9/30/02	12/23/02
Americium-241	09	Los Alamos Airport	03Q1	1.6	2.6	12/23/02	3/31/03
Americium-241	09	Los Alamos Airport	03Q2	-1.0	2.0	3/31/03	6/23/03
Americium-241	10	Eastgate	00Q1	-0.8	2.3	12/20/99	3/27/00
Americium-241	10	Eastgate	00Q2	1.0	5.1	3/27/00	6/19/00
Americium-241	10	Eastgate	00Q3	1.5	2.7	6/19/00	9/25/00
Americium-241	10	Eastgate	00Q4	1.2	3.6	9/25/00	12/18/00
Americium-241	10	Eastgate	01Q1	-1.2	2.0	12/18/00	3/26/01
Americium-241	10	Eastgate	01Q2	2.7	4.0	3/26/01	6/18/01
Americium-241	10	Eastgate	01Q3	1.3	2.9	6/18/01	9/24/01
Americium-241	10	Eastgate	01Q4	-0.7	2.4	9/24/01	12/17/01
Americium-241	10	Eastgate	02Q1	0.4	2.5	12/17/01	3/18/02
Americium-241	10	Eastgate	02Q2	0.9	2.1	3/18/02	6/24/02
Americium-241	10	Eastgate	02Q3	-0.2	1.7	6/24/02	9/30/02
Americium-241	10	Eastgate	02Q4	1.0	2.7	9/30/02	12/23/02
Americium-241	10	Eastgate	03Q1	0.0	2.0	12/23/02	3/31/03
Americium-241	10	Eastgate	03Q2	-0.4	2.2	3/31/03	6/23/03
Americium-241	20	TA-21 Area B	00Q1	0.7	2.3	12/20/99	3/27/00
Americium-241	20	TA-21 Area B	00Q2	1.3	3.7	3/27/00	6/19/00
Americium-241	20	TA-21 Area B	00Q3	0.4	1.9	6/19/00	9/25/00
Americium-241	20	TA-21 Area B	00Q4	0.7	2.5	9/25/00	12/18/00
Americium-241	20	TA-21 Area B	01Q1	0.0	2.0	12/18/00	3/26/01
Americium-241	20	TA-21 Area B	01Q2	-0.7	3.1	3/26/01	6/18/01
Americium-241	20	TA-21 Area B	01Q3	0.8	2.8	6/18/01	9/24/01
Americium-241	20	TA-21 Area B	01Q4	-0.3	2.2	9/24/01	12/17/01
Americium-241	20	TA-21 Area B	02Q1	0.8	2.6	12/17/01	3/18/02
Americium-241	20	TA-21 Area B	02Q2	2.4	2.5	3/18/02	6/24/02

Table M-2.0-1 (continued)

Analyte	Site Number	Site Name	Period ID	Net Air Concentration (aCi/m³) Measurement	2s Uncertainty	Start Date	End Date
Americium-241	20	TA-21 Area B	02Q3	-0.3	1.8	6/24/02	9/30/02
Americium-241	20	TA-21 Area B	02Q4	0.1	2.3	9/30/02	12/23/02
Americium-241	20	TA-21 Area B	03Q1	0.9	2.3	12/23/02	3/31/03
Americium-241	20	TA-21 Area B	03Q2	0.1	2.8	3/31/03	6/23/03
Americium-241	62	Crossroads Bible Church	00Q1	-0.1	2.2	12/20/99	3/27/00
Americium-241	62	Crossroads Bible Church	00Q2	0.6	3.8	3/27/00	6/19/00
Americium-241	62	Crossroads Bible Church	00Q3	1.8	2.2	6/19/00	9/25/00
Americium-241	62	Crossroads Bible Church	00Q4	3.1	3.7	9/25/00	12/18/00
Americium-241	62	Crossroads Bible Church	01Q1	-2.0	2.1	12/18/00	3/26/01
Americium-241	62	Crossroads Bible Church	01Q2	-0.2	3.1	3/26/01	6/18/01
Americium-241	62	Crossroads Bible Church	01Q3	0.6	2.9	6/18/01	9/24/01
Americium-241	62	Crossroads Bible Church	01Q4	0.1	2.4	9/24/01	12/17/01
Americium-241	62	Crossroads Bible Church	02Q1	-0.6	2.4	12/17/01	3/18/02
Americium-241	62	Crossroads Bible Church	02Q2	-0.5	1.7	3/18/02	6/24/02
Americium-241	62	Crossroads Bible Church	02Q3	4.5	2.7	6/24/02	9/30/02
Americium-241	62	Crossroads Bible Church	02Q4	0.1	2.2	9/30/02	12/23/02
Americium-241	62	Crossroads Bible Church	03Q1	-0.3	2.1	12/23/02	3/31/03
Americium-241	62	Crossroads Bible Church	03Q2	-0.7	2.2	3/31/03	6/23/03
Americium-241	68	Los Alamos Airport Road	01Q4	5.3	9.8	9/24/01	12/17/01
Americium-241	68	Los Alamos Airport Road	02Q1	-0.1	2.6	12/17/01	3/18/02
Americium-241	68	Los Alamos Airport Road	02Q2	-0.1	1.8	3/18/02	6/24/02
Americium-241	68	Los Alamos Airport Road	02Q3	0.6	1.9	6/24/02	9/30/02
Americium-241	68	Los Alamos Airport Road	02Q4	0.8	2.3	9/30/02	12/23/02
Americium-241	68	Los Alamos Airport Road	03Q1	-0.9	2.1	12/23/02	3/31/03
Americium-241	68	Los Alamos Airport Road	03Q2	-0.8	2.3	3/31/03	6/23/03
Americium-241	69	DP Road - West Entrance	02Q2	-1.4	3.1	3/18/02	6/24/02
Americium-241	69	DP Road - West Entrance	02Q3	-0.6	1.6	6/24/02	9/30/02
Americium-241	69	DP Road - West Entrance	02Q4	-0.8	2.1	9/30/02	12/23/02
Americium-241	71	TA-21.01 (NW Bldg 344)	00Q1	-0.1	2.4	12/20/99	3/27/00
Americium-241	71	TA-21.01 (NW Bldg 344)	00Q2	0.4	3.6	3/27/00	6/19/00
Americium-241	71	TA-21.01 (NW Bldg 344)	00Q3	0.7	2.1	6/19/00	9/25/00
Americium-241	71	TA-21.01 (NW Bldg 344)	00Q4	2.6	3.7	9/25/00	12/18/00
Americium-241	71	TA-21.01 (NW Bldg 344)	01Q1	1.1	3.2	12/18/00	3/26/01
Americium-241	71	TA-21.01 (NW Bldg 344)	01Q2	0.5	3.2	3/26/01	6/18/01
Americium-241	71	TA-21.01 (NW Bldg 344)	01Q3	-0.7	2.4	6/18/01	9/24/01
Americium-241	71	TA-21.01 (NW Bldg 344)	01Q4	-1.7	2.6	9/24/01	12/17/01
Americium-241	72	TA-21.02 (N Bldg 344)	00Q1	0.8	2.8	12/20/99	3/27/00
Americium-241	72	TA-21.02 (N Bldg 344)	02Q3	1.2	6.2	6/24/02	9/30/02
Americium-241	72	TA-21.02 (N Bldg 344)	02Q4	0.1	2.2	9/30/02	12/23/02
Americium-241	72	TA-21.02 (N Bldg 344)	03Q1	0.2	2.1	12/23/02	3/31/03

Table M-2.0-1 (continued)

Analyte	Site Number	Site Name	Period ID	Net Air Concentration (aCi/m³) Measurement	2s Uncertainty	Start Date	End Date
Americium-241	72	TA-21.02 (N Bldg 344)	03Q2	2.0	2.9	3/31/03	6/23/03
Americium-241	73	TA-21.03 (NE Bldg 344)	00Q1	2.7	2.8	12/20/99	3/27/00
Americium-241	73	TA-21.03 (NE Bldg 344)	02Q3	0.8	6.3	6/24/02	9/30/02
Americium-241	73	TA-21.03 (NE Bldg 344)	02Q4	4.5	3.1	9/30/02	12/23/02
Americium-241	74	TA-21.04 (SE Bldg 344)	00Q1	1.6	2.7	12/20/99	3/27/00
Americium-241	74	TA-21.04 (SE Bldg 344)	02Q3	3.0	7.0	6/24/02	9/30/02
Americium-241	74	TA-21.04 (SE Bldg 344)	02Q4	0.2	2.3	9/30/02	12/23/02
Americium-241	75	TA-21.05 (S Bldg 344)	00Q1	-1.2	2.0	12/20/99	3/27/00
Americium-241	75	TA-21.05 (S Bldg 344)	02Q3	2.2	6.8	6/24/02	9/30/02
Americium-241	75	TA-21.05 (S Bldg 344)	02Q4	-0.5	2.0	9/30/02	12/23/02
Americium-241	90	Eastgate - Backup	01Q3	-2.1	5.2	6/18/01	9/24/01
Americium-241	90	Eastgate - Backup	01Q4	-1.1	2.1	9/24/01	12/17/01
Americium-241	90	Eastgate - Backup	02Q1	-1.3	2.5	12/17/01	3/18/02
Americium-241	90	Eastgate - Backup	02Q2	0.3	2.0	3/18/02	6/24/02
Americium-241	90	Eastgate - Backup	02Q3	2.1	2.6	6/24/02	9/30/02
Americium-241	90	Eastgate - Backup	02Q4	-0.7	2.1	9/30/02	12/23/02
Americium-241	90	Eastgate - Backup	03Q1	0.6	2.2	12/23/02	3/31/03
Americium-241	90	Eastgate - Backup	03Q2	0.0	2.2	3/31/03	6/23/03
Plutonium-238	09	Los Alamos Airport	00Q1	0.1	1.0	12/20/99	3/27/00
Plutonium-238	09	Los Alamos Airport	00Q2	0.9	2.8	3/27/00	6/19/00
Plutonium-238	09	Los Alamos Airport	00Q3	0.1	0.7	6/19/00	9/25/00
Plutonium-238	09	Los Alamos Airport	00Q4	-0.3	0.8	9/25/00	12/18/00
Plutonium-238	09	Los Alamos Airport	01Q1	0.0	1.5	12/18/00	3/26/01
Plutonium-238	09	Los Alamos Airport	01Q2	-0.3	0.8	3/26/01	6/18/01
Plutonium-238	09	Los Alamos Airport	01Q3	0.5	1.2	6/18/01	9/24/01
Plutonium-238	09	Los Alamos Airport	01Q4	-0.3	0.7	9/24/01	12/17/01
Plutonium-238	09	Los Alamos Airport	02Q1	0.0	0.7	12/17/01	3/18/02
Plutonium-238	09	Los Alamos Airport	02Q2	0.2	1.2	3/18/02	6/24/02
Plutonium-238	09	Los Alamos Airport	02Q3	-0.9	0.9	6/24/02	9/30/02
Plutonium-238	09	Los Alamos Airport	02Q4	-0.5	1.4	9/30/02	12/23/02
Plutonium-238	09	Los Alamos Airport	03Q1	-0.3	0.6	12/23/02	3/31/03
Plutonium-238	09	Los Alamos Airport	03Q2	-0.9	1.0	3/31/03	6/23/03
Plutonium-238	10	Eastgate	00Q1	0.7	1.4	12/20/99	3/27/00
Plutonium-238	10	Eastgate	00Q2	1.1	2.4	3/27/00	6/19/00
Plutonium-238	10	Eastgate	00Q3	-0.3	0.7	6/19/00	9/25/00
Plutonium-238	10	Eastgate	00Q4	-0.5	1.6	9/25/00	12/18/00
Plutonium-238	10	Eastgate	01Q1	-0.4	1.0	12/18/00	3/26/01
Plutonium-238	10	Eastgate	01Q2	0.2	1.6	3/26/01	6/18/01
Plutonium-238	10	Eastgate	01Q3	0.3	1.0	6/18/01	9/24/01
Plutonium-238	10	Eastgate	01Q4	-0.3	0.7	9/24/01	12/17/01

Table M-2.0-1 (continued)

Analyte	Site Number	Site Name	Period ID	Net Air Concentration (aCi/m^3)		Start Date	End Date
				Measurement	2s Uncertainty		
Plutonium-238	10	Eastgate	02Q1	-0.2	0.8	12/17/01	3/18/02
Plutonium-238	10	Eastgate	02Q2	-0.1	0.8	3/18/02	6/24/02
Plutonium-238	10	Eastgate	02Q3	-0.4	1.0	6/24/02	9/30/02
Plutonium-238	10	Eastgate	02Q4	0.3	2.0	9/30/02	12/23/02
Plutonium-238	10	Eastgate	03Q1	0.2	0.7	12/23/02	3/31/03
Plutonium-238	10	Eastgate	03Q2	-0.4	1.2	3/31/03	6/23/03
Plutonium-238	20	TA-21 Area B	00Q1	0.2	1.5	12/20/99	3/27/00
Plutonium-238	20	TA-21 Area B	00Q2	0.1	1.7	3/27/00	6/19/00
Plutonium-238	20	TA-21 Area B	00Q3	0.1	0.7	6/19/00	9/25/00
Plutonium-238	20	TA-21 Area B	00Q4	-0.3	0.8	9/25/00	12/18/00
Plutonium-238	20	TA-21 Area B	01Q1	0.2	1.6	12/18/00	3/26/01
Plutonium-238	20	TA-21 Area B	01Q2	0.3	1.6	3/26/01	6/18/01
Plutonium-238	20	TA-21 Area B	01Q3	0.1	0.8	6/18/01	9/24/01
Plutonium-238	20	TA-21 Area B	01Q4	-0.3	1.0	9/24/01	12/17/01
Plutonium-238	20	TA-21 Area B	02Q1	0.3	0.8	12/17/01	3/18/02
Plutonium-238	20	TA-21 Area B	02Q2	1.1	1.3	3/18/02	6/24/02
Plutonium-238	20	TA-21 Area B	02Q3	-0.5	0.8	6/24/02	9/30/02
Plutonium-238	20	TA-21 Area B	02Q4	0.5	1.7	9/30/02	12/23/02
Plutonium-238	20	TA-21 Area B	03Q1	0.0	0.9	12/23/02	3/31/03
Plutonium-238	20	TA-21 Area B	03Q2	-0.9	1.2	3/31/03	6/23/03
Plutonium-238	62	Crossroads Bible Church	00Q1	0.5	1.0	12/20/99	3/27/00
Plutonium-238	62	Crossroads Bible Church	00Q2	0.1	1.2	3/27/00	6/19/00
Plutonium-238	62	Crossroads Bible Church	00Q3	0.3	1.2	6/19/00	9/25/00
Plutonium-238	62	Crossroads Bible Church	00Q4	0.0	1.7	9/25/00	12/18/00
Plutonium-238	62	Crossroads Bible Church	01Q1	0.9	1.6	12/18/00	3/26/01
Plutonium-238	62	Crossroads Bible Church	01Q2	-0.1	1.6	3/26/01	6/18/01
Plutonium-238	62	Crossroads Bible Church	01Q3	-0.2	0.5	6/18/01	9/24/01
Plutonium-238	62	Crossroads Bible Church	01Q4	-1.0	1.6	9/24/01	12/17/01
Plutonium-238	62	Crossroads Bible Church	02Q1	-0.2	0.5	12/17/01	3/18/02
Plutonium-238	62	Crossroads Bible Church	02Q2	0.4	1.2	3/18/02	6/24/02
Plutonium-238	62	Crossroads Bible Church	02Q3	0.2	1.1	6/24/02	9/30/02
Plutonium-238	62	Crossroads Bible Church	02Q4	-0.3	1.3	9/30/02	12/23/02
Plutonium-238	62	Crossroads Bible Church	03Q1	-0.5	0.6	12/23/02	3/31/03
Plutonium-238	62	Crossroads Bible Church	03Q2	-0.2	1.3	3/31/03	6/23/03
Plutonium-238	68	Los Alamos Airport Road	01Q4	0.5	2.8	9/24/01	12/17/01
Plutonium-238	68	Los Alamos Airport Road	02Q1	-0.5	0.6	12/17/01	3/18/02
Plutonium-238	68	Los Alamos Airport Road	02Q2	-0.3	0.7	3/18/02	6/24/02
Plutonium-238	68	Los Alamos Airport Road	02Q3	-0.3	1.1	6/24/02	9/30/02
Plutonium-238	68	Los Alamos Airport Road	02Q4	-0.6	1.4	9/30/02	12/23/02
Plutonium-238	68	Los Alamos Airport Road	03Q1	-0.1	0.8	12/23/02	3/31/03