9-1-2005

Justification for Class III Permit Modification September 2005, SWMUs 1 and 3, Operable Unit 1303, Radioactive Waste Landfill and Chemical Disposal Pits

Sandia National Laboratories/NM

SWMU 1, Radioactive Waste Landfill, and SWMU 3, Chemical Disposal Pits

This work supported by the
United States Department of Energy
under contract DE-AC04-94185000.

Environmental Restoration Project

Site History

- SWMU 1, the Radioactive Waste Landfill (RWL) and SWMU 3, the Chemical Disposal Pits (CDPs), are located in the eastern portion of TA II. The sites cover approximately 0.3 acres.
- During 1949 to 1959, disposal activities were conducted at the RWL and the CDPs. The RWL consisted of three trenches and three pits. The pits ranged from 10 to 15 ft wide, varied in length from 12 to 15 ft, and had a maximum depth of 19 ft. The trenches ranged in length from 25 to 50 ft, and in width from 5 to 15 ft; the maximum depth was 23 ft. Weapons-related debris was buried in the unlined earthen trenches and pits. The debris consisted of a heterogeneous mixture of many things; including weapon components, radiation sources, and laboratory refuse (gloves, glassware, etc.). After being filled with the debris, all six disposal cells of the RWL were covered with native soil and capped with concrete.
- The CDPs consisted of several poorly defined earthen pits (disposal cells), which together had a diameter of approximately 25 ft. The CDPs had a depth of about 15 ft and were located at the northeast corner of the RWL. Debris in the CDPs included glass bottles containing acids (nitric, hydrochloric, and phosphoric) and some Pu-239. After being filled with the glass bottles, the CDPs were covered with soil.
- SWMUs 1 and 3 have been administratively combined because the site boundary for SWMU 1 encompasses SWMU 3.

Depth to Groundwater

- The regional aquifer is approximately 520 ft bgs, and a perched aquifer (not a source of drinking water) is approximately 320 ft bgs.

Constituents of Concern

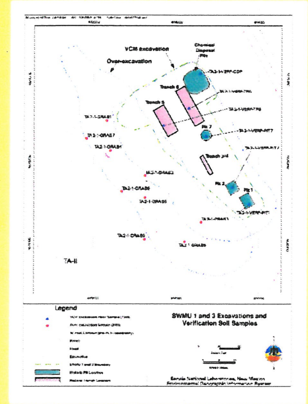
- Metals
- Radionuclides

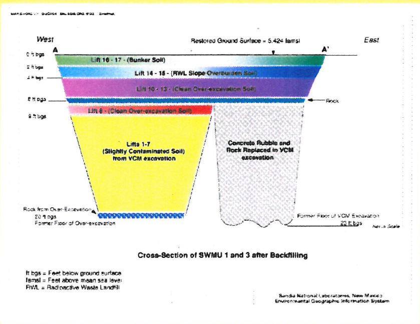
Investigations

- During 1991 to 1994, several nonintrusive investigations were conducted including geophysical surveys, surface radiological surveys, personnel interviews, and a review of historical aerial photographs. The investigations confirmed the location of the disposal cells and identified the types of buried debris.
- In December 1993, a passive soil-vapor survey was conducted across the eastern half of TA-II. Soil-vapor collectors were buried for 30 days at a depth of approximately 1 ft. After retrieval, the collectors were analyzed at an off-site laboratory. No VOCs or SVOCs were detected.

VCM Activities

- In May to August 1996, a VCM was conducted to remediate the site by excavating the entire SWMU 1 area. The resulting VCM excavation was 120 ft wide and 220 ft long, with a maximum excavation depth of approximately 23 ft. The original floor of each disposal cell was left exposed for sampling. The excavated soil was segregated into two categories according to the field screening for radionuclides, VOCs, explosives and visual appearance. The two categories consisted of potentially uncontaminated and potentially contaminated. Further laboratory analysis of samples from the piles determined the final designation. Approximately 400 cu yds of radioactively contaminated soil were shipped to an off-site waste disposal facility. Approximately 96 cu yds of weapon debris and solid material were also shipped off site. Approximately 5,000 cu yds of excavated soil were sampled and stockpiled for later use.





Backfilling VCM excavation..

Aerial Photograph of TA-II.

- At the conclusion of the VCM excavation, verification surveys (radiation and geophysical) were conducted across the floor and sidewalls of the excavation. No radioactive or metallic anomalies were detected, indicating complete removal of buried debris.
- In July and August 1996, prior to backfilling, six composite soil samples were collected as verification samples from the floors of the disposal cells and analyzed for radionuclides and metals. The sampling depths ranged from 15 to 23 ft bgs. Metals and radionuclides were detected above background values. Because these were composite samples, the results were not used in the risk assessments.
- In November 1999, six discrete soil samples were collected from the floors of the disposal cells at depths ranging from 15 to 23 ft bgs. Samples were analyzed for cadmium, mercury and silver by an off-site laboratory and for radionuclides by on-site and off-site laboratories. There was a detection of mercury that exceeded the background value. The radionuclides Pu-238 and Pu-239/240 were detected but there are no background values calculated for plutonium isotopes. Tritium was detected at activities exceeding the background value. The MDAs for U-235 exceeded background activities. Despite the above-background activity results, no additional soil removal was deemed necessary, as the analytical results meet ER Project risk criteria.
- In 2000, consolidation (combining) of the soil piles into fewer piles was conducted in preparation for the backfilling operation. Extensive soil sampling was conducted in 1997, prior to consolidation, and after consolidation, in 2000 through 2003. Soil samples were analyzed for radionuclides by alpha and gamma spectroscopy, isotopic plutonium, tritium, and RCRA metals plus beryllium, nickel and total uranium. Elevated levels of metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and uranium) and radionuclides (Cs-137, Pu-238, Pu-239/240, Th-232, tritium, U-235 and U-238) were detected. Analytical results and risk assessments showed that the "slightly contaminated" soil piles would be suitable as backfill material if a layer of at least 5 ft of "clean" soil was used to cover the piles.
- In 2001, soil from two areas (the RWL slope and TA-II bunkers) outside of known contamination was stockpiled and sampled in preparation for use as fill. The soil was analyzed for radionuclides by gamma spectroscopy, and for isotopic plutonium, tritium, and RCRA metals plus beryllium, nickel and total uranium. The samples had detections of Pu-238 and Pu-239/240, concentrations of radionuclides (Cs-137, tritium, U-235 and U-238) above background values and concentrations of metals (arsenic, barium, cadmium, chromium, mercury, and uranium) above background values. This soil was referred to as "clean" soil and was later used to cover the "slightly contaminated" soil. The term "clean" soil refers to soil piles that contained radionuclides an/or metals with activities or concentrations that meet ER Project risk criteria for the depth range of 0 to 5 ft bgs.
- During May to June 2003, an "over-excavation" trench was dug immediately west of the VCM excavation; it was approximately 25 ft wide, 200 ft long, and approximately 20 ft deep. The soil was analyzed for isotopic plutonium, tritium, and RCRA metals plus beryllium, nickel and total uranium. There were detections of Pu-238 and Pu-239/240, and tritium had concentrations above the background value; four metals (arsenic, barium, mercury and silver) were detected at concentrations above background values. This soil was also referred to as "clean" soil and was later used to cover the "slightly contaminated" soil.
In June and July 2003, the VCM excavation and the adjacent over-excavation trench were backfilled to the original (pre-VCM) ground elevation. Backfill plans designated 17 lifts of soil utilizing the "slightly contaminated" and the "clean" soil piles. Sampling results determined which soil pile was used for each of the 17 lifts. The deepest lifts (10 to 20 ft bgs) contained slightly elevated concentrations of metals and radionuclides. The uppermost lifts (0 to 10 ft bgs) consisted of "clean" soils from the over-excavated trench and from outside of known contamination areas (the RWL slope and TA-II bunkers).
- In November 2003, final verification soil samples were collected from the restored ground surface and analyzed for radionuclides and metals. There were several detections of Pu-238 and Pu-239/240. There was one detection of Cs-137 above the background value and four detections of tritium above the background value. There was one detection of barium and two detections of mercury that exceeded the background values.
- During January to March 2004, comprehensive walkover radiation surveys were conducted across the restored ground surface. A few small radioactive anomalies (uranium and plutonium) were identified and removed.

Summary of Data Used for NFA Justification

- A total of 954 confirmatory soil analyses were used in the risk assessments.
- Soil samples were collected from the floors of the disposal cells in the VCM excavation, the VCM soil piles, the over-excavation trench, the RWL slope, TA-II bunkers, and the restored ground surface.

Recommended Futrue Land Use

- Industrial land use was established for this site.

Results of Risk Analysis

- Risk assessment results for the industrial land-use scenario are calculated per NMED risk assessment guidance as presented in "Supplemental Risk Document Supporting Class 3 Permit Modification Process."
- Because COCs were present in concentrations greater than background-screening levels or because constituents were present that did not have background-screening numbers, it was necessary to perform a risk assessment for the site. The risk assessment analysis evaluated the potential for adverse health effects for an industrial land-use scenario.
- The maximum concentration value for lead was 81.7 J mg/kg; this concentration is greater than the background value. The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. The NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1,500 mg/kg, respectively. The EPA screening guidance value for a residential land-use scenario is 400 mg/kg. The maximum concentration for lead at this site is less than all the screening values; therefore, lead was eliminated from further consideration in the human health risk assessment.
- The total human health HI was 0.10 and the total estimated excess cancer risk was 4E-6 for the industrial land-use scenario, both of which are below the NMED guidelines.
- The human health incremental TEDE for an industrial land-use scenario with a 5-ft layer of "clean" soil over the contaminated soil (using the maximum reported activity) was 2.9E-2 mrem/yr, which is below the EPA numerical guideline of 15 mrem/yr. The human health incremental TEDE for an industrial land-use scenario for direct contact with the "clean" soil that is 0 to 5 ft bgs is 8.3E-1 mrem/yr, which is below the EPA numerical guideline of 15 mrem/yr. The incremental TEDE for a residential land-use scenario that results from a complete loss of institutional control is 15.2 mrem/yr, below the guideline of 75 mrem/yr, with an associated risk of 5.1E-5. Therefore, SWMU 1 is eligible for unrestricted radiological release. Using the SNL predictive ecological risk assessment methodology, the ecological risk for SWMU 1 is predicted to be low.
- In conclusion, human health and ecological risks are acceptable per NMED guidance for an industrial land-use scenario. Thus, the site is proposed for CAC with institutional controls.

Risk Assessment Values for SWMU 1 Nonradiological COCs

COC[a]	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[b]	
		Hazard Index	Cancer Risk
Arsenic	6.99	0.03	4E-6
Barium	479	0.01	–
Cadmium	6.7	0.01	2E-9
Chromium, total	19.2	0.01	4E-8
Mercury	7.8	0.03	–
Selenium	2.0	0.00	–
Silver	1.95	0.00	–
Uranium	58.6	0.02	–
Total		**0.10**	**4E-6**

[a]Maximum concentration exceeded background value, where applicable, or was detected above MDL.
[b]EPA 1989.

For More Information Contact

U.S. Department of Energy
Sandia Site Office
Environmental Restoration
Mr. John Gould
Telephone (505) 845-6089

Sandia National Laboratories
Environmental Restoration Project
Task Leader: Brenda Langkopf
Telephone (505) 284-3272

National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

AUG 3 0 2005

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Mr. James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Road East
Building 1
Santa Fe, NM 87505

cc: Carolyn O
SEC

Dear Mr. Bearzi,

On behalf of Sandia Corporation and the Department of Energy (DOE), DOE is initiating a Class 3 Modification for the designation of twenty-eight (28) solid waste management units (SWMUs) and areas of concern (AOCs) as "approved for No Further Action" in Table A.2 of the Hazardous and Solid Waste Amendments (HSWA) Module (Module IV) of the Resource Conservation and Recovery Act (RCRA) Permit for Sandia National Laboratories/New Mexico (SNL/NM) (EPA ID No. NM5890110518-1).

On April 29, 2004, the final Compliance Order on Consent (Consent Order) for Sandia National Laboratories was issued. Under Section III.V of the Consent Order, work that has been satisfactorily completed prior to the effective date of the Order, that fulfills the substantive requirements of the Order, and that has been approved by the New Mexico Environment Department (NMED) in writing, is deemed to comply with the Consent Order. In this case, the work completed at the twenty-eight (28) SWMUs/AOCs satisfies these requirements, as evidenced by written NMED approvals of no further action. An NFA approval is equivalent to a determination of Corrective Action Complete under the Consent Order.

DOE requests that the twenty-eight (28) SWMU/AOCs identified in the enclosed table be designated as no further action approved (Corrective Action Complete) in Table A-2 of the HSWA Module. When comprehensive changes are made to the HSWA Module to incorporate changes related to the Consent Order, two new tables (Corrective Action Complete with Controls and Corrective Action Complete without Controls) will be added to the HSWA Module. When these tables are completed, all but SWMUs 1 and 3, and AOC 1081 are expected to be included on the table Corrective Action Complete without Controls. SWMUs 1 and 3, and AOC 1081 are expected to be designated as Corrective Action Complete with Controls. SWMUs 1 and 3 will be administratively combined as SWMU 1 in the Corrective Action Complete with Controls table, documenting that the investigation, cleanup, and No Further Action Proposal for SWMU 1 addressed both sites as one unit.

For each SWMU or AOC, the rationale for designation as "no further action approved" has been documented in a Corrective Action Complete (CAC) proposal, a No Further

Action (NFA) proposal (for SWMUs) or a SWMU Assessment Report (for AOCs). The CAC proposals, NFA proposals and SWMU Assessment Reports have been reviewed by NMED, and NMED has determined that each SWMU/AOC is appropriate for no further action.

In accordance with 20.4.1.900 NMAC, incorporating 40 CFR 270.42(c)(1), and Section IV.B.3.b of the above referenced Permit, the following information is provided.

DOE requests that the twenty-eight (28) SWMU/AOCs, identified in Enclosure 1, be designated as no further action approved (Corrective Action Complete) in Table A-2 of the HSWA Module.

This permit modification is needed to designate the twenty-eight (28) SWMUs/AOCs as no further action approved in Table A-2. The information necessary for this designation is presented in the CAC proposals, NFA proposals, SWMU Assessment Reports, and, if applicable, associated comments and responses.

For each SWMU/AOC, the following information is provided in Enclosure 1: CAC proposal, NFA proposal or SWMU Assessment Report submittal date, the CAC/NFA batch number, and applicable supplementary submittal dates. Copies of the CAC proposals, NFA proposals, SWMU Assessment Reports and supplementary information are available for public review at the University of New Mexico Zimmerman Library, Government Documents Section.

The requested modification, asking that no further action approved (Corrective Action Complete) determinations be finalized for the specified sites, is a Class 3 permit modification. Approval of this request would result in changes only to the HSWA Module of the Permit; there would be no changes to the information required by 20.4.1.900 NMAC, incorporating 40 CFR 270.13 through 270.21, 270.62, or 270.63.

A notice about the permit modification request will be mailed to all persons on the facility mailing list and will be published in the Albuquerque Journal. The notice will be mailed and published within seven days of the date of this request and will include an announcement of the availability of the complete request and supporting documentation at the public reading room. The notice will contain all information required by 20.4.1.900 NMAC, incorporating 40 CFR 270.42(c)(2).

As required by 20.4.1.900 NMAC, incorporating 40 CFR 270.42(c)(3)-(5), DOE will: make available copies of the request and supporting documents in the public reading room; host a public meeting in Albuquerque within the allotted timeframe; and provide a 60-day comment period for public input.

Please contact John Gould at (505) 845-6089 with any questions regarding this submittal.

Sincerely,

Patty Wagner
Manager

Enclosures

cc w/enclosures:
W. Moats, NMED (via Certified Mail)
L. King, EPA, Region 6 (via Certified Mail)
M. Gardipe, NNSA/SC/ERD
J. Estrada, NNSA/SSO, MS 0184
J. Volkerding, NMED-OB (2 copies)
A. Blumberg, SNL, MS 0141
F. Nimick, SNL, MS 1089
P. Freshour, SNL, MS 1089
D. Stockham, SNL, MS 1087
B. Langkopf, SNL, MS 1087
S. Griffith, SNL, MS 1087
R. E. Fate, SNL, MS 1089
M. J. Davis, SNL, MS 1089
ESHSEC Records Center, SNL, MS 1087

NOTICE
Sandia National Laboratories
Environmental Restoration Project

Notification of a Request for a Class 3 Permit Modification To the Hazardous and Solid Waste Amendments Module Of the Resource Conservation and Recovery Act Permit

No Further Action Approved Determinations

The Department of Energy (DOE) hereby notifies you that it is initiating a Class 3 Modification for the designation of twenty-eight (28) solid waste management units (SWMUs) and areas of concern (AOCs) as "approved for No Further Action" in Table A.2 of the Hazardous and Solid Waste Amendments (HSWA) Module (Module IV) of the Resource Conservation and Recovery Act (RCRA) Permit for Sandia National Laboratories/New Mexico (SNL/NM) (EPA ID No. NM5890110518-1).

For each SWMU or AOC, the rationale for no further action designation has been documented in either a No Further Action (NFA) proposal (for SWMUs) or a SWMU Assessment Report (for AOCs). The New Mexico Environment Department (NMED) has reviewed the NFA proposals and SWMU Assessment Reports and the NMED has determined that each SWMU/AOC is appropriate for no further action.

On April 29, 2004, the final Compliance Order on Consent (Consent Order) for Sandia National Laboratories was issued. Under Section III.V of the Consent Order, work that has been satisfactorily completed prior to the effective date of the Order, that fulfills the substantive requirements of the Order, and that has been approved by the NMED in writing, is deemed to comply with the Consent Order. In this case, the work completed at the twenty-eight (28) SWMUs/AOCs satisfies these requirements, as evidenced by written NMED approvals of no further action. An NFA approval is equivalent to a determination of Corrective Action Complete under the Consent Order.

DOE requests that the twenty-eight (28) SWMU/AOCs, identified in the table below, be designated as no further action approved (Corrective Action Complete) in Table A-2 of the HSWA Module. When comprehensive changes are made to the HSWA Module to incorporate changes related to the Consent Order, two new tables (Corrective Action Complete with Controls and Corrective Action Complete without Controls) will be added to the HSWA Module. When these tables are completed, all but SWMU 1 and 3, and AOC 1081 are expected to be included on the table Corrective Action Complete without Controls. SWMU 1 and 3, and AOC 1081 are expected to be included on the table Corrective Action Complete with Controls.

Identification of SWMUs Proposed for Designation as No Further Action Approved (Corrective Action Complete)

SWMU/AOC		NFA Date Submitted/Batch No.
ER Site 1	Radioactive Waste Landfill	September 1997/9
ER Site 3	Chemical Disposal Pit	September 1997/9

ER Site 45 Liquid Discharge (behind TA-IV)	September 1997/9
ER Site 78 Gas Cylinder Disposal Pit	June 1996/TA 3/5 RFI Report
ER Site 137 Bldg. 6540/6542 Septic System (TA-III)	January 1997/ 6
ER Site 146 Bldg. 9920 Drain System (Coyote Test Field)	August 1995/2
ER Site 148 Bldg. 9927 Septic System (Coyote Test Field)	August 1995/2
ER Site 152 Bldg. 9950 Septic System (Coyote Test Field)	January 1997/ 6
ER Site 153 Bldg. 9956 Septic Systems (Coyote Test Field)	January 1997/ 6
AOC 276 Former Bldg 829X, Silver Recovery Sump (TA-I)	December 2004/Round 7 DSS
AOC 1004 Bldg. 6969 Septic System (Robotic Vehicle Range)	December 2004/Round 7 DSS
AOC 1031 Former Bldgs. 6589 and 6600 Septic System (TA-III)	December 2004/Round 7 DSS
AOC 1034 Bldg. 6710 Septic System (TA-III)	September 2004/Round 6 DSS
AOC 1035 Bldg. 6715 Septic System (TA-III)	September 2004/Round 6 DSS
AOC 1036 Bldg. 6922 Septic System (TA-III)	September 2004/Round 6 DSS
AOC 1052 Bldg. 803 Seepage Pit (TA-I)	December 2004/Round 7 DSS
AOC 1078 Bldg. 6640 Septic System (TA-III)	September 2004/Round 6 DSS
AOC 1079 Bldg. 6643 Septic System (TA-III)	September 2004/Round 6 DSS
AOC 1080 Bldg. 6644 Septic System (TA-III)	December 2004/Round 7 DSS
AOC 1081 Bldg. 6650 Septic System (TA-III)	March 2005/Round 8 DSS
AOC 1084 Bldg. 6505 Septic System (TA-III)	September 2004/Round 6 DSS
AOC 1087 Bldg. 6743 Seepage Pit (TA-III)	December 2004/Round 7 DSS
AOC 1092 MO 228-230 Septic System (TA-III)	March 2005/Round 8 DSS
AOC 1098 TA-V Plenum Rooms Drywell (TA-V)	September 2004/Round 6 DSS
AOC 1102 Former Bldg. 889 Septic System (TA-I)	December 2004/Round 7 DSS
AOC 1104 Bldg. 6595 Seepage Pit (TA-V)	September 2004/Round 6 DSS
AOC 1113 Bldg. 6597 Drywell (TA-V)	December 2004/Round 7 DSS
AOC 1120 Bldg. 6643 Drywell (TA-III)	September 2004/Round 6 DSS

AOC = Area of Concern.
DSS = Drain and Septic System.
ER = Environmental Restoration.
NFA = No Further Action.
SWMU = Solid Waste Management Unit.
TA = Technical Area.

This permit modification is needed to designate the twenty-eight (28) SWMUs/AOCs as no further action approved (Corrective Action Complete) in Table A-2 of the HSWA Module.

Comment Period. A 60-day public comment period has been initiated with the publication of this notice. Comments on this request for permit modification will be accepted through **October 28, 2005**. Comments should be directed to:

Mr. John Gould
U.S. Department of Energy
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87115
Ref: Sandia National Laboratories – **Permit Modification August 05**

AND

John E. Kieling, Program Manager
Hazardous Waste Bureau - New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303
Ref: Sandia National Laboratories – **Permit Modification August 05**

Public Meeting. Each SWMU/AOC proposed for No Further Action will be presented in a poster format, and SNL/NM staff will be available to answer questions. The meeting will be conducted as an open house, with posters available for individual review at any time throughout the four hour time period. The meeting will be held on **September 13, 2005**, from 1:00 to 3:00 pm and from 6:00 to 8:00 pm at the Manzano Mesa Multigenerational Center, 501 Elizabeth NE, Albuquerque, NM 87123.

Department of Energy Contact. Questions may be directed to John Gould, (505) 845-6089.

Sandia National Laboratories Contact. Questions may be directed to Fran Nimick, (505) 284-2577.

New Mexico Environment Department Contact. Questions may be directed to John Kieling, (505) 428-2535.

Public Inspection of Documents. A copy of the request for permit modification and supporting documentation is available for public inspection at the Government Information Department, Zimmerman Library, University of New Mexico, Albuquerque, NM 87131-1466.

Compliance History. The permittee's compliance history during the life of the permit being modified is available from the NMED contact person.

ENCLOSURE 1

Identification of SWMUs Proposed for No Further Action Approved and Associated Documentation

SWMU/AOC	NFA/CAC Date Submitted/Batch	Submittal of Supplementary Information with Date
ER Site 1 Radioactive Waste Landfill	September 1997/9	RSI Response September 1999 RSI Response March 2003 NFA/RSI Addendum November 2004 RSI Response May 2005
ER Site 3 Chemical Disposal Pit	September 1997/9	RSI Response September 1999 RSI Response March 2003 NFA/RSI Addendum November 2004 RSI Response May 2005
ER Site 45 Liquid Discharge (behind TA-IV)	September 1997/9	RSI Response September 1999 RSI Response November 2004
ER Site 78 Gas Cylinder Disposal Pit	June 1996/TA 3/5 RFI Report	NOD Response October 1997 NOD Response July 1998 RSI Response November 2000 RSI Response November 2004 RSI Response May 2005
ER Site 137 Bldg. 6540/6542 Septic System (TA-III)	January 1997/ 6	RSI Response September 1999 Soil Vapor Results November 2003 NOD Response March 2005
ER Site 146 Bldg. 9920 Drain System (Coyote Test Field)	August 1995/2	NOD Response June 1997 NOD Response March 2005
ER Site 148 Bldg. 9927 Septic System (Coyote Test Field)	August 1995/2	NOD Response June 1997 NOD Response March 2005
ER Site 152 Bldg. 9950 Septic System (Coyote Test Field)	January 1997/ 6	RSI Response September 1999 NOD Response March 2005
ER Site 153 Bldg. 9956 Septic Systems (Coyote Test Field)	January 1997/ 6	RSI Response September 1999 NOD Response March 2005
AOC 276 (TA-I) Former Bldg 829X, Silver Recovery Sump	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1004 Bldg. 6969 Septic System (Robotic Vehicle Range)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1031 Former Bldgs. 6589 and 6600 Septic System (TA-III)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1034 Bldg. 6710 Septic System (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1035 Bldg. 6715 Septic System (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1036 Bldg. 6922 Septic System (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1052 Bldg. 803 Seepage Pit (TA-I)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005

Identification of SWMUs Proposed for No Further Action Approved and Associated Documentation (Concluded)

SWMU/AOC	NFA Date Submitted/Batch	Submittal of Supplementary Information with Date
AOC 1078 Bldg. 6640 Septic System (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1079 Bldg. 6643 Septic System (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1080 Bldg. 6644 Septic System (TA-III)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1081 Bldg. 6650 Septic System (TA-III)	March 2005/Round 8 DSS	RSI Response April 2005
AOC 1084 Bldg. 6505 Septic System (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1087 Bldg. 6743 Seepage Pit (TA-III)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1092 MO 228-230 Septic System (TA-III)	March 2005/Round 8 DSS	RSI Response April 2005
AOC 1098 TA-V Plenum Rooms Drywell (TA-V)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1102 Former Bldg. 889 Septic System (TA-I)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1104 Bldg. 6595 Seepage Pit (TA-V)	September 2004/Round 6 DSS	RSI Response April 2005
AOC 1113 Bldg. 6597 Drywell (TA-V)	December 2004/Round 7 DSS	RSI Response March 2005 RSI Response April 2005
AOC 1120 Bldg. 6643 Drywell (TA-III)	September 2004/Round 6 DSS	RSI Response April 2005

AOC = Area of Concern.
CAC = Corrective Action Complete.
DSS = Drain and Septic System.
ER = Environmental Restoration.
NFA = No Further Action.
NOD = Notice of Deficiency.
RSI = Request for Supplemental Information.
SWMU = Solid Waste Management Unit.
TA = Technical Area.

Sandia National Laboratories

Justification for Class III Permit Modification

September 2005

SWMUs 1 and 3
Operable Unit 1303
Radioactive Waste Landfill and Chemical Disposal Pits

NFA Submitted September 1997
RSI Submitted September 1999
RSI Submitted March 2003
NFA/RSI Addendum Submitted November 2004
RSI Submitted May 2005

Environmental
Restoration
Project

United States Department of Energy
Sandia Site Office

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

NFA

ER/REQ/MAN

Department of Energy
Field Office, Albuquerque
Kirtland Area Office
P.O. Box 5400
Albuquerque New Mexico 87185-5400

SEP 26 1997

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Benito Garcia, Bureau Chief
New Mexico Environment Department
Hazardous and Radioactive Materials Bureau
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87505-2100

Dear Mr. Garcia:

Enclosed are two copies of the ninth submission of No Further Action (NFA) proposals for Sandia National Laboratories/New Mexico (SNL/NM), ID Number NM5890110518-1. Fourteen SNL/NM environmental restoration sites are included in this package:

OU 1303

Site 1	Rad Waste Landfill/Chemical Disposal Pits
Site 3	Chemical Disposal Pit (TA-II)
Site 44A&B	Decon Site & Uranium Calibration Pits

OU 1309

Site 45	Liquid Discharge (Behind TA-IV)

OU 1332

Site 19	TRUPAK Boneyard Storage Area

OU 1333

Site 59	Pendulum Site
Site 63A	Balloon Test Area PDSP Site
Site 63B	Balloon Test Area Balloon/Helicopter Site
Site 64	Gun Site (Madera Canyon)

OU 1334

Site 11	Explosive Burial Mounds
Site 21	Metal Scrap (Coyote Springs)
Site 57B	Workman Site: Target Area
Site 88B	Firing Site: Instrumentation Pole
Site 70	Explosives Test Pit (Water Towers)

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Sincerely,

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Sandia National Laboratories/New Mexico

PROPOSAL FOR
RISK-BASED NO FURTHER ACTION
ENVIRONMENTAL RESTORATION SITES 1 AND 3
RADIOACTIVE WASTE LANDFILL AND CHEMICAL DISPOSAL PITS
OPERABLE UNIT 1303

September 1997

Environmental
Restoration
Project

United States Department of Energy
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Prepared by
Sandia National Laboratories/New Mexico
Environmental Restoration Project
Albuquerque, New Mexico

Prepared for
the U. S. Department of Energy

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ACRONYMS AND ABBREVIATIONS

amp/m^2	ampere(s) per square meter
CDP	Chemical Disposal Pits
CEARP	Comprehensive Environmental Assessment and Response Program
COC	constituents of concern
COPEC	constituents of potential ecological concern
cpm	counts per minute
cy	cubic yards
DOE	U.S. Department of Energy
EC/VCM	expedited clean-up/voluntary corrective measures
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
fbgs	feet below ground surface
ft	foot (feet)
g	gram(s)
GM	Geiger-Mueller
mg/kg	milligrams per kilogram
mrem/hr	millirem(s) per hour
mR/hr	milliroentgen per hour
NFA	no further action
NMED	New Mexico Environment Department
pCi/g	picocuries per gram
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RWL	Radioactive Waste Landfill
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SVS	soil vapor survey
SWMU	solid waste management unit
TA-II	Technical Area II
VOC	volatile organic compound

1.0 INTRODUCTION

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a Risk-Based No Further Action (NFA) for Environmental Restoration (ER) Sites 1 and 3, the Radioactive Waste Landfill (RWL), and the Chemical Disposal Pits (CDP), respectively, Operable Unit 1303.

The RWL/CDPs were originally proposed for expedited clean-up/voluntary corrective measures (EC/VCM) through a One Pass Class III permit modification request, which was submitted to the New Mexico Environment Department (NMED) and the U.S. Environmental Protection Agency (EPA) in August 1995. This proposal provides a description, history, evaluation of relevant evidence, and rationale for the NFA decision for ER Sites 1 and 3.

1.1 Description of ER Sites 1 and 3

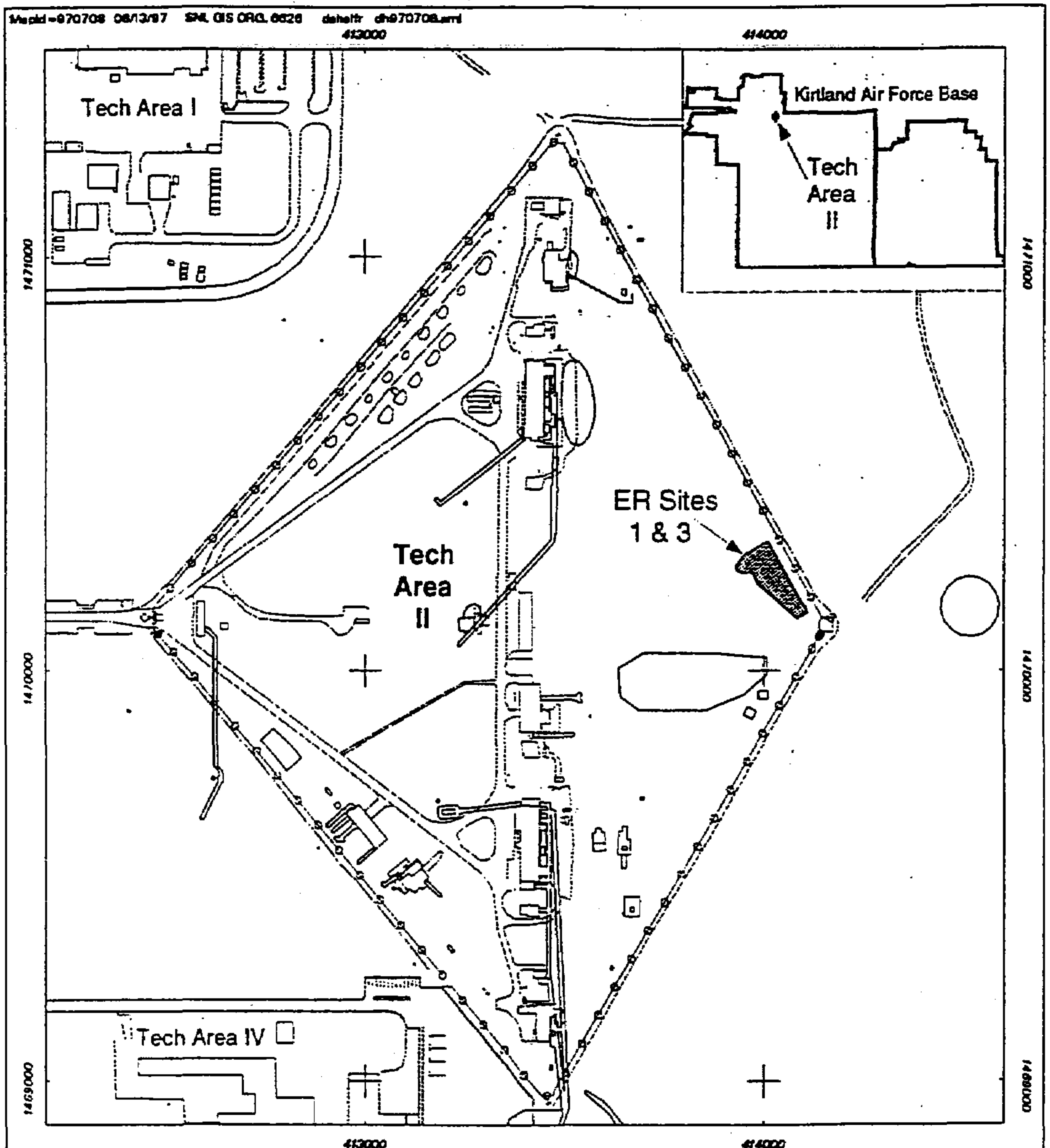
The RWL/CDPs were located in the eastern portion of Technical Area II (TA-II), about 25 feet (ft) west of the eastern apex of the TA-II perimeter fence (Figure 1-1). The 0.3 acre RWL was surrounded by a barbed wire fence posted with radiation warning signs (Haines et al. 1991). The location of the CDPs was based on information collected from interviews with employees, aerial photographs, and regional geophysical survey data.

The regional aquifer in the vicinity of ER Sites 1 and 3 is within the upper unit of the Santa Fe Group. The depth to groundwater in the monitor well nearest to ER Sites 1 and 3 (TA2-NW1-595) is approximately 520 ft below ground surface (fbgs) or 4,889.3 ft above mean sea level. TA2-NW1-595 has a total depth of 598 fbgs, with screens from 535 to 555 fbgs and 585 to 595 fbgs. A shallow water-bearing zone also exists in the vicinity of ER Sites 1 and 3. The depth to the shallow zone in the vicinity of ER Sites 1 and 3 ranges from approximately 267 to 320 fbgs. Monitor wells TA2-SW1-325, TA2-NW1-320, WYO-2, TA2-W-19, and TA2-W-01 are located in the vicinity of ER Sites 1 and 3 and are screened in the shallow water-bearing zone.

The area is essentially flat, with a gentle slope to the west of approximately 4 percent. Tijeras Arroyo, the largest drainage feature at SNL/NM, is located immediately southeast of TA-II. The surface geology at ER Sites 1 and 3 consists of unconsolidated alluvial and colluvial deposits derived from the Sandia and Manzanita Mountains. These deposits consist of sediments ranging from clay to gravel derived from the granitic rocks of the Sandia Mountains and greenstone, limestone, and quartzite derived from the Manzanita Mountains (SNL/NM 1996).

Surficial deposits are underlain by the upper unit of the Santa Fe Group. Hawley and Haase (1992) estimate that in this area, the piedmont-slope alluvium may be up to 100 ft thick, and the upper Santa Fe unit is approximately 1,200 ft thick.

The piedmont-slope alluvium, which was deposited by the ancestral Tijeras Arroyo, is generally coarse-grained sand and gravel. The upper Santa Fe unit was deposited from 5 to 1 million years ago and consists of coarse- to fine-grained fluvial deposits from the ancestral Rio Grande that intertongues with coarse-grained alluvial-fan/piedmont-veneer facies, which extend



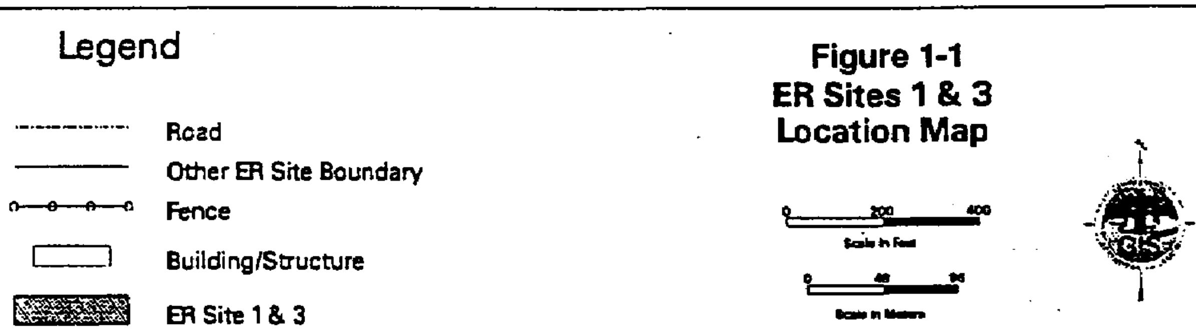


Figure 1-1
ER Sites 1 & 3
Location Map

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

westward from the Sandia and Manzanita Mountains. ER Sites 1 and 3 are near the easternmost limit of the ancestral Rio Grande deposits (Hawley and Haase 1992).

Several rift-bounding faults are located east of ER Sites 1 and 3. The nearest is the Sandia fault-zone, characterized by north-trending, west-dipping normal faults. The westernmost fault is located approximately 1.2 miles east of the site (Hawley and Haase 1992). The Sandia fault-zone merges with the Tijeras fault-zone and the Hubbell Springs fault near the southern edge of Kirtland Air Force Base. These faults are discussed in the 1995 Site-Wide Hydrogeologic Characterization Project Annual Report (SNL/NM 1996), as well as in Hawley and Haase (1992).

1.2 No Further Action Basis

Review and analysis of all relevant data for ER Sites 1 and 3 indicate that concentrations of constituents of concern (COC) at these sites are less than the applicable risk assessment action levels (Section 6.1). Thus, ER Sites 1 and 3 are being proposed for a risk-based NFA decision. COCs that may have been released from this site into the environment pose an acceptable level of risk under current and projected future land use, designated as industrial, per NFA Criterion 5 of the ER Document of Understanding (NMED April 1996).

2.0 HISTORY OF ER SITES 1 AND 3

This section discusses the historical operations and previous audits, inspections, and findings at ER Sites 1 and 3.

2.1 Historical Operations

Radioactive Waste Landfill (ER Site 1)

Initial information about the RWL was based on employee interviews (Haines et al. 1991). The RWL had three pits and three trenches where low-level radioactive waste was disposed of from 1949 to 1959. Supposedly, after March 1959, all radioactive waste was disposed of at a separate facility in TA-III, although one item removed from the landfill was dated 1978.

The RWL pits were approximately 12 ft wide by 20 ft long by 25 ft deep. The trenches ranged from 5 to 15 ft wide, 25 to 50 ft long, and 15 ft deep. The pits and trenches were labeled as Pits 1, 2, and 7 and Trenches 3/4, 5, and 6. The majority of the waste was not containerized before disposal. The pits and trenches were unlined and did not contain leachate detection or collection systems. The pits and trenches were filled with debris, and then covered with native soil and capped with 3 ft of concrete.

No detailed records of waste material disposed of in the RWL are available. However, U.S. Department of Energy (DOE) Solid Waste Information Management System records showed that an estimated 11,110 cubic ft of radioactive waste was buried in the landfill, with an estimated total activity of 2,847 curies. This estimated volume reportedly referred to disposed material and did not include the backfilled native soil. The estimate also may not have reflected any classified and/or unclassified hazardous chemicals that were disposed of in the RWL.

Waste material disposed of in the RWL mainly consisted of solids, although lesser amounts of liquids were present. Chemical waste material included lead, which was typically used for radioactive shielding, thermal batteries, and nitric acid.

The RWL primarily contained low-level waste, although some minor transuranic waste material was also present in the landfill. Most of the material buried in the RWL consisted of weapons components, irradiated and neutron-activated material, thermal batteries, and radioactive sources. The weapons components and waste material contained depleted uranium, thorium, tritium, cobalt, cesium, americium, and plutonium.

In 1954, tritiated waste, mainly from booster cylinders, was reportedly buried in the RWL. Other items buried in the RWL included neutron generator parts, irradiated material from nuclear rocket tests, and radium-beryllium neutron sources. In addition, cobalt sources were buried in the RWL. Cesium-containing gap tubes and tracer materials collected on fallout plates were also buried in the landfill.

Other waste material in the RWL consisted of laboratory-generated waste, such as contaminated gloves, pipettes, absorbent pads, forceps, beakers, test tubes, paper, tools, clothing, and soil and bioassay samples. Some of the samples reportedly contained hydrochloric acid, toluene, possibly other solvents, and potentially a total of 2 to 3 grams (g) of plutonium. Low-level waste material from nuclear reactor studies conducted at the Sandia Engineering Reactor Facility and Sandia Pulsed Reactor also were reportedly disposed of in the RWL.

Chemical Disposal Pits (ER Site 3)

Initial information about the CDPs was based on employee interviews (Haines et al. 1991). The CDPs reportedly were used in the late 1940s and 1950s to dispose of chemical waste. The CDPs may have been originally excavated with a backhoe, filled with waste, and backfilled with native soil. One former employee recalled that one disposal pit was approximately 10 ft by 30 ft with depth unknown. It is not known if chemicals were disposed of in bulk or in drums. Although no information has been found regarding detailed construction of the pits, it was assumed that the pits were unlined and were not constructed with leachate containment or monitoring devices. No records were maintained regarding the actual locations of the pits, the types or volumes of chemicals disposed of in the pits, how chemicals were disposed of, how the pits were excavated, or the length of time the pits were actually used.

2.2 Previous Audits, Inspections, and Findings

In 1987, a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was performed for the entire SNL/NM installation (EPA 1987). At that time, ER Sites 1 and 3 were identified as solid waste management unit (SWMU) Numbers 32 through 37, and ER Site 3 was identified as SWMU Number 40. Both sites were described as having the potential for release of hazardous waste or constituents. A more comprehensive assessment was performed under Phase 1 of the Comprehensive Environmental Assessment and Response Program (CEARP) (DOE 1987), during which ER Sites 1 and 3 were assessed and, again, were found to require additional investigation. The scope of the Phase 1 assessment included a literature and records search, interviews with current and former employees, and, in some cases, visual site inspections. No samples and only limited background data were collected during both the RFA and CEARP Phase 1 assessment.

3.0 EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics and Operating Practices

The characteristics and operating practices are described in Section 2.1. No activities are known to have occurred at ER Sites 1 and 3 since those described in Section 2.1.

3.2 Results of SNL/NM ER Project Sampling/Surveys

Several rounds of sampling have occurred at ER Sites 1 and 3, including radiation, organic vapor, geophysical, and soil vapor surveys (SVS). The results of the surveys are summarized in the sections below.

3.2.1 Summary of Prior Investigations

The following sources of information, presented in chronological order, were used to evaluate ER Sites 1 and 3:

- Aerial photograph interpretation (1939 to 1993)
- Interviews of SNL/NM personnel
- Photographs and field notes collected at the site by SNL/NM ER staff
- Radiological survey (December 1991)
- Organic vapor survey (December 1991)
- SVS (November and December 1993)
- Geophysical surveys (December 1993)
- VCM samples (Summer 1996).

3.2.2 Aerial Photograph Interpretation

Interpretation of historical aerial photographs taken in 1951 and 1959 clearly show two bermed pits believed to be the CDPs (Ebert and Associates 1994). The 1951 photo shows one pit located on the southeastern boundary of the RWL fenceline; the 1959 photo shows another pit on the northwestern boundary of the landfill fenceline. No other disturbances were noted during the interpretation of aerial photographs with dates ranging from 1939 to 1993 in the area of the reported chemical disposal pits.

3.2.3 Radiological Survey

A radiation survey of the RWL was performed on December 4, 1991. The survey was conducted using a Bicron 2000 gamma detector/survey meter with a Geiger-Mueller (GM) pancake probe held at ground level for beta-gamma detection. The radiation survey was designed to determine radiation levels within the landfill and identify any possible surface contamination. Beta-gamma readings from the surface ranged from 40 to 100 counts per minute (cpm); background activity was established at 60 cpm. The general area radiation levels ranged from 0.01 to 0.035 millirem per hour (mrem/hr); background activity was established at 0.03 mrem/hr. The variations were minor and considered not to be distinguishable from background. The radiation survey determined that no significant external radiation exposure rates were expected for nonintrusive fieldwork.

3.2.4 Organic Vapor Survey

An organic vapor survey of the RWL was performed on December 4, 1991. The organic vapor survey was conducted 4 ft above ground level using an HNu PI101 photoionization detector, which was calibrated to benzene. No organic vapors were detected during the survey.

3.2.5 Soil Vapor Survey

A passive SVS was conducted in the vicinity of the RWL between November 11 and December 2, 1993. No volatile organic compounds (VOC) or semivolatile organic compounds (SVOC) were identified in soil vapor from the SVS investigation (SNL/NM 1994a).

3.2.6 Geophysical Surveys

A STOLS™ survey was performed at the RWL in December 1993 (SNL/NM 1994b). Five large (>10 amperes per square meter [amp/m^2]), three small (0-5 amp/m^2), and two point-source anomalies were identified in the RWL during the survey. The eight objects are directly attributable to buried waste in the RWL pits and trenches. The two point locations could be a product of ferromagnetic near-surface trash or a concentration of ferromagnetic soil or rock.

An electromagnetic survey was performed during the period of December 6, 1993, through February 24, 1994 (SNL/NM 1994c). The RWL was surveyed as part of the Phase I Survey Design using the EM-31 survey instrument. The survey identified the fenceline boundary of the landfill. The individual burials were not all distinguishable due to the high "noise" level of the landfill (i.e., too much buried activity).

3.2.7 Voluntary Corrective Measures Sampling

The RWL/CDPs were remediated in the summer of 1996 as an EC/VCM. Excavation of the sites began in late May 1996 and continued through August 1996. The following describes the activities performed at the RWL, and the results of sampling, which occurred as part of the VCM.

All waste material and contaminated soil was removed from the excavation, characterized for hazardous and radioactive contamination, and appropriately containerized or stockpiled. Upon completion of excavation activities, verification soil samples were collected and analyzed for hazardous and radioactive constituents. Additionally, geophysical and radiation surveys were conducted to ensure that all material had been removed.

Approximately 96 cubic yards (cy) of solid (radioactive, hazardous, and mixed) waste debris, 700 cy of contaminated soil, 3,000 cy of potentially contaminated soil, and 5,000 cy of clean soil were removed from the RWL/CDPs.

Results of Sampling/Surveys

Prior to beginning excavation activities, soil samples were collected and analyzed to determine background radioactivity levels. Soil samples were not analyzed for metals because they were not anticipated to be a COC based on site history. Furthermore, background metals data were available (IT Corporation 1994). Background measurements were required to provide a baseline reference point for segregation of excavated soils and for verification that the excavation was complete. Background soil samples were collected within the vicinity of TA-II at locations unaffected by site operations or potential runoff. A total of 20 surface soil background samples were collected and analyzed as listed in Table 3-1. The background sample location and statistical analysis performed in order to determine background values are included in Section 6.2.

Table 3-1
Summary of Sampling Performed for Background Determinations

Parameter	On-Site Laboratory	Off-Site Laboratory	Field Screening
Gross alpha/beta	X		X
Gross gamma			X
Gamma spectroscopy	X	X	
Tritium	X	X	

All background samples were analyzed on site for gross alpha/beta, by gamma spectroscopy, and for tritium. Twenty percent of the background samples were also analyzed off site by gamma spectroscopy and for tritium (Section 6.2). Field screening of the background soil samples was used to calibrate field screening instruments to ensure the average value represented the true mean to within +/- 20 percent at the 95 percent confidence level, as specified in NUREG/CR-5849 (NRC 1992).

Soil excavated from the landfill was initially segregated into various stockpiles based on field screening and excavation location. The segregation of all soil stockpiles was verified using laboratory analysis. Excavated soil was segregated into one of two stockpile areas, suspect clean or suspect contaminated. Initial segregation was based on field screening for VOCs and explosives, visual staining or unusual appearance, or radioactivity levels greater than three times background.

For suspect clean soil, approximately 100-g grab samples were collected from each front end loader bucket (approximately 5 cy of soil) as it was placed into a stockpile. Each stockpile was kept to approximately 250 cy. Approximately 50 aliquots (100 g/aliquot) were combined to form one composite sample for each 250 cy stockpile. The composite samples were analyzed for both radiological and chemical parameters. Radiological analyses included 100 percent on-site analyses of gross alpha/beta, tritium, and gamma spectroscopy. Portions of 20 percent of the samples were also analyzed off site for gamma spectroscopy, tritium, and any isotopic analyses determined to be necessary. Chemical analyses included total RCRA metals and beryllium; 100 percent of samples were analyzed on site and portions of 20 percent of the samples were analyzed off site. Organic and high explosives analyses were not performed because no potential for organic soil contamination was present based on excavated debris and field screening. Section 6.3 lists the analytical results for the stockpiled suspect clean soil.

For suspect contaminated soil, an approximately 500-g grab sample was collected from each front end loader bucket as it was placed into a stockpile. Each stockpile was kept to less than 100 cy. Approximately 10 aliquots (500 g/aliquot) were combined to form one composite sample for each stockpile. Based on suspected contaminants, analyses were performed for VOCs, SVOCs, total RCRA metals, polychlorinated biphenyls (PCB), explosives, tritium, gamma spectroscopy, and gross alpha/beta. Section 6.4 lists the analytical results for stockpiled suspect contaminated soil.

Once the excavation was complete, prior to backfilling, the excavation was surveyed and sampled to verify adequate cleanup. Metal detector surveys were conducted to ensure no metal items remained. A shallow detector (White Model 9400-DLMAX) and an ordnance detector (Schonstedt Magnetic Locator Model CA-72 Cd) were used to conduct surveys on an established 10-meter-square grid system. Survey results showed no additional material to be buried beneath the extent of excavation.

Radiological verification closely followed guidance provided by NUREG CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination (NRC 1992), for open land areas. A 10-meter-square grid, including floor and walls of the excavation, was established at each trench/pit location, using the sampling pattern presented in NUREG CR-5849 (NRC 1992). If the excavation area was less than 10 meters square, those sampling locations of the standard grid that fell within the excavation area became sampling points. A GM pancake detector, sodium iodide scintillometer, and a FIDLER low-energy gamma detector were used to survey and count 100 percent of each grid area. Excavation walls were surveyed using shielded detectors to minimize changes in geometry and the influence of Compton scattered gamma-rays from surrounding soils.

When it was determined that 100 percent of the excavated area had radiation levels less than or equal to background plus three standard deviations by field scan, preliminary sampling was initiated. Preliminary sampling consisted of collecting 13 surface (0 to 6 inches) soil samples inside each grid cell. These samples were analyzed for gross alpha/beta/tritium, gamma spectroscopy, and alpha spectroscopy, if necessary. The average results for the 13 grid samples were compared to background. When an average was less than or equal to three times background, verification sampling for that grid was implemented.

Verification sampling included collecting surface (0 to 6 inches) soil samples at four locations, each equidistant from the center and corner location, within each sampling grid cell. These samples were composited into one sample and analyzed for radionuclides and total RCRA metals. Organic analyses were not conducted because no organic constituents were identified that might contribute to soil contamination. Section 6.5 lists analytical results for the verification samples.

The radionuclide concentrations in the verification pit samples were lower than the site-specific background concentrations (Section 6.2) for all radionuclides, except thorium-232 and thorium-228. The concentration of thorium-232 in the Verification Pit 7 sample was 1.35 picocuries per gram (pCi/g). Although the concentration exceeds the site-specific background concentration of 0.96 pCi/g (Section 6.2), it is less than the regional background concentration (IT Corporation 1994) for thorium-232, which is 1.54 pCi/g.

The concentration for thorium-228 ranged from 1.22 to 1.54 pCi/g in the pits, with a site-specific background concentration of 1.04 pCi/g. The regional background concentration (IT Corporation 1994) is 1.33 pCi/g for thorium-228. The concentration of thorium-228 slightly exceeds the regional background in pits 2, 6, and 7.

The concentrations of metals in the verification pit samples were all nondetects with the exception of results for silver and barium. Silver had a concentration of 5.9 milligrams per kilogram (mg/kg), and barium had concentrations of 260 and 290 mg/kg in Pile 5 samples. The regional concentrations for silver and barium are 5.9 and 200 mg/kg, respectively. The value for silver is considered an anomaly because no sources of silver were seen during the VCM activities. Barium occurs naturally in the soils beneath TA-II, and the variation from background concentration is considered acceptable. No sources of barium were seen during the VCM activities.

3.2.7.1 VCM Quality Assurance/Quality Control Summary

Extensive quality assurance (QA)/quality control (QC) analyses were performed as part of the VCM. Section 6.6 contains three tables that summarize the sampling and corresponding QA/QC analyses performed.

The type of QA/QC samples analyzed included equipment blanks, method blanks, matrix spikes, and matrix spike duplicates. The analysis results indicate a high degree of compliance with QA/QC requirements.

3.3 Gaps in Information

Initial information about the activities at ER Sites 1 and 3 was largely gathered by interpretation of aerial photographs and employee interviews. Landfill contents at ER Sites 1 and 3 were revealed during the VCM. Information obtained during the various survey and sampling events at ER Sites 1 and 3 was used, along with other available information, to help identify the most likely COCs that might be found at the sites. Analytical data from soil samples collected at the sites (Section 3.2.8) and the subsequent risk assessment (Section 3.4) are sufficient to characterize the site and to establish the resulting risk to human health.

3.4 Risk Evaluation

The Risk Assessment Report prepared for ER Sites 1 and 3 is included in Section 6.1.

3.4.1 Human Health Risk Assessment

ER Sites 1 and 3 have been recommended for industrial land-use (DOE and USAF 1995). A complete discussion of the risk assessment process, results, and uncertainties is provided in Section 6.1. Due to the presence of several metals and radionuclides in concentrations and activities greater than background levels, it was necessary to perform a human health risk assessment analysis for the sites. Metals detected above their reporting limits and any radionuclide compounds either detected above background levels and/or minimum detectable activity (MDA) were included in this assessment. The risk assessment process provides a quantitative evaluation of the potential adverse human health effects caused by constituents in the site soil. The Risk Assessment Report presents calculations of the Hazard Index, excess cancer risk, and total effective dose equivalent (TEDE) for both an industrial land-use and residential land-use setting. The excess cancer risk from nonradioactive COCs and the radioactive COCs is not additive (EPA 1989).

Note that analytical data from potentially contaminated soil piles 5, 15, 20, and 25 were not used in the risk assessment due to a current effort to remediate these piles. Radionuclide contamination is being reduced using a segmented gate system, which sorts soils according to their radiological activities. The results of the effort must be below the maximum concentrations included in the risk assessment or the soil will be shipped off site for disposal and not used as backfill.

In summary, the Hazard Index calculated for ER Sites 1 and 3 nonradiological COCs is 0.08 for an industrial land-use setting, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). Incremental risk is determined by subtracting risk associated with background from potential nonradiological COC risk. The incremental Hazard Index is 0.07. The excess cancer risk for ER Sites 1 and 3 nonradiological COCs is 1×10^{-5} for an industrial land-use setting, which is at the low end of the suggested range of acceptable risk of 10^{-4} to 10^{-6} (EPA 1989). The incremental excess cancer risk for the sites is 8×10^{-6}. The incremental total effective dose equivalent for radionuclides for an industrial land-use setting is 3.4 mrem/yr, which is well below the standard dose limit of 15 mrem/yr (40CFR196 1994). The incremental excess cancer risk for radionuclides is 1×10^{-4} for the industrial land-use scenario, which is much less than risk values calculated due to naturally occurring radiation and from intakes considered background concentration values.

The residential land-use scenarios for these sites are provided only for comparison in the Risk Assessment Report (Section 6.1). The report concludes that ER Sites 1 and 3 do not have significant potential to affect human health under an industrial land-use scenario.

3.4.2 Ecological Risk Assessment

An ecological risk assessment was conducted to evaluate potential ecological risks associated with the COCs at ER Sites 1 and 3. Five radionuclides present that might have been an ecological concern were americium-241, plutonium-239/240, plutonium-238, tritium, and uranium-238. The maximum total dose rate calculated for the receptors was approximately 1.0×10^{-5} rad/day, well below the acceptable benchmark of 0.1 rad/day. Nine inorganic COCs were found at levels of potential ecological concern using the maximum values of all the soil piles. The maximum total chromium concentration (18 mg/kg) and barium concentration (230 mg/kg) are within the background ranges. Five other COPECs (arsenic, cadmium, mercury, selenium, and silver) produced HQs greater than 1.0 for more than one receptor. However, Soil Piles 1 through 16 are proposed to be placed at 0 to 10 feet below ground. Using the maximum concentrations in Piles 1 through 16, arsenic (2.4 mg/kg), cadmium (1.05 mg/kg), and mercury (0.03 mg/kg) will produce HQs of less than 1.0 for all receptors. Selenium in Piles 1 through 16 has an average concentration of 7.2 mg/kg, which would result in HQs of 7.2 and 2.21 for the plant and the deer mouse, respectively. However, based upon material retrieved from the RWL and sampling data for the sites, selenium is not a COC. Based upon these results, the ecological risk for ER Sites 1 and 3 is expected to be insignificant.

4.0 RATIONALE FOR NO FURTHER ACTION DECISION

Based on field investigation data and the human health risk assessment analysis, an NFA is recommended for ER Sites 1 and 3 for the reasons given below.

- VCM sampling results demonstrate that the remediated site no longer poses an unacceptable risk to human health or the environment under the current and projected land use, designated as industrial.
- No VOCs were detected during the field screening program or were reportedly used at the site.
- No COCs (particularly metals, VOCs, or radionuclides) remain in concentrations considered hazardous to human health for an industrial land-use scenario.

Based on the evidence provided above, ER Sites 1 and 3 are proposed for an NFA based on Criterion 5 of the Document of Understanding.

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6.0 ANNEXES

6.1 ER Sites 1 and 3: Risk Assessment Report

6.2 Statistical Analysis of TA-II, Radioactive Waste Landfill (ER Sites 1 and 3), Radiological Background Data

6.3 Analytical Results for Stockpiled Suspect Clean Soil

6.4 Analytical Results for Stockpiled Suspect Contaminated Soil

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Section 6.1
ER Sites 1 and 3: Risk Assessment Report

ER SITES 1 AND 3: RISK ASSESSMENT ANALYSIS

I. Site Description and History

Sandia National Laboratories/New Mexico (SNL/NM) Environmental Restoration (ER) Sites 1 and 3 consist of the Radioactive Waste Landfill (RWL) and the Chemical Disposal Pit (CDP). The RWL/CDPs were located in the eastern portion of Technical Area (TA) II. The RWL had three pits and three trenches where low-level radioactive waste was disposed of from 1949 to 1959. Supposedly, after March 1959, all radioactive waste was disposed of at a separate facility at TA-III, although one item removed from the landfill was dated 1978. The RWL pits were approximately 12 feet wide by 20 feet long by 25 feet deep. The trenches ranged from 5 to 15 feet wide, 25 to 50 feet long, and 15 feet deep. The majority of the waste was not containerized before disposal. The pits and trenches were not lined and did not contain leachate detection or collection systems. The pits and trenches were filled with debris, and then covered with native soil and capped with 3 feet of concrete.

The CDPs reportedly were used in the late 1940s and 1950s to dispose of chemical waste. The CDPs may have been originally excavated with a backhoe, filled with waste, and backfilled with native soil. One former employee recalled that one disposal pit was approximately 10 feet by 30 feet, with depth unknown. It is not known if chemicals were disposed of in bulk or in drums. Although no information has been found regarding detailed construction of the pits, it was assumed that the pits were unlined and were not constructed with leachate containment or monitoring devices. No records were maintained regarding the actual locations of the pits, the types or volumes of chemicals disposed of in the pits, how chemicals were disposed of, how the pits were excavated, or the years the pits were actually used. The constituents of concern (COC) for the RWL/CDP include 9 metals and 15 radionuclides.

II. Human Health Risk Assessment Analysis

Risk assessment of this site includes a number of steps, which culminate in a quantitative evaluation of the potential adverse human health effects caused by constituents located at the site. The steps to be discussed include:

Step 1. Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2. Potential pathways by which a representative population might be exposed to the COCs are identified.
Step 3. The potential intake of these COCs by the representative population is calculated using a tiered approach. The tiered approach includes screening steps, followed by potential intake calculations and a discussion or evaluation of the uncertainty in those calculations. Potential intake calculations are also applied to background screening data.
Step 4. Data are described on the potential toxicity and cancer effects from exposure to the COCs and associated background constituents and subsequent intake.

Step 5.	Potential toxicity effects (specified as a Hazard Index) and cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and incremental estimated cancer risk are calculated by subtracting applicable background concentrations directly from maximum on-site contaminant values. This background subtraction only occurs when a radiological COC occurs as contamination and exists as a natural background radionuclide.
Step 6.	These values are compared with guidelines established by the U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE) to determine if further evaluation, and potential site clean-up, is required. Nonradiological COC risk values are also compared to background risk so that an incremental risk may be calculated.
Step 7.	Uncertainties in the previous steps are discussed.

II.1 Step 1. Site Data

Site history and characterization activities are used to identify potential COCs. The identification of COCs and the sampling to determine the concentration levels of those COCs across the site are described in the ER Sites 1 and 3 No Further Action Proposal. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC determined for the entire site. Maximum concentrations reported from on-site and off-site laboratories subsurface and surface samples were combined into a single table to provide conservative risk calculations. For radiological COCs, the soil strata were broken up into cover taken from above the landfill caps and along the perimeter of ER Sites 1 and 3 and, as a separate strata, soil taken from within and near the cells beneath the caps. The minimum upper tolerance limit (UTL) or 95th percentile, as appropriate, was selected to provide the background screen in Table 1 and to be used to calculate risk attributable to background in Table 8. Chemicals that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment (EPA 1989). Both radioactive and nonradioactive COCs are evaluated. The nonradioactive COCs evaluated are metals.

Note that analytical data from potentially contaminated soil piles 5, 15, 20, and 25 were not used in the risk assessment due to a current effort to remediate these piles. Radionuclide contamination is being reduced using a segmented gate system, which sorts soils according to their radiological activities. The results of the effort will be included when the remediation is completed.

II.2 Step 2. Pathway Identification

ER Sites 1 and 3 have been designated with a future land-use scenario of industrial (DOE and USAF 1995) (see Appendix 1 for default exposure pathways and parameters). Because of the location and the characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for chemical COCs and radon inhalation for radiological exposure. The inhalation pathway for both chemicals and radionuclides is included because of the potential to inhale dust and volatiles. The soil ingestion pathway is included for radionuclides. No contamination at depth was determined, and therefore no pathways to the groundwater are considered. Depth to groundwater at ER Sites 1 and 3 is approximately

320 feet below ground surface. Because of the lack of surface water or other significant mechanisms for dermal contact, the dermal exposure pathway is considered not to be significant. No intake routes through plant, meat, or milk ingestion are considered appropriate for the industrial land-use scenario. However, plant uptake is considered for the residential land-use scenario.

PATHWAY IDENTIFICATION

Chemical Constituents	Radionuclide Constituents
Soil ingestion	Soil ingestion
Inhalation (dust)	Inhalation (dust and volatiles)
Plant uptake (residential only)	Plant uptake (residential only)
	Direct gamma

II.3 Steps 3-5. Calculation of Hazard Indices and Cancer Risks

Steps 3 through 5 are discussed in this section. These steps include the discussion of the tiered approach in eliminating potential COCs from further consideration in the risk assessment process and the calculation of intakes from all identified exposure pathways, the discussion of the toxicity information, and the calculation of the hazard indices and cancer risks.

The risks from the COCs at ER Sites 1 and 3 were evaluated using a tiered approach. First, the maximum concentrations of COCs were compared to the SNL/NM background screening level for this area (IT Corporation 1996), as modified during verbal discussion with representatives of New Mexico Environment Department (NMED). If a SNL/NM-specific screening level was not available for a constituent, then a background value was obtained, when possible, from the U.S. Geological Survey (USGS) National Uranium Resource Evaluation program (USGS 1994).

The maximum concentration of each COC was used in order to provide a conservative estimate of the associated risk. If any nonradiological COCs were above either the SNL/NM background screening levels or the USGS background value, all nonradiological COCs were considered in further risk assessment analyses.

For radiological COCs that exceeded the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that did not exceed these background levels were not carried any further in the risk assessment. This approach is consistent with DOE orders. Radioactive COCs that did not have a background value and were detected above the analytical minimum detectable activity were carried through the risk assessment at their maximum levels. This step is performed (rather than carry the below-background radioactive COCs through the risk assessment and then perform a background risk assessment to determine incremental TEDE and estimated cancer risk) to prevent the "masking" of radiological contamination that may occur if on-site background radiological COCs exist in concentrations far enough below the assigned background level. When this "masking" occurs, the final incremental TEDE and estimated cancer risk are reduced and, therefore, provide a nonconservative estimate of the potential impact on an on-site receptor. This approach is also consistent with the regulatory approach (40 CFR Part 196

1994), which sets a TEDE limit to the on-site receptor in excess of background. The resultant radioactive COCs remaining after this step are referred to as background-adjusted radioactive COCs.

Second, if any nonradiological COC failed the initial screening step, the maximum concentration for each nonradiological COC was compared with action levels calculated using methods and equations promulgated in the proposed Resource Conservation and Recovery Act (RCRA) Subpart S (40 CFR Part 264 1990) and Risk Assessment Guidance for Superfund (RAGS) (EPA 1989) documentation. If there are ten or fewer COCs and each has a maximum concentration less than one-tenth of the action level, then the site would be judged to pose no significant health hazard to humans. If there are more than ten COCs, the Subpart S screening procedure was skipped.

Third, hazard indices and risk due to carcinogenic effects were calculated using reasonable maximum exposure (RME) methods and equations promulgated in RAGS (EPA 1989). The combined effects of all nonradiological COCs in the soils were calculated. The combined effects of the nonradiological COCs at their respective UTL or 95th percentile background concentration in the soil were also calculated. For toxic compounds, the combined effects were calculated by summing the individual hazard quotients for each compound into a total Hazard Index. This Hazard Index is compared to the recommended guideline of 1. For potentially carcinogenic compounds, the individual risks were summed. The total risk was compared to the recommended acceptable risk range of 10^{-4} to 10^{-6}. For the radioactive COCs, the incremental TEDE was calculated and the corresponding incremental cancer risk estimated using DOE's RESRAD computer code. In determining the incremental TEDE and corresponding incremental cancer risk, a separate analysis was performed on the two soil strata. The first was performed on the backfill cover containing limited levels of various radionuclides discussed below. The final analysis was performed on the second soil strata consisting of soils taken from within the landfill. The resultant incremental TEDEs and incremental cancer risks from these two analyses were then added to develop a final incremental TEDE and incremental cancer risk.

II.3.1 Comparison to Background and Action Levels

Nonradioactive ER Sites 1 and 3 COCs are listed in Table 1, and radioactive COCs are listed in Tables 2 and 3. All tables show the associated 95th percentile or UTL background levels (IT Corporation 1996), as modified during verbal discussion with representatives of NMED.

The SNL/NM background levels have not yet been approved by the EPA or the NMED but are the result of a comprehensive study of joint SNL/NM and U.S. Air Force data from Kirtland Air Force Base (KAFB). The values shown in Table 1 supersede the background values described in an interim background study report (IT Corporation 1994).

Several compounds have maximum measured values greater than background screening levels. Therefore, all nonradiological COCs were retained for further analysis with the exception of lead. The maximum concentration value for lead is 41 milligrams per kilogram (mg/kg). The EPA intentionally does not provide any toxicological data on lead, and therefore no risk parameter values can be calculated. However, EPA guidance for the screening value for lead for an industrial land-use scenario is 2,000 mg/kg (EPA 1996a); for a residential land-

Table 1
Nonradioactive COCs at ER Sites 1 and 3 and Comparison to the Background Screening Values

COC name	Maximum concentration (mg/kg)	SNL/NM 95th% or UTL Level (mg/kg)	Is maximum COC concentration less than or equal to the applicable SNL/NM background screening value?
Arsenic	13*	4.4	No
Barium	300	200	No
Beryllium	2	0.80	No
Cadmium	6.5	<1^	No
Chromium, total**	16	NC	NA
Lead	41	11.2	No
Mercury	7.8	<0.1^	No
Selenium	25*	<1^	No
Silver	8.5	<1^	No

NC - Not calculated.
NA - Not applicable.
*values are one-half the detection limit.
**total chromium assumed to be chromium VI (most conservative).
^ uncertainty due to detection limits.

Table 2
Radioactive COCs from the Landfill Soil Strata at ER Sites 1 and 3 and Comparison to the Background Screening Values

COC name	Maximum concentration (pCi/g)	SNL/NM 95th % or UTL Level (pCi/g)	Is maximum COC concentration less than or equal to the applicable SNL/NM background screening value?
U-238	326	1.3	No
U-235	9.19	0.18	No
U-234	97.8	1.6	No
Th-232	3.47	1.54	No
Ra-228	3.75[1]	1.2	No
Th-228	3.75	1.2[2]	No
Th-230	2.79	1.6[3]	No
Am-241	19.7	NC[4]	No
Pu-239/240	113.5	NC	No
Pu-238	2.23	NC	No
Co-60	ND[5]	NC	Yes
Sr-90	1.7	NC	No
H-3	1616	NC	No
Cs-137	14.8	0.08	No
Cs-134	ND	NC	Yes
Ra-226	0.97	1.76	Yes

Note 1: Reported maximum was lower, assumed maximum concentration of daughter product, Th-228.
Note 2: Th-228 background assumed to be that of its parent nuclide Ra-228.
Note 3: Th-230 background assumed to be that of its parent nuclide U-234.
Note 4: Not Calculated.
Note 5: Not Detected.

Table 3
Radioactive COCs from the Landfill Cover at ER Sites 1 and 3 and Comparison to the Background Screening Values

COC name	Maximum concentration (pCi/g)	SNL/NM 95th % or UTL Level (pCi/g)	Is maximum COC concentration less than or equal to the applicable SNL/NM background screening value?
U-238	1.42[1]	1.3	No
U-235	0.105	0.18	Yes
U-234	NS[2]	1.6	Yes
Th-232	0.937	1.54	Yes
Ra-228	1.03	1.33	Yes
Th-228	0.86	1.33[3]	Yes
Am-241	0.16	NC	No
Pu-239/240	1.28[4]	NC	No
Pu-238	0.053[5]	NC	No
Co-60	ND	NC	Yes
H-3	78.9	NC	No
Cs-137	0.185	0.836	Yes
Cs-134	ND	NC	Yes

Note 1: Based on the activity of its short-lived daughter Th-234.
Note 2: Not Sampled. Since U-238 was not found above background it was assumed that U-234 would be within background.
Note 3: Th-228 background assumed to be that of its parent nuclide Ra-228.
Note 4: Pu-239 not detected, conservatively assumed to be 8x the activity of Am-241 to be consistent with higher activity samples taken from within the landfill.
Note 5: Pu-238 not detected, conservatively assumed to be 0.33x the activity of Am-241 to be consistent with higher activity samples taken from within the landfill.

use scenario, the EPA screening guidance value is 400 mg/kg (EPA 1994). The maximum concentration value for lead at this site is less than both of those screening values, and therefore lead is eliminated from further consideration in this risk assessment.

Because several nonradiological COCs had concentrations greater than their respective SNL/NM background 95th percentile or UTL, the site fails the background screening criteria, and all nonradiological COCs proceed to the proposed Subpart S action level screening procedure.

Table 4 shows the nonradioactive COCs compared to the proposed Subpart S action level for soils. The table compares the maximum concentration values to 1/10 of the proposed Subpart S action level. This methodology was guidance given to SNL/NM from the EPA (EPA 1996b). This is the second screening process in the tiered risk assessment approach. Several compounds had a concentration greater than 1/10 of the proposed Subpart S action level. Because of these compounds, the site fails the proposed Subpart S screening criteria, and a Hazard Index value and cancer risk value must be calculated for all of the nonradioactive COCs.

Table 4
Comparison of ER Sites 1 and 3 Nonradioactive COC Concentrations to Proposed Subpart S Action Levels

COC name	Maximum concentration (mg/kg)	Proposed Subpart S Action Level (mg/kg)	Is individual contaminant less than 1/10 the Action Level?
Arsenic	13**	0.5	No
Barium	300	6,000	Yes
Beryllium	2	0.2	No
Cadmium	6.5	80	Yes
Chromium, total*	16	400	Yes
Mercury	7.8	20	No
Selenium	25**	400	Yes
Silver	8.5	400	Yes

* total chromium assumed to be chromium VI (most conservative).
** concentrations are assumed to be one-half of the detection limit.

II.3.2 Identification of Toxicological Parameters

Tables 5 and 6 show the COCs that have been retained in the risk assessment and the values for the toxicological information available for those COCs. Dose conversion factors (DCF) used in determining the excess TEDE values for the individual pathways were the default values provided in the RESRAD computer code as developed in the following:

- For ingestion and inhalation, DCFs are taken from Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion* (EPA 1988a).

- The DCFs for surface contamination (contamination on the surface of the site) were taken from DOE/EH-0070, *External Dose-Rate Conversion Factors for Calculation of Dose to the Public* (DOE 1988).

- The DCFs for volume contamination (exposure to contamination deeper than the immediate surface of the site) were calculated using the methods discussed in *Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil* (Health Physics 28:193-205) (Kocher 1983), and ANL/EAIS-8, *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil* (Yu et al. 1993a).

Radioactive contamination does not have predetermined action levels analogous to proposed Subpart S, and therefore this step in the screening process is not performed for radionuclides.

Table 5
Nonradioactive Toxicological Parameter Values for ER Sites 1 and 3 COCs

COC name	RfD_o (mg/kg/d)	RfD_{inh} (mg/kg/d)	Confidence	Sf_o (kg-d/mg)	SF_{inh} (kg-d/mg)	Cancer Class ^
Arsenic	0.0003	--	M	1.5	15.1	A
Barium	0.07	0.000143	M	--	--	D
Beryllium	0.005	--	L	4.3	8.4	B2
Cadmium	0.0005	0.0000571	H	--	6.3	B1
Chromium, total*	0.005	--	L	--	42	A
Mercury	0.0003	0.0000857	M	--	--	D
Selenium	0.005	--	H	--	--	D
Silver	0.005	--	L	--	--	D

* total chromium assumed to be chromium VI (most conservative).
RfD_o - oral chronic reference dose in mg/kg-day.
RfD_{inh} - inhalation chronic reference dose in mg/kg-day.
Confidence - L = low, M = medium, H = high.
SF_o - oral slope factor in $(mg/kg\text{-}day)^{-1}$.
SF_{inh} - inhalation slope factor in $(mg/kg\text{-}day)^{-1}$.
^ EPA weight-of-evidence classification system for carcinogenicity:
A - human carcinogen.
B1 - probable human carcinogen. Limited human data are available.
B2 - probable human carcinogen. Indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - possible human carcinogen.
D - not classifiable as to human carcinogenicity.
E - evidence of noncarcinogenicity for humans.
-- information not available.

Table 6
Radiological Toxicological Parameter Values for ER Sites 1 and 3 COCs

COC name	SF_o (1/pCi)	Sf_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class^
U-238	6.2E-11	1.2E-8	5.7E-8	A
U-235	4.7E-11	1.3E-8	2.7E-7	A
U-234	4.4E-11	1.4E-8	2.1E-11	A
Th-232	3.3E-11	1.9E-8	2.0E-11	A
Ra-228	2.5E-10	9.9E-10	3.3E-6	A
Th-228	2.3E-10	9.7E-8	9.9E-7	A
Am-241	3.3E-10	3.9E-8	4.6E-9	A
Pu-239/240	3.2E-10	2.8E-8	1.3E-11	A
Pu-238	3.0E-10	2.7E-8	1.9E-11	A
Sr-90	5.6E-11	6.9E-11	1.9E-8	A
H-3	7.2E-14	9.6E-14	0	A
Cs-137	3.2E-11	1.9E-11	2.1E-6	A

SF_o - oral (ingestion) slope factor (risk/pCi).
SF_{inh} - inhalation slope factor (risk/pCi).
SF_{ev}- *external volume exposure slope factor (risk/yr per pCi/g).*
^ *EPA weight-of-evidence classification system for carcinogenicity:*
A - human carcinogen.
B1 - probable human carcinogen. Limited human data are available.
B2 - probable human carcinogen. Indicates sufficient evidence in animals and inadequate or no evidence in humans.
C - possible human carcinogen.
D - not classifiable as to human carcinogenicity.
E - evidence of noncarcinogenicity for humans.

II.3.3 Exposure Assessment and Risk Characterization

Section II.3.3.1 describes the exposure assessment for this risk assessment. Section II.3.3.2 provides the risk characterization, including the Hazard Index value and the excess cancer risk, for both the potential nonradiological COCs and associated background industrial and residential land-uses. The incremental TEDE and incremental estimated for cancer risk are provided for the background-adjusted radiological COCs for industrial and residential land-uses.

II.3.3.1 Exposure Assessment

Appendix 1 shows the equations and parameter values used in the calculation of intake values and the subsequent Hazard Index and excess cancer risk values for the individual exposure pathways. The appendix shows the parameters for both industrial and residential land-use scenarios. The equations are based on RAGS (EPA 1989). The parameters are based on information from RAGS (EPA 1989) as well as other EPA guidance documents and reflect the RME approach advocated by RAGS (EPA 1989). For radionuclides, the coded equations provided in the RESRAD computer code were used to estimate the incremental TEDE and cancer risk for the individual exposure pathways. Further discussion of this process is provided in Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0 (Yu et al. 1993b).

Although the designated land-use scenario is industrial for this site, the risk and TEDE values for a residential land-use scenario are also presented. These residential risk and TEDE values are presented to only provide perspective of the potential for risk to human health under the more restrictive land-use scenario.

II.3.3.2 Risk Characterization

Table 7 shows that for the ER Sites 1 and 3 nonradioactive COCs, the Hazard Index value is 0.08, and the excess cancer risk is 1×10^{-5} for the designated industrial land-use scenario. The numbers presented included exposure from soil ingestion and dust inhalation for the nonradioactive COCs. Table 8 shows that assuming the maximum background concentrations of the ER Sites 1 and 3 associated nonradiological background constituents, the Hazard Index is 0.01, and the excess cancer risk is 4×10^{-6} for the designated industrial land-use scenario.

For the radioactive COCs, contribution from the direct gamma exposure pathway is included. The incremental TEDE for industrial land use is 3.4 millirem per year (mrem/yr). This includes 3.3 mrem/yr attributed to the landfill soil strata radon emanation from below the 10-foot cover and 0.1 mrem/yr due to the residual radionuclides that exist in the 10-foot cover material. In accordance with proposed EPA guidance, the standard being utilized is an incremental TEDE of 15 mrem/yr (40 CFR Part 196 1994) for the probable land-use scenario (industrial in this case); the calculated dose value for ER Sites 1 and 3 for the industrial land-use scenario is below this standard. The estimated excess cancer risk is 1×10^{-4} from the landfill soil strata and 1×10^{-6} from the cover, for a net estimated excess cancer risk of 1×10^{-4}.

For the residential land-use scenario, the Hazard Index value increases to 29, and the excess cancer risk is 1×10^{-4}. The numbers presented include exposure from soil ingestion, dust and volatile inhalation, and plant uptake. Although the EPA (1991) generally recommends that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and, subsequently, for dust to be present even in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Appendix 1). Table 6 shows that for the ER Sites 1 and 3 associated nonradiological background constituents, the Hazard Index increases to 0.3, and the excess cancer risk is 6×10^{-5}.

For the radioactive COCs, the incremental TEDE for residential land use is 15.5 mrem/yr. This includes 13.2 mrem/yr attributed to the landfill soil strata radon emanation from below the 10-foot cover and 2.3 mrem/yr due to the residual radionuclides that exist in the 10-foot cover material. In accordance with proposed EPA guidance, the standard being utilized is an excess TEDE of 75 mrem/yr (40 CFR Part 196 1994) for a loss of institutional controls (residential land use in this case); the calculated dose value for ER Sites 1 and 3 for the residential land use is below this standard. The estimated excess cancer risk is 2×10^{-4} from the landfill soil strata and 7×10^{-5} from the cover, for a net estimated excess cancer risk of 3×10^{-4}. The excess cancer risk from the nonradioactive COCs and the radioactive COCs is not additive, as noted in RAGS (EPA 1989).

Table 7
Nonradioactive Risk Assessment Values for ER Sites 1 and 3 COCs

COC Name	Maximum concentration (mg/kg)	Industrial Land-Use Scenario		Residential Land-Use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	13	0.04	8E-6	0.74	1E-4
Barium	300	0.00	--	0.04	--
Beryllium	2	0.00	4E-6	0.00	2E-5
Cadmium	6.5	0.01	3E-9	5.31	4E-9
Chromium, total*	16	0.00	4E-8	0.01	6E-8
Mercury	7.8	0.03	--	13.44	--
Selenium	25	0.00	--	8.8	--
Silver	8.5	0.00	--	0.35	--
TOTAL		0.08	1E-5	29	1E-4

* total chromium assumed to be chromium VI (most conservative).
-- information not available.

Table 8
Nonradioactive Risk Assessment Values for ER Sites 1 and 3 Background Constituents

Constituent Name	Background concentration (mg/kg)	Industrial Land-Use Scenario		Residential Land-Use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.01	3E-6	0.25	5E-5
Barium	200	0.00	--	0.03	--
Beryllium	0.80	0.00	1E-6	0.00	6E-6
Cadmium	<1	--	--	--	--
Chromium, total*	NC	--	--	--	--
Mercury	<0.1	--	--	--	--
Selenium	<1	--	--	--	--
Silver	<1	--	--	--	--
TOTAL		0.01	4E-6	0.3	6E-5

-- information not available.
* total chromium assumed to be chromium VI (consistent with Table 5).

II.4 Step 6. Comparison of Risk Values to Numerical Guidelines

The risk assessment analyses considered the evaluation of the potential for adverse health effects for both an industrial land-use scenario, which is the designated land-use scenario for this site, and a residential land-use scenario.

For the industrial land-use scenario, the Hazard Index calculated for the nonradioactive COCs is 0.08; this is much less than the numerical guideline of 1 suggested in RAGS (EPA 1989). The excess cancer risk is estimated at 1 x 10^{-5}. In RAGS, the EPA suggests that a range of values (10^{-6} to 10^{-4}) be used as the numerical guideline; the value calculated for these sites is in the middle of the suggested acceptable risk range. This risk assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. For the industrial land-use scenario, the Hazard Index is 0.01. The excess cancer risk is estimated at 4 x 10^{-6}. Incremental risk is determined by subtracting risk associated with background from potential nonradiological COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and discussed within the text. The incremental Hazard Index is 0.07, and the incremental cancer risk is 8 x 10^{-6} for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from the COCs considering an industrial land-use scenario.

For the radioactive components of the industrial land-use scenario, the incremental TEDE is 3.4 mrem/yr, which is less than the numerical standard of 15 mrem/yr suggested in the draft EPA guidance. The incremental estimated excess cancer risk is 1 x 10^{-4}.

For the residential land-use scenario, the calculated Hazard Index for the nonradioactive COCs is 29, which is above the numerical guidance. The excess cancer risk is estimated at 1 x 10^{-4}; this value is at the upper limit of the suggested acceptable risk range. The Hazard Index for associated background for the residential land-use scenario is 0.3. The excess cancer risk is estimated at 6 x 10^{-5}. For the residential land-use scenario, the incremental Hazard Index is 28.41, and the incremental cancer risk is estimated at 6.4 x 10^{-5}. These incremental risk calculations indicate significant contribution to human health risk from the COCs considering a residential land-use scenario.

The incremental TEDE from the radioactive components is 15.5 mrem/yr, which is less than the numerical standard of 75 mrem/yr suggested in the draft EPA guidance. The estimated excess cancer risk is 3 x 10^{-4}.

II.5 Step 7 Uncertainty Discussion

The RWL/CDPs were remediated in the summer of 1996 as an expedited clean-up/voluntary corrective measure. Three types of sampling, in accordance with the VCM Plan, were performed: sampling of potentially clean piles, sampling of potentially contaminated piles, and verification pit samples. The nonradioactive COCs are listed in Table 1, and the radioactive COCs are listed in Tables 2 and 3. The nonradioactive COCs were analyzed using EPA Methods 6010 and 7470. The radioactive COCs were analyzed using alpha spectroscopy and gamma spectroscopy, with the exception of tritium, which was analyzed using liquid scintillation.

The analyses were performed using a combination of on-site and off-site laboratories. The off-site laboratories are Contract Laboratory Program (CLP) certified. The composite samples were analyzed for both radiological and chemical parameters. For the suspect clean piles, radiological analyses included 100 percent on-site analyses of gross alpha/beta, tritium, and gamma spectroscopy. Twenty percent of the samples were also analyzed off site for gamma spectroscopy, tritium, and any isotopic analyses determined necessary. Chemical analyses included total RCRA metals and beryllium, also split 100 percent on site/20 percent off site. For the suspect contaminated piles and verification samples, a similar split of on-site and off-site analyses were performed. A summary of the sampling performed, including the quality assurance/quality control samples, is included in Section 6.6 of this report. The data provided by the CLP laboratory, as well as the on-site laboratory, are considered definitive data suitable for use in a risk assessment analysis.

The conclusion from the risk assessment analysis is that the potential effects caused by potential nonradiological COCs on human health are within the acceptable range compared to established numerical guidelines for the industrial land-use scenario. Calculated incremental risk between potential nonradiological COCs and associated background indicates small contribution of risk from nonradiological COCs when considering the industrial land-use scenario.

For the radiological COCs, the conclusion from the risk assessment is that the potential effects on human health, for both the industrial and residential land-use scenario, are within proposed standards (40 CFR Part 196 1994) and are a small fraction of the estimated 290 mrem/yr received due to natural background (NCRP 1987). To address potential uncertainties associated with the risk assessment, a sensitivity analysis was performed on the parameters most likely to affect the incremental TEDE result for the residential (i.e., most limiting) land-use scenario. This did not include residual radionuclide concentrations in the soil. All varied parameters were adjusted by a factor of two (i.e., divided by 2 and multiplied by 2). Results from this analysis showed that in no case did the incremental TEDE exceed those referenced above (40 CFR Part 196 1994).

The potential effects on human health for the nonradiological COCs are greater when considering the residential land-use scenario. Incremental risk between potential nonradiological COCs and associated background also indicates an increased contribution of risk from the nonradiological COCs. The increased effects on human health are primarily the result of including the plant uptake exposure pathway. Constituents that posed little to no risk considering an industrial land-use scenario (some of which are below background screening levels) contribute a significant portion of the risk associated with the residential land-use scenario. These constituents bioaccumulate in plants. Because ER Sites 1 and 3 are designated as an industrial land-use area (DOE and USAF 1995), the likelihood of significant plant uptake in this area is highly unlikely. The uncertainty in this conclusion is considered to be small.

Because of the locations, history of the sites, and the future land uses (DOE and USAF 1995), there is low uncertainty in the land-use scenarios and the potentially affected populations that were considered in making the risk assessment analysis. Because the COCs are found in surface and near-surface soils and because of the location and physical characteristics of the sites, there is little uncertainty in the exposure pathways relevant to the analysis.

A RME approach was used to calculate the risk assessment values, which means that the parameter values used in the calculations were conservative and that the calculated intakes are likely overestimates. Maximum measured values of the concentrations of the COCs and minimum value of the 95th UTL or percentile background concentration value, as applicable, of background concentrations associated with the COCs were used to provide conservative results.

Table 5 shows the uncertainties (confidence) in the nonradiological toxicological parameter values. There is a mixture of estimated values and values from the Health Effects Assessment Summary Tables (HEAST) (EPA 1996c) and Integrated Risk Information System (IRIS) (EPA 1988b, 1997a) databases. Where values are not provided, information is not available from HEAST, IRIS, or EPA regions. Because of the conservative nature of the RME approach, the uncertainties in the toxicological values are not expected to be of high enough concern to change the conclusion from the risk assessment analysis.

The nonradiological risk assessment values are within the acceptable range for the industrial land-use scenario compared to the established numerical guidelines. Although the residential land-use Hazard Index is above the numerical guideline and the excess cancer risk is at the upper limit of the acceptable risk range, it has been determined that future land use at these localities will not be residential (DOE and USAF 1995). The overall uncertainty in all of the steps in the risk assessment process is considered insignificant with respect to the conclusion reached.

II.6 Summary

ER Sites 1 and 3, the RWL and the CDPs, had contamination consisting of some inorganic nonradioactive and radioactive compounds. Because of the location of the sites on KAFB, the designated industrial land-use scenario (DOE and USAF 1995), and the nature of the contamination, the potential exposure pathways identified for these sites included soil ingestion and dust and volatile inhalation. Plant uptake was included as an exposure pathway for the residential land-use scenario. These sites are designated for industrial land-use (DOE and USAF 1995); the residential land-use scenario is provided for perspective only.

Using conservative assumptions and employing a RME approach to the risk assessment, the calculations for the nonradiological COCs show that for the industrial land-use scenario the Hazard Index (0.08) is significantly less than the accepted numerical guidance from the EPA. The estimated cancer risk (1×10^{-5}) is in the middle of the suggested acceptable risk range. The incremental Hazard Index is 0.07, and the incremental cancer risk is 8×10^{-6} for the industrial land-use scenario. Incremental risk calculations indicate insignificant contribution to risk from the nonradiological COCs considering an industrial land-use scenario.

The main contributor to the nonradiological industrial land-use scenario risk assessment was arsenic. The maximum arsenic concentration (13 mg/kg) is within the subsurface samples background range (0.033 to 17.0) and therefore may not be indicative of contamination.

The incremental TEDE and corresponding estimated cancer risk from the radioactive components are less than EPA guidance values; the estimated TEDE is 3.4 mrem/yr for the industrial land-use scenario. This value is less than the numerical guidance of 15 mrem/yr (for industrial land use) in draft EPA guidance. The corresponding estimated incremental cancer risk value is 1×10^{-4} for the industrial land-use scenario.

The uncertainties associated with the calculations are considered small relative to the conservativeness of the risk assessment analysis. It is therefore concluded that these sites do not have significant potential to affect human health under an industrial land-use scenario.

III. Ecological Risk Assessment

III.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPEC) at SNL/NM ER Sites 1 and 3, the RWL and the CDPs. The ecological risk assessment process performed for these site is a screening-level assessment that follows the methodology presented in IT Corporation (1997) and SNL/NM (1997). The methodology was based on screening-level guidance presented by the EPA (EPA 1992, 1996d, 1997b) and by Wentsel et al. (1996) and is consistent with a phased approach. This assessment utilizes conservatism in the estimation of ecological risks; however, ecological relevance and professional judgment are also incorporated as recommended by the EPA (1996d) and Wentsel et al. (1996) to ensure that the predicted exposures of selected ecological receptors reasonably reflect those expected to occur at the sites.

III.2 Site Description and Ecological Pathways

ER Sites 1 and 3 are part of Operable Unit 1303 and are located in TA-II near its eastern boundary fence. In general, the land within TA-II has been developed or is highly disturbed (IT Corporation 1995). The vegetation in and around ER Sites 1 and 3 is best described as disturbed grassland dominated by early successional and ruderal species. No threatened, endangered, or sensitive species are known to occur at these sites, and none are expected due to the disturbed condition of the habitat. Complete ecological pathways may exist through the exposures of plants, soil invertebrates, and small mammals to COPECs on the sites and through the potential for consumption of the small mammals by predators. These pathways are limited, however, to soils from the landfill cover strata.

III.3 Constituents of Potential Ecological Concern

The potential nonradiological COCs at these sites are arsenic, barium, beryllium, cadmium, chromium, lead, mercury, selenium, and silver. All of these COCs were found to exceed their respective background screening levels (Table 1) and were, therefore, identified as COPECs. Inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included as COPECs in this assessment. Radioactive COCs from the landfill cover at ER Sites 1 and 3 that exceeded background screening values were americium-241, plutonium-239/240, plutonium-238, uranium-239, and tritium (Table 3).

III.4 Receptors and Exposure Modeling

A nonspecific perennial plant was used as the receptor to represent plant species at these sites. Two wildlife receptors (deer mouse and burrowing owl) were used to represent wildlife use of the sites. Exposure modeling for the wildlife receptors was limited to the food ingestion pathway. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was modeled as an omnivore (50 percent of the diet as plants and 50 percent as soil invertebrates), and the burrowing owl was modeled as a strict predator on small mammals (100 percent of the diet as deer mice). Both were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 9 presents the species-specific factors used in modeling exposures in the wildlife receptors. Although home range is also included in this table, exposures for this screening-level assessment were modeled using an area use factor of 1, implying that all food items and soil ingested are from the sites being investigated.

The maximum measured COPEC concentrations from both surface and subsurface soil samples were used to conservatively estimate potential exposures and risks to plants and wildlife at these sites. Table 10 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 11 presents the maximum concentrations of COPECs in soil and the derived concentrations in the various food-chain elements.

With respect to the radionuclides, the receptors are exposed to radiation internally and externally from americium-241, plutonium-239/240, plutonium-238, and uranium-238, and are exposed internally from tritium. Internal and external dose rates to the deer mouse and burrowing owl are approximated using dose rate models from the *Hanford Site Risk Assessment Methodology* (DOE 1995). Radionuclide-dependent data for the dose rate calculations were referenced from Baker and Soldat (1992). The external dose rate models assume a soil density of 1.5 grams per cubic centimeter (g/cm^3). Only gamma-emitting radionuclides are considered for the external dose rate calculation. The average gamma energy per disintegration (MeV/disintegration) was used for each particular gamma emitter. The internal dose rate model assumes that absorbed energy (Baker and Soldat 1992) is a function of the effective body radius of the receptor. Any radionuclides present in the body of the receptor are assumed to concentrate at the center of the organism and contribute to a whole-body dose. The internal dose rate model assumes that the deer mouse ingests radionuclides from soil and plants and the burrowing owl is assumed to ingest radionuclides from soil and its diet of deer mice. A detailed description of the method to estimate radiation dose to these receptors is presented in DOE (1995) and IT (1997). The total dose rate to a receptor is the sum of the external and internal dose rates.

Table 9
Exposure Factors for Ecological Receptors at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

Receptor species	Class/ Order	Trophic level	Body weight (kg)[a]	Food intake rate (kg/d)[b]	Dietary Composition[c]	Home range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	0.0239[d]	0.00372	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	0.27[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	0.155[f]	0.0173	Rodents: 100% (+ Soil at 2% of intake)	34.6[g]

[a]Body weights are in kilograms wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kilograms dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2 percent of food intake.
[d]From Silva and Downing (1995).
[e]From EPA (1993), based on the average home range measured in semi-arid shrubland in Idaho.
[f]From Dunning (1993).
[g]From Haug et al. (1993).

Table 10
Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Arsenic	4.00×10^{-2} [a]	1.00×10^{0} [b]	2.00×10^{-3} [a]
Barium	1.50×10^{-1} [a]	1.00×10^{0} [b]	2.00×10^{-4} [c]
Beryllium	1.00×10^{-2} [a]	1.00×10^{0} [b]	1.00×10^{-3} [c]
Cadmium	5.50×10^{-1} [a]	6.00×10^{-1} [d]	5.50×10^{-4} [a]
Chromium (Total)	4.00×10^{-2} [a]	1.30×10^{-1} [b]	3.00×10^{-2} [c]
Lead	9.00×10^{-2} [a]	4.00×10^{-2} [b]	8.00×10^{-4} [a]
Mercury	1.00×10^{0} [a]	1.00×10^{0} [b]	2.50×10^{-1} [c]
Selenium	5.00×10^{-1} [c]	1.00×10^{0} [b]	1.00×10^{-1} [c]
Silver	1.00×10^{0} [c]	2.50×10^{-1} [d]	5.00×10^{-3} [c]

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (1989).
[d]From Stafford et al. (1991).

Table 11
Media Concentrations (mg/kg)[a] for Constituents of Potential Ecological Concern at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

Constituent of Potential Ecological Concern	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Arsenic	1.30×10^{1}	5.20×10^{-1}	1.30×10^{1}	4.39×10^{-2}
Barium	3.00×10^{2}	4.50×10^{1}	3.00×10^{2}	1.12×10^{-1}
Beryllium	2.00×10^{0}	2.00×10^{-2}	2.00×10^{0}	3.28×10^{-3}
Cadmium	6.50×10^{0}	3.58×10^{0}	3.90×10^{0}	6.65×10^{-3}
Chromium (total)	1.60×10^{1}	6.40×10^{-1}	2.08×10^{0}	1.58×10^{-1}
Lead	4.10×10^{1}	3.69×10^{0}	1.64×10^{0}	8.71×10^{-3}
Mercury	7.80×10^{0}	7.80×10^{0}	7.80×10^{0}	6.22×10^{0}
Selenium	2.50×10^{1}	1.25×10^{1}	2.50×10^{1}	6.02×10^{0}
Silver	8.50×10^{0}	8.50×10^{0}	2.13×10^{0}	8.57×10^{-2}

[a]Milligrams per kilogram. All are based on dry weight of the media.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Product of the average concentration in food times the food-to-muscle transfer factor times the wet weight-dry weight conversion factor of 3.125 (from EPA 1993).

III.5 Toxicity Benchmarks

Benchmark toxicity values for the plant and wildlife receptors are presented in Table 12. For plants, the benchmark soil concentrations are based on the lowest-observed-adverse-effect level. For wildlife, the toxicity benchmarks are based on the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. The benchmark used for exposure of terrestrial receptors to radiation is 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should offer sufficient protection to other components within the terrestrial environment of ER Sites 1 and 3.

III.6 Risk Characterization

The maximum soil concentrations and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. The results of these comparisons are presented in Table 13. Hazard quotients (HQ) are used to quantify the comparison with the benchmarks for wildlife exposure. HQs for plants exceeded unity for arsenic (HQ = 1.3), cadmium (HQ = 2.17), total chromium (HQ = 16.0), mercury (HQ = 26.0), selenium (HQ = 25.0), and silver (HQ = 4.25). In the deer mouse, HQs exceeded unity for arsenic (HQ = 8.19), barium (HQ = 2.64), mercury (HQ = 19.8), and selenium (HQ = 7.66). In the burrowing owl,

Table 12
Toxicity Benchmarks for Ecological Receptors at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

		Mammalian NOAELs			Avian NOAELs		
Constituent of Potential Ecological Concern	Plant Benchmark[a]	Mammalian Test Species[b]	Test Species NOAEL[c]	Deer Mouse NOAEL[d]	Avian Test Species[e]	Test Species NOAEL[e]	Burrowing Owl NOAEL[f]
Arsenic	10	Lab mouse	0.126	0.13	Mallard	5.14	5.14
Barium	500	Lab rat[g]	5.1	10.53	Chicks	20.8	20.8
Beryllium	10	Lab rat	0.66	1.29			
Cadmium	3	Lab rat[h]	1.0	1.89	Mallard	1.45	1.45
Chromium (total)	1	Lab rat	2,737	5,354	Black Duck	1.0	1.0
Lead	50	Lab rat	8	15.7	American kestrel	3.85	3.85
Mercury	0.3	Lab rat	0.032	0.06	Mallard	0.0064	0.0064
Selenium	1	Lab rat	0.20	0.39	Screech owl	0.44	0.44
Silver	2	Lab rat	17.8	34.8			

[a]From Will and Suter (1995).
[b]From Sample et al. (1996), except where noted. Body weights (in kilograms) for NOAEL conversion are: lab mouse, 0.030, and lab rat, 0.350 (except where noted).
[c]From Sample et al. (1996).
[d]Based on NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.239 kilograms and a mammalian scaling factor of 0.25.
[e]From Sample et al. (1996).
[f]Based on NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[g]*Study-specific body weight: 0.435 kg.*
[h]Study-specific body weight: 0.303 kg.

selenium (HQ = 1.65) and mercury (HQ = 111) were found to produce HQs greater than unity. Although the maximum total chromium concentration of 16.0 mg/kg was carried through the risk assessment, the background value for total chromium (18.8 mg/kg), which is not reported in the human health risk assessment screening table, is actually greater than the maximum concentrations at ER Sites 1 and 3. The total radiation dose rate to the mouse was predicted to be 9.70×10^{-6} rad/day (Table 14). The total dose rate to the burrowing owl was predicted to be 8.12×10^{-6} rad/day (Table 15). The internal dose rate, for this case, is the major contributor to the total dose rate. The dose rates for the deer mouse and the burrowing owl are considerably less than the benchmark of 0.1 rad/day. Based upon this information, radiological risks associated with ER Sites 1 and 3 are expected to be insignificant; however, potential risks from exposures in ecological receptors to nonradiological COPECs at this site may exist. These COPECs include arsenic, barium, cadmium, chromium, mercury, selenium, and silver.

Table 13
Comparisons to Toxicity Benchmarks for Ecological Receptors at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

Constituent of Potential Ecological Concern	Plant Hazard Quotient[a]	Deer Mouse Hazard Quotient	Burrowing Owl Hazard Quotient
Arsenic	**1.30×10^{0}**	**8.19×10^{0}**	6.59×10^{-3}
Barium	6.00×10^{-1}	**2.64×10^{0}**	3.28×10^{-2}
Beryllium	2.00×10^{-1}	1.27×10^{-1}	---[b]
Cadmium	**2.17×10^{0}**	3.19×10^{-1}	1.05×10^{-2}
Chromium (total)	**1.60×10^{1}**	4.88×10^{-5}	5.32×10^{-2}
Lead	8.20×10^{-1}	3.47×10^{-2}	2.40×10^{-2}
Mercury	**2.60×10^{1}**	**1.98×10^{1}**	**1.11×10^{2}**
Selenium	**2.50×10^{1}**	**7.66×10^{0}**	**1.65×10^{0}**
Silver	**4.25×10^{0}**	2.45×10^{-2}	---

[a]Bold text indicates hazard quotient exceeds unity.
[b]*--- designates insufficient toxicity data available for risk estimation purposes.*

III.7 <u>Uncertainties</u>

Many uncertainties are associated with the characterization of ecological risks at ER Sites 1 and 3. These uncertainties result in the use of assumptions in estimating risk that may lead to an overestimation or underestimation of the true risk presented at a site. For this screening-level risk assessment, assumptions are made that are more likely to overestimate risk rather than to underestimate it. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the sites. Conservatisms incorporated into this risk assessment include the use of the maximum measured soil concentration to evaluate risk, the use of wildlife toxicity benchmarks based on NOAEL values, the use of earthworm-based transfer factors or a default factor of 1.0 for modeling COPECs into soil invertebrates in the absence of insect data, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size.

Uncertainties associated with the estimation of risk to ecological receptors following exposure to radiological COPECs are primarily related to those inherent in the dose rate models and related exposure parameters. The external dose rate models are based on the assumption that the receptor is underground in soil uniformly contaminated with the maximum detected concentration of the radionuclides present at the site. The internal models are based on the assumption that ingested radionuclides are present at the center of a spherical-shaped receptor, forming a point source of radiation. In addition, the receptor is assumed to be exposed uniformly from this source of radiation at the center and receives a total-body dose.

Table 14
Internal and External Dose Rates for Mice Exposed to Radionuclides at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/d)	External Dose (rad/d)	Total Dose (rad/d)
Americium-241	0.16	5.86×10^{-8}	3.43×10^{-7}	4.02×10^{-7}
Plutonium-239/240[a]	1.28	4.40×10^{-7}	6.39×10^{-8}	5.04×10^{-7}
Plutonium-238	0.053	1.94×10^{-8}	6.47×10^{-9}	2.59×10^{-8}
Tritium	78.9	7.43×10^{-6}	NA[b]	1.21×10^{-6}
Uranium-238	1.42	7.40×10^{-6}	1.31×10^{-7}	7.56×10^{-6}
Totals		9.16×10^{-6}	5.45×10^{-7}	9.70×10^{-6}

[a]Modeled as Plutonium-239.
[b]NA indicates that this radionuclide does not significantly contribute to the external dose.

Table 15
Internal and External Dose Rates for Owl Exposed to Radionuclides at Environmental Restoration Sites 1 and 3, Sandia National Laboratories, New Mexico

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/d)	External Dose (rad/d)	Total Dose (rad/d)
Americium-241	0.16	3.66×10^{-8}	3.43×10^{-7}	3.80×10^{-7}
Plutonium-239/240[a]	1.28	6.21×10^{-7}	6.39×10^{-8}	6.85×10^{-7}
Plutonium-238	0.053	2.74×10^{-8}	6.47×10^{-9}	3.39×10^{-8}
Tritium	78.9	2.12×10^{-6}	NA[b]	2.12×10^{-6}
Uranium-238	1.42	4.76×10^{-6}	1.31×10^{-7}	4.89×10^{-6}
Totals		7.57×10^{-6}	5.45×10^{-7}	8.12×10^{-6}

[a]Modeled as Plutonium-239.
[b]NA indicates that this radionuclide does not significantly contribute to the external dose.

III.6 Summary

An ecological risk assessment was conducted to evaluate potential ecological risks associated with the COCs at ER Sites 1 and 3. Five radionuclides present that might have been an ecological concern were americium-241, plutonium-239/240, plutonium-238, tritium, and uranium-238. The maximum total dose rate calculated for the receptors was approximately 1.0×10^{-5} rad/day, well below the acceptable benchmark of 0.1 rad/day. Nine inorganic COCs were found at levels of potential ecological concern using the maximum values of all the soil piles. The maximum total chromium concentration (18 mg/kg) and barium concentration (230 mg/kg) are within the background ranges. Five other COPECs (arsenic, cadmium, mercury, selenium, and silver) produced HQs greater than 1.0 for more than one receptor. However, Soil Piles 1 through 16 are proposed to be placed at 0 to 10 feet below ground. Using the maximum concentrations in Piles 1 through 16, arsenic (2.4 mg/kg), cadmium (1.05 mg/kg), and mercury (0.03 mg/kg) will produce HQs of less than 1.0 for all receptors. Selenium in Piles 1 through 16 has an average concentration of 7.2 mg/kg, which would result in HQs of 7.2 and 2.21 for the plant and the deer mouse, respectively. However, based upon material retrieved from the RWL and sampling data for the sites, selenium is not a COC. Based upon these results, the ecological risk for ER Sites 1 and 3 is expected to be insignificant.

IV. References

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APPENDIX 1.

Sandia National Laboratories Environmental Restoration Program

EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

BACKGROUND

Sandia National Laboratories (SNL) proposes that a default set of exposure routes and associated default parameter values be developed for each future land-use designation being considered for SNL/NM Environmental Restoration (ER) project sites. This default set of exposure scenarios and parameter values would be invoked for risk assessments unless site-specific information suggested other parameter values. Because many SNL/NM ER sites have similar types of contamination and physical settings, SNL believes that the risk assessment analyses at these sites can be similar. A default set of exposure scenarios and parameter values will facilitate the risk assessments and subsequent review.

The default exposure routes and parameter values suggested are those that SNL views as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the USEPA Region VI and NMED, SNL proposes that these default exposure routes and parameter values be used in future risk assessments.

At SNL/NM, all Environmental Restoration sites exist within the boundaries of the Kirtland AFB. Approximately 157 potential waste and release sites have been identified where hazardous, radiological, or mixed materials may have been released to the environment. Evaluation and characterization activities have occurred at all of these sites to varying degrees. Among other documents, the SNL/ER draft Environmental Assessment (DOE 1996) presents a summary of the hydrogeology of the sites, the biological resources present and proposed land use scenarios for the SNL/NM ER sites. At this time, all SNL/NM ER sites have been tentatively designated for either industrial or recreational future land use. The NMED has also requested that risk calculations be performed based on a residential land use scenario. All three land use scenarios will be addressed in this document.

The SNL/NM ER project has screened the potential exposure routes and identified default parameter values to be used for calculating potential intake and subsequent hazard index, risk and dose values. EPA (EPA 1989a) provides a summary of exposure routes that could potentially be of significance at a specific waste site. These potential exposure routes consist of:

- Ingestion of contaminated drinking water;
- Ingestion of contaminated soil;
- Ingestion of contaminated fish and shell fish;
- Ingestion of contaminated fruits and vegetables;
- Ingestion of contaminated meat, eggs, and dairy products;
- Ingestion of contaminated surface water while swimming;
- Dermal contact with chemicals in water;
- Dermal contact with chemicals in soil;
- Inhalation of airborne compounds (vapor phase or particulate), and;

- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water and exposure from ground surfaces with photon-emitting radionuclides).

Based on the location of the SNL ER sites and the characteristics of the surface and subsurface at the sites, we have evaluated these potential exposure routes for different land use scenarios to determine which should be considered in risk assessment analyses (the last exposure route is pertinent to radionuclides only). At SNL/NM ER sites, there does not presently occur any consumption of fish, shell fish, fruits, vegetables, meat, eggs, or dairy products that originate on-site. Additionally, no potential for swimming in surface water is present due to the high-desert environmental conditions. As documented in the RESRAD computer code manual (ANL 1993), risks resulting from immersion in contaminated air or water are not significant compared to risks from other radiation exposure routes.

For the industrial and recreational land use scenarios, SNL/NM ER has therefore excluded the following four potential exposure routes from further risk assessment evaluations at any SNL/NM ER site:

- Ingestion of contaminated fish and shell fish;
- Ingestion of contaminated fruits and vegetables;
- Ingestion of contaminated meat, eggs, and dairy products; and
- Ingestion of contaminated surface water while swimming.

That part of the exposure pathway for radionuclides related to immersion in contaminated air or water is also eliminated.

For the residential land-use scenario, we will include ingestion of contaminated fruits and vegetables because of the potential for residential gardening.

Based on this evaluation, for future risk assessments, the exposure routes that will be considered are shown in Table 1. Dermal contact is included as a potential exposure pathway in all land use scenarios. However, the potential for dermal exposure to inorganics is not considered significant and will not be included. In general, the dermal exposure pathway is generally considered to not be significant relative to water ingestion and soil ingestion pathways but will be considered for organic components. Because of the lack of toxicological parameter values for this pathway, the inclusion of this exposure pathway into risk assessment calculations may not be possible and may be part of the uncertainty analysis for a site where dermal contact is potentially applicable.

EQUATIONS AND DEFAULT PARAMETER VALUES FOR IDENTIFIED EXPOSURE ROUTES

In general, SNL/NM expects that ingestion of compounds in drinking water and soil will be the more significant exposure routes for chemicals; external exposure to radiation may also be significant for radionuclides. All of the above routes will, however, be considered for their appropriate land use scenarios. The general equations for calculating potential intakes via these routes are shown below. The equations are from the Risk Assessment Guidance for Superfund (RAGS): Volume 1 (EPA 1989a and 1991). These general equations also apply to

Table 1. Exposure Pathways Considered for Various Land Use Scenarios

Industrial	Recreational	Residential
Ingestion of contaminated drinking water	Ingestion of contaminated drinking water	Ingestion of contaminated drinking water
Ingestion of contaminated soil	Ingestion of contaminated soil	Ingestion of contaminated soil
Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)
Dermal contact	Dermal contact	Dermal contact
External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces	Ingestion of fruits and vegetables
		External exposure to penetrating radiation from ground surfaces

calculating potential intakes for radionuclides. A more in-depth discussion of the equations used in performing radiological pathway analyses with the RESRAD code may be found in the RESRAD Manual (ANL 1993). Also shown are the default values SNL/NM ER suggests for use in Reasonable Maximum Exposure (RME) risk assessment calculations for industrial, recreational, and residential scenarios, based on EPA and other governmental agency guidance. The pathways and values for chemical contaminants are discussed first, followed by those for radionuclide contaminants. RESRAD input parameters that are left as the default values provided with the code are not discussed. Further information relating to these parameters may be found in the RESRAD Manual (ANL 1993).

Generic Equation for Calculation of Risk Parameter Values

The equation used to calculate the risk parameter values (i.e., Hazard Quotient/Index, excess cancer risk, or radiation total effective dose equivalent [dose]) is similar for all exposure pathways and is given by:

Risk (or Dose) = Intake x Toxicity Effect (either carcinogenic, noncarcinogenic, or radiological)

$$= C \times (CR \times EFD/BW/AT) \times \text{Toxicity Effect} \quad (1)$$

where

- C = contaminant concentration (site specific);
- CR = contact rate for the exposure pathway;
- EFD = exposure frequency and duration;
- BW = body weight of average exposure individual;
- AT = time over which exposure is averaged.

The total risk/dose (either cancer risk or hazard index) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants.

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk range of 10^{-4} to 10^{-6}. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the Hazard Index) for the toxicity resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of this quantitative estimate with the EPA standard Hazard Index of unity (1). The evaluation of the health hazard due to radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989a) and the RESRAD Manual (ANL 1993). Table 2 shows the default parameter values suggested for used by SNL at ER sites, based on the selected land use scenario. References are given at the end of the table indicating the source for the chosen parameter values. The intention of SNL is to use default values that are consistent with regulatory guidance and consistent with the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways based on the assumption that a particular site has no unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

SNL proposes the described default exposure routes and parameter values for use in risk assessments at sites that have an industrial, recreational or residential future land-use scenario. There are no current residential land-use designations at SNL ER sites, but this scenario has been requested to be considered by the NMED. For sites designated as industrial or recreational land-use, SNL will provide risk parameter values based on a residential land-use scenario to indicate the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on Sandia ER sites. The parameter values are based on EPA guidance and supplemented by information from other government sources. The values are generally consistent with those proposed by Los Alamos National Laboratory, with a few minor variations. If these exposure routes and parameters are acceptable, SNL will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Table 2. Default Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure frequency (d/y)	***	***	***
Exposure duration (y)	30[a,b]	30[a,b]	30[a,b]
Body weight (kg)	70[a,b]	56[a,b]	70 adult[a,b] 15 child
Averaging Time (days) for carcinogenic compounds (=70 y x 365 d/y) for noncarcinogenic compounds (=ED x 365 d/y)	25550[a] 10950	25550[a] 10950	25550[a] 10950
Soil Ingestion Pathway			
Ingestion rate	100 mg/d[c]	6.24 g/y[d]	114 mg-y/kg-d[a]
Inhalation Pathway			
Inhalation rate (m^3/yr)	5000[a,b]	146[d]	5475[a,b,d]
Volatilization factor (m^3/kg)	chemical specific	chemical specific	chemical specific
Particulate emission factor (m^3/kg)	1.32E9[a]	1.32E9[a]	1.32E9[a]
Water Ingestion Pathway			
Ingestion rate (L/d)	2[a,b]	2[a,b]	2[a,b]
Food Ingestion Pathway			
Ingestion rate (kg/yr)	NA	NA	138[b,d]
Fraction ingested	NA	NA	0.25[b,d]
Dermal Pathway			
Surface area in water (m^2)	2[b,e]	2[b,e]	2[b,e]
Surface area in soil (m^2)	0.53[b,e]	0.53[b,e]	0.53[b,e]
Permeability coefficient	chemical specific	chemical specific	chemical specific

*** The exposure frequencies for the land use scenarios are often integrated into the overall contact rate for specific exposure pathways. When not included, the exposure frequency for the industrial land use scenario is 8 h/d for 250 d/y; for the recreational land use, a value of 2 hr/wk for 52 wk/y is used (EPA 1989b); for a residential land use, all contact rates are given per day for 350 d/y.

[a] RAGS, *Vol 1, Part B* (EPA 1991).

[b] Exposure Factors Handbook (EPA 1989b)

[c] EPA Region VI guidance.

[d] For radionuclides, RESRAD (ANL 1993) is used for human health risk calculations; default parameters are consistent with RESRAD guidance.

[e] Dermal Exposure Assessment (EPA 1992).

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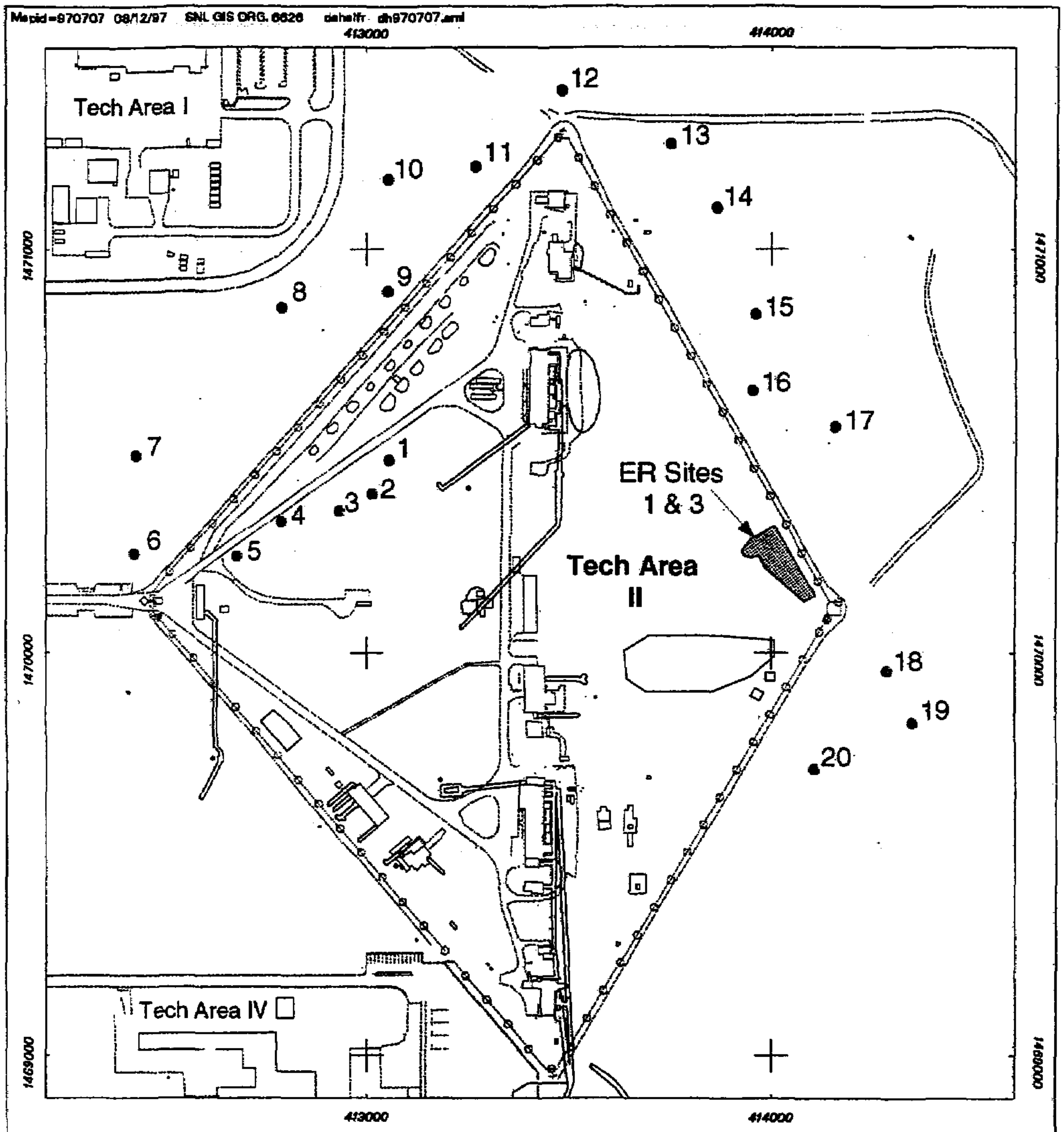
Section 6.2
Statistical Analysis of TA-II,
Radioactive Waste Landfill (ER Sites 1 and 3),
Radiological Background Data

Statistical Analysis of TA-II, Radioactive Waste Landfill (ER Site 1), Radiological Background Data

By Tom Tharp
Date: 4/5/97

3. Determination of Background UTLs for Background Radionuclides

The 95th UTL or Percentile was calculated for the individual constituents of the RWL radionuclide data set. If the distribution of a particular constituent was parametric, an UTL was calculated. If the distribution was non-parametric, a 95th percentile was determined. These values are provided in Table 5. A summary of the UTLs/percentiles, as appropriate, and the range of concentrations for a particular radionuclides are provided in Table 6.



Legend

- ● Background Soil Sample Location
- Road
- Other ER Site Boundary
- ○ ○ ○ ○ Fence
- Building/Structure
- ER Site 1 & 3

Figure 1
Radioactive Waste Landfill
Background Soil Sample Locations

Scale in Feet: 0 200 400

Scale in Meters: 0 48 96

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Table 1. Radiological background concentrations for TA-II, Radioactive Waste Landfill

Sample #	028081-01	028082-01	028083-01	028084-01	028085-01	028086-01	028087-01	028088-01	028089-01	028090-01
U-238	3.25 (ND)	1.19 (ND)	3.20 (ND)	1.11 (ND)	2.95 (ND)	1.10 (ND)	3.23 (ND)	1.11 (ND)	3.26 (ND)	1.13
Th-234	0.56 (ND)	1.01	0.53 (ND)	1.15	0.752	1.04	0.811	0.896	0.776	0.856
Ra-226	1.08	1.47	1.38	1.97	0.762	1.42	1.18	1.59	1.57	1.56
Pb-214	0.542	0.733	0.552	0.725	0.578	0.675	0.666	0.653	0.658	0.757
Bi-214	0.504	0.701	0.51	0.641	0.501	0.657	0.602	0.637	0.603	0.711
Th-232	0.792	0.734	0.695	0.861	0.707	0.799	0.814	0.777	0.778	0.82
Ra-228	0.821	0.679	0.839	0.911	0.651	0.723	0.853	0.751	0.84	0.855
Ac-228	0.748	0.828	0.863	0.827	0.735	0.754	0.756	0.725	0.824	0.983
Th-228	0.683	0.497	0.878	0.497	0.583	0.669	0.719	0.644 (ND)	0.568	0.518
Ra-224	0.894	0.833	0.755	0.854	0.703	0.789	0.862	0.732	0.865	0.96
Pb-212	0.767	0.826	0.773	0.808	0.709	0.758	0.817	0.722	0.831	0.885
Bi-212	0.681	0.771	0.918	0.722	0.72	0.974	0.753	0.779	0.781	1.05
Tl-208	0.672	0.771	0.706	0.83	0.691	0.696	0.692	0.674	0.733	0.826
U-235	0.231 (ND)	0.178 (ND)	0.228 (ND)	0.165 (ND)	0.204 (ND)	0.159 (ND)	0.227 (ND)	0.169 (ND)	0.227 (ND)	0.172 (ND)
Cs-137	0.0146	0.169	0.0364 (ND)	0.147	missing	0.105	0.443	0.0957	0.31	missing

Sample #	028091-01	028092-01	028093-01	028094-01	028095-01	028096-01	028097-01	028098-01	028099-01	028100-01
U-238	3.17 (ND)	1.11 (ND)	3.22 (ND)	1.23 (ND)	3.19 (ND)	1.13 (ND)	3.00 (ND)	1.22 (ND)	3.28 (ND)	3.29 (ND)
Th-234	0.978	1.02	0.969	1.13	0.784	1.18	0.941	1.18	0.96	1.02
Ra-226	1.23	1.16	1.5	2.28	1.2	1.45	1.09	1.59	1.21	1.52
Pb-214	0.642	0.761	0.636	0.824	0.662	0.836	0.58	0.764	0.715	0.688
Bi-214	0.543	0.658	0.607	0.79	0.633	0.785	0.501	0.717	0.597	0.588
Th-232	0.635	0.824	0.767	0.929	0.713	0.89	0.782	1.07	0.86	0.802
Ra-228	0.789	0.798	0.886	0.884	0.77	0.833	0.804	0.939	0.839	0.832
Ac-228	0.768	0.842	0.76	0.952	0.809	0.817	0.714	0.872	0.871	0.887
Th-228	0.731	0.648 (ND)	0.729	0.701 (ND)	0.736	0.788	0.467	0.831	0.536	0.917
Ra-224	0.742	0.951	0.81	0.827	0.778	0.912	0.724	0.791	0.971	0.863
Pb-212	0.776	0.806	0.781	0.855	0.787	0.845	0.713	0.914	0.852	0.939
Bi-212	0.696	0.509	0.788	1.15	0.775	0.99	0.82	0.799	0.961	0.986
Tl-208	0.701	0.701	0.716	0.819	0.679	0.707	0.63	0.91	0.814	0.715
U-235	0.225 (ND)	0.166 (ND)	0.225 (ND)	0.185 (ND)	0.225 (ND)	0.168 (ND)	0.214 (ND)	0.187 (ND)	0.227 (ND)	0.225 (ND)
Cs-137	0.358	0.208	0.402	0.534	0.308	0.221	0.405	0.782	0.0903	0.472

Table 2. *A Priori* Screening for TA II, Radioactive Waste Landfill, Background Radionuclides

Parameter	Max Value	Next Max	X Factor	Results
Th-234	1.18	1.18	1.00	PASS
Ra-226	2.28	1.97	1.16	PASS
Pb-214	0.836	0.824	1.01	PASS
Bi-214	0.79	0.785	1.01	PASS
Th-232	1.07	0.929	1.15	PASS
Ra-228	0.939	0.911	1.03	PASS
Ac-228	0.983	0.952	1.03	PASS
Th-228	0.917	0.878	1.04	PASS
Ra-224	0.971	0.96	1.01	PASS
Pb-212	0.939	0.914	1.03	PASS
Bi-212	1.15	1.05	1.10	PASS
Tl-208	0.91	0.83	1.10	PASS
Cs-137	0.782	0.534	1.46	PASS

X Factor - maxiumum value divided by next maximum value

Table 3. Distribution Summary for TA-II, Radioactive Waste Landfill, Background Radionuclides

Parameter	Distribution Type	Shapiro-Wilk Test (0.905) (0.897 for Cs-137 and 0.901 for Th-232)	Coefficient of Skewness (-1 to 1)	Histogram	Probability Plot	Number of Samples	Distribution
Th-234	Normal	0.828 (F)	-1.44 (F)	?	?	20	Nonparametric
	Lognormal	0.666 (F)	-2.15 (F)	?	?	20	
Ra-226	Normal	0.933	0.69	X		20	Lognormal
	Lognormal	0.951	-0.24		X	20	
Pb-214	Normal	0.969	0.07		X	20	Normal
	Lognormal	0.966	-0.16	X		20	
Bi-214	Normal	0.945	0.25		*	20	Lognormal
	Lognormal	0.945	-0.005	X	*	20	
Th-232	Normal	0.985	-0.14	X	X	19	Normal
	Lognormal	0.977	-0.39			19	
Ra-228	Normal	0.957	-0.61	*	X	20	Normal
	Lognormal	0.936	-0.83	*		20	
Ac-228	Normal	0.943	0.59			20	Lognormal
	Lognormal	0.953	0.42	X	X	20	
Th-228	Normal	0.958	-0.12	X	X	20	Normal
	Lognormal	0.926	-0.6			20	
Ra-224	Normal	0.962	0.19			20	Lognormal
	Lognormal	0.966	0.05	X	X	20	
Pb-212	Normal	0.973	0.3	*		20	Lognormal
	Lognormal	0.977	0.13	*	X	20	
Bi-212	Normal	0.951	0.21	X	X	20	Normal
	Lognormal	0.944	-0.36			20	
Tl-208	Normal	0.880 (F)	0.95	?	?	20	Nonparametric
	Lognormal	0.899 (F)	0.79	?	?	20	
Cs-137	Normal	0.945	0.69	X	X	18	Normal
	Lognormal	0.874 (F)	-1.17 (F)			18	

F - failed statistical test

* - both plots exhibit same degree of being parametrically distributed

? - constituent does not exhibit a parametric distribution

Table 4. T_n Statistic Analysis for TA-II, Radioactive Waste Landfill, Background Radionuclides

Parameter	Distribution	Maximum Observation	Mean	Standard Deviation	T_n Statistic	N	Upper 5% Critical Value	Pass or Fail T_n Statistic
Th-234	Nonparametric	N/A	N/A	N/A	N/A	20	N/A	N/A
Ra-226	Lognormal	0.824175	0.31822	0.234747	2.155	20	2.557	Pass
Pb-214	Normal	0.836	0.68235	0.0832247	1.846	20	2.557	Pass
Bi-214	Lognormal	-0.235722	-0.480466	0.14034	1.744	20	2.557	Pass
Th-232	Lognormal	0.0676586	-0.22629	0.113235	2.596	20	2.557	Fail
Th-232	Normal	0.929	0.788368	0.0714852	1.967	19	2.532	Pass
Ra-228	Normal	0.939	0.81485	0.0728829	1.703	20	2.557	Pass
Ac-228	Lognormal	-0.0171462	-0.206208	0.0887606	2.130	20	2.557	Pass
Th-228	Normal	0.917	0.617175	0.178508	1.680	20	2.557	Pass
Ra-224	Lognormal	-0.0294288	-0.1898	0.0965696	1.661	20	2.557	Pass
Pb-212	Lognormal	-0.0629398	-0.215779	0.0771079	1.982	20	2.557	Pass
Bi-212	Normal	1.15	0.83115	0.151062	2.111	20	2.557	Pass
Tl-208	Nonparametric	N/A	N/A	N/A	N/A	20	N/A	N/A
Cs-137	Normal	0.782	0.282378	0.202391	2.469	18	2.504	Pass

N/A - not applicable because constituent had more than 15% non-detects (nonparametric distribution by default)
N - number of samples

Table 5. 95th UTL or Percentile Calculations for TA-II, Radioactive Waste Landfill, Background Radionuclides

Parameter	Distribution	Censored?	Log Mean	Log SD	Mean	SD	One-sided Tolerance Factor (K)	Log UTL	UTL/95th (pCi/g)	Sample #
U-238	Nonparametric (95% NDs)	No							N/A	20
Th-234	Nonparametric	No							1.18	20
Ra-226	Lognormal	No	0.31822	0.234747			2.396	0.88067	2.41	20
Pb-214	Normal	No			0.68235	0.08322	2.396		0.88	20
Bi-214	Lognormal	No	-0.480466	0.14034			2.396	-0.14421	0.87	20
Th-232	Normal	Yes			0.78837	0.07149	2.423		0.96	19
Ra-228	Normal	No			0.81485	0.07288	2.396		0.99	20
Ac-228	Lognormal	No	-0.206208	0.088761			2.396	0.00646	1.01	20
Th-228	Normal	No			0.61718	0.17851	2.396		1.04	20
Ra-224	Lognormal	No	-0.1898	0.09657			2.396	0.04158	1.04	20
Pb-212	Lognormal	No	-0.215779	0.077108			2.396	-0.03103	0.97	20
Bi-212	Normal	No			0.83115	0.15106	2.396		1.19	20
Tl-208	Nonparametric	No							0.87	20
U-235	Nonparametric (100% NDs)	No							N/A	20
Cs-137	Normal	No			0.28238	0.20239	2.543		0.80	18

N/A - not applicable because constituent had 95% or greater non-detects
ND - concentration was non-detect
SD - standard deviation
UTL - upper tolerance limit
Log - natural log of value

Table 6. Summary of TA-II, Radioactive Waste Landfill, UTLs/95th percentiles and concentration ranges

Parameter	Distribution	UTL/95th (pCi/g)	Range (pCi/g)
U-238	Nonparametric (95% NDs)	N/A	ND to 1.13
Th-234	Nonparametric	1.18	0.265 to 1.18
Ra-226	Lognormal	2.41	0.762 to 2.28
Pb-214	Normal	0.88	0.542 to 0.836
Bi-214	Lognormal	0.87	0.501 to 0.79
Th-232	Normal	0.96	0.635 to 1.07
Ra-228	Normal	0.99	0.651 to 0.939
Ac-228	Lognormal	1.01	0.714 to 0.983
Th-228	Normal	1.04	0.322 to 0.917
Ra-224	Lognormal	1.04	0.703 to 0.971
Pb-212	Lognormal	0.97	0.709 to 0.939
Bi-212	Normal	1.19	0.509 to 1.15
Tl-208	Nonparametric	0.87	0.63 to 0.91
U-235	Nonparametric (100% NDs)	N/A	All ND
Cs-137	Normal	0.80	0.0146 to 0.782

N/A - not applicable because constituent had 95% or greater non-detects
ND - concentration was non-detect

Section 6.3
Analytical Results for Stockpiled Suspect Clean Soil

Section 6.3, Table 1
Summary of Radionuclides in Clean Soil Stockpile Samples Collected at RWL/CDPs
(Off-Site Laboratory Only)

				Gamma Spectroscopy Activity[b]										
Sample Number	ER Sample ID	Sample Matrix	Sample Date	Am-241	Cs-134	Cs-137	Ra-226	Ra-228	Th-232	U-235	U-238	Co-60	Tritium	Units
029498-04	Pile 1	Soil	5/17/96	<0 U (0.128)	<0 U (0.0319)	0.185 (0.0363)	0.865 U (0.0668)	1.03 (0.106)	0.975 U (0.0476)	0.221 U (0.191)	0.480 U (1.12)	<0 U (0.0361)		pCi/g
029498-05	Pile 1	Soil	5/17/96										0.0301	pCi/g
030602-05	Pile 10	Soil	7/31/96	<0 U (0.112)	<0 U (0.0234)	0.0281 (0.0294)	0.756 (0.0460)	0.845 (0.103	0.927 (0.0408)	0.0476 U (0.153)	0.474 (0.922)	0.00152 U (0.0342)		pCi/g
030602-06	Pile 10	Soil	7/31/96										19.44	pCi/g
030603-05	Pile 11	Soil	7/31/96	<0 U (0.105)	<0 U (0.0265)	0.0297 (0.0318)	0.786 (0.0550)	0.922 (0.124)	0.937 (0.0447)	0.0170 U (0.165)	0.713 (0.898)	0.0118 (0.0423)		pCi/g
030603-06	Pile 11	Soil	7/31/96										0.28	pCi/g
030604-05	Pile 12	Soil	7/31/96	<0 U (0.122)	<0 U (0.0266)	0.00512 U (0.0332)	0.643 (0.0540)	0.911 (0.121)	0.936 (0.0465)	0.105 (0.179)	1.42 (0.973)	<0 U (0.0343)		pCi/g
030604-06	Pile 12	Soil	7/31/96										1.66	pCi/g
032609-001	Pile 16	Soil	1/29/97										0.16606	pCi/g
Equipment Blank 029499 04	Pile 1	Water	5/17/96	5.73 U (17.2)	0.894 U (3.74)	0.480 U (4.04)	0.519 U (7.77)	0.00 U (15.7)	0.00 U (7.41)	2.46 U (26.6)	52.7 U (167)	0.308 U (4.05)		pCi/L
Equipment Blank 029499 05	Pile 1	Water	5/17/96										0.0488 UB	pCi/L
TA-II Background Range[c]	NA	NA	NA											pCi/g
TA-II Soil Background UTL or 95th Percentile	NA	NA	NA											NA

Summary of Radionuclides in Clean Soil Stockpile Samples Collected at RWL/CDPs
(Off-Site Laboratory Only)

[a]half-lives < 6 months are not included in this table.
[b]Value in parenthesis represents the minimum detection activity (MDA).
[c]Background ranges are site-specific.
Am = amerecium
B = detected in blank
Co = cobalt
Cs = cesium
ID = identification
MDA = minimum detection activity
pCi/g = picocuries per gram
pCi/L = picocuries per liter
NA = not applicable
ND = nondetect - the analyte was not observed above the MDA
Ra = radium
Th = thorium

Section 6.3, Table 2
Summary of Radionuclides in Clean Soil Stockpile Samples Collected at RWL/CDPs
(On-site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a]									Tritium	Units
				Am-241	Cs-134	Cs-137	Ra-226	Ra-228	Th-232	U-235	U-238	Co-60		
029498-01	Pile 1	Soil	5/17/96	ND (.108)	ND (.0189)	.170 (.0246)	1.76 (.577)	.721 (.120)	.782 (.155)	ND (.117)	ND (.926)	ND (.0247)		pCi/g
029498-03	Pile 1	Soil	5/17/96										3.66	pCi/g
029500-01	Pile 1 D	Soil	5/17/96	ND (.148)	ND (.0543)	.174 (.0263)	1.84 (.509)	.652 (.166)	.795 (.148)	ND (.171)	0.991 (.991)	ND (.0391)		pCi/g
029500-03	Pile 1 D	Soil	5/17/96										6.05	pCi/g
029501-01	Pile 2	Soil	5/22/96	ND (.107)	ND (.0193)	.0311 (.0226)	1.43 (.581)	.784 (.121)	0.755 (.157)	ND (.118)	ND (.937)	ND (.0233)	8.83	pCi/g
030288-01	Pile 3	Soil	7/10/96	ND (.138)	ND (.0517)	.0260 (.0238)	1.25 (.455)	.772 (.151)	.679 (.112)	ND (.164)	.645 (.649)	ND (.0374)		pCi/g
030288-03	Pile 3	Soil	7/10/96										37	pCi/g
030289-01	Pile 4	Soil	7/10/96	ND (.125)	ND (.0478)	ND (.0339)	1.38 (.446)	.767 (.142)	.707 (.130)	.0353 (.0909)	ND (1.03)	ND (.0368)		pCi/g
030289-03	Pile 4	Soil	7/10/96										5.96	pCi/g
030290-01	Pile 5	Soil	7/10/96	.157 (.114)	ND (.0523)	ND (.0358)	1.41 (.464)	.863 (.162)	.813 (.140)	ND (.167)	ND (1.13)	ND (.0370)		pCi/g
030290-03	Pile 5	Soil	7/10/96										17.7	pCi/g
030292-01	Pile 6	Soil	7/26/96	ND (.187)	ND (.0377)	ND (.0332)	1.34 (.475)	.717 (.147)	.719 (.128)	ND (.167)	ND (1.21)	ND (.0351)		pCi/g
030292-03	Pile 6	Soil	7/26/96										35.3	pCi/g
030293-01	Pile 7	Soil	7/26/96	ND (.158)	ND (.0374)	ND (.222)	1.65 (.528)	.719 (.141)	.631 (.133)	.0720 (.114)	ND (1.2)	ND (.0375)		pCi/g
030293-03	Pile 7	Soil	7/26/96										35.6	pCi/g
030294-01	Pile 8	Soil	7/26/96	ND (.174)	ND (.0380)	ND (.0368)	1.55 (.561)	.898 (.163)	.768 (.143)	ND (.170)	ND (1.32)	ND (.0380)		pCi/g
030294-03	Pile 8	Soil	7/26/96										78.9	pCi/g
030599-01	Pile 9	Soil	7/26/96	ND (.173)	ND (.0391)	ND (.0346)	1.41 (.474)	.732 (.140)	.682 (.138)	ND (.178)	ND (1.34)	ND (.0399)		pCi/g
030599-03	Pile 9	Soil	7/26/96										32.5	pCi/g
030602-01	Pile 10	Soil	7/31/96	ND (.462)	ND (.0436)	.0121 (.0152)	1.62 (.499)	.716 (.117)	.727 (.120)	ND (.209)	ND (2.91)	ND (.0294)		pCi/g
030602-03	Pile 10	Soil	7/31/96										44.4	pCi/g

Section 6.3, Table 2 (Continued)
Summary of Radionuclides in Clean Soil Stockpile Samples Collected at RWL/CDPs
(On-site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a] Am-241	Cs-134	Cs-137	Ra-226	Ra-228	Th-232	U-235	U-238	Co-60	Tritium	Units
030603-01	Pile 11	Soil	7/31/96	ND (.483)	ND (.0458)	ND (.0326)	1.22 (.433)	.819 (.132)	.697 (.115)	ND (.214)	ND (2.97)	ND (.0317)		pCi/g
030603-03	Pile 11	Soil	7/31/96										45.2	pCi/g
030604-01	Pile 12	Soil	7/31/96	ND (.450)	ND (.0418)	.0199 (.0144)	1.37 (.458)	.678 (.110)	.660 (.109)	ND (.195)	ND (2.78)	ND (.0304)		pCi/g
030604-03	Pile 12	Soil	7/31/96										52.6	pCi/g
030607-01	Pile 13	Soil	8/5/96	ND (.182)	ND (.0407)	.0402 (.02790)	1.35 (.530)	.880 (.158)	.772 (.143)	ND (.189)	ND (1.39)	ND (.0386)		pCi/g
030607-03	Pile 13	Soil	8/5/96										55	pCi/g
030608-01	Pile 14	Soil	8/5/96	ND (.172)	ND (.0411)	ND (.0363)	1.47 (.531)	.679 (.158)	.767 (.130)	ND (.183)	ND (1.33)	ND (.0398)		pCi/g
030608-03	Pile 14	Soil	8/5/96										41.3	pCi/g
030609-01	Pile 15	Soil	8/5/96	ND (.162)	ND (.0371)	ND (.0330)	1.22 (.487)	.674 (.132)	.616 (.139)	ND (.165)	ND (1.24)	ND (.0356)		pCi/g
030609-03	Pile 15	Soil	8/5/96										28.5	pCi/g
032607-001	Pile 16	Soil	1/29/97	ND (.101)	ND (.0191)	ND (.0215)	1.45 (.421)	.666 (.245)	.656 (.113)	ND (.116)	ND (.940)	ND (.0250)		pCi/g
032608-001	Pile 16	Soil	1/29/97										<0	pCi/g
Equipment Blank 029499 01	Pile 1	Water	5/17/96	ND (.0538)	ND (.0151)	ND (.0154)	ND (.261)	ND (.0896)	ND (.0811)	ND (.0733)	ND (.503)	ND (.0172)		pCi/mL
Equipment Blank 029499 03	Pile 1	Soil	5/17/96										2.01	pCi/g
TA-II Background Range[c]	NA	NA	NA											pCi/g
TA-II Soil Background UTL or 95th Percentile	NA	NA	NA											NA

[a]half-lives < 6 months are not included in this table.
[b]Value in parenthesis represents the minimum detection activity.
[c]Background ranges are site specific.
Am = amerecium
Co = cobalt
Cs = cesium
D = duplicate
ER = environmental restoration
ID = identification
MDA = minimum detection activity
pCi/g = picocuries per gram
pCi/L = picocuries per liter
NA = not applicable
ND = nondetect - the analyte was not observed above the MDA
Ra = radium
Th = thorium
D = duplicate
U = uranium

Section 6.3 Table 3
Summary of RCRA Metals in Clean Soil Stockpile Samples Collected at RWL/CDPs
(On-site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals plus Be, Methods 6010 and 7470									Units
				Ag	As	Ba	Be	Cd	Cr	Hg	Pb	Se	
029498-11	Pile 1	Soil	5/17/96	U	U	170	U	U	U	U	3.7	U	mg/kg
029500-07	Pile 1 D	Soil	5/17/96	U	U	170	U	U	5.3	U	7.5	U	mg/kg
029501-04	Pile 2	Soil	5/22/96	U	U	130	U	U	U	NA	U	U	mg/kg
030288-04	Pile 3	Soil	7/10/96	7.4	U	200	2	U	14	U	14	U	mg/kg
030289-04	Pile 4	Soil	7/10/96	6.9	U	170	U	U	5.4 J	U	U	U	mg/kg
030290-04	Pile 5	Soil	7/10/96	5.8	U	200	U	U	U	U	U	U	mg/kg
030292-04	Pile 6	Soil	7/26/96	U	U	180	0.72	U	6.1 J	U	U	U	mg/kg
030293-04	Pile 7	Soil	7/26/96	U	U	150	0.69	U	9.5 J	U	U	U	mg/kg
030294-04	Pile 8	Soil	7/26/96	U	U	160	0.72	U	8.8 J	U	U	U	mg/kg
030599-04	Pile 9	Soil	7/26/96	U	U	140	0.64	U	5 J	U	U	U	mg/kg
030602-04	Pile 10	Soil	7/31/96	U	U	89	0.96	U	U	U	U	U	mg/kg
030603-04	Pile 11	Soil	7/31/96	U	U	99	1.1	U	U	U	U	U	mg/kg
030604-04	Pile 12	Soil	7/31/96	U	U	100	0.98	U	U	U	U	U	mg/kg
030607-04	Pile 13	Soil	8/5/96	4 J	U	200	U	U	7 J	U	33	U	mg/kg
060608-04	Pile 14	Soil	8/5/96	8.5	U	230	U	U	8.9 J	U	14	U	mg/kg
030609-04	Pile 15	Soil	8/5/96	U	U	210	U	U	9.4 J	U	18	U	mg/kg
032912-001	Pile 16	Soil	1/29/97	ND (.041)	1.7 (.61)	80 (.51)	.21 (.028)	.14 (.041)	5.8 (.71)	ND (.041)	4.0 (.3)	.47 (.3)	mg/kg
Equipment Blank 029499-07	Pile 1	Water	5/17/96	U	U	U	U	U	U	U	U	U	mg/L
Matrix Spike 029498-12	Pile 1	Soil	5/17/96	U	U	180	U	U	7.2	U	U	U	mg/kg
Matrix Spike Duplicate 029498-13	Pile 1	Soil	5/17/96	U	U	180	U	U	8.6	U	U	U	mg/L

Section 6.3 Table 3 (Continued)
Summary of RCRA Metals in Clean Soil Stockpile Samples Collected at RWL/CDPs
(On-site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals plus Be, Methods 6010 and 7470 Ag	As	Ba	Be	Cd	Cr	Hg	Pb	Se	Units
Method Detection Limit	Pile 1, 2	Soil	5/17/96	1.7	26	10	0.11	2.1	5	0.06	3.4	50	mg/kg
Method Detection Limit	Pile 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	Soil	7/10/96	0.66	4.8	2.2	0.11	1	1.8	0.06	2.4	10	mg/kg
Method Detection Limit	Pile 1	Water	5/17/96	0.017	0.26	0.1	0.001	0.021	0.05	0.06	0.034	0.5	mg/L
SNL/NM Background Range[a]	NA	NA	NA	0.00159-8.7	0.033-17.0	0.587-1,300	0.01-1.8	0.00265-6.2	0.0056-58.4	0.0001-0.68	0.0159-112	0.037-17.2	mg/kg
SNL/NM Background UTL or 95th Percentile[a]	NA	NA	NA	<1	4.4	336	0.8	0.9	12.8	<0.1	11.2	<1	mg/kg
Proposed Subpart S Action Level for Soil[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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[a]Background range from SNL/NM sitewide background data (SNL/NM 1996).
[b]Subpart S Action Level value only applies to sites within a residential land-use scenario and if only one contaminant has been identified at the site.
Ag = silver
As = arsenic
Ba = barium
Be = beryllium
Cd = cadmium
Cr = chromium
D = duplicate
ER = environmental restoration
Hg = mercury
ID = identification
J = detected below PQL or above highest calibration limit
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable/analyzed
U = undetected - the analyte was not observed above the MDL
Pb = lead
RCRA = Resource Conservation and Recovery Act
Se = selenium

Section 6.3, Table 4
Summary of RCRA Metals in Clean Soil Stockpile Samples Collected at RWL/CDPs
(Off-site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals plus Be, Methods 6010 and 7470									Units
				Ag	As	Ba	Be	Cd	Cr	Hg	Pb	Se	
029498-08	Pile 1	Soil	5/17/96	ND	2.65	109 B	0.378 JB	ND	7.92 B	0.0180 JB	9.18	0.301 J	mg/kg
030602-07	Pile 10	Soil	7/31/96	ND U	2.33	159	0.262 J	0.146 J	3.95	ND U	5.31	ND U	mg/kg
030603-07	Pile 11	Soil	7/31/96	ND U	2.46	126	0.257 J	0.0883 J	4.53	0.00334 J	6.2	0.214 J	mg/kg
030604-07	Pile 12	Soil	7/31/96	ND U	2.16	164	0.228 J	0.0813 J	3.52	0.00801 J	5.29	ND U	mg/kg
Equipment Blank 029499-06	Pile 1	Water	5/17/96	ND	ND	0.000191 JB	0.0000449 JB	ND	ND	ND	ND	ND	mg/L
Method Detection Limit	Pile 1	Soil	5/17/96	0.247	0.184	0.00656	0.00113	0.0096	0.059	0.00244	0.112	0.142	mg/kg
Method Detection Limit	Pile 10, 11, 1	Soil	7/31/96	0.124	0.093	0.003	0.0005	0.005	0.596	0.02	0.565	0.072	mg/kg
Method Detection Limit	Pile 1	Water	5/17/96	0.00249	0.00186	0.0000663	0.0000114	0.000097	0.000596	0.0000148	0.00113	0.00143	mg/L
SNL/NM Background Range	NA	NA	NA	0.00159-8.7	0.033-17.0	0.587-1,300	0.01-1.8	0.00265-6.2	0.0056-58.4	0.0001-0.68	0.0159-112	0.037-17.2	mg/kg
SNL/NM Background UTL or 95th Percentile	NA	NA	NA	<1	4.4	336	0.8	0.9	12.8	<0.1	11.2	<1	mg/kg
Proposed Subpart S Action Level for Soil[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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[a]Background range from SNL/NM sitewide background data (SNL/NM 1996).
[b]Subpart S Action Level value only applies to sites within a residential land-use scenario and if only one contaminant has been identified at the site.
Ag = silver
As = arsenic
B = detected in the blank
Ba = barium
Be = beryllium
Cd = cadmium
Cr = chromium
D = duplicate
ER = environmental restoration
Hg = mercury
ID = identification
J = detected below the MDL
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable
ND = nondetect
U = undetected - the analyte was not observed above the MDL
Pb = lead
RCRA = Resource Conservation and Recovery Act
Se = selenium

Section 6.4
Analytical Results for Stockpiled Suspect Contaminated Soil

Section 6.4, Table 1
Summary of Radionuclides in Potentially Contaminated Soil Stockpile Collected at RWL/CDPs
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a]									Tritium	Units
				Am-241	Cs-134	Cs-137	Co-60	Ra-226	Ra-228	Th-232	U-235	U-238		
030594-02	Pile 2	Soil	7/15/96										15.24	pCi/g
030594-12	Pile 2	Soil	7/15/96	0.145 (0.261)	<0 U (0.0308)	0.126 (0.0372)	<0 U (0.0344)	0.779 (0.0630)	0.769 (0.126)	0.807 (0.0575)	2.63 (0.382)	117 (1.90)		pCi/g
030595-02	Pile 3	Soil	7/15/96										13.14	pCi/g
030595-12	Pile 3	Soil	7/15/96	0.0478 (0.142)	<0 U (0.0240)	0.0331 (0.0293)	0.00345 U (0.0375)	0.707 (0.0527)	0.842 (0.121)	0.805 (0.0463)	0.0215 U (0.194)	6.85 (1.13)		pCi/g
030295-02	Pile 4	Soil	7/17/96										31.02	pCi/g
030295-12	Pile 4	Soil	7/17/96	0.315 (0.164)	0.000133 U (0.0291)	0.119 (0.0323)	<0 U (0.0329)	0.698 (0.0597)	0.747 (0.136)	0.935 (0.0487)	0.147 (0.235)	18.8 (1.30)		pCi/g
030296-02	Pile 5	Soil	7/17/96										6.21	pCi/g
030296-12	Pile 5	Soil	7/17/96	0.0214 U (0.124)	0.00630 U (0.0248)	0.0239 (0.0300)	<0 U (0.0298)	0.663 (0.0497)	0.742 (0.101)	0.787 (0.0402)	0.117 (0.157)	5.90 (0.931)		pCi/g
030297-02	Pile 6	Soil	7/19/96										6.72	pCi/g
030297-12	Pile 6	Soil	7/19/96	0.0190 U (0.137)	<0 U (0.0265)	0.0248 (0.0348)	0.0203 (0.0393)	0.725 (0.0574)	0.729 (0.117)	0.681 (0.0472)	0.139 (0.209)	9.65 (1.08)		pCi/g
030298-02	Pile 7	Soil	7/19/96										51.08	pCi/g
030298-12	Pile 7	Soil	7/19/96	0.306 (0.332)	<0 U (0.0362)	0.0205 (0.0452)	0.00217 U (0.0378)	0.717 (0.0798)	0.634 (0.136)	0.715 (0.0678)	2.21 (0.425)	106 (2.49)		pCi/g
030596-02	Pile 8	Soil	7/25/96										60.32	pCi/g
030596-10	Pile 8	Soil	7/25/96	0.0679 (0.123)	0.00469 U (0.0271)	0.0597 (0.0290)	0.000743 U (0.0368)	0.699 (0.0552)	0.867 (0.111)	0.941 (0.0411)	0.103 (0.170)	1.34 (0.967)		pCi/g
030596-10	Pile 8 D	Soil	7/25/96	0.181 (0.0977)	0.00764 U (0.0257)	0.0538 (0.0311)	0.000539 U (0.0361)	0.785 (0.0522)	0.970 (0.104)	0.960 (0.0403)	0.101 (0.154)	1.44 (0.792)		pCi/g
030600-02	Pile 9	Soil	7/29/96										254.2	pCi/g
030600-09	Pile 9	Soil	7/29/96	19.7 (0.163)	<0 U (0.0239)	0.0133 (0.0297)	<0 U (0.0333)	0.543 (0.0494)	0.784 (0.0988)	0.782 (0.0391)	0.0455 U (0.150)	1.59 (0.866)		pCi/g
030601-02	Pile 10 - 14	Soil	7/30/96										30.97	pCi/g
030601-10	Pile 10 - 14	Soil	7/30/96	1.61 (0.137)	<0 U (0.0245)	0.307 (0.0324)	0.00445 U (0.0345)	0.841 (0.0534)	0.953 (0.118)	0.970 (0.0420)	0.0748 (0.185)	2.82 (1.04)		pCi/g
030605-02	Pile 15	Soil	8/2/96										91.23	pCi/g
030605-10	Pile 15	Soil	8/2/96	0.636 (0.181)	<0 U (0.0384)	15.6 (0.0439)	0.000472 U (0.0384)	0.615 (0.0806)	2.97 (0.115)	2.99 (0.0770)	0.108 (0.261)	2.53 (1.45)		pCi/g
030606-02	Pile 16	Soil	8/2/96										461.84	pCi/g
030606-10	Pile 16	Soil	8/2/96	3.14 (0.111)	0.00568 U (0.0250)	0.0790 (0.0270)	0.00238 U (0.0360)	0.605 (0.0516)	0.827 (0.0983)	0.940 (0.0408)	0.185 (0.151)	2.40 (0.794)		pCi/g

Section 6.4, Table 1 (Concluded)
Summary of Radionuclides in Potentially Contaminated Soil Stockpile Collected at RWL/CDPs
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a]									Tritium	Units
				Am-241	Cs-134	Cs-137	Co-60	Ra-226	Ra-228	Th-232	U-235	U-238		
030610-02	Pile 17 - 22	Soil	8/6/96										564.35	pCi/g
030610--08	Pile 17 - 22	Soil	8/6/96	40.9 (0.227)	0.00551 U (0.0268)	0.0268 (0.0305)	<0 U (0.0313)	0.616 (0.0551)	0.748 (0.110)	0.760 (0.0413)	0.130 (0.160)	2.31 (1.04)		pCi/g
030612-02	Pile 23	Soil	8/7/96										3.56	pCi/g
030612-08	Pile 23	Soil	8/7/96	0.308 (0.106)	<0 U (0.0264)	0.0791 (0.0312)	0.00660 U (0.0375)	0.609 (0.0524)	0.902 (0.106)	0.782 (0.0421)	0.0639 (0.161)	1.17 (0.898)		pCi/g
030613-02	Pile 24	Soil	8/7/96										29.75	pCi/g
030613-08	Pile 24	Soil	8/7/96	0.757 (0.183)	0.000438 U (0.0389)	13.5 (0.0418)	0.00221 U (0.0368)	0.619 (0.0845)	1.78 (0.112)	1.69 (0.0741)	0.0126 U (0.264)	0.849 (1.40)		pCi/g
030619-02	Pile 25	Soil	8/13/96										125.86	pCi/g
030619-08	Pile 25	Soil	8/13/96	0.427 (0.408)	<0 U (0.568)	18.1 (0.0958)	0.00156 U (0.0763)	0.966 (0.162)	29.8 (0.233)	30.6 (0.146)	<0 U (0.545)	2.98 (3.32)		pCi/g
Equipment Blank 030600-10	Pile 9	Water	7/29/96										10.8	pCi/L
TA-II Background Range	NA	NA	NA											pCi/g
TA-II Soil Background UTL or 95th Percentile	NA	NA	NA											NA

[a]Value in parenthesis represents the minimum detection activity (MDA).
[b]Background ranges are site-specific.
Am = americium
B = detected in blank
Co = cobalt
Cs = cesium
D = duplicate
ER = environmental restoration
ID = identification
pCi/g = picocuries per gram
NA = not applicable
Ra = radium
Sr = strontium
Th = thorium
U = detected below the MDA
U-235/238 = uranium

Section 6.4, Table 2
Summary of Radionuclides in Potentially Contaminated Soil Stockpiles
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Alpha Spectroscopy Activity: Am-241	Pu-238	Pu-239/240	Th-228	Th-230	Th-232	U-233/234	U-235	U-238	H-3	Sr-89	Sr-90	Units*
032590-001	Pile 1	Soil	3/3/97	5.78 (.012)	.626 (.0047)	31.1 (.0095)	.995 (.029)	.774 (.011)	.830 (.0083)	.77 (.037)	.073 (.024)	.85 (.022)	0.146	-0.25 (1.5)	0.30 (1.4)	pCi/g
030594-04	Pile 2	Soil	7/15/96	0.163 (0.033)	0.0724 (0.0215)	1.45 (0.00897)	1.27 B (0.643)	1.69 B (0.200)	1.03 B (0.200)	97.8 (0.278)	9.19 (0.278)	326 (0.320)				pCi/g
032591-001	Pile 2	Soil	2/3/97											0.9 (1.8)	-0.45 (1.7)	pCi/g
030595-04	Pile 3	Soil	7/15/96	1.08 (0.0845)	0.808 (0.279)	6.08 (0.289)	0.894 B (0.562)	1.33 B (0.219)	1.16 B (0.117)	15.5 (0.229)	1.32 (0.144)	52.7 (0.116)				pCi/g
032592-001	Pile 3	Soil	2/3/97											0.38 (1.6)	-0.16 (1.5)	pCi/g
030295-04	Pile 4	Soil	7/17/96	0.141 (0.0301)	0.0616 (0.0239)	2.16 (0.00836)	0.875 B (0.305)	1.46 B (0.0442)	0.944 B (0.111)	197 (0.812)	17.3 (0.861)	666 (0.861)				pCi/g
032593-001	Pile 4	Soil	2/3/97											-1.3 (2.3)	1.01 (1.4)	pCi/g
030296-04	Pile 5	Soil	7/17/96	0.132 (0.0240)	0.0239 (0.0248)	0.461 (0.00307)	1.25 B (0.229)	1.83 B (0.116)	1.03 B (0.116)	3.65 (0.289)	0.235 (0.210)	9.03 (0.289)				pCi/g
032594-001	Pile 5	Soil	2/4/97											-0.56 (1.4)	0.60 (1.3)	pCi/g
030297-04	Pile 6	Soil	7/19/96	0.112 (0.0537)	0.0342 (0.0301)	0.577 B (0.0175)	0.955 B (0.101)	0.900 B (0.0127)	0.943 (0.0321)	2.67 B (0.0467)	0.227 (0.0420)	8.45 B (0.0297)				pCi/g
032595-001	Pile 6	Soil	2/6/97											-0.25 (1.6)	0.46 (1.5)	pCi/g
030298-04	Pile 7	Soil	7/19/96	0.0214 (0.00800)	0.0165 (0.0157)	0.123 B (0.00269)	0.710 B (0.0661)	0.683 B (0.0348)	0.631 (0.0247)	16.8 B (0.199)	1.52 (0.0492)	76.5 B (0.124)				pCi/g
032596-001	Pile 7	Soil	2/17/96											-0.3 (2.1)	0.56 (1.5)	pCi/g
030296-04	Pile 8	Soil	7/25/96	0.327 (0.0443)	0.0283 (0.0196)	1.01 (0.0104)	1.26 (0.200)	1.50 (.0484)	0.983 (0.0484)	0.419 (0.170)	0.0348 (0.171)	0.994 (0.171)				pCi/g
032597-001	Pile 8	Soil	2/17/97											0.6 (2.0)	.53 (1.5)	pCi/g
030600-04	Pile 9	Soil	7/29/96	18.4 (0.0413)	2.12 (0.273)	107 (0.178)	1.48 (0.171)	1.20 (.0910)	0.762 (0.0910)	1.04 (0.0151)	0.0962 (0.0189)	1.92 (0.0188)				pCi/g
032598-001	Pile 9	Soil	2/17/97											-1.0 (1.9)	.66 (1.3)	pCi/g
032578-001	Pile 10	Soil	2/17/97		-0.0009 (.015)	0.064 (.0070)	1.01 (.033)	0.776 (.019)	.954 (.013)	1.11 (.037)	.066 (.017)	1.65 (.027)		-1.4 (2.0)	1.24 (1.4)	pCi/g
032578-002	Pile 10	Soil	2/17/97										6.5048			pCi/g
030601-04	Pile 10 - 14	Soil	7/30/96	0.532 (0.0544)	0.0514 (0.0275)	1.85 (.00623)	1.07 (0.186)	1.42 (.0328)	0.744 (0.0826)	1.58 (0.0157)	0.125 (0.0158)	3.75 (0.0157)				pCi/g

Section 6.4, Table 2 (Continued)
Summary of Radionuclides in Potentially Contaminated Soil Stockpiles
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Alpha Spectroscopy Activity												
				Am-241	Pu-238	Pu-239/240	Th-228	Th-230	Th-232	U-233/234	U-235	U-238	H-3	Sr-89	Sr-90	Units*
032579-001	Pile 11	Soil	2/7/97		0.022 (0.0092)	0.575 (0.010)	1.16 (0.038)	0.833 (0.016)	0.96 (0.016)	1.01 (0.041)	0.071 (0.028)	1.17 (0.028)		-0.56 (1.2)	0.82 (1.4)	pCi/g
032579-002	Pile 11	Soil	2/7/97										98.34			pCi/g
032580-001	Pile 12	Soil	1/31/97		0.0100 (0.011)	0.154 (0.0098)	1.11 (0.063)	0.97 (0.022)	1.10 (0.022)	0.958 (0.0092)	0.045 (0.0051)	1.56 (0.010)		0.8 (1.9)	-0.6 (1.7)	pCi/g
032580-002	Pile 12	Soil	1/31/97										2.6602			pCi/g
032581-001	Pile 13	Soil	1/31/97		2.23 (0.0093)	113.5 (0.0093)	3.75 (0.079)	1.56 (0.022)	3.47 (0.026)	4.17 (0.058)	0.46 (0.023)	13.60 (0.061)		0.2 (1.7)	0.18 (1.6)	pCi/g
032581-002	Pile 13	Soil	1/31/97										453000 (68)*			pCi/L
032582-001	Pile 14	Soil	1/31/97		0.346 (0.011)	14.56 (0.0097)	1.20 (0.068)	1.05 (0.028)	1.08 (0.018)	1.70 (0.032)	0.176 (0.021)	4.19 (0.030)		0.7 (1.9)	-0.4 (1.7)	pCi/g
032582-002	Pile 14	Soil	1/31/97										1167000 (68)*			pCi/L
030605-04	Pile 15	Soil	8/2/96	0.697 (0.0403)	0.109 (0.237)	5.62 (0.0646)	6.11 (0.640)	1.54 (0.276)	5.19 (0.259)	1.34 (0.0389)	0.118 (0.0186)	1.23 (0.0389)				pCi/g
032599-001	Pile 15	Soil	2/6/97											-0.56 (1.2)	0.91 (1.4)	pCi/g
030606-04	Pile 16	Soil	8/2/96	5.90 (0.0477)	2.05 (0.648)	104 (0.240)	1.09 (0.557)	1.31 (0.137)	1.07 (0.225)	1.25 (0.0478)	0.0906 (0.0546)	1.45 (0.0478)				pCi/g
032600-001	Pile 16	Soil	1/30/97											-0.24 (1.3)	1.70 (1.5)	pCi/g
032583-001	Pile 17	Soil	2/11/97		.213 (0.014)	9.11 (0.011)	.91 (0.058)	.78 (0.021)	.83 (0.021)	1.24 (0.041)	.169 (0.031)	1.80 (0.035)		-0.7 (2.0)	.45 (1.5)	pCi/g
032583-002	Pile 17	Soil	2/11/97										50.208			pCi/g
030610-04	Pile 17 - 22	Soil	8/6/96	13.9 (0.0691)	1.10 (0.310)	50.5 (0.162)	0.829 (0.133)	1.69 (0.105)	0.986 (0.105)	4.16 (0.0263)	0.375 (0.0339)	13.6 (0.0263)				pCi/g
032584-001	Pile 18	Soil	2/11/97		.0037 (0.0095)	.038 (0.011)	1.70 (0.039)	.901 (0.019)	1.44 (0.018)	1.11 (0.038)	.159 (0.032)	1.12 (0.027)		-0.2 (2.1)	.78 (1.6)	pCi/g
032584-002	Pile 18	Soil	2/11/97										3.61			pCi/g
032585-001	Pile 19	Soil	2/11/97		.011 (0.012)	.069 (0.0067)	1.87 (0.026)	1.053 (0.012)	1.76 (0.011)	1.03 (0.046)	.073 (0.031)	.85 (0.042)		-1.5 (2.0)	1.11 (1.5)	pCi/g
032585-002	Pile 19	Soil	2/11/97										3.9715			pCi/g
032586-001	Pile 20	Soil	2/7/97		5.80 (0.16)	273 (0.075)	1.95 (0.040)	.90 (0.014)	.92 (0.014)	2.09 (0.077)	.108 (0.053)	2.80 (0.077)		-0.19 (1.1)	.66 (1.2)	pCi/g
032586-002	Pile 20	Soil	2/7/97										184.44			pCi/g

Section 6.4, Table 2 (Concluded)
Summary of Radionuclides in Potentially Contaminated Soil Stockpiles
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Alpha Spectroscopy Activity												
				Am-241	Pu-238	Pu-239/240	Th-228	Th-230	Th-232	U-233/234	U-235	U-238	H-3	Sr-89	Sr-90	Units*
032587-001	Pile 21	Soil	2/11/97		.060 (0.014)	3.32 (0.011)	.833 (0.040)	.803 (0.017)	.870 (0.017)	2.08 (0.033)	.082 (0.020)	1.90 (0.030)		-0.7 (2.0)	0.69 (1.3)	pCi/g
032587-002	Pile 21	Soil	2/11/97										187.11			pCi/g
032588-001	Pile 22	Soil	2/10/97		.500 (0.012)	25.5 (0.0064)	.786 (0.015)	.967 .0095	.791 (0.011)	65.9 (0.044)	3.05 (0.033)	70.4 (0.052)		-0.1 (2.0)	.36 (1.3)	pCi/g
032588-002	Pile 22	Soil	2/10/97										1616.46			pCi/g
030612-04	Pile 23	Soil	8/7/96	0.704 (0.0460)	0.0403 U (0.129)	0.486 (0.0734)	1.23 (0.434)	1.08 (.0576)	0.768 (0.0576)	0.986 (0.250)	<0 U (0.293)	0.787 (0.250)				pCi/g
032601-001	Pile 23	Soil	2/11/97											-1.1 (2.1)	0.30 (1.4)	pCi/g
030613-04	Pile 24	Soil	8/7/96	1.48 (0.0599)	0.145 (0.160)	8.33 (0.100)	2.05 (0.489)	1.37 (.0687)	1.74 (0.0687)	7.05 (0.401)	0.247 (0.388)	1.13 (0.252)				pCi/g
032602-001	Pile 24	Soil	2/7/97											-0.42 (1.4)	0.52 (1.2)	pCi/g
030619-04	Pile 25	Soil	8/13/96	0.00262 U (0.0465)	0.000904 U (0.0891)	0.0692 (0.0462)	6.78 (0.371)	2.21 (0.170)	6.18 (0.208)	0.887 (0.0204)	.0422 (.0250)	0.796 (0.0204)				pCi/g
032603-001	Pile 25	Soil	3/3/97											-0.12 (1.5)	0.25 (1.5)	pCi/g
032589-001	Pile 26	Soil	2/10/97		0.058 (0.0071)	2.45 (0.011)	1.41 (0.035)	0.911 (.016)	1.34 (0.011)	1.88 (0.029)	0.10 (0.024)	1.28 (0.024)		-0.1 (2.1)	.27 (1.4)	pCi/g
032589-002	Pile 26	Soil	2/10/97										41.405			pCi/g
Equipment Blank 030600-12	Pile 9	Water	7/29/96	0.00730 U (0.0698)	0.00792 U (0.0845)	0.0663 (0.0451)	0.0987 U (0.282)	0.754 (0.0371)	0.0124 U (0.0371)	0.126 (0.0549)	<0 U (0.0452)	0.0276 (0.0312)				pCi/L

[a]Value in parenthesis represents the minimum detection activity (MDA).
[b]Background ranges are site specific.
*Percent moisture is not available.
Am = americium
B = detected in blank
Co = cobalt
Cs = cesium
D = duplicate
ER = environmental restoration
ID = identification
pCi/g = picocuries per gram
NA = not applicable
Ra = radium
Sr = strontium
Th = thorium
U = detected below the MDA
U-235/238 = uranium

Section 6.4, Table 3
Summary of Radionuclides in Potentially Contaminated Soil Stockpiles at RWL/CDPs
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a]								Units
				Am-241	Cs-134	Cs-137	Co-60	Ra-228	Th-232	U-235	U-238	
030286-01	Pile 1	Soil	7/8/96	1.01 (.153)	ND (.0183)	.0384 (.0186)	ND (.0236)	.772 (.121)	.586 (.106)	ND (.112)	ND (.889)	pCi/g
030594-01	Pile 2	Soil	7/15/96	ND (.178)	ND (.0462)	.0652 (.0225)	ND (.0373)	.713 (.154)	.745 (.135)	ND (.112)	ND (1.09)	pCi/g
029503-01	Pile 3	Soil	5/24/96	121 (.545)	ND (.0600)	.0317 (.0246)	ND (.0432)	.760 (.168)	.902 (.166)	ND (.189)	ND (1.79)	pCi/g
030595-01	Pile 3	Soil	7/15/96	.219 (.175)	ND (.0434)	.0727 (.0249)	ND (.0368)	.830 (.153)	.683 (.139)	.404 (.149)	14.5 (1.47)	pCi/g
030295-01	Pile 4	Soil	7/17/96	ND (.235)	ND (.0455)	0.117 (.0250)	ND (.0413)	.779 (.0963)	.821 (.156)	.388 (.149)	13.3 (1.59)	pCi/g
030296-01	Pile 5	Soil	7/17/96	.206 (.152)	ND (.0461)	.0249 (.0215)	ND (.0370)	.770 (.172)	.754 (.137)	.0929 (.192)	4.08 (1.17)	pCi/g
030297-01	Pile 6	Soil	7/19/96	ND (.184)	ND (.0434)	ND (.0208)	ND (.0378)	ND (.167)	.612 (.134)	.0718 (.116)	4.50 (1.53)	pCi/g
030298-01	Pile 7	Soil	7/19/96	ND (.174)	ND (.0460)	ND (.0359)	ND (.0397)	.540 (.156)	.522 (.139)	ND (.187)	3.39 (1.78)	pCi/g
0300596-01	Pile 8	Soil	7/25/96	.311 (.1588)	ND (.0426)	.189 (.0264)	ND (.0429)	.758 (.178)	.690 (.159)	ND (.187)	ND (1.35)	pCi/g
030598-01	Pile 8 D	Soil	7/25/96	ND (.125)	ND (.0403)	.0760 (.0249)	ND (.0390)	.649 (.188)	.723 (.140)	ND (.184)	ND (1.35)	pCi/g
030600-01	Pile 9	Soil	7/29/96	1.71 (.137)	ND (.0376)	ND (.0354)	ND (.0355)	.828 (.140)	.674 (.133)	ND (.0970)	ND (1.27)	pCi/g
030601-01	Pile 12	Soil	7/30/96	ND (.439)	ND (.0393)	.0580 (.173)	ND (.0270)	.634 (.104)	.617 (.114)	ND (.188)	ND (2.75)	pCi/g
030601-01	Pile 10 - 14	Soil	7/30/96	ND (.439)	ND (.0393)	.0580 (.0173)	ND (.0270)	.634 (.104)	.617 (.114)	ND (.188)	ND (2.75)	pCi/g
030605-01	Pile 15	Soil	8/2/96	ND (2.49)	ND (.133)	197 (.0791)	ND (.0468)	3.87 (.169)	4.30 (.925)	ND (1.06)	ND (14.9)	pCi/g
030606-01	Pile 16	Soil	8/2/96	12.9 (.528)	ND (.0484)	.0927 (.0220)	ND (.0375)	.779 (.134)	.627 (.141)	.127 (.140)	ND (3.48)	pCi/g
030610-01	Pile 17 - 20	Soil	8/6/96	10.4 (.196)	ND (.0494)	.0545 (.0226)	ND (.0408)	.621 (.166)	.588 (.136)	.167 (.113)	ND (1.63)	pCi/g

Section 6.4, Table 3 (Concluded)
Summary of Radionuclides in Potentially Contaminated Soil Stockpiles at RWL/CDPs
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a]								Units
				Am-241	Cs-134	Cs-137	Co-60	Ra-228	Th-232	U-235	U-238	
032604-001	Pile 21	Soil	2/11/97	.995 (.162)	ND (.004)	.0398 (.0214)	ND (.0341)	.545 (.163)	.546 (.130)	ND (.175)	ND (.879)	pCi/g
032605-001	Pile 22	Soil	2/10/97	1.85 (.390)	ND (.0511)	ND (.0354)	ND (.0470)	.561 (.216)	.650 (.196)	2.83 (.250)	51.6 (2.66)	pCi/g
030612-01	Pile 23	Soil	8/9/96	.387 (.340)	ND (.420)	.695 (.0220)	ND (.0279)	.605 (.106)	.662 (.118)	ND (.202)	ND (2.88)	pCi/g
030613-01	Pile 24	Soil	8/9/96	1.16 (.708)	ND (.0575)	14.8 (.0379)	.0255 (.0234)	3.59 (.142)	ND (.270)	.360 (.304)	ND (5.90)	pCi/g
030619-001	Pile 25	Soil	8/13/96	ND (.390)	ND (.0586)	12.90 (.0686)	ND (.0548)	29.90 (.251)	28.10 (.403)	ND (.404)	ND (3.21)	pCi/g
032606-001	Pile 26	Soil	2/10/97	.205 (.154)	ND (.0428)	.512 (.0265)	ND (.0405)	.815 (.170)	ND (.156)	ND (.196)	ND (1.37)	pCi/g
Equipment Blank 030600-15	Pile 9	Water	7/29/96	ND (.0979)	ND (.0235)	ND (.0236)	ND (.0244)	ND (.152)	ND (.155)	ND (.116)	ND (.729)	pCi/mL
TA-II Background Range	NA	NA	NA									pCi/g
TA-II Soil Background UTL or 95th Percentile	NA	NA	NA									pCi/g

[a]Value in parenthesis represents the minimum detection activity.
[b]Background ranges are site specific.
[c]Ra-226 values from on-site laboratory not provided due to inaccurate results. Analysis of Ra-226 short-lived daughters showed background concentrations in all samples.
Am = americium
Co = cobalt
Cs = cesium
D = duplicate

ER = environmental restoration
ID = identification
pCi/g = picocuries per gram
pCi/L = picocuries per liter
NA = not applicable
ND = nondetect - the analyte was not observed above the miminum detection activity
Ra = radium
Th = thorium
U = uranium

Section 6.4, Table 4
Summary of RCRA Metals in Potentially Contaminated Soil Stockpiles at RWL/CDPs
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals, Methods 6010 and 7470								Units
				Ag	As	Ba	Cd	Cr	Hg	Pb	Se	
032552-001	Pile 1	Soil	3/3/97	.067 (.044)	3.6 (.66)	130 (.55)	.18 (.044)	7.1 (.77)	ND (.044)	6.8 (.33)	.90 (.33)	mg/kg
032553-001	Pile 2	Soil	2/3/97	ND (.043)	2.5 (.64)	190 (.54)	.45 (.043)	11 (.75)	ND (.043)	7.7 (.32)	1.0 (.32)	mg/kg
032554-001	Pile 3	Soil	2/3/97	ND (.043)	3.0 (.65)	120 (.54)	.5 (.043)	8.9 (.76)	ND (.043)	9.5 (.32)	.97 (.32)	mg/kg
032555-001	Pile 4	Soil	2/3/97	.068 (.041)	2.6 (.61)	130 (.51)	.35 (.041)	7.7 (.72)	ND (.041)	6.3 (.31)	.82 (.31)	mg/kg
032556-001	Pile 5	Soil	2/4/97	ND (.042)	2.4 (.63)	120 (.52)	.32 (.042)	7.1 (.74)	ND (.042)	6.2 (.32)	.69 (.32)	mg/kg
032557-001	Pile 6	Soil	2/6/97	ND (.042)	2.4 (.64)	170 (.53)	4.1 (.042)	8.5 (.74)	ND (.042)	5.4 (.32)	.97 (.32)	mg/kg
032558-001	Pile 7	Soil	2/17/97	ND (.041)	3.3 (.62)	180 (.52)	.53 (.041)	6.4 (.72)	ND (.041)	4.6 (.31)	.58 (.31)	mg/kg
032559-001	Pile 8	Soil	2/17/97	ND (.04)	1.3 (.6)	200 (.5)	.6 (.04)	11 (.7)	.14 (.04)	5.8 (.3)	.79 (.3)	mg/kg
032560-001	Pile 9	Soil	2/17/97	ND (.042)	2 (.63)	110 (.53)	.65 (.042)	7.3 (.74)	1.8 (.042)	6.6 (.32)	.48 (.32)	mg/kg
032561-001	Pile 10	Soil	2/17/97	ND (.046)	2.4 (.69)	120 (.57)	.2 (.046)	6.8 (.8)	.54 (.046)	4.9 (.34)	.58 (.34)	mg/kg
032562-001	Pile 11	Soil	2/7/97	ND (.042)	2.2 (.62)	140 (.52)	.25 (.042)	16 (.73)	.074 (.042)	8.4 (.31)	.66 (.31)	mg/kg
032563-001	Pile 12	Soil	1/31/97	ND (.04)	1.8 (.6)	150 (.5)	.32 (.04)	8.4 (.7)	.18 (.04)	6.5 (.3)	.85 (.3)	mg/kg
032564-001	Pile 13	Soil	1/31/97	ND (.041)	2.2 (.61)	240 (.51)	.44 (.041)	11 (.71)	.095 (.041)	6.7 (.3)	1.1 (.3)	mg/kg
032565-001	Pile 14	Soil	1/31/97	ND (.043)	2.0 (.65)	120 (.54)	.41 (.043)	12 (.76)	.19 (.043)	7.3 (.32)	1.3 (.32)	mg/kg
032566-001	Pile 15	Soil		ND (.043)	2.6 (.64)	140 (.53)	3.6 (.043)	9.8 (.75)	1.5 (.043)	9.4 (.32)	1.1 (.32)	mg/kg
032567-001	Pile 16	Soil	1/30/97	ND (.04)	2.1 (.6)	130 (.5)	.40 (.04)	8.4 (.7)	.12 (.04)	41 (.3)	.71 (.3)	mg/kg

Section 6.4, Table 4 (Continued)
Summary of RCRA Metals in Potentially Contaminated Soil Stockpiles at RWL/CDPs
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals, Methods 6010 and 7470								Units
				Ag	As	Ba	Cd	Cr	Hg	Pb	Se	
032568-001	Pile 17	Soil	2/11/97	ND (.04)	2.6 (.6)	300 (.5)	.35 (.04)	6.6 (.7)	.18 (.04)	5.5 (.3)	.62 (.3)	mg/kg
032569-001	Pile 18	Soil	2/11/97	ND (.042)	2.1 (.63)	100 (.52)	.55 (.042)	8.0 (.73)	.13 (.042)	4.7 (.31)	.43 (.31)	mg/kg
032570-001	Pile 19	Soil	2/11/97	ND (.042)	2.0 (.64)	110 (.53)	.41 (.042)	8.2 (.74)	.15 (.042)	4.8 (.32)	.59 (.32)	mg/kg
032571-001	Pile 20	Soil	2/7/97	.28 (.042)	1.4 (.63)	100 (.53)	.29 (.042)	8.2 (.74)	1.3 (.042)	9.4 (.32)	.42 (.32)	mg/kg
032572-001	Pile 21	Soil	2/11/97	ND (.046)	4.2 (.68)	200 (.57)	.20 (.046)	7.3 (.80)	.69 (.046)	7.2 (.34)	.70 (.34)	mg/kg
032573-001	Pile 22	Soil	2/10/97	.048 (.043)	3.5 (.65)	200 (.54)	2.6 (.043)	9.3 (.76)	1.2 (.043)	20 (.32)	.73 (.32)	mg/kg
032574-001	Pile 23	Soil	2/11/97	1.8 (.044)	1.9 (.065)	89 (.54)	3.6 (.044)	12 (.76)	3.0 (.044)	14 (.33)	.63 (.33)	mg/kg
032575-001	Pile 24	Soil	2/7/97	ND (.04)	2.3 (.6)	98 (.5)	.98 (.04)	7.1 (.7)	.77 (.04)	7.0 (.3)	.52 (.3)	mg/kg
032576-001	Pile 25	Soil	3/3/97	.49 (.041)	2.4 (.61)	110 (.51)	6.5 (.041)	12 (.71)	7.8 (.041)	24 (.30)	.59 (.30)	mg/kg
032577-001	Pile 26	Soil	2/10/97	ND (.041)	2.0 (.62)	100 (.52)	.60 (.041)	5.2 (.72)	.50 (.041)	6.7 (.31)	.79 (.31)	mg/kg
030600-17	Pile 9	Soil	7/29/96	6.4	U	140	U	U	U	U	U	mg/kg
030612-10	Pile 23	Soil	8/9/96	U	U	140	U	10 J		5.7 J	U	mg/kg
030613-10	Pile 24	Soil	8/9/96	U	U	110	34	8.8 J	U	79	U	mg/kg
030295-13	Pile 24	Soil	8/13/96	U	U	190	5.8 J	9.6 J	U	15	U	mg/kg
030619-10	Pile 25	Soil	8/13/96	U	U	210	190	9.3 J	U	150	U	mg/kg
Equipment Blank 030600-16	Pile 9	Water	7/29/96	U	U	U	U	U	U	U	U	mg/L
Method Detection Limit	Pile 9, 23, 24, 25	Soil	7/29/96	0.66	4.8	2.2	1	1.8	0.06	2.4	10	mg/kg

Section 6.4, Table 4 (Concluded)
Summary of RCRA Metals in Potentially Contaminated Soil Stockpiles at RWL/CDPs
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals, Methods 6010 and 7470								
				Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Units
Method Detection Limit	Pile 9	Water	7/29/96	0.005	0.012	0.022	0.009	0.001	0	0.019	0.088	mg/L
SNL/NM Background Range	NA	NA	NA	0.00159-8.7	0.033-17.0	0.587-1,300	0.00265-6.2	0.0056-58.4	0.0001-0.68	0.0159-112	0.037-17.2	mg/kg
SNL/NM Background UTL or 95th Percentile	NA	NA	NA	<1	4.4	336	0.9	12.8	<0.1	11.2	<1	mg/kg
Proposed Subpart S Action Level for Soil[b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a]Background range from SNL/NM sitewide background data (SNL/NM 1996).
[b]Subpart S Action Level value only applies to sites within a residential land use scenario and if only one contaminant
has been identified at the site.
Ag = silver
As = arsenic
Ba = barium
Be = beryllium
Cd = cadmium
Cr = chromium
D = duplicate
ER = environmental restoration
Hg = mercury
ID = identification
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable/analyzed
U = undetected - the analyte was not observed above the MDL
Pb = lead
RCRA = Resource Conservation and Recovery Act
Se = selenium

Section 6.5
Analytical Results for Excavation Verification

Section 6.5, Table 1
Summary of Radionuclides in Verification Pits
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a]										
				Am-241	Cs-134	Cs-137	Co-60	Ra-226	Ra-228	Th-232	U-235	U-238	Tritium	Units
030285-02	Other Pits	Concrete	6/28/96										0.36	pCi/g
030617-02	Ver. Pit 1	Soil	8/1/96										2.77	pCi/g
030617-08	Ver. Pit 1	Soil	8/1/96	0.0312 U (0.156)	0.000245 U (0.0364)	0.0672 (0.0426)	<0 U (0.0485)	0.762 (0.0771)	0.844 (0.170)	0.864 (0.0555)	0.0595 U (0.219)	1.89 (1.22)		pCi/g
030618-02	Ver. Pit 2	Soil	8/1/96										520.03	pCi/g
030618-08	Ver. Pit 2	Soil	8/1/96	0.0576 (0.103)	<0 U (0.0267)	0.0172 (0.0334)	<0 U (0.0313)	0.686 (0.0525)	0.816 (0.111)	0.821 (0.0408)	0.0443 U (0.161)	0.714 (0.834)		pCi/g
030616-02	Ver. Pit 3/4	Soil	8/1/96										0.18	pCi/g
030616-08	Ver. Pit 3/4	Soil	8/1/96	<0 U (0.110)	<0 U (0.0276)	0.0104 (0.0312)	0.00570 U (0.0341)	0.572 (0.0561)	0.729 (0.110)	0.626 (0.0503)	0.0838 (0.171)	0.614 (0.907)		pCi/g
030597-02	Ver. Pit 5	Soil	7/25/96										15.08	pCi/g
030597-04	Ver. Pit 5	Soil	7/25/96	<0 U (0.106)	<0 U (0.0269)	0.00666 U (0.0321)	<0 U (0.0312)	0.617 (0.0541)	0.733 (0.109)	0.704 (0.0423)	0.120 (0.174)	1.72 (0.883)		pCi/g
030614-02	Ver. Pit 6	Soil	8/1/96										100.11	pCi/g
030614-08	Ver. Pit 6	Soil	8/1/96	0.0495 (0.105)	0.000467 U (0.0256)	<0 U (0.0320)	<0 U (0.0334)	0.808 (0.0513)	0.795 (0.109)	0.878 (0.0402)	0.0802 (0.159)	1.47 (0.824)		pCi/g
030615-02	Ver. Pit 7	Soil	8/1/96										0.3	pCi/g
030615-08	Ver. Pit 7	Soil	8/1/96	<0 U (0.108)	0.00895 (0.0245)	0.00251 U (0.0305)	<0 U (0.0306)	0.859 (0.0508)	0.987 (0.101)	0.954 (0.0427)	0.0925 (0.167)	1.78 (0.899)		pCi/g
030284-02	Pit 6	Concrete	6/28/96										1.14	pCi/g
TA-II Background Range	NA	NA	NA											pCi/g
TA-II Soil Background UTL or 95th Percentile	NA	NA	NA											NA

[a]Value in parenthesis represents the minimum detection activity (MDA).
[b]Background ranges are site-specific.
Am = americium
B = detected in blank
Co = cobalt
Cs = cesium
D = duplicate
ER = environmental restoration
ID = identification
pCi/g = picocuries per gram
NA = not applicable
Ra = radium
Sr = strontium
Th = thorium
U = detected below the MDA
U-235/238 = uranium

Section 6.5, Table 2
Summary of Radionuclides in Verification Pits
(Off-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Alpha Spectroscopy Activity: Am-241	Pu-238	Pu-239/240	Th-228	Th-230	Th-232	U-233/234	U-235	U-238	Units[a]
030617-04	Ver. Pit 1	Soil	8/1/96	0.00105 U (0.0492)	0.0237 (0.0563)	0.0213 (0.0273)	1.29 (0.440)	2.35 (0.227)	0.761 (0.251)	0.962 (0.0268)	0.0614 (0.0221)	0.726 (0.0363)	pCi/g
030618-04	Ver. Pit 2	Soil	8/1/96	0.0299 U (0.0587)	0.00313 U (0.0995)	0.0591 (0.0489)	1.35 (0.527)	1.63 (0.0740)	0.866 (0.232)	0.718 (0.00883)	0.0546 (0.0186)	0.724 (0.00883)	pCi/g
030616-04	Ver. Pit 3/4	Soil	8/1/96	0.152 U (0.152)	0.00858 U (0.0482)	0.871 (0.0104)	1.22 (0.681)	2.79 (0.258)	0.760 (0.317)	0.894 (0.198)	0.0681 (0.0681)	1.26 (0.143)	pCi/g
NA	Ver. Pit 5	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	pCi/g
030614-04	Ver. Pit 6	Soil	8/1/96	0.0326 U (0.0431)	0.014 U (0.0973)	0.101 (0.0715)	1.54 (0.434)	1.50 (0.169)	0.768 (0.169)	0.949 (0.0216)	0.0326 (0.0300)	0.935 (0.0216)	pCi/g
030615-04	Ver. Pit 7	Soil	8/1/96	0.0324 U (0.0489)	<0 U (0.0418)	0.101 (0.0271)	1.35 (0.444)	1.89 (0.186)	1.35 (0.186)	1.07 (0.0251)	0.0599 (0.0120)	1.25 (0.0306)	pCi/g
030284-03	Pit 6	Concrete	6/28/96	NA	0.161 (0.0213)	6.24 (0.00491)	NA	NA	NA	NA	NA	NA	pCi/g
030285-03	Other Pits	Concrete	6/28/96	NA	0.0446 (0.0116)	0.922 (0.0116)	NA	NA	NA	NA	NA	NA	pCi/g

[a]Value in parenthesis represents the minimum detection activity (MDA).
[b]Background ranges are site-specific.
Am = americium
B = detected in blank
Co = cobalt
Cs = cesium
D = duplicate
ER = environmental restoration
ID = identification
pCi/g = picocuries per gram
NA = not applicable
Ra = radium
Th = thorium
U = detected below the MDA
U-235/238 = uranium

Section 6.5, Table 3
Summary of Radionuclides in Verification Pits
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	Gamma Spectroscopy Activity[a] Am-241	Cs-134	Cs-137	Co-60	Ra-226	Ra-228	Th-232	U-235	U-238	Units
030617-001	Ver. Pit 1	Soil	8/16/96	ND (.154)	ND (.0355)	.128 (.0220)	ND (.0330)	2.27 (.476)	.680 (.157)	.640 (.127)	ND (.171)	ND (1.18)	pCi/g
030618-001	Ver. Pit 2	Soil	8/16/96	ND (.161)	ND (.0373)	.0178 (.0218)	ND (.0360)	1.40 (.463)	.677 (.145)	.584 (.130)	ND (.167)	.907 (1.04)	pCi/g
030616-001	Ver. Pit 3/4	Soil	8/16/96	ND (.147)	ND (.0332)	ND (.0309)	ND (.0350)	1.29 (.491)	.584 (.135)	.529 (.124)	ND (.155)	ND (1.09)	pCi/g
030597-01	Ver. Pit 5	Soil	7/25/96	ND (.148)	ND (.0353)	ND (.0308)	ND (.0324)	1.15 (.414)	.510 (.136)	.560 (.123)	ND (.157)	ND (1.15)	pCi/g
030614-001	Ver. Pit 6	Soil	8/16/96	ND (.178)	ND (.0402)	ND (.0363)	ND (.0383)	1.82 (.614)	.730 (.163)	ND (.146)	ND (.183)	.899 (.993)	pCi/g
030615-001	Ver. Pit 7	Soil	8/16/96	ND (.150)	ND (.0323)	ND (.0293)	ND (.0317)	1.62 (.430)	.912 (.135)	.809 (.122)	ND (.159)	ND (1.14)	pCi/g
030284-01	Pit 6	Concrete	6/28/96	.454 (.150)	ND (.0431)	.0332 (.0221)	ND (.0359)	1.25 (.426)	.709 (.128)	.728 (.130)	ND (.169)	.693 (1.06)	pCi/g
030285-01	Other Pits	Concrete	6/28/96	.127 (.142)	ND (.0437)	.0538 (.0239)	ND (.0358)	1.46 (.510)	.820 (.144)	.790 (.139)	ND (.172)	ND (1.27)	pCi/g

[a]Value in parenthesis represents the minimum detection activity (MDA).
[b]Background ranges are site-specific.
Am = americium
B = detected in blank
Co = cobalt
Cs = cesium
D = duplicate
ER = environmental restoration
ID = identification
pCi/g = picocuries per gram
NA = not applicable
Ra = radium
Sr = strontium
Th = thorium
U = detected below the MDA
U-235/238 = uranium

Section 6.5, Table 4
Summary of RCRA Metals in Verification Pits
(On-Site Laboratory)

Sample Number	ER Sample ID	Sample Matrix	Sample Date	RCRA Metals, Methods 6010 and 7470								Units
				Ag	As	Ba	Cd	Cr	Hg	Pb	Se	
030597-08	Ver. Pit 5	Soil	7/24/96	5.9	U	260	U	U	U	U	U	mg/kg
030597-10	Ver. Pit 5 D	Soil	7/24/96	5.9	U	290	U	U	U	U	U	mg/kg
Matrix Spike Matrix Spike Duplicate 030597-08	Ver. Pit 5	Soil	7/24/96	5.3	U	280	U	U	U	U	U	mg/kg
Method Detection Limit	Ver. Pit 5	Soil	7/29/96	0.66	4.8	2.2	1	1.8	0.06	2.4	10	mg/kg

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^a^Background range from SNL/NM sitewide background data (SNL/NM 1996).
Ag = silver
As = arsenic
Ba = barium
Be = beryllium
Cd = cadmium
Cr = chromium
D = duplicate
ER = environmental restoration
Hg = mercury
ID = identification
MDL = method detection limit
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = not applicable/analyzed
U = undetected - the analyte was not observed above the MDL
Pb = lead
RCRA = Resource Conservation and Recovery Act
Se = selenium

Section 6.6
Summary of VCM Sampling, Including QA/QC

Table 1
Sampling at 26 Potentially Contaminated Soil Piles

Laboratory	Analysis	Sampling Performed	QA/QC	QA/QC Results
Off-site CLP laboratory	Analysis for 9 radionuclides using gamma spectroscopy	16 samples		
	Analysis for tritium	15 samples	1 equipment blank	Tritium: 10.8 pCi/l
	Analysis for 9 radionuclides using alpha spectroscopy	27 samples	1 equipment blank	See data in Annex 6.4
	Analysis for tritium	12 samples		
	Analysis for Sr-89, Sr-90	26 samples	Method blank, matrix spike, matrix spike duplicate for every analysis	See data in Annex 6.4
On-site SNL/NM laboratory	Analysis for 9 radionuclides using gamma spectroscopy	22 samples	1 equipment blank	All nondetects
	Analysis for 8 RCRA metals using Method 6010	26 samples	1 equipment blank	All nondetects

Table 2
Sampling at 7 Verification Pits

Laboratory	Analysis	Sampling Performed	QA/QC	QA/QC Results
Off-site CLP laboratory	Analysis for 9 radionuclides using gamma spectroscopy	6 samples		
	Analysis for tritium	6 samples		
	Analysis for 9 radionuclides using alpha spectroscopy	5 samples		
	Analysis for 7 RCRA metals using Method 6010	6 samples		
On-site SNL/NM laboratory	Analysis for 9 radionuclides using gamma spectroscopy	8 samples		
	Analysis for 7 RCRA metals using Method 6010	7 samples	Matrix spike, matrix spike duplicate	Ag 5.3 mg/kg Ba 280 mg/kg, others nondetects

Table 3
Sampling at 16 Clean Soil Piles

Laboratory	Analysis	Sampling Performed	QA/QC	QA/QC Results
Off-site CLP laboratory	Analysis for 9 radionuclides using gamma spectroscopy	4 samples	2 equipment blanks	See Annex 6.3
	Analysis for tritium	5 samples		Ba and Be values < mdl, see Annex 6.3
	Analysis for 9 RCRA metals using Method 6010	4 samples	1 equipment blank	
On-site SNL/NM laboratory	Analysis for 9 radionuclides using gamma spectroscopy	16 samples	1 equipment blanks	All nondetects
	Analysis for tritium	16 samples	1 equipment blank	2.01 pCi/g
	Analysis for 9 RCRA metals using Method 6010	17 samples	1 equipment blank, 1 ms/msd	See Annex 6.3

RSI

U.S. Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P.O. Box 5400
Albuquerque, NM 87185-5400

SEP 15 [illegible]

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. James Bearzi, Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87502-2100

Dear Mr. Bearzi:

Enclosed is one of two NMED copies of the Department of Energy and Sandia National Laboratories/New Mexico response to the NMED Request for Supplemental Information (RSI) for the sixth through the eleventh rounds of No Further Action (NFA) proposals.

If you have any questions, please contact John Gould at (505) 845-6089.

Sincerely,

Michael J. Zamorski
Area Manager

Enclosure

cc w/enclosure:
D. Bourne, AL, ERD
J. Parker, NMED-OB
R. Kennett, NMED-OB
D. Neleigh, EPA, Region 6 (2 copies via certified mail)
~~W. Moats, NMED-HRMB~~ (via Certified Mail)

cc w/o enclosure:
J. Cormier, KAO-AIP
W. Cox, SNL, MS 1089

Sandia National Laboratories
Albuquerque, New Mexico
September 1999

Environmental Restoration Project
Responses to NMED Request for Supplemental Information
No Further Action Proposals (9th Round)
Dated September 1997

INTRODUCTION

This document responds to comments received in a letter from the State of New Mexico Environment Department (NMED) to the U.S. Department of Energy (DOE) (Kieling, June 9, 1999) documenting the review of 13 No Further Action (NFA) Proposals submitted in September 1997.

The following five operable units (OU) and thirteen environmental restoration (ER) sites were included in the September 1997 NFA proposals:

- OU 1303
  - ER Sites 1 & 3, Radioactive Waste Landfill and Chemical Disposal Pits
  - ER Site 44, Uranium Calibration Pits and Decontamination Area
- OU 1309
  - ER Site 45, Liquid Discharge
- OU 1332
  - ER Site 19, TRUPAK Boneyard Storage Area
- OU 1333
  - ER Site 59, Pendulum Site
  - ER Site 63A, Balloon Test Area: Plutonium Dispersal Studies Project Site
  - ER Site 64, Gun Site
  - ER Site 63B, Balloon Test Area: Balloon/Helicopter Site

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- OU 1334
  - ER Site 11, Radioactive Explosives Burial Mounds
  - ER Site 21, Metal Scrap
  - ER Site 57B, Workman Site: Target Area
  - ER Site 70, Explosives Test Pit
  - ER Site 88B, Firing Site: Instrumentation Poles

Of these thirteen sites, three were designated appropriate for NFA: ER Site 19 (OU 1332) and ER Sites 59 and 63B (in OU 1333). The remaining ten sites have supplemental information included within this response document.

This response document is organized on the first level by OU number and on the second level by ER site number. Each OU section restates the New Mexico Environment Department comments (in **bold** font) in the same order in which they were provided in the call for response to comments. Following each comment, the word "Response" introduces the reply (in normal font style) of the U.S. Department of Energy/Sandia National Laboratories/New Mexico. Responses to general technical comments begin on page 5 and responses to site-specific technical comments begin on page 7. Additional supporting information for the site-specific comments is included in the attachments that follow each OU section. Changes to previously submitted text or tables are provided with redline/strikeout indicators and are labeled "Revised." Changes to previously submitted figures are not provided with redline/strikeout indicators but are labeled "Revised." Newly submitted information (including text, tables, and figures) is labeled "Supplemental."

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RESPONSES TO COMMENTS ON NO FURTHER ACTION PROPOSALS SEPTEMBER 1997 (9TH ROUND)

GENERAL COMMENTS

1. **Drafts of maps, supporting documents, appendices, and data tables are unfinished products. For the purpose of a No Further Action (NFA) proposal, final versions of these and other types of information must be submitted.**

   Response: Final versions of maps, supporting documents, appendices, and data tables will be submitted in this response or subsequent to any additional work.

2. **Tables of laboratory data supplied with some NFA proposals are incomplete. As applicable, data tables should include sample identification numbers, analytical methods, method detection limits (MDL's) or minimum detectable activities (MDA's), analytical results, maximum contaminant limits, and approved background levels. Also, offsite laboratory results must be included and clearly identified.**

   Response: All tables will be completed as requested.

3. **It is helpful to include analytical results for field and equipment blanks, and duplicates in data tables. Quality assurance/quality control (QA/QC) data should not be mixed with environmental data in the same tables. If applicable, the QA/QC data tables should also include comparisons of offsite and onsite laboratory results (e.g., RPD's). The text should include a discussion of field and laboratory quality control results (the good points as well as the not-so-good points) and should indicate whether the sampling results are generally acceptable.**

   Response: For those NFAs for which additional information is requested, the data presentation will be examined and the information requested will be provided in the recommended format.

4. **Many data tables for volatile organic compounds (VOC's), semi-volatile organic compounds (SVOC's), high explosives (HE), and polychlorinated biphenyls (PCB's) list only the constituents that were detected, or list just whether any constituent of a group was detected. While summary tables like these are acceptable (and preferred for review purposes), they provide only part of the information needed to fully evaluate a NFA proposal. To complete the data package, additional tables must be submitted listing all of the various constituents that were analyzed for and their MDL's. Please note that "J-coded" data must be reported as detected constituents.**

General Comments

Response: The additional information will be provided for those specific NFAs for which such information has been requested as part of this Request for Supplemental Information. J-coded data will be reported as detects, as previously agreed to between U.S. Department of Energy, Sandia National Laboratories/New Mexico and the Hazardous and Radioactive Materials Bureau.

5. **For many data tables, sample locations and depths must be inferred from the sample identification numbers. Notes describing how such information is encoded into the sample identification numbers must be added to the tables or to the text.**

Response: The data tables or text referring to the data tables will be revised so that map location, sample locations, and depth all correspond.

6. **To ensure that appropriate background levels are utilized, Area or Super Groups need to be specified for all NFA proposals.**

Response: The area or supergroup for approved background values will be clearly identified. Correct values will be used.

Site-Specific Comments

SPECIFIC COMMENTS

OU 1303

ER Sites 1 & 3, Radioactive Waste Landfill and Chemical Disposal Pits

ER Sites 1 &3 may be appropriate for NFA petition, pending review and approval of the information requested below:

Response: Based on General Comments 1 through 6, the analytical data summary tables from Annex 6.3 (Analytical Results for Stockpiled Suspect Clean Soil), Annex 6.4 (Analytical Results for Stockpiled Suspect Contaminated Soil), and Annex 6.5 (Analytical Results for Excavation Verification) of the original ER Sites 1 and 3 NFA Proposals have been revised and updated based on the current NFA Proposal format. Separate data summary tables have been developed for each analysis and data from both off- and on-site laboratories have been combined.

The revised analytical data summary tables from Annex 6.3 (Analytical Results for Stockpiled Suspect Clean Soil) are presented in Attachment A. Table A-1 summarizes gamma spectroscopy results, Table A-2 summarizes tritium results, and Table A-3 summarizes metals results.

The revised analytical data summary tables from Annex 6.4 (Analytical Results for Stockpiled Suspect Contaminated Soil) are presented in Attachment B. Table B-1 summarizes gamma spectroscopy results, Table B-2 summarizes alpha spectroscopy results, Table B-3 summarizes tritium results, Table B-4 summarizes isotopic strontium results, and Table B-5 summarizes metals results.

The revised analytical data summary tables from Annex 6.5 (Analytical Results for Excavation Verification) are presented in Attachment C. Table C-1 summarizes gamma spectroscopy results, Table C-2 summarizes alpha spectroscopy results, Table C-3 summarizes tritium results, and Table C-4 summarizes metals results.

1. **DOE/SNL must provide an inventory of the types and volumes (or mass) of wastes that were excavated and removed from the various pits as a result of the Voluntary Corrective Measure (VCM).**

   Response: The types and volumes of material excavated from ER Sites 1 and 3 during the Voluntary Corrective Measure in 1996 are summarized below. The material consists of a heterogeneous mixture that includes depleted uranium fragments, transformers, neutron generators, a mechanical jack, spark gap tubes, wood, rubber, horse hair, thermal batteries, bomb bolsters, glass, scrap metal, cardboard, nose cone, telephone wire, cesium sources, forceps, gas cylinders, a B-53 weapon mock-up, crucibles, electronic components, glass bottles, some classified components, a fan, cable, iron pipe, plexiglass, a car spring, metal castings, metal tile, and a hydraulic pump. Some of the waste types listed below are tentative since waste disposal options for material suspected of being mixed radioactive and hazardous waste are not finalized. Treatment options for some of the material are also being considered. Most of the material has been shipped for disposal or is being staged at the Sandia National Laboratories/New Mexico Radioactive Mixed Waste Management Facility.

Radioactive Waste:
13 55-gallon drums of classified material
168 55-gallon drums of debris
1 lead pig containing a radium-226 source
2 radioactive sources
2 gallons of vacuum pump oil
1 55-gallon drum of concrete blocks

Potential Mixed Radioactive and Hazardous Waste:
2 55-gallon drums of potentially classified material
8 55-gallon drums of debris
2 20-gallon poly drums of debris
3 55-gallon drums of electrical/electronic components
1 5-gallon bucket of debris
2 744 (7- x 4- x 4-foot) steel boxes of thermal batteries
30 55-gallon drums of thermal batteries
14 55-gallon drums of spark gap tubes
1 55-gallon drum of lead scrap and lead pigs
1 55-gallon drum of potentially classified lead debris

Potential Radioactive/Toxic Substances Control Act Waste:
1 55-gallon drum of asbestos-containing material
1 20-gallon poly drum of asbestos-containing material

Recycled Scrap Metal:
10 pallets of scrap metal (primarily bomb bolsters)

Potential Hazardous Waste:
1.5 gallons of phosphoric acid
20 gallons of nitric acid

Approximately 400 cubic yards of soil were characterized as being radioactive waste and shipped to the Nevada Test Site for disposal in August and September of 1998.

2. **The VCM included the excavation and removal of 96 CY of debris, 700 CY of contaminated soil, 3000 CY of potentially contaminated soil, and 5000 CY of "clean" soil from various pits.**

Site-Specific Comments

A. **DOE/SNL must provide data that characterize the nature of the contaminated soil.**

B. **DOE/SNL must provide information as to the disposition or future disposition of each soil stockpile (whether contaminated, potentially contaminated, or "clean").**

Response A: Refer to Response B for clarification of soil designations "contaminated," "potentially contaminated," and "clean." Analytical results for contaminated soil are listed in Tables D-1 through D-8 of Attachment D for gamma spectroscopy, alpha spectroscopy, tritium, toxicity characteristic leaching procedure metals, volatile organic compounds, semivolatile organic compounds, high explosives, and herbicides and pesticides, respectively.

Because no volatile organic compounds, semivolatile organic compounds, herbicides, or pesticides were detected, Tables D-6, D-7, and D-8 present only the detection limits associated with these analyses.

Response B: "Contaminated" soil was separated from "potentially contaminated" Soil Piles 4, 15, 20, and 25 during processing (screening) through the Thermo NUtech Segmented Gate System in August and September 1997 (Thermo NUtech September 1997). In August and September 1997, additional contaminated soil was separated from potentially contaminated soil associated with the Chemical Disposal Pit area (previously staged on site in 2-cubic-yard "supersacks") by processing (screening) through the Thermo NUtech Segmented Gate System (Thermo NUtech September 1997). All soil characterized as "contaminated," or well above risk-based concentrations indicating the potential for redeposition, was shipped to the Nevada Test Site in August and September 1998.

Soil characterized as "clean" or proposed for redeposition was removed during excavation of the overburden surrounding the waste pits/trenches at the Radioactive Waste Landfill and the Chemical Disposal Pit area. This "clean" soil was initially staged at the Soil Stockpile Area in 16 soil piles. Since that time, these soil piles have all been consolidated into a single mound that remains on site. A second "clean" soil pile contains soil that was separated in August and September 1997 during the screening (processing) of potentially contaminated soil through the Segmented Gate System (Thermo NUtech September 1997). Concentrations of constituents of concern in this pile are believed to be below risk-based levels that would allow redeposition. Both soil piles will eventually be used as backfill for the excavation that remains at ER Sites 1 and 3, following completion and approval by the New Mexico Environment Department of a final risk assessment.

All "potentially contaminated" soil piles remain on site except potentially contaminated Soil Piles 4, 15, 20, and 25, which were processed through the Segmented Gate System in August and September 1997 (Thermo NUtech September 1997). Because of the presence of residual landfill debris in the "potentially contaminated" soil piles, these soils will be processed through the ER Site 2 screening plant for removal of debris before final disposition is determined. All soil processed during the screening activity will be used as backfill as determined by the final site risk assessment.

3. **Section 6.3, Tables 1, 2, and 3 – Data in these tables indicate that nearly all of the "clean" soil piles are contaminated with low levels of tritium (up to 78.9 pCi/g), and some soil piles contain low concentrations of silver (up to 8.5 mg/kg). If any contaminated soil was used to backfill any of the VCM pits, a risk assessment must be done to ensure that this soil does not pose an unacceptable risk to human health and the environment.**

   Response: None of the pits/trenches at ER Sites 1 and 3 have been backfilled. Because of the proximity of ER Sites 1 and 3 to ER Site 2, a final risk assessment covering all three sites will be performed when the excavation of ER Site 2 is complete. At that time, the current risk assessment methodology will be used (as set forth by the New Mexico Environment Department's March 1998 risk guidance) to evaluate the soil piles characterization data. The results of the risk assessment will then determine the level below grade at which the different piles must be redeposited, with soil from overburden or clean fill completing the backfill.

4. **Section 6.4, Tables 1,2,3, and 4 – Data in these tables indicate that all of the "potentially contaminated" soil piles are contaminated with low levels of various radionuclides. Radiological contaminants include Am-241 (up to 121 pCi/g), Cs-137 (up to 197 pCi/g), U-235 (up to 17.3 pCi/g), U-238 (up to 666 pCi/g), U-233/234 (up to 97.8 pCi/g), Pu-238 (up to 2.12 pCi/g), Pu-239/240 (up to 273 pCi/g), and tritium (up to 1600 pCi/g). Additionally, low concentrations of Hg (up to 7.8 mg/kg) and moderate levels of Cd (up to 190 mg/kg) are present in soil piles 9, 15, and 20-26. If any of these soil piles were used to backfill any of the VCM pits, a risk assessment must be done to ensure that this soil does not pose an unacceptable risk to human health and the environment.**

   Response: As stated in the response to Specific Comment 3, no backfilling of the excavation at ER Sites 1 and 3 has occurred. The final risk assessment will include the concentrations of contaminants in the "potentially contaminated" soil piles. Because of the presence of some landfill debris in these soil piles, the soil will be processed through the ER Site 2 screening plant for debris removal before performing the final risk assessment.

5. **DOE/SNL must provide information as to where the various VCM pits were located relative to the historical waste pits that make up ER Sites 1&3.**

   Response: The voluntary corrective measure conducted at ER Sites 1 and 3 did not involve a separate excavation for each historic waste pit/trench. Because of the proximity of the historic waste pits/trenches, the entire Radioactive Waste Landfill/Chemical Disposal Pit area was remediated as a single excavation. Figure 1 in Attachment E depicts the historic Radioactive Waste Landfill Pit/Trench locations relative to the voluntary corrective measure excavation. In addition, the location of the Chemical Disposal Pit area is also shown in Figure 1 (Attachment E), based on the discovery of the type of wastes in the Chemical Disposal Pit during excavation of the Radioactive Waste Landfill.

6. **DOE/ SNL must provide information on the final depth of each VCM pit.**

Response: As noted in the response to Specific Comment 5, the voluntary corrective measure conducted at ER Sites 1 and 3 did not involve a separate excavation for each . However, the final excavation depths at each historic waste pit/trench in ER Sites 1 and 3 are listed below in Table 1.

Table 1.
Final Excavation Depths at the Historic Waste Disposal Pits/Trenches in ER Sites 1 and 3

ER Sites 1 and 3 Pit/Trench Number[a]	Final Excavation Depth (feet)
Pit 1	17.18
Pit 2	18.58
Trench 3/4	16.85
Trench 5	18.6
Trench 6	22.92
Pit 7	16.48

[a]See Figure 1 of Attachment E for the historic waste disposal pit/trench locations.

7. **DOE/SNL must provide a map showing where each verification sample was collected.**

Response: As stated in the original NFA Proposal for ER Sites 1 and 3, verification sampling included collecting surface soil samples (at 0 to 6 inches) from four locations, each equidistant from the center and corner location within each sampling grid cell (SNL/NM September 1997). These surface soil samples were collected from the excavation floor (see response to Specific Comment 9) and then were composited into one sample for analysis for radionuclide and Resource Conservation and Recovery Act metals (see response to Specific Comment 10).

Figure 2 in Attachment E presents the typical sampling grid cell from the Excavation Sampling and Analysis Plan, based on guidance provided by NUREG CR-5849, *Manual for Conducting Radiological Surveys in Support of License Termination* (NRC 1992). Figure 2 (Attachment E) shows the preliminary verification survey locations and the final verification sample locations used to form the composite sample for that grid cell. Based on discussions with former site workers present at the time verification sampling took place, a typical grid cell would be expanded or contracted as necessary to conform to the final excavation dimensions of each historic waste pit/trench location. This approach was used because the final excavation for each historic waste pit/trench resulted in a smaller surface area than a typical sampling grid cell. Table 2 presents the final excavation surface area for each historical waste pit/trench.

Table 2.
Final Excavation Surface Areas at the Historic Waste Disposal Pits/Trenches in ER Sites 1 and 3

ER Site 1 and 3 Pit/Trench Number[a]	Final Excavation Dimensions (feet)	Final Excavation Surface Area (feet^2)
Pit 1	12 x 10	120
Pit 2	15 x 14	210
Trench 3/4	5 x 25	125
Trench 5	35 x 12	420
Trench 6	50 x 15	750
Pit 7	15 (diameter)	176
Typical Sampling Grid Cell	32 x 32	1024

[a]See Figure 1 of Attachment E for the historic waste disposal pit/trench locations.

8. **Page 3-4, Section 3.2.7, third paragraph – DOE/SNL must provide data tables showing the results for the analyses of VOC's, SVOC's, PCB's, and HE. See also general comments 2-4.**

<u>Response</u>: Toxicity characteristic leaching procedure analysis results for volatile organic compounds and semivolatile organic compounds in the samples from the potentially contaminated soil piles are presented Tables F-6 and F-7, respectively, of Attachment F. Because no volatile organic compounds or semivolatile organic compounds were detected, Tables F-6 and F-7 present only the detection limits associated with these analyses.

Larger debris items removed from the excavation at ER Sites 1 and 3 were field screened for high explosives using EXPRAY. In addition, soil and debris were visually examined for staining or other signs that may indicate the presence of liquids, metals, or high explosives. Based on these field-screening techniques, no high explosives or polychlorinated biphenyls contamination was suspected. As a result, no analyses for polychlorinated biphenyls or high explosives were conducted on the samples from the potentially contaminated soil piles.

9. **Page 3-5, Section 3.2.7, first and second paragraph – these paragraphs refer to "surface-soil samples". For clarification, DOE/SNL must state whether the samples truly represent "surface soil", or whether instead the samples were collected at depths of 0-6" starting at the bottom of the pits.**

Response: The samples depths referred to are from 0 to 6 inches starting at the bottom of the excavation.

10. **DOE/SNL must state whether the verification samples are discrete or composite samples.**

Response: The verification sample results summarized in Tables C-1 through C-4 of Attachment C are based on composite samples.

11. **It is not clear in the risk assessment report (Annex 6.1) what activities and concentrations were used to calculate radiological and chemical risk to human health and the environment. The risk assessment must consider the levels of contaminants left on site (including backfilled soil). If this is not the case, then the risk assessment must be revised.**

Response: When the excavation of ER Site 2 is complete, a final risk assessment (as set forth by the New Mexico Environment Department's March 1998 risk guidance) will be performed that will incorporate contaminant concentrations in verification samples and characterization of backfill soil from ER Sites 1 and 3, and ER Site 2. Therefore, the risk assessment presented in Annex 6.1 should be disregarded pending submittal of the final risk assessment.

ER Sites 1 and 3 References:

Dinwiddie, R.S. (New Mexico Environment Department). Letter to M.J. Zamorski (U.S. Department of Energy), "Request for Supplemental Information: Background Concentrations Report, SNL/KAFB," September 24, 1997.

New Mexico Environment Department (NMED), March 1998. "RPMP Document Requirement Guide," Resource Conservation and Recovery Act Permits Management Program, Hazardous and Radioactive Materials Bureau, New Mexico Environment Department, Santa Fe, New Mexico.

NMED, see New Mexico Environment Department.

Sandia National Laboratories/New Mexico (SNL/NM) September 1997. "Proposal for Risk-Based No Further Action Environmental Restoration Sites 1 and 3 Radioactive Waste Landfill and Chemical Disposal Pits Operable Unit 1303," Environmental Restoration Project, Albuquerque Operations Office, U.S. Department of Energy, Albuquerque New Mexico.

SNL/NM, see Sandia National Laboratories/New Mexico.

Site-Specific Comments

Thermo Nutech, September 1997. "Segmented Gate System, TA-II Remediation Project, Sandia National Laboratories, Final Report," Thermo NUtech, Albuquerque, New Mexico.

NRC, see U.S. Nuclear Regulatory Commission.

U.S. Nuclear Regulatory Commission (NRC), 1992. *Manual for Conducting Radiological Surveys in Support of License Termination*, NUREG/CR-5849, ORAU-92/C57, U.S. Nuclear Regulatory Commission, Washington, D.C.

ATTACHMENT A

ER SITES 1 AND 3
SUPPLEMENTAL TABLES A-1 THROUGH A-3

Table A-1
Summary of ER Sites 1 and 3 Clean Soil Stockpile Sampling Gamma Spectroscopy Analysis, May, July, and August 1996 and January 1997

Sample Attributes				Activity (pCi/g)[a]									
				Americum-241		Cesium-134		Cesium-137		Cobalt-60		Radium-226	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05323	Pile 1	5-17-96	NA	ND (1.08E-01)	--	ND (1.89E-02)	--	1.70E-01	3.06E-02	ND (2.47E-02)	--	1.76	4.65E-01
05323	Pile 1 D	5-17-96	NA	ND (1.48E-01)	--	ND (5.43E-02)	--	1.74E-01	4.83E-02	ND (3.91E-02)	--	1.84E+00	6.50E-01
05324	Pile 1 (off-site laboratory)	5-17-96	NA	ND (0.128)	--	ND (0.0319)	--	0.185	0.0574	ND (0.0361)	--	ND (0.0688)	--
05326	Pile 2	5-22-96	NA	ND (1.07E-01)	--	ND (1.93E-02)	--	3.11E-02	1.56E-02	ND (2.33E-02)	--	1.43	4.38E-01
05490	Pile 3	7-10-96	NA	ND (1.38E-01)	--	ND (5.17E-02)	--	2.60E-02	2.10E-02	ND (3.74E-02)	--	1.25E+00	4.34E-01
05490	Pile 4	7-10-96	NA	ND (1.25E-01)	--	ND (4.78E-02)	--	ND (3.39E-02)	--	ND (3.68E-02)	--	1.38E+00	6.72E-01
05490	Pile 5	7-10-96	NA	1.57E-01	8.53E-02	ND (5.23E-02)	--	ND (3.58E-02)	--	ND (3.70E-02)	--	1.41E+00	4.87E-01
05492	Pile 6	7-26-96	NA	ND (1.54E-01)	--	ND (3.77E-02)	--	ND (3.32E-02)	--	ND (3.51E-02)	--	1.34E+00	2.61E-01
05492	Pile 7	7-26-96	NA	ND (1.58E-01)	--	ND (3.74E-02)	--	ND (3.14E-02)	--	ND (3.75E-02)	--	1.65E+00	5.37E-01
05492	Pile 8	7-26-96	NA	ND (1.74E-01)	--	ND (3.80E-02)	--	ND (3.88E-02)	--	ND (3.80E-02)	--	1.55E+00	7.63E-01
05492	Pile 9	7-26-96	NA	ND (1.73E-01)	--	ND (3.91E-02)	--	ND (3.46E-02)	--	ND (3.99E-02)	--	1.41E+00	5.10E-01
05656	Pile 10	7-31-96	NA	ND (4.62E-01)	--	ND (4.36E-02)	--	1.21E-02	2.05E-02	ND (2.94E-02)	--	1.62E+00	6.55E-01
05657	Pile 10 (off-site laboratory)	7-31-96	NA	ND (0.112)	--	ND (0.0234)	--	0.0281	0.0241	ND (0.0342)	--	0.756	0.0839
05656	Pile 11	7-31-96	NA	ND (4.83E-01)	--	ND (4.58E-02)	--	ND (3.26E-02)	--	ND (3.17E-02)	--	1.22E+00	4.90E-01
05657	Pile 11 (off-site laboratory)	7-31-96	NA	ND (0.105)	--	ND (0.0266)	--	0.0297	0.022	0.0118	0.0365	0.786	0.0967
05656	Pile 12	7-31-96	NA	ND (4.50E-01)	--	ND (4.18E-02)	--	1.99E-02	1.09E-02	ND (3.04E-02)	--	1.37E+00	4.21E-01
05657	Pile 12 (off-site laboratory)	7-31-96	NA	ND (0.122)	--	ND (0.00302)	--	ND (0.0332)	--	ND (0.0343)	--	0.643	0.0854
05662	Pile 13	8-5-96	NA	ND (1.82E-01)	--	ND (4.07E-02)	--	4.02E-02	2.77E-02	ND (3.86E-02)	--	1.35E+00	6.57E-01
05662	Pile 14	8-5-96	NA	ND (1.72E-01)	--	ND (4.11E-02)	--	ND (3.63E-02)	--	ND (3.98E-02)	--	1.47E+00	6.15E-01
05662	Pile 15	8-5-96	NA	ND (1.62E-01)	--	ND (3.71E-02)	--	ND (3.30E-02)	--	ND (3.56E-02)	--	1.22E+00	5.21E-01
06258	Pile 16	1-29-97	NA	ND (1.01E-01)	--	ND (1.91E-02)	--	ND (2.15E-02)	--	ND (2.50 E-02)	--	1.45E+00	5.83E-01
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	0.084	NA	NE	NA	NE	NA
Quality Assurance/Quality Control Samples (all in pCi/L)													
05323	Pile 1-EB[e]	5-17-96	NA	ND (5.38E+01)	--	ND (1.51E+01)	--	ND (1.54E+01)	--	ND (1.72E+01)	--	ND (2.61E+02)	--
05324	Pile 1-EB (off-site laboratory)	5-17-96	NA	ND (17.2)	--	ND (3.74)	--	ND (4.04)	--	ND (4.05)	--	ND (7.77)	--

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of ER Sites 1 and 3 Clean Soil Stockpile Sampling Gamma Spectroscopy Analysis, May, July, and August 1996 and January 1997

Sample Attributes				Activity (pCi/g)[a]							
				Radium-228		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05323	Pile 1	5-17-96	NA	7.21E-01	1.70E-01	7.82E-01	3.63E-01	ND (1.17E-01)	--	ND (9.26E-01)	--
05323	Pile 1 D	5-17-96	NA	6.52E-01	2.42E-01	7.95E-01	4.23E-01	ND (1.71E-01)	--	9.91E-01	7.02E-01
05324	Pile 1 (off-site laboratory)	5-17-96	NA	1.03	0.161	ND (0.0476)	--	ND (0.191)	--	ND (1.12)	--
05326	Pile 2	5-22-96	NA	7.84E-01	1.99E-01	7.55E-01	3.52E-01	ND (1.18E-01)	--	ND (9.37E-01)	--
05490	Pile 3	7-10-96	NA	7.72E-01	2.67E-01	6.79E-01	3.61E-01	ND (1.64E-01)	--	6.45E-01	8.29E-01
05490	Pile 4	7-10-96	NA	7.67E-01	1.99E-01	7.07E-01	3.62E-01	3.53E-02	6.57E-02	ND (1.03E+00)	--
05490	Pile 5	7-10-96	NA	8.63E-01	2.22E-01	8.13E-01	4.40E-01	ND (1.67E-01)	--	ND (1.13E+00)	--
05492	Pile 6	7-26-96	NA	7.17E-01	2.03E-01	7.19E-01	3.75E-01	ND (1.67E-01)	--	ND (1.21E+00)	--
05492	Pile 7	7-26-96	NA	7.19E-01	1.94E-01	6.31E-01	3.15E-01	7.20E-02	6.81E-02	ND (1.20E+00)	--
05492	Pile 8	7-26-96	NA	8.98E-01	2.77E-01	7.68E-01	4.09E-01	ND (1.70E-01)	--	ND (1.32E+00)	--
05492	Pile 9	7-26-96	NA	7.32E-01	2.17E-01	6.82E-01	3.61E-01	ND (1.78E-01)	--	ND (1.34E+00)	--
05656	Pile 10	7-31-96	NA	7.16E-01	1.80E-01	7.27E-01	3.44E-01	ND (2.09E-01)	-	ND (2.91E+00)	--
05657	Pile 10 (off-site laboratory)	7-31-96	NA	0.845	0.162	0.927	0.0601	ND (0.153)	--	0.474	1.08
05656	Pile 11	7-31-96	NA	8.19E-01	2.37E-01	6.97E-01	3.33E-01	ND (2.14E-01)	--	ND (2.97E+00)	--
05657	Pile 11 (off-site laboratory)	7-31-96	NA	0.922	0.161	0.937	0.0613	ND (0.165)	--	0.713	0.973
05656	Pile 12	7-31-96	NA	6.78E-01	1.85E-01	6.60E-01	3.14E-01	ND (1.95E-01)	--	ND (2.78E+00)	--
05657	Pile 12 (off-site laboratory)	7-31-96	NA	0.911	0.152	0.938	0.0675	0.105	0.106	1.42	1.16
05662	Pile 13	8-5-96	NA	8.80E-01	3.46E-01	7.72E-01	3.76E-01	ND (1.89E-01)	--	ND (1.39E+00)	--
05662	Pile 14	8-5-96	NA	6.79E-01	2.16E-01	7.67E-01	4.13E-01	ND (1.83E-01)	--	ND (1.33E+00)	--
05662	Pile 15	8-5-96	NA	6.74E-01	1.07E-01	6.16E-01	3.34E-01	ND (1.65E-01)	--	ND (1.24E+00)	--
06258	Pile 16	1-29-97	NA	6.66E-01	2.27E-01	6.56E-01	4.07E-01	ND (1.16E-01)	--	ND (9.40E-01)	--
Background Soil Activities—North Area Subsurface[d]				1.76	NA	1.54	NA	0.18	NA	1.3	NA
Quality Assurance/Quality Control Samples (all in pCi/L)											
05323	Pile 1-EB[e]	5-17-96	NA	ND (8.96E+01)	--	ND (8.11E+01)	--	ND (7.33+01)	--	ND (5.03E+02)	--
05324	Pile 1-EB (off-site laboratory)	5-17-96	NA	ND (15.7)	NA	ND (7.41)	--	ND (26.6)	--	ND (167)	--

Refer to footnotes at end of table.

Table A-1 (Concluded)
Summary of ER Sites 1and 3 Clean Soil Stockpile Sampling Gamma Spectroscopy Analysis, May, July, and August 1996 and January 1997

Note: Values in **bold** exceed background.

[a]Scientific notation of results provided as reported by laboratory.

[b]Analysis request/chain of custody record.

[c]Two standard deviations about the mean detected activity.

[d]Dinwiddie, September 1997.

[e]Analytical results presented have been converted from picocuries per milliliter to picocuries per liter.

D = Duplicate sample.
EB = Equipment blank.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
-- = Error not calculated for nondetectable results.

Table A-2
Summary of ER Sites 1 and 3 Clean Soil Stockpile Sampling Tritium Analytical Results, May, July, and August 1996 and January 1997

Sample Attributes				Activity (pCi/g)[a]	
			Sample	Tritium[c]	
Record Number[b]	ER Sample ID	Date Sampled	Depth (ft)	Result	Error[d]
05323	Pile 1	5-17-96	NA	**3.66E+00**	1.15E+01
05323	Pile 1 D	5-17-96	NA	**6.05E+00**	1.26E+01
05324	Pile 1 (off-site laboratory)	5-17-96	NA	0.0301 B	0.004
05326	Pile 2	5-22-96	NA	**8.83E+00**	1.15E+01
05490	Pile 3	7-10-96	NA	**3.70E+01**	6.39E+01
05490	Pile 4	7-10-96	NA	**5.96E+00**	5.46E+01
05490	Pile 5	7-10-96	NA	**1.77E+01**	6.15E+01
05492	Pile 6	7-26-96	NA	**3.53E+01**	6.32E+01
05492	Pile 7	7-26-96	NA	**3.56E+01**	6.72E+01
05492	Pile 8	7-26-96	NA	**7.89E+01**	7.65E+01
05492	Pile 9	7-26-96	NA	**3.25E+01**	6.88E+01
05656	Pile 10	7-31-96	NA	7.03E+01	4.44E+01
05657	Pile 10 (off-site laboratory)	7-31-96	NA	**19.44**	0.100
05656	Pile 11	7-31-96	NA	6.99E+01	4.52E+01
05657	Pile 11 (off-site laboratory)	7-31-96	NA	**0.29**	0.005
05656	Pile 12	7-31-96	NA	1.22E+02	5.26E+01
05657	Pile 12 (off-site laboratory)	7-31-96	NA	1.66d	0.015
05662	Pile 13	8-5-96	NA	5.50E+01	8.49E+01
05662	Pile 14	8-5-96	NA	4.13E+01	7.18E+01
05662	Pile 15	8-5-96	NA	2.85E+01	7.11E+01
06257	Pile 16 (off-site laboratory)	1-29-97	NA	0.167	0.013
SNL/NM Background Activity in Surface Soils[e]				0.021	NA
Quality Assurance/Quality Control Samples (all in pCi/L)					
05323	Pile 1-EB	5-17-96	NA	5.25E+02	7.37E+02
05324	Pile 1-EB (off-site laboratory)	5-17-96	NA	ND (167) B	--

Note: Values in **bold** exceed background.
[a]Scientific notation of results provided as reported by laboratory.
[b]Analysis request/chain of custody record.
[c]Off-site laboratory results and errors have been converted from pCi/L to pCi/g based upon the percent soil moisture reported by the laboratory
[d]Two standard deviations about the mean detected activity.
[e]Tharp, February 1999.

B = Analyte detected in associated blank.
D = Duplicate sample.
EB = Equipment blank.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected above the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SNL/NM = Sandia National Laboratories/New Mexico.
-- = Error not calculated for nondetectable results.

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Table A-3
Summary of ER Sites 1 and 3 Clean Soil Stockpile Sampling Metals Analytical Results, May, July, and August 1996 and January 1997

Sample Attributes				Metals (EPA 6010/7000[a]) (mg/kg)								
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
05325	Pile 1	5-17-96	NA	ND (26)	170	ND (0.11)	ND (2.1)	ND (5)	3.7	ND (0.06)	ND (50)	ND (1.7)
05325	Pile 1 D	5-17-96	NA	ND (26)	170	ND (0.11)	ND (2.1)	5.3	7.5	ND (0.06)	ND (50)	ND (1.7)
05324	Pile 1 (off-site laboratory)	5-17-96	NA	2.65	109 B	0.378 BJ (0.495)	ND (0.00960)	7.92 B	9.18	0.0180 BJ (0.033)	0.301 J (0.495)	ND (0.247)
05327	Pile 2	5-22-96	NA	ND (26)	130	ND (0.11)	ND (2.1)	ND (5)	ND (3.4)	NA	ND (50)	ND (1.7)
05491	Pile 3	7-10-96	NA	ND (4.8)	200	2	ND (1)	14	14	ND (0.06)	ND (10)	7.4
05491	Pile 4	7-10-96	NA	ND (4.8)	170	ND (0.11)	ND (1)	5.4 J (6.9)	ND (2.4)	ND (0.06)	ND (10)	6.9
05491	Pile 5	7-10-96	NA	ND (4.8)	200	ND (0.11)	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	5.8
05585	Pile 6	7-26-96	NA	ND (4.8)	180	0.72	ND (1)	6.1 J (6.7)	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05585	Pile 7	7-26-96	NA	ND (4.8)	150	0.69	ND (1)	9.5	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05585	Pile 8	7-26-96	NA	ND (4.8)	160	0.72	ND (1)	8.8	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05585	Pile 9	7-26-96	NA	ND (4.8)	140	0.64	ND (1)	5 J (6.7)	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05658	Pile 10	7-31-96	NA	ND (4.8)	89	0.96	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05657	Pile 10 (off-site laboratory)	7-31-96	NA	2.33	159	0.262 J (0.490)	0.146 J (0.490)	3.95	5.31	ND (0.02)	ND (0.072)	ND (0.124)
05658	Pile 11	7-31-96	NA	ND (4.8)	99	1.1	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05657	Pile 11 (off-site laboratory)	7-31-96	NA	2.46	126	0.257 J (0.500)	0.0883 J (0.500)	4.53	6.20	ND (0.02)	0.214 J (0.500)	ND (0.124)
05658	Pile 12	7-31-96	NA	ND (4.8)	100	0.98	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	ND (0.66)
05657	Pile 12 (off-site laboratory)	7-31-96	NA	2.16	164	0.228 J (0.481)	0.0813 J (0.481)	3.52	5.29	ND (0.02)	ND (0.072)	ND (0.124)
05661	Pile 13	8-5-96	NA	ND (4.8)	200	ND (0.11)	ND (1)	7 J (6.9)	33	ND (0.06)	ND (10)	4 J (2.5)
05661	Pile 14	8-5-96	NA	ND (4.8)	230	ND (0.11)	ND (1)	8.9 J (6.9)	14	ND (0.06)	ND (10)	8.5
05661	Pile 15	8-5-96	NA	ND (4.8)	210	ND (0.11)	ND (1)	9.4 J (6.9)	18	ND (0.06)	ND (10)	ND (0.66)
06486	Pile 16	1-29-97	NA	1.7 J (2.4)	80	0.21	0.14 J (0.16)	5.8	4.0	ND (0.041)	0.47 J (1.2)	ND (0.041)
Background Soil Concentrations—North Area Subsurface[c]				4.4	200	0.80	0.9	12.8	11.2	<0.1	<1	<1

Refer to footnotes at end of table.

Table A-3 (Concluded)
Summary of ER Sites 1 and 3 Clean Soil Stockpile Sampling Metals Analytical Results, May, July, and August 1996 and January 1997

Sample Attributes				Metals (EPA 6010/7000)[a] (mg/kg)								
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Quality Assurance/Quality Control Samples (all in mg/L)												
05325	Pile 1-EB	5-17-96	NA	ND (0.26)	ND (0.1)	ND (0.001)	ND (0.021)	ND (0.05)	ND (0.034)	ND (0.06)	ND (0.5)	ND (0.017)
05324	Pile 1-EB (off-site laboratory)	5-17-96	NA	ND (0.00186)	0.000191 BJ (0.01)	0.0000449 BJ (0.005)	ND (0.000097)	ND (0.000596)	ND (0.00113)	ND (0.0000148)	ND (0.00143)	ND (0.00249)

Note: Values in bold exceed background.

[a]EPA November 1986.

[b]Analysis request/chain of custody record.

[c]Dinwiddie, September 1997.

B = Analyte was detected in associated blank.
D = Duplicate sample.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
ft = Foot (feet).
J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the reporting limit, shown in parentheses, or is above the highest calibration level.
ID = Identification.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the minimum detectable limit, shown in parentheses.

ATTACHMENT B

ER SITES 1 AND 3
SUPPLEMENTAL TABLES B-1 THROUGH B-5

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Table B-1
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Gamma Spectroscopy Analytical Results, May, July, and August 1996 and February and March 1997

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Cesium-134		Cesium-137		Cobalt-60		Radium-226	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05486	Pile 1	7-8-96	NA	1.01E+00	2.84E-01	ND (1.83E-02)	--	3.84E-02	2.28E-02	ND (2.36E-02)	--	NR	NR
06214	Pile 1 (off-site laboratory)	3-3-97	NA	5.06	0.65	ND (0.013)	--	0.045	0.026	ND (0.013)	--	0.61	0.46
05586	Pile 2	7-15-96	NA	ND (1.78E-01)	--	ND (4.62E-02)	--	8.52E-02	3.98E-02	ND (3.73E-02)	--	1.70E+00	5.61E-01
05587	Pile 2 (off-site laboratory)	7-15-96	NA	0.145	0.194	ND (0.0308)	--	0.126	0.0487	ND (0.0344)	--	0.779	0.108
05331	Pile 3	5-24-96	NA	1.21E+02	1.88E+01	ND (6.00E-02)	--	3.17E-02	5.80E-03	ND (4.32E-02)	--	NR	NR
05586	Pile 3	7-15-96	NA	2.19E-01	1.09E-01	ND (4.34E-02)	--	7.27E-02	3.76E-02	ND (3.68E-02)	--	7.91E+00	3.60E+00
05587	Pile 3 (off-site laboratory)	7-15-96	NA	0.0478	0.111	ND (0.0240)	--	0.0331	0.0194	ND (0.0375)	--	0.707	0.113
05588	Pile 4	7-17-96	NA	ND (2.35E-01)	--	ND (4.55E-02)	--	1.17E-01	1.48E-01	ND (4.13E-02)	--	NR	NR
05589	Pile 4 (off-site laboratory)	7-17-96	NA	0.315	0.152	ND (0.0291)	--	0.119	0.0327	ND (0.0329)	--	0.698	0.0913
05588	Pile 5	7-17-96	NA	2.06E-01	9.47E-02	ND (4.61E-02)	--	2.49E-02	2.22E-02	ND (3.70E-02)	--	NR	NR
05589	Pile 5 (off-site laboratory)	7-17-96	NA	ND (0.124)	--	ND (0.0248)	--	0.0239	0.0224	ND (0.0298)	--	0.663	0.0762
05590	Pile 6	7-19-96	NA	ND (1.84E-01)	--	ND (4.34E-02)	--	ND (2.06E-02)	--	ND (3.78E-02)	--	NR	NR
05591	Pile 6 (off-site laboratory)	7-19-96	NA	ND (0.137)	--	ND (0.0265)	--	0.0248	0.0199	(0.0203)	0.0205	0.725	0.856
05590	Pile 7	7-19-96	NA	ND (1.74E-01)	--	ND (4.60E-02)	--	ND (3.59E-02)	--	ND (3.97E-02)	--	NR	NR
05591	Pile 7 (off-site laboratory)	7-19-96	NA	0.306	0.222	ND (0.0362)	--	0.0205	0.0247	ND (0.0378)	--	0.717	0.849
05592	Pile 8	7-25-96	NA	3.11E-01	2.16E-01	ND (4.26E-02)	--	1.89E-01	3.21E-01	ND (4.29E-02)	--	NR	NR
05593	Pile 8 (off-site laboratory)	7-25-96	NA	0.0679	0.069	ND (0.0271)	--	0.0597	0.0252	ND (0.0368)	--	0.699	0.115
05592	Pile 8 D	7-25-96	NA	ND (1.25E-01)	--	ND (4.03-02)	--	7.60E-02	2.86E-02	ND (3.90E-02)	--	NR	NR
05593	Pile 8 D (off-site laboratory)	7-25-96	NA	0.181	0.15	ND (0.0257)	--	0.0538	0.0306	ND (0.0361)	--	0.785	0.0891
05614	Pile 9	7-29-96	NA	1.71E+00	3.79E-01	ND (3.76E-02)	--	ND (3.54E-02)	--	ND (3.55E-02)	--	NR	NR
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	0.084	NA	NE	NA	1.76	NA

Refer to footnotes at end of table.

Table B-1 (Continued)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Gamma Spectroscopy Analytical Results, May, July, and August 1996 and February and March 1997

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Cesium-134		Cesium-137		Cobalt-60		Radium-228	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05613	Pile 9 (off-site laboratory)	7-29-96	NA	19.7	0.38	ND (0.0239)	--	0.0113	0.0236	ND (0.0333)	--	0.543	0.0865
05616	Piles 10–14	7-30-96	NA	ND (4.39E-01)	--	ND (3.93E-02)	--	5.80E-02	1.99E-02	ND (2.70E-02)	--	NR	NR
05655	Piles 10–14 (off-site laboratory)	7-30-96	NA	1.61	0.29	ND (0.0245)	--	0.307	0.0507	ND (0.0345)	--	0.841	0.125
05659	Pile 15	8-2-96	NA	ND (2.49E+00)	--	ND (1.33E-01)	--	1.97E+02	2.53E+01	ND (4.68E-02)	--	1.67E+00	1.90E+00
05660	Pile 15 (off-site laboratory)	8-2-96	NA	0.636	0.181	ND (0.0384)	--	15.6	0.21	ND (0.0384)	--	0.615	0.103
05659	Pile 16	8-2-96	NA	1.29E+01	2.37E+00	ND (4.84E-02)	--	9.27E-02	3.82E-02	ND (3.75E-02)	--	ND (4.76E-01)	--
05660	Pile 16 (off-site laboratory)	8-2-96	NA	3.14	0.199	ND (0.0250)	--	0.0790	0.032	ND (0.0360)	--	0.605	0.0786
05663	Piles 17–20	8-6-96	NA	1.04E+01	1.67E+00	ND (4.94E-02)	--	5.45E-02	2.35E-02	ND (4.08E-02)	--	NR	NR
05664	Piles 17–20 (off-site laboratory)	8-6-96	NA	40.9	0.549	ND (0.0268)	--	0.0268	0.0347	ND (0.0313)	--	0.616	0.0781
06228	Pile 21	2-11-97	NA	9.95E-01	1.88E-01	ND (4.00E-02)	--	3.98E-02	2.68E-02	ND (3.41E-02)	--	NR	NR
06229	Pile 22	2-10-97	NA	1.85E+00	4.02E-01	ND (5.11E-02)	--	ND (3.54E-02)	--	ND (4.70E-02)	--	NR	NR
05665	Pile 23	8-7-96	NA	3.87E-01	2.34E-01	ND (4.20E-02)	--	6.95E-01	5.45E-01	ND (2.79E-02)	--	NR	NR
05683	Pile 23 (off-site laboratory)	8-7-96	NA	0.308	0.143	ND (0.0264)	--	0.0791	0.0274	ND (0.0375)	--	0.609	0.093
05665	Pile 24	8-9-96	NA	1.16E+00	5.86E-01	ND (5.75E-02)	--	1.48E+01	1.91E+00	2.55E-02	3.92E-02	NR	NR
05683	Pile 24 (off-site laboratory)	8-7-96	NA	0.757	0.208	ND (0.0389)	--	13.5	1.24	ND (0.0368)	--	0.619	0.122
05688	Pile 25	8-13-96	NA	ND (3.90E-01)	--	ND (5.86E-02)	--	1.29E+01	1.81E+00	ND (5.48E-02)	--	NR	NR
05689	Pile 25 (off-site laboratory)	8-13-96	NA	0.427	0.428	ND (0.0796)	--	18.1	0.255	ND (0.0763)	--	0.966	0.182
06230	Pile 26	2-10-97	NA	2.05E-01	1.01E-01	ND (4.28E-02)	--	5.12E-01	2.14E-01	ND (4.05E-02)	--	NR	NR
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	0.084	NA	NE	NA	1.76	NA
Quality Assurance/Quality Control Samples (all in pCi/mL)													
05614	Pile 9-EB	7-29-96	NA	ND (9.79E-02)	--	ND (2.35E-02)	--	ND (2.36E-02)	--	ND (2.44E-02)	--	NR	NR

Refer to footnotes at end of table.

Table B-1 (Continued)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Gamma Spectroscopy Analytical Results, May, July, and August 1996 and February and March 1997

Sample Attributes				Activity (pCi/g)[a]							
				Radium-228		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05486	Pile 1	7-8-96	NA	7.72E-01	2.86E-01	5.86E-01	2.89E-01	ND (1.12E-01)	--	ND (8.89E-01)	--
06214	Pile 1 (off-site laboratory)	3-3-97	NA	NR	NR	NR	NR	ND (0.088)	--	NR	NR
05586	Pile 2	7-15-96	NA	7.13E-01	5.74E-01	7.45E-01	5.11E-01	ND (1.12E-01)	--	ND (1.09E+00)	--
05587	Pile 2 (off-site laboratory)	7-15-96	NA	0.769	0.169	0.807	0.063	**2.63**	0.327	**117**	3.68
05331	Pile 3	5-24-96	NA	7.60E-01	7.80E-01	9.02E-01	5.08E-01	ND (1.89E-01)	--	ND (1.79E+00)	--
05586	Pile 3	7-15-96	NA	8.30E-01	2.23E-01	6.83E-01	4.60E-01	4.04E-01	1.27E-01	**1.45E+01**	4.01E+00
05587	Pile 3 (off-site laboratory)	7-15-96	NA	0.842	0.191	0.805	0.105	ND (0.194)	--	**6.85**	2.03
05588	Pile 4	7-17-96	NA	7.54E-01	2.87E-01	8.21E-01	4.07E-01	3.88E-01	1.28E-01	**1.33E+01**	6.69E+00
05589	Pile 4 (off-site laboratory)	7-17-96	NA	0.747	0.173	0.935	0.0677	0.147	0.206	**18.8**	1.59
05588	Pile 5	7-17-96	NA	7.70E-01	2.82E-01	7.54E-01	6.76E-01	9.29E-02	1.31E-01	**4.08E+00**	1.44E+00
05589	Pile 5 (off-site laboratory)	7-17-96	NA	0.742	0.14	0.787	0.055	0.117	0.17	**5.90**	1.38
05590	Pile 6	7-19-96	NA	ND (1.67E-01)	--	6.12E-01	3.10E-01	7.18E-02	5.89E-02	**4.50E+00**	1.61E+00
05591	Pile 6 (off-site laboratory)	7-19-96	NA	0.729	27.9	0.881	8.11	0.139	0.211	**9.65**	132
05590	Pile 7	7-19-96	NA	5.40E-01	1.81E-01	5.22E-01	5.39E-01	ND (1.87E-01)	--	**3.39E+00**	2.13E+00
05591	Pile 7 (off-site laboratory)	7-19-96	NA	0.634	24.3	0.715	9.57	**2.21**	0.392	**106**	1450
05592	Pile 8	7-25-96	NA	7.58E-01	3.41E-01	6.90E-01	3.58E-01	ND (1.87E-01)	--	ND (1.35E+00)	--
05593	Pile 8 (off-site laboratory)	7-25-96	NA	0.867	0.201	0.941	0.118	0.103	0.0986	**1.34**	1.06
05592	Pile 8 D	7-25-96	NA	6.49E-01	2.17E-01	7.23E-01	3.99E-01	ND (1.84E-01)	--	ND (1.35E+00)	--
05593	Pile 8 D (off-site laboratory)	7-25-96	NA	0.970	0.129	0.960	0.0590	0.101	0.0849	**1.44**	1.07
05614	Pile 9	7-29-96	NA	8.28E-01	3.10E-01	6.74E-01	3.29E-01	ND (9.70E-02)	--	ND (1.27E+00)	--
Background Soil Activities—North Area Subsurface[d]				1.20	NA	1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table B-1 (Continued)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Gamma Spectroscopy Analytical Results
May, July, and August 1996 and February and March 1997

Sample Attributes				Activity (pCi/g)[a]							
				Radium-228		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05613	Pile 9 (off-site laboratory)	7-29-96	NA	0.784	0.17	0.782	0.0551	ND (0.150)	--	**1.59**	0.978
05616	Piles 10–14	7-30-96	NA	6.34E-01	1.79E-01	6.17E-01	3.16E-01	ND (1.88E-01)	--	ND (2.75E+00)	--
05655	Piles 10–14 (off-site laboratory)	7-30-96	NA	0.953	0.205	0.970	0.121	0.0748	0.161	**2.82**	1.25
05659	Pile 15	8-2-96	NA	**3.87E+00**	6.40E-01	**4.30E+00**	7.50E+00	ND (1.06E+00)	--	ND (1.49E+01)	--
05660	Pile 15 (off-site laboratory)	8-2-96	NA	**2.97**	0.207	**2.99**	0.107	0.108	0.151	**2.53**	2.05
05659	Pile 16	8-2-96	NA	7.74E-01	2.87E-01	6.27E-01	3.14E-01	1.27E-01	1.47E-01	ND (3.48E+00)	--
05660	Pile 16 (off-site laboratory)	8-2-96	NA	0.827	0.152	0.940	0.0476	**0.185**	0.0401	**2.40**	0.961
05663	Piles 17–20	8-6-96	NA	6.21E-01	2.44E-01	5.88E-01	3.10E-01	1.67E-01	1.38E-01	ND (1.63+00)	--
05664	Piles 17–22 (off-site laboratory)	8-6-96	NA	0.748	0.127	0.760	0.0563	0.130	0.126	**2.31**	1.06
06228	Pile 21	2-11-97	NA	5.45E-01	1.86E-01	5.46E-01	2.75E-01	ND (1.75E-01)	--	ND (6.79E-01)	--
06229	Pile 22	2-10-97	NA	5.61E-01	2.32E-01	6.50E-01	3.38E-01	2.83E+00	4.85E-01	**5.16E+01**	1.28E+01
05665	Pile 23	8-9-96	NA	6.05E-01	1.88E-01	6.62E-01	3.20E-01	ND (2.02E-01)	--	ND (2.88E+00)	--
05683	Pile 23 (off-site laboratory)	8-7-96	NA	0.902	0.16	0.782	0.0586	0.0639	0.0908	1.17	0.923
05665	Pile 24	8-7-96	NA	**3.59E+00**	6.00E-01	ND (2.70E-01)	--	3.60E-01	3.42E-01	ND (5.90E+00)	--
05683	Pile 24 (off-site laboratory)	8-7-96	NA	**1.78**	0.307	**1.69**	0.202	ND (0.264)	--	0.849	1.41
05688	Pile 25	8-13-96	NA	**2.99E+01**	4.32E+00	**2.81E+01**	1.24E+01	ND (4.04E-01)	--	ND (3.21E+00)	--
05689	Pile 25 (off-site laboratory)	8-13-96	NA	**29.8**	0.659	**30.6**	0.309	ND (0.545)	--	**2.98**	2.93
06230	Pile 26	2-10-97	NA	8.15E-01	3.85E-01	ND (1.58E-01)	--	ND (1.96E-01)	--	ND (1.37E+00)	--
Background Soil Activities—North Area Subsurface[d]				1.20	NA	1.54	NA	0.18	NA	1.3	NA
Quality Assurance/Quality Control Samples (all in pCi/mL)											
05614	Pile 9-EB	7-29-96	NA	ND (1.52E-01)	--	ND (1.55E-01)	--	ND (1.16E-01)	--	ND (7.29E-01)	--

Refer to footnotes at end of table.

Table B-1 (Concluded)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Gamma Spectroscopy Analytical Results
May, July, and August 1996 and February and March 1997

Note: Values in **bold** exceed background.

[a] Scientific notation of results provided as reported by laboratory.

[b] Analysis request/chain of custody record.

[c] Two standard deviations about the mean detected activity.

[d] Dinwiddie, September 1997.

D	=	Duplicate sample.
EB	=	Equipment blank.
ER	=	Environmental restoration.
ft	=	Foot (feet).
ID	=	Identification.
NA	=	Not applicable.
ND ( )	=	Not detected at or above the minimum detectable activity, shown in parentheses.
NE	=	Background not established for North Area.
NR	=	Not reported in analytical results or Ra-226 values from on-site laboratory not reported because of inaccurate results (analysis of Ra-226 short-lived daughters showed background concentrations in all samples).
pCi/g	=	Picocurie(s) per gram.
PCi/mL	=	Picocurie(s) per milliliter.
--	=	Error not calculated for nondectectable results.

Table B-2
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling, Alpha Spectroscopy Analytical Results, July and August 1996 and January, February, and March 1997 (Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Plutonium-238		Plutonium-239/240		Thorium-228		Thorium-230	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
06214	Pile 1	3-3-97	NA	5.78	0.36	0.626	0.072	31.1	1.6	0.995	0.094	0.774	0.078
05587	Pile 2	7-15-96	NA	0.163	0.0437	0.0724	0.0217	1.45	0.112	1.27 B	0.476	1.69 B	0.377
05587	Pile 3	7-15-96	NA	1.08	0.207	0.808	0.268	6.08	0.735	0.894 B	0.394	1.33 B	0.314
05589	Pile 4	7-17-96	NA	0.141	0.0405	0.0616	0.0212	2.16	0.159	0.875	0.282	1.46	0.302
05589	Pile 5	7-17-96	NA	0.132	0.0309	0.0239	0.0175	0.461	0.0507	1.25	0.285	1.83	0.32
05591	Pile 6	7-19-96	NA	0.112	0.0465	0.0342	0.0226	0.577 B	0.0754	0.955 B	0.158	0.900 B	0.143
05591	Pile 7	7-19-96	NA	0.0214	0.00969	0.0165	0.0116	0.123 B	0.0222	0.710 B	0.119	0.683 B	0.112
05593	Pile 8	7-25-96	NA	0.327	0.0709	0.0283	0.0153	1.01	0.0842	1.26	0.309	1.50	0.321
05613	Pile 9	7-29-96	NA	18.4	1.15	2.12	0.365	107	7.04	1.48	0.255	1.20	0.216
05655	Piles 10–14	7-30-96	NA	0.532	0.0814	0.0514	0.0219	1.85	0.139	1.07	0.243	1.42	0.26
06202	Pile 10	2-17-97	NA	NE	NE	ND (0.015)	--	0.064	0.025	1.01	0.11	0.776	0.087
06203	Pile 11	2-7-97	NA	NE	NE	0.022	0.013	0.575	0.068	1.16	0.12	0.833	0.097
06204	Pile 12	1-31-97	NA	NE	NE	0.0100	0.010	0.154	0.038	1.11	0.13	0.97	0.12
06205	Pile 13	1-31-97	NA	NE	NE	2.23	0.18	113.5	5.8	3.75	0.30	1.56	0.17
06206	Pile 14	1-31-97	NA	NE	NE	0.346	0.058	14.56	0.81	1.20	0.14	1.05	0.12
05660	Pile 15	8-2-96	NA	0.697	0.0958	0.109	0.142	5.62	0.738	6.11	0.937	1.54	0.419
05660	Pile 16	8-2-96	NA	5.90	0.478	2.05	0.648	104	9.32	1.09	0.411	1.31	0.349
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	NE	NA	NE	NA	NE	NA

Refer to footnotes at end of table.

Table B-2 (Continued)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling, Alpha Spectroscopy Analytical Results, July and August 1996 and January, February, and March 1997 (Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Plutonium-238		Plutonium-239/240		Thorium-228		Thorium-230	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05664	Piles 17–20	8-6-96	NA	13.9	1.07	1.10	0.322	50.5	3.42	0.829	0.227	1.69	0.321
06207	Pile 17	2-11-97	NA	NE	NE	0.213	0.047	9.11	0.54	0.91	0.13	0.78	0.11
06208	Pile 18	2-11-97	NA	NE	NE	ND (0.0095)	--	0.038	0.019	1.70	0.16	0.901	0.10
06209	Pile 19	2-11-97	NA	NE	NE	0.011	0.011	0.069	0.026	1.87	0.15	1.053	0.10
06210	Pile 20	2-7-97	NA	NE	NE	5.80	0.84	273	15	1.95	0.18	0.90	0.11
06211	Pile 21	2-11-97	NA	NE	NE	0.060	0.026	3.32	0.25	0.833	0.10	0.803	0.097
06212	Pile 22	2-10-97	NA	NE	NE	0.500	0.072	25.5	1.4	0.786	0.084	0.967	0.094
05683	Pile 23	8-7-96	NA	0.704	0.106	ND (0.129)	--	0.486	0.118	1.23	0.392	1.08	0.129
05683	Pile 24	8-7-96	NA	1.48	0.185	0.145	0.103	8.33	0.827	2.05	0.521	1.37	0.364
05689	Pile 25	8-13-96	NA	ND (0.0465)	--	ND (0.0891)	--	0.0692	0.0458	6.75	0.955	2.21	0.496
06213	Pile 26	2-10-97	NA	NE	NE	0.058	0.024	2.45	0.20	1.41	0.13	0.911	0.096
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	NE	NA	NE	NA	NE	NA
Quality Assurance/Quality Control Samples (all in pCi/L)													
05613	Pile 9-EB	7-29-96	NA	ND (0.0698)	--	ND (0.0845)	--	0.0663	0.0432	ND (0.282)	--	0.754	0.2

Refer to footnotes at end of table.

Table B-2 (Continued)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling, Alpha Spectroscopy Analytical Results, July and August 1996 and January, February, and March 1997
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]							
				Thorium-232		Uranium-233/234		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
06214	Pile 1	3-3-97	NA	0.830	0.081	0.77 B	0.11	0.073	0.034	0.85	0.12
05587	Pile 2	7-15-96	NA	1.03 B	0.295	**97.8**	7.5	**9.19**	1.23	**326**	23.1
05587	Pile 3	7-15-96	NA	1.16 B	0.279	**15.5**	1.32	**1.32**	0.302	**52.7**	3.5
05589	Pile 4	7-17-96	NA	0.944	0.244	**197**	18.2	**17.3**	2.59	**666**	57.9
05589	Pile 5	7-17-96	NA	1.03	0.237	**3.65**	0.653	**0.235**	0.171	**9.03**	1.11
05591	Pile 6	7-18-96	NA	0.943	0.147	**2.67 B**	0.245	**0.227**	0.0538	**8.45 B**	0.641
05591	Pile 7	7-19-96	NA	0.631	0.106	**16.8 B**	1.42	**1.52**	0.328	**76.5 B**	4.88
05593	Pile 8	7-25-96	NA	0.983	0.257	0.419	0.261	0.0348	0.0775	0.994	0.414
05613	Pile 9	7-29-96	NA	0.762	0.17	1.04	0.111	0.0962	0.0294	**1.92**	0.171
05655	Piles 10–14	7-30-96	NA	0.744	0.187	1.58	0.147	0.125	0.0337	**3.75**	0.282
06202	Pile 10	2-17-97	NA	0.954	0.099	1.11 F	0.14	0.066 F	0.032	**1.65 F**	0.18
06203	Pile 11	2-7-97	NA	0.96	0.11	1.01	0.15	0.071	0.039	1.17	0.16
06204	Pile 12	1-31-97	NA	1.10	0.12	0.958	0.096	0.045	0.018	**1.56**	0.13
06205	Pile 13	1-31-97	NA	**3.47**	0.28	**4.17 B**	0.43	**0.46**	0.13	**13.60**	0.95
06206	Pile 14	1-31-97	NA	1.08	0.12	**1.70 B**	0.18	0.176	0.053	**4.19**	0.33
05660	Pile 15	8-2-96	NA	**5.19**	0.802	1.34	0.203	0.118	0.0545	1.23	0.193
05660	Pile 16	8-2-96	NA	1.07	0.323	1.25	0.197	0.0906	0.0516	**1.45**	0.216
Background Soil Activities—North Area Subsurface[d]				1.54	NA	1.6	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table B-2 (Concluded)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling, Alpha Spectroscopy Analytical Results, July and August 1996 and January, February, and March 1997
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]							
				Thorium-232		Uranium-233/234		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
05664	Piles 17–20	8-6-96	NA	0.986	0.242	**4.16**	0.354	**0.375**	0.0712	**13.6**	0.992
06207	Pile 17	2-11-97	NA	0.83	0.11	1.24	0.16	0.169	0.058	**1.80**	0.20
06208	Pile 18	2-11-97	NA	1.44	0.14	1.11	0.15	0.159	0.057	1.12	0.15
06209	Pile 19	2-11-97	NA	**1.76**	0.14	1.03	0.16	0.073	0.041	0.85	0.14
06210	Pile 20	2-7-97	NA	0.92	0.11	**2.09 Y**	0.33	0.108 Y	0.074	**2.80 Y**	0.39
06211	Pile 21	2-11-97	NA	0.870	0.10	**2.08**	0.22	0.082	0.039	**1.90**	0.21
06212	Pile 22	2-10-97	NA	0.791	0.083	**65.9**	3.6	**3.05**	0.34	**70.4**	3.8
05683	Pile 23	8-7-96	NA	0.768	0.247	0.986	0.47	ND (0.293)	--	0.787	0.416
05683	Pile 24	8-7-96	NA	**1.74**	0.412	**7.05**	1.7	**0.247**	0.259	1.13	0.539
05689	Pile 25	8-13-96	NA	**6.18**	0.882	0.887	0.122	0.0422	0.0249	0.796	0.114
06213	Pile 26	2-10-97	NA	1.34	0.12	**1.88**	0.19	0.10	0.040	1.28	0.15
Background Soil Activities—North Area Subsurface[d]				1.54	NA	1.6	NA	0.18	NA	1.3	NA
Quality Assurance/Quality Control Samples (all in pCi/L)											
05613	Pile 9-EB	7-29-96	NA	ND (0.0371)	--	0.126	0.0526	ND (0.0452)	--	0.0276	0.0242

Note: Values in bold exceed background.

[a]Scientific notation of results provided as reported by laboratory.

[b]Analysis request/chain of custody record.

[c]Two standard deviations about the mean detected activity.

[d]Dinwiddie, September 1997.

B = Associated analyte was detected in the method blank.
EB = Equipment blank.
ER = Environmental restoration.
F = Full width half max exceeded the acceptance limits.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
Y = Chemical yield exceeded acceptance limits.
-- = Error not calculated for nondetectable results.

Table B-3
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling
Tritium Analytical Results, July and August 1996 and January, February and March 1997
(Off-Site Laboratory)

				Activity (pCi/g)[a]	
				Tritium[c]	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[d]
06214	Pile 1	3-3-97	NA	0.15 B	0.02
05587	Pile 2	7-15-96	NA	15.24	0.07
05587	Pile 3	7-15-96	NA	13.14	0.06
05589	Pile 4	7-17-96	NA	31.02	0.09
05589	Pile 5	7-17-96	NA	6.21	0.04
05591	Pile 6	7-19-96	NA	6.72	0.04
05591	Pile 7	7-19-96	NA	51.08	0.15
05593	Pile 8	7-25-96	NA	60.32	0.14
05613	Pile 9	7-29-96	NA	254.2	0.25
05655	Piles 10–14	7-30-96	NA	30.97	1.75
06202	Pile 10	2-17-97	NA	6.50 B	0.33
06203	Pile 11	2-7-97	NA	98.34 B	4.95
06204	Pile 12	1-31-97	NA	2.66	0.14
06205	Pile 13[e]	1-31-97	NA	22.65	1.15
06206	Pile 14[e]	1-31-97	NA	58.35	2.9
05660	Pile 15	8-2-96	NA	91.23	0.21
05660	Pile 16	8-2-96	NA	461.84	0.37
05664	Piles 17–20	8-6-96	NA	564.35	0.50
06207	Pile 17	2-11-97	NA	50.21	2.50
06208	Pile 18	2-11-97	NA	3.61	0.19
06209	Pile 19	2-11-97	NA	3.97	0.21
06210	Pile 20	2-7-97	NA	184.44 B	9.28
06211	Pile 21	2-11-97	NA	187.11 B	9.35
06212	Pile 22	2-10-97	NA	1616.46 B	80.91
05683	Pile 23	8-7-96	NA	3.56	0.06
05683	Pile 24	8-7-96	NA	29.75	0.10
05689	Pile 25	8-13-96	NA	125.86	5.92
06213	Pile 26	2-10-97	NA	41.41 B	2.06
SNL/NM Background Activity in Surface Soil[f]				0.021	NA
Quality Assurance/Quality Control Samples (all in pCi/L)					
05613	Pile 9-EB	7-29-96	NA	ND (172)	--

Refer to footnotes at end of table.

Table B-3 (Concluded)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling
Tritium Analytical Results, July and August 1996 and January, February and March 1997
(Off-Site Laboratory)

Note: Values in **bold** exceed background.

[a] Scientific notation of results provided as reported by laboratory.

[b] Analysis request/chain of custody record.

[c] Result and error have been converted from pCi/L to pCi/g based upon the percent soil moisture reported by the laboratory.

[d] Two standard deviations about the mean detected activity.

[e] Percent soil moisture not reported by laboratory and result and error based upon an assumed 5 percent soil moisture.

[f] Tharp, February 1999.

B = Associated analyte was detected in the method blank.
EB = Equipment blank.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected above the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SNL/NM = Sandia National Laboratories/New Mexico.
-- = Error not calculated for nondetectable results.

Table B-4
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling
Strontium Analytical Results, January, February and March 1997
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]			
				Strontium-89		Strontium-90	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]
06214	Pile 1	3-3-97	NA	ND (1.5)	--	ND (1.4)	--
06215	Pile 2	2-3-97	NA	0.9	1.1	ND (1.7)	--
06216	Pile 3	2-3-97	NA	ND (1.6)	--	ND (1.5)	--
06217	Pile 4	2-3-97	NA	ND (2.3)	--	1.01 B	0.84
06218	Pile 5	2-4-97	NA	ND (1.4)	--	ND (1.3)	--
06219	Pile 6	2-6-97	NA	ND (1.6)	--	ND (1.5)	--
06220	Pile 7	2-17-97	NA	ND (2.1)	--	ND (1.5) B	--
06221	Pile 8	2-17-97	NA	ND (2.0)	--	ND (1.5) B	--
06222	Pile 9	2-17-97	NA	ND (1.9)	--	ND (1.3) B	--
06202	Pile 10	2-17-97	NA	ND (2.0)	--	**1.24 B**	0.89
06203	Pile 11	2-7-97	NA	ND (1.2)	--	0.82	0.81
06204	Pile 12	1-31-97	NA	ND (1.9)	--	ND (1.7)	--
06205	Pile 13	1-31-97	NA	ND (1.7)	--	ND (1.6)	--
06206	Pile 14	1-31-97	NA	ND (1.9)	--	ND (1.7)	--
06223	Pile 15	2-6-97	NA	ND (1.2)	--	0.91	0.84
06224	Pile 16	1-30-97	NA	ND (1.3)	--	**1.70**	0.99
06207	Pile 17	2-11-97	NA	ND (2.0)	--	ND (1.5)	--
06208	Pile 18	2-11-97	NA	ND (2.1)	--	0.78	0.94
06209	Pile 19	2-11-97	NA	ND (2.0)	--	**1.11**	0.90
06210	Pile 20	2-7-97	NA	ND (1.1)	--	0.66	0.73
06211	Pile 21	2-11-97	NA	ND (2.0)	--	0.69 B	0.79
06212	Pile 22	2-10-97	NA	ND (2.0)	--	ND (1.3) B	--
06225	Pile 23	2-11-97	NA	ND (2.1)	--	0.84	0.93
06226	Pile 24	2-7-97	NA	ND (1.4)	--	ND (1.2)	--
06227	Pile 25	3-3-97	NA	ND (1.5)	--	ND (1.5)	--
06213	Pile 26	2-10-97	NA	ND (2.1)	--	ND (1.4) B	--
Background Soil Activities—North Area Subsurface[d]				NE	NA	1.08	NA

Note: Values in **bold** exceed background.
[a]Scientific notation of results provided as reported by laboratory.
[b]Analysis request/chain of custody record.
[c]Two standard deviations about the mean detected activity.
[d]Dinwiddie, September 1997.

B = Associated analyte was detected in the method blank.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
NE = Not established for North Area.
ND ( ) = Not detected above the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
-- = Error not calculated for nondetectable results.

Table B-5 (Concluded)
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Metals Analytical Results, July and August 1996, and January, February, and March 1997 (On-Site Laboratory)

Sample Attributes				Metals (EPA 6010/7000)[a] (mg/kg)							
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
06251	Pile 21	2-11-97	NA	4.2	200	0.20 B	7.3	7.2	**0.69**	0.70 J (1.4)	ND (0.046)
06252	Pile 22	2-10-97	NA	3.5	200	**2.6 B**	9.3	**20**	**1.2**	0.73 J (1.3)	0.048 BJ (0.17)
06253	Pile 23	2-11-97	NA	1.9 J (2.6)	89	**3.6**	12	**14**	**3.0**	0.63 J (1.3)	**1.8**
06254	Pile 24	2-7-97	NA	2.3 J (2.4)	98	0.98	7.1	7.0	**0.77**	0.52 J (1.2)	ND (0.04)
06255	Pile 25	3-3-97	NA	2.4	110	**6.5 B**	12	**24**	**7.8 E**	0.59 J (1.2)	0.49 B
06256	Pile 26	2-10-97	NA	2.0 J (2.5)	100	0.60 B	5.2	6.7	**0.50**	0.79 J (1.2)	ND (0.041)
05615	Pile 9	7-29-96	NA	ND (4.8)	140	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	**6.4**
05684	Pile 23	8-9-96	NA	ND (4.8)	140	ND (1)	10 J (6.9)	5.7 J (9.2)	ND (0.06)	ND (10)	ND (0.66)
05684	Pile 24	8-9-96	NA	ND (4.8)	110	**34**	8.8 J (6.9)	**79**	ND (0.06)	ND (10)	ND (0.66)
05690	Pile 24	8-13-96	NA	ND (4.8)	190	**5.8 J (3.4)**	9.6 J (6.9)	**15**	ND (0.06)	ND (10)	ND (0.66)
05690	Pile 25	8-13-96	NA	ND (4.8)	**210**	**190**	9.3 J (6.9)	**150**	ND (0.06)	ND (10)	ND (0.66)
Background Soil Concentrations—North Area Subsurface[c]				4.4	200	0.9	12.8	11.2	<0.1	<1	<1
Quality Assurance/Quality Control Samples (all in mg/L)											
05615	Pile 9-EB	7-29-96	NA	ND (0.012)	ND (0.022)	ND (0.009)	ND (0.0016)	ND (0.019)	ND (0.0002)	ND (0.088)	ND (0.005)

Note: Values in **bold** exceed background.

[a]EPA November 1986.

[b]Analysis request/chain of custody record.

[c]Dinwiddie, September 1997.

B = The associated analyte was observed in the method blank.
E = The associated concentration was observed above the highest calibration level.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
J () = The associated concentration was observed below the practical quantitation limit, shown in parentheses, or above the highest calibration level.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND () = Not detected above the method detection limit, shown in parentheses.

Table B-5
Summary of ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling Metals Analytical Results, July and August 1996, and January, February, and March 1997 (On-Site Laboratory)

Sample Attributes				Metals (EPA 6010/7000[a]) (mg/kg)							
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
06231	Pile 1	3-3-97	NA	3.6	130	0.18 B	7.1	6.8	ND (0.044)	0.90 J (1.3)	0.067 BJ (0.18)
06232	Pile 2	2-3-97	NA	2.5 J (2.6)	190	0.45 B	11	7.7 B	ND (0.043)	1.0 J (1.3)	ND (0.043)
06233	Pile 3	2-3-97	NA	3.0	120	0.5 B	8.9	9.5 B	ND (0.043)	0.97 J (1.3)	ND (0.043)
06234	Pile 4	2-3-97	NA	2.6	130	0.35 B	7.7	6.3	ND (0.041)	0.82 J (1.2)	0.068 BJ (0.16)
06235	Pile 5	2-4-97	NA	2.4 J (2.5)	120	0.32	7.1	6.2	ND (0.042)	0.69 J (1.3)	ND (0.042)
06236	Pile 6	2-6-97	NA	2.4 J (2.6)	170	4.1	8.5	5.4	ND (0.042)	0.97 J (1.3)	ND (0.042)
06237	Pile 7	2-17-97	NA	3.3	180	0.53	6.4	4.6	ND (0.041)	0.58 J (1.2)	ND (0.041)
06238	Pile 8	2-17-97	NA	1.3 J (2.4)	200 E	0.6	11	5.8	0.14 J (0.16)	0.79 J (1.2)	ND (0.04)
06239	Pile 9	2-17-97	NA	2 J (2.5)	110	0.65	7.3	6.6	1.8	0.48 J (1.3)	ND (0.042)
06240	Pile 10	2-17-97	NA	2.4 J (2.7)	120	0.2	6.8	4.9	0.54	0.58 J (1.4)	ND (0.046)
06241	Pile 11	2-7-97	NA	2.2 J (2.5)	140	0.25	16	8.4	0.074 J (0.17)	0.66 J (1.2)	ND (0.042)
06243	Pile 12	1-31-97	NA	1.8 J (2.4)	150	0.32 B	8.4	6.5 B	0.18	0.85 J (1.2)	ND (0.04)
06242	Pile 13	1-31-97	NA	2.2 J (2.4)	240 E	0.44 B	11	6.7	0.095 J (0.16)	1.1 J (1.2)	ND (0.041)
06244	Pile 14	1-31-97	NA	2.0 J (2.6)	120	0.41 B	12	7.3 B	0.19	1.3	ND (0.043)
06245	Pile 15	2-6-97	NA	2.6	140	3.6 B	9.8	9.4	1.5	1.1 J (1.3)	0.067 BJ (0.17)
06246	Pile 16	1-30-97	NA	2.1 J (2.4)	130	0.40 B	8.4	41 B	0.12 J (0.16)	0.71 J (1.2)	ND (0.04)
06247	Pile 17	2-11-97	NA	2.6	300 E	0.35	6.6	5.5	0.18	0.62 J (1.2)	ND (0.04)
06248	Pile 18	2-11-97	NA	2.1 J (2.5)	100	0.55	8.0	4.7	0.13 J (0.17)	0.43 J (1.2)	ND (0.042)
06249	Pile 19	2-11-97	NA	2.0 J (2.6)	110	0.41	8.2	4.8	0.15 J (0.17)	0.59 J (1.3)	ND (0.042)
06250	Pile 20	2-7-97	NA	1.4 J (2.5)	100	0.29	8.2	9.4	1.3	0.42 J (1.3)	0.28

Refer to footnotes at end of table.

ATTACHMENT C

ER SITES 1 AND 3
SUPPLEMENTAL TABLES C-1 THROUGH C-4

Table C-1
Summary of ER Sites 1 and 3 Verification Soil Sampling, Gamma Spectroscopy Analytical Results, June, July, and August 1996

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Cesium-134		Cesium-137		Cobalt-60		Radium-226	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Soil Samples													
05685	Verification Pit 1	8-16-96	NA	ND (1.54E-01)	--	ND (3.55E-02)	--	1.28E-01	3.52E-02	ND (3.30E-02)	--	2.27E+00	5.53E-01
05686	Verification Pit 1 (off-site laboratory)	8-1-96	NA	ND (0.156)	--	ND (0.0364)	--	0.0672	0.0547	ND (0.0485)	--	0.762	0.107
05685	Verification Pit 2	8-16-96	NA	ND (1.61E-01)	--	ND (3.73E-02)	--	1.78E-02	7.39E-03	ND (3.60E-02)	--	1.40E+00	5.61E-01
05686	Verification Pit 2 (off-site laboratory)	8-1-96	NA	0.0576	0.0596	ND (0.0267)	--	0.0172	0.018	ND (0.0313)	--	0.686	0.0775
05685	Verification Pit 3/4	8-16-96	NA	ND (1.47E-01)	--	ND (3.32E-02)	--	ND (3.09E-02)	--	ND (3.50E-02)	--	1.29E+00	5.25E-01
05686	Verification Pit 3/4 (off-site laboratory)	8-1-96	NA	ND (0.110)	--	ND (0.0267)	--	0.0104	0.0172	ND (0.0341)	--	0.572	0.0912
05592	Verification Pit 5	7-25-96	NA	ND (1.48E-01)	--	ND (3.53E-02)	--	ND (3.08E-02)	--	ND (3.24E-02)	--	1.15E+00	6.16E-01
05593	Verification Pit 5 (off-site laboratory)	7-25-96	NA	ND (0.106)	--	ND (0.0269)	--	ND (0.0321)	--	ND (0.0312)	--	0.617	0.0998
05685	Verification Pit 6	8-16-96	NA	ND (1.78E-01)	--	ND (4.02E-02)	--	ND (3.63E-02)	--	ND (3.83E-02)	--	1.82E+00	1.17E+00
05686	Verification Pit 6 (off-site laboratory)	8-1-96	NA	0.0495	0.0613	ND (0.0256)	--	ND (0.0320)	--	ND (0.0334)	--	0.808	0.0937
05685	Verification Pit 7	8-16-96	NA	ND (1.60E-01)	--	ND (3.23E-02)	--	ND (2.93E-02)	--	ND (3.17E-02)	--	1.62E+00	5.30E-01
05686	Verification Pit 7 (off-site laboratory)	8-1-96	NA	ND (0.108)	--	0.00895	0.0158	ND (0.0305)	--	ND (0.0306)	--	0.859	0.0907
Concrete Samples													
05484	Pit 6	6-28-96	NA	4.54E-01	1.41E-01	ND (4.31E-02)	--	3.32E-02	2.32E-02	ND (3.59E-02)	--	1.25E+00	5.09E-01
05484	Other Pits	6-28-96	NA	1.27E-01	1.24E-01	ND (4.37E-02)	--	5.36E-02	2.43E-02	ND (3.58E-02)	--	1.46E+00	5.00E-01
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	0.084	NA	NE	NA	1.76	NA

Refer to footnotes at end of table.

Table C-1 (Concluded)
Summary of ER Sites 1 and 3 Verification Soil Sampling, Gamma Spectroscopy Analytical Results, June, July, and August 1996

Sample Attributes				Activity (pCi/g)[a]							
				Radium-228		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Soil Samples											
05685	Verification Pit 1	8-16-96	NA	6.80E-01	2.56E-01	6.40E-01	3.11E-01	ND (1.71E-01)	--	ND (1.18E+00)	--
05686	Verification Pit 1 (off-site laboratory)	8-1-96	NA	0.844	0.181	0.864	0.068	ND (0.219)	--	**1.89**	1.47
05685	Verification Pit 2	8-16-96	NA	6.77E-01	2.23E-01	5.84E-01	3.51E-01	ND (1.67E-01)	--	9.07E-01	7.73E-01
05686	Verification Pit 2 (off-site laboratory)	8-1-96	NA	0.816	0.174	0.821	0.0571	ND (0.161)	--	0.714	1
05685	Verification Pit 3/4	8-16-96	NA	5.84E-01	2.38E-01	5.29E-01	2.64E-01	ND (1.55E-01)	--	ND (1.09E+00)	--
05686	Verification Pit 3/4 (off-site laboratory)	8-1-96	NA	0.729	0.198	0.626	0.0924	0.0838	0.0985	0.614	1.15
05592	Verification Pit 5	7-25-96	NA	5.10E-01	1.66E-01	5.60E-01	2.80E-01	ND (1.57E-01)	--	ND (1.15E+00)	--
05593	Verification Pit 5 (off-site laboratory)	7-25-96	NA	0.733	0.164	0.704	0.0948	0.120	0.1	**1.72**	1.27
05685	Verification Pit 6	8-16-96	NA	7.30E-01	3.13E-01	ND (1.46E-01)	--	ND (1.83E-01)	--	8.99E-01	9.95E-01
05686	Verification Pit 6 (off-site laboratory)	8-1-96	NA	0.795	0.172	0.878	0.0584	0.0802	0.0881	**1.47**	1.05
05685	Verification Pit 7	8-16-96	NA	9.12E-01	2.48E-01	8.09E-01	4.16E-01	ND (1.59E-01)	--	ND (1.14E+00)	--
05686	Verification Pit 7 (off-site laboratory)	8-1-96	NA	0.987	0.139	0.954	0.0609	0.0925	0.0986	**1.78**	1.2
Concrete Samples											
05484	Pit 6	6-28-96	NA	7.09E-01	2.28E-01	7.28E-01	1.25E+00	ND (1.69E-01)	--	6.93E-01	5.59E-01
05484	Other Pits	6-28-96	NA	8.20E-01	2.16E-01	7.90E-01	6.44E-01	ND (1.72E-01)	--	ND (1.27E+00)	--
Background Soil Activities—North Area Subsurface[d]				1.20	NA	1.54	NA	0.18	NA	1.3	NA

Note: Values in **bold** exceed background.

[a]Scientific notation of results provided as reported by laboratory.
[b]Analysis request/chain of custody record.
[c]Two standard deviations about the mean detected activity.
[d]Dinwiddie, September 1997.

ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
-- = Error not calculated for nondectectable results.

Table C-2
Summary of ER Sites 1 and 3 Verification Soil Sampling, Alpha Spectroscopy Analytical Results, June and August 1996
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Plutonium-238		Plutonium-239/240		Thorium-228		Thorium-230	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Soil Samples													
05686	Verification Pit 1	8-1-96	NA	ND (0.0492)	--	0.0237	0.0356	0.0213	0.0203	1.29	0.421	2.35	0.506
05686	Verification Pit 2	8-1-96	NA	ND (0.0587)	--	ND (0.0995)	--	0.0591	0.0441	1.35	0.457	1.63	0.414
05686	Verification Pit 3/4	8-1-96	NA	ND (0.152)	--	ND (0.0482)	--	0.871	0.121	1.22	0.548	2.79	0.69
05686	Verification Pit 6	8-1-96	NA	ND (0.0431)	--	ND (0.0973)	--	0.101	0.0585	1.54	0.46	1.50	0.405
05686	Verification Pit 7	8-1-96	NA	ND (0.0489)	--	ND (0.0418)	--	0.101	0.0363	1.35	0.421	1.89	0.435
Concrete Samples													
05485	Pit 6	6-28-96	NA	NR	NR	0.161	0.036	6.24	0.521	NR	NR	NR	NR
05485	Other Pits	6-28-96	NA	NR	NR	0.0446	0.0144	0.922	0.0822	NR	NR	NR	NR
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	NE	NA	NE	NA	NE	NA

Refer to footnotes at end of table.

Table C-2 (Concluded)
Summary of ER Sites 1 and 3 Verification Soil Sampling, Alpha Spectroscopy Analytical Results,
June and August 1996
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]							
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Thorium-232		Uranium-233/234		Uranium-235		Uranium-238	
				Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Soil Samples											
05686	Verification Pit 1	8-1-96	NA	0.761	0.293	0.962	0.134	0.0614	0.0303	0.726	0.113
05686	Verification Pit 2	8-1-96	NA	0.866	0.31	0.718	0.104	0.0546	0.0262	0.724	0.105
05686	Verification Pit 3/4	8-1-96	NA	0.760	0.364	0.894	0.323	0.0681	0.0794	1.26	0.39
05686	Verification Pit 6	8-1-96	NA	0.768	0.288	0.949	0.133	0.0326	0.0237	0.935	0.132
05686	Verification Pit 7	8-1-96	NA	1.35	0.365	1.07	0.151	0.0599	0.0312	1.25	0.167
Concrete Samples											
05485	Pit 6	6-28-96	NA	NR	NR	NR	NR	NR	NR	NR	NR
05485	Other Pits	6-28-96	NA	NR	NR	NR	NR	NR	NR	NR	NR
Background Soil Activities—North Area Subsurface[d]				1.54	NA	1.6	NA	0.18	NA	1.3	NA

[a]Scientific notation of results provided as reported by laboratory.

[b]Analysis request/chain of custody record.

[c]Two standard deviations about the mean detected activity.

[d]Dinwiddie, September 1997.

ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parentheses.
NE = Background not established for North Area.
NR = Analysis not requested for this sample.
pCi/g = Picocurie(s) per gram.
-- = Error not calculated for nondetectable results.

Table C-3
Summary of ER Sites 1 and 3 Verification Soil Sampling Tritium Analytical Results, June, July, and August 1996
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]	
				Tritium[c]	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[d]
Soil Samples					
05686	Verification Pit 1	8-1-96	NA	**2.77**	0.14
05686	Verification Pit 2	8-1-96	NA	**520.03**	15.44
05686	Verification Pit 3/4	8-1-96	NA	0.18	0.02
05593	Verification Pit 5	7-25-96	NA	**15.08**	0.91
05686	Verification Pit 6	8-1-96	NA	**100.11**	4.62
05686	Verification Pit 7	8-1-96	NA	0.30	0.02
Concrete Samples					
05485	Pit 6	6-28-96	NA	**1.14**	0.029
05485	Other Pits	6-28-96	NA	0.36	0.019
SNL/NM Background Activity in Surface Soil[e]				0.021	NA

Note: Values in **bold** exceed background.
[a]Scientific notation of results provided as reported by laboratory.
[b]Analysis request/chain of custody record.
[c]Result and error have been converted from pCi/L to pCi/g based upon the percent soil moisture reported by the laboratory.
[d]Two standard deviations about the mean detected activity.
[e]Tharp, February 1999.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SNL/NM = Sandia National Laboratories/New Mexico.

Table C-4
Summary of ER Sites 1 and 3 Verification Soil Sampling Metals Analytical Results, August and July 1996

Sample Attributes				Metals (EPA 6010/7000[a]) (mg/kg)							
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Soil Samples											
05686	Verification Pit 1 (off-site laboratory)	8-1-96	NA	1.84	118	ND (0.0105)	3.54	4.82	ND (0.02)	0.283 J (0.481)	ND (0.0212)
05686	Verification Pit 2 (off-site laboratory)	8-1-96	NA	2.73	145	ND (0.0105)	5.53	5.39	1.34	ND (0.114)	0.168 J (0.926)
05686	Verification Pit 3/4 (off-site laboratory)	8-1-96	NA	2.43	252	0.108 J (0.467)	7.40	4.16	ND (0.02)	ND (0.114)	ND (0.0212)
05612	Verification Pit 5	7-24-96	NA	ND (4.8)	260	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	5.9
05612	Verification Pit 5 D	7-24-96	NA	ND (4.8)	290	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	5.9
05612	Verification Pit 5 MS/MSD	7-24-96	NA	ND (4.8)	280	ND (1)	ND (1.8)	ND (2.4)	ND (0.06)	ND (10)	5.3
05686	Verification Pit 6 (off-site laboratory)	8-1-96	NA	3.47	127	0.0726 J (0.467)	6.94	6.73	0.120	0.362 J (0.467)	ND (0.0212)
05686	Verification Pit 7 (off-site Laboratory)	8-1-96	NA	2.14	100	0.249 J (0.472)	4.97	5.66	ND (0.02)	ND (0.114)	ND (0.0212)
Background Soil Concentrations—North Area Subsurface[c]				4.4	200	0.9	12.8	11.2	<0.1	<1	<1

Note: Values in **bold** exceed background.

[a]EPA November 1986.

[b]Analysis request/chain of custody record.

[c]Dinwiddie, September 1997.

D = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The associated concentration was observed below the practical limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
MS/MSD = Matrix spike/matrix spike duplicate.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parentheses.

ATTACHMENT D

ER SITES 1 AND 3
SUPPLEMENTAL TABLES D-1 THROUGH D-8

Table D-1
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, Gamma Spectroscopy Analytical Results
August—September 1997 and March 1998

Sample Attributes				Activity (pCi/g)[a]									
				Americium-241		Cesium-134		Cesium-137		Cobalt-60		Radium-226	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Contaminated Soil Separated from Potentially Contaminated Soil Pile 4													
NA	SAN-2-UR-004-HOT	8-19-97	NA	NR	NR	NR	NR	ND (0.11)	--	NR	NR	NR	NR
510250	RWL-SGS-Pile 4	3-30-98	NA	1.0	0.3	0.1	0.1	0.4	0.2	0.4	0.1	1.3	0.4
510638	RWL-SGS-Pile 4 (on-site laboratory)	3-30-98	NA	7.60E-01	1.90E-01	ND (5.41E-02)	--	9.82E-02	3.49E-02	ND (4.06E-02)	--	ND (5.54E-01)	--
Contaminated Soil Separated from Potentially Contaminated Soil Pile 15													
NA	SAN-2-CS-002-HOT	8-15-97	NA	26.6	0.8	NR	NR	0.81	0.11	NR	NR	NR	NR
510250	RWL-SGS-Pile 15	3-30-98	NA	25.9	1.5	0.0	0.0	1.0	0.2	0.0	0.0	1.7	0.4
510638	RWL-SGS-Pile 15 (on-site laboratory)	3-30-98	NA	1.04E+01	1.74E+00	ND (5.47E-02)	--	4.24E-01	1.52E-01	ND (4.00E-02)	--	1.87E+00	8.52E-01
Contaminated Soil Separated from Potentially Contaminated Soil Pile 20													
NA	SAN-2-20-HOT	9-3-97	NA	NR	NR	NR	NR	0.51	0.14	NR	NR	NR	NR
510250	RWL-SGS-Pile 20	3-30-98	NA	35.9	2.4	0.1	0.1	6.1	0.5	0.2	0.1	1.5	0.4
510638	RWL-SGS-Pile 20 (on-site laboratory)	3-30-98	NA	1.49E+02	2.43E+01	ND (5.55E-02)	--	4.50E-01	8.97E-02	ND (4.16E-02)	--	ND (5.50E-01)	--
Contaminated Soil Separated from Potentially Contaminated Soil Pile 25													
NA	SAN-2-25-HOT	8-27-97	NA	NR	NR	NR	NR	16.9	0.62	NR	NR	NR	NR
510250	RWL-SGS-Pile 25	3-30-98	NA	1.3	0.3	0.1	0.1	6.0	0.5	0.0	0.0	1.4	0.3
510638	RWL-SGS-Pile 25 (on-site laboratory)	3-30-98	NA	4.56E+00	7.92E-01	ND (6.94E-02)	--	4.76E+00	6.43E-01	ND (5.09E-02)	--	ND (9.43E-01)	--
Contaminated Soil Separated from Potentially Contaminated Soil Associated with the CDP Area													
NA	SAN-2-27-HOT	9-12-97	NA	NR	NR	NR	NR	0.15	0.09	NR	NR	NR	NR
510250	RWL-SGS-Pile 27	3-30-98	NA	35.7	2.2	0.0	0.0	0.4	0.2	0.0	0.0	1.3	0.3
510638	RWL-SGS-Pile 27 (on-site laboratory)	3-30-98	NA	3.75E+01	6.17E+00	ND (5.07E-02)	--	1.52E-01	4.15E-02	ND (3.59E-02)	--	1.71E+00	6.23E-01
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area													
510250	RWL-SGS-4-15-20-25-27	3-30-98	NA	15.1	1.0	0.1	0.1	4.3	0.4	0.2	0.1	1.3	0.7
510638	RWL-SGS-4-15-20-25-27 (on-site laboratory)	3-30-98	NA	1.11E+01	1.85E+00	ND (5.75E-02)	--	3.02E+00	4.16E-01	ND (4.16E-02)	--	ND (7.41E-01)	--
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	0.084	NA	NE	NA	1.76	NA

Refer to footnotes at end of table.

Table D-1 (Continued)
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, Gamma Spectroscopy Analytical Results
August-September 1997 and March 1998

Sample Attributes				Activity (pCi/g)[a]							
				Radium-228		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Contaminated Soil Separated from Potentially Contaminated Soil Pile 4											
NA	SAN-2-UR-004-HOT	8-19-97	NA	0.80	0.28	NR	NR	NR	NR	NR	NR
510250	RWL-SGS-Pile 4	3-30-98	NA	**1.9**	0.3	1.3	53.7	**0.5**	0.1	**16.9**	5.0
510638	RWL-SGS-Pile 4 (on-site laboratory)	3-30-98	NA	6.82E-01	2.53E-01	6.71E-01	3.83E-01	**3.92E-01**	1.90E-01	**1.20E+01**	3.04E+00
Contaminated Soil Separated from Potentially Contaminated Soil Pile 15											
NA	SAN-2-CS-002-HOT	8-15-97	NA	**1.92**	0.49	NR	NR	NR	NR	NR	NR
510250	RWL-SGS-Pile 15	3-30-98	NA	**2.0**	0.5	0.0	0.0	**0.2**	0.1	**6.4**	2.0
510638	RWL-SGS-Pile 15 (on-site laboratory)	3-30-98	NA	1.31E+00	3.23E-01	1.34E+00	6.17E-01	ND (2.16E-01)	--	1.25E+00	7.81E-01
Contaminated Soil Separated from Potentially Contaminated Soil Pile 20											
NA	SAN-2-20-HOT	9-3-97	NA	**5.5**	0.69	NR	NR	NR	NR	NR	NR
510250	RWL-SGS-Pile 20	3-30-98	NA	**1.9**	0.6	0.0	0.0	**0.2**	0.1	**9.9**	4.8
510638	RWL-SGS-Pile 20 (on-site laboratory)	3-30-98	NA	1.10E+00	3.57E-01	1.19E+00	5.71E-01	1.41E-01	9.84E-02	**2.44E+00**	7.91E-01
Contaminated Soil Separated from Potentially Contaminated Soil Pile 25											
NA	SAN-2-25-HOT	8-27-97	NA	**13.4**	1.2	NR	NR	NR	NR	NR	NR
510250	RWL-SGS-Pile 25	3-30-98	NA	**4.4**	0.7	0.0	0.0	**0.2**	0.1	**6.3**	1.7
510638	RWL-SGS-Pile 25 (on-site laboratory)	3-30-98	NA	**4.43E+00**	3.04E+00	**4.32E+00**	2.67E+00	**1.85E-01**	1.53E-01	**2.76E+00**	1.40E+00
Contaminated Soil Separated from Potentially Contaminated Soil Associated with the CDP Area											
NA	SAN-2-27-HOT	9-12-97	NA	0.98	0.37	NR	NR	NR	NR	NR	NR
510250	RWL-SGS-Pile 27	3-30-98	NA	**1.7**	0.3	0.0	0.0	0.1	0.1	**2.2**	2.0
510638	RWL-SGS-Pile 27 (on-site laboratory)	3-30-98	NA	7.97E-01	3.45E-01	8.09E-01	4.23E-01	ND (1.92E-01)	--	ND (1.33E+00)	--
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area											
510250	RWL-SGS-4-15-20-25-27	3-30-98	NA	**7.0**	0.8	0.0	0.0	**0.2**	0.1	**6.8**	1.7
510638	RWL-SGS-4-15-20-25-27 (on-site laboratory)	3-30-98	NA	**2.29E+00**	5.63E-01	**2.07E+00**	1.36E+00	1.32E-01	9.47E-02	**3.10E+00**	9.20E-01
Background Soil Activities—North Area Subsurface[d]				1.20	NA	1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table D-1 (Concluded)
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, Gamma Spectroscopy Analytical Results
August-September 1997 and March 1998

Note: Values in bold exceed background.
[a] Scientific notation of results provided as reported by laboratory.
[b] Analysis request/chain of custody record.
[c] Two standard deviations about the meandetected activity.
[d] Dinwiddie, September 1997.

CDP	= Chemical Disposal Pit.
ER	= Environmental restoration.
ft	= Foot (feet).
ID	= Identification.
NA	= Not applicable.
ND ( )	= Not detected at or above the minimum detectable activity, shown in parentheses.
NE	= Background not established for North Area.
NR	= Radionuclide not reported in gamma spectroscopy results (Thermo NuTech, September 1997).
pCi/g	= Picocurie(s) per gram.
--	= Error not calculated for nondetectable results.

Table D-2
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, Alpha Spectroscopy Analytical Results, August—September 1997 and March 1998 (Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]									
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Americum-241 Result	Americum-241 Error[c]	Nickel-63 Result	Nickel-63 Error[c]	Plutonium-238 Result	Plutonium-238 Error[c]	Plutonium-239/240 Result	Plutonium-239/240 Error[c]	Strontium-90 Result	Strontium-90 Error[c]
Contaminated Soil Separated from Potentially Contaminated Soil Pile 4													
NA	SAN-2-UR-004-HOT	8-19-97	NA	3.78	0.50	NR	NR	0.32	0.09	18.37	1.35	NR	NR
Contaminated Soil Separated from Potentially Contaminated Soil Pile 15													
NA	SAN-2-CS-002-HOT	8-15-97	NA	13.1	1.7	NR	NR	0.86	0.23	49.5	3.6	NR	NR
Contaminated Soil Separated from Potentially Contaminated Soil Pile 20													
NA	SAN-2-20-HOT	9-3-97	NA	23	5.8	NR	NR	2.2	0.4	110	7.3	NR	NR
Contaminated Soil Separated from Potentially Contaminated Soil Pile 25													
NA	SAN-2-25-HOT	8-27-97	NA	2.07	0.50	NR	NR	0.74	0.15	14.41	1.12	NR	NR
Contaminated Soil Separated from Potentially Contaminated Soil Associated with the CDP Area													
NA	SAN-2-27-HOT	9-12-97	NA	52	19	NR	NR	4.12	0.61	208	15	NR	NR
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area													
510250	RWL-SGS-WAC	3-30-98	NA	22.5	14.3	0.3	3.2	59.5	23.0	70.3	25.3	0.9	0.880
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	NE	NA	NE	NA	1.08	NA

Refer to footnotes at end of table.

Table D-2 (Concluded)
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, Alpha Spectroscopy Analytical Results, August-September 1997 and March 1998 (Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)[a]											
				Thorium-228		Thorium-230		Thorium-232		Uranium-234		Uranium 235		Uranium-238	
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Contaminated Soil Separated from Potentially Contaminated Soil Pile 4															
NA	SAN-2-UR-004-HOT	8-19-97	NA	1.37	0.34	0.91	0.25	0.94	0.25	**18.1**	1.98	**1.13**	0.29	**56.2**	5.54
Contaminated Soil Separated from Potentially Contaminated Soil Pile 15															
NA	SAN-2-CS-002-HOT	8-15-97	NA	1.97	0.81	1.09	0.44	**2.21**	0.61	1.43	0.41	0.10	0.09	**1.47**	0.38
Contaminated Soil Separated from Potentially Contaminated Soil Pile 20															
NA	SAN-2-20-HOT	9-3-97	NA	6.6	1.0	1.2	0.3	**4.9**	0.7	**2.4**	0.6	ND (0.24)	--	**4.7**	0.9
Contaminated Soil Separated from Potentially Contaminated Soil Pile 25															
NA	SAN-2-25-HOT	8-27-97	NA	15.10	1.72	2.36	0.42	**16.21**	1.82	**8.3**	1.2	**0.21**	0.14	**3.4**	0.62
Contaminated Soil Separated from Potentially Contaminated Soil Associated with the CDP Area															
NA	SAN-2-27-HOT	9-12-97	NA	1.56	0.43	0.96	0.27	1.20	0.31	0.65	0.47	ND (0.60)	--	1.14	0.66
Composite of Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area															
510250	RWL-SGS-WAC	3-30-98	NA	4.00	0.810	1.18	0.340	**3.68**	0.770	**3.53**	0.800	**0.570**	0.220	**3.68**	0.710
Background Soil Activities—North Area Subsurface[d]				NE	NA	NE	NA	1.54	NA	1.6	NA	0.18	NA	1.3	NA

Note: Values in bold exceed background.

[a] Scientific notation of results provided as reported by laboratory.

[b] Analysis request/chain of custody record.

[c] Two standard deviations about the mean detected activity.

[d] Dinwiddie, September 1997.

CDP = Chemical Disposal Pit.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parentheses.
NE = Background not established for North Area.
NR = Radionuclide not reported in isotopic analysis results (Thermo NuTech, September 1997).
pCi/g = Picocurie(s) per gram.
-- = Error not calculated for nondetectable results.

Table D-3
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, Tritium Analytical Results, March, 1998
(Off-Site Laboratory)

Sample Attributes				Activity (pCi/g)	
				Tritium[b]	
Record Number[a]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[c]
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area.					
510250	RWL-SGS-WAC	3-30-98	NA	**10.9**	0.12
SNL/NM Background Activity in Surface Soil[d]				0.021	NA

Note: Values in **bold** exceed background.
[a]Analysis request/chain of custody record.
[b]Result and error have been converted from pCi/L to pCi/g based upon the percent soil moisture reported by the Laboratory.
[c]Two standard deviations about the mean detected activity.
[d]Tharp, February 1999.
CDP = Chemical Disposal Pit.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SNL/NM = Sandia National Laboratories/New Mexico.

Table D-4
Summary of ER Sites 1 and 3 TCLP Metals Analytical Results, March 1998
(Off-Site Laboratory)

Sample Attributes				Metals (EPA 1311/6010/7000[a]) (mg/L)									
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Selenium	Silver	Zinc
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area													
510250	RWL-SGS-WAC	3-30-98	NA	ND (0.033079)	1.15	0.0741	ND (0.003826)	0.0141 J (0.05)	0.0863	ND (0.000047)	0.0585 J (0.1)	ND (0.002914)	0.243
Maximum concentration of the contaminants for the toxicity characteristic[c]				5.0	100.0	1.0	5.0	NA	5.0	0.2	1.0	5.0	NA

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]40 CFR Part 261.24.

CDP = Chemical Disposal Pit.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the practical quantitation limit, shown in parentheses.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
TCLP = Toxicity characteristic leaching procedure.

Table D-5
Summary of ER Sites 1 and 3 Contaminated Soil Sampling, TCLP HE Analytical Results, March 1998
(Off-Site Laboratory)

Sample Attributes				Explosives (EPA 1311/8330[a]) (µg/L)						
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	2,4,6-trinitrotoluene	2,4-dinitrotoluene	2,6-dinitrotoluene	2-amino-4,6-dinitrotoluene	4-amino-2,6-dinitrotoluene	o-nitrotoluene	m-nitrotoluene
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area										
510250	RWL-SGS-WAC	3-30-98	NA	ND (0.11)	ND (0.10)	ND (0.13)	ND (0.14)	ND (0.16)	ND (0.16)	ND (0.39)

Sample Attributes				Explosives (EPA 1311/8330[a]) (µg/L)						
Record Number[b]	ER Sample ID	Date Sampled	Sample Depth (ft)	p-nitrotoluene	Nitrobenzene	1,3-dinitrobenzene	1,3,5-trinitrobenzene	RDX	Tetryl	HMX
Composite of Contaminated Soil Separated from Potentially Contaminated Soil Pile 4, 15, 20, 25, and CDP Area										
510250	RWL-SGS-WAC	3-30-98	NA	ND (0.19)	**0.22 J (0.5)**	ND (0.11)	ND (0.32)	**0.18 J (0.5)**	ND (0.18)	**0.30 J (0.5)**

Note: Values in **bold** represent detected HE compounds.

[a]EPA November 1986.

[b]Analysis request/chain of custody.

CDP = Chemical Disposal Pit.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
ft = Foot (feet).
HE = High explosives.
HMX = Cyclotetramethylene tetranitramine.
ID = Identification.
J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the practical quantitation limit, shown in parentheses.
µg/L = Microgram(s) per liter.
ND ( ) = Not detected above the MDL, shown in parentheses.
RDX = Cyclo-1,3,5-trimethylene-2,4,6-trinitramine.
TCLP = Toxicity Characteristic Leaching Procedure.
Tetryl = 2,4,6-trinitrophenylmethylnitramine.

Table D-6
Summary of TCLP VOC Analytical Method Detection Limits (EPA Method 8240[a])
Used for ER Sites 1 and 3 Contaminated Soil Sampling, March 1998
(Off-Site Laboratory)

Analyte	MDL (µg/L)
1,1-dichloroethane	1.4
1,2-dichloroethane	2.2
1,1-dichloroethene	2.9
cis-1,2-dichloroethene	1.1
1,2-dichloropropane	3.1
1,4-dichlorobenzene	1.3
1,1,1-trichloroethane	2.2
2-butanone	9.3
Benzene	2.1
Carbon tetrachloride	1.6
Chlorobenzene	0.68
Chloroform	1.8
Tetrachloroethene	1.9
Trichloroethene	1.9
Trichlorofluormethane	2.1
Vinyl chloride	3.3

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/L = Microgram(s) per liter.
TCLP = Toxicity Characteristic Leaching Procedure.
VOC = Volatile organic compound.

Table D-7
Summary of TCLP SVOC Analytical Method Detection Limits (EPA Method 8270[a])
Used for ER Sites 1 and 3 Contaminated Soil Sampling, March 1998
(Off-Site Laboratory)

Analyte	MDL (µg/L)
1,4-dichlorobenzene	1.3
2,4-dinitrotoluene	0.5
2,4,5-trichlorophenol	0.9
2,4,6-trichlorophenol	2.3
Hexachlorobenzene	0.9
Hexachlorobutadiene	0.9
Hexachloroethane	1.1
Nitrobenzene	1.0
Pentachlorophenol	3.7
Pyridine	1.4
m,p-cresol	3.0
o-cresol	1.0

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/L = Microgram(s) per liter.
SVOC = Semivolatile organic compound.
TCLP = Toxicity Characteristic Leaching Procedure.

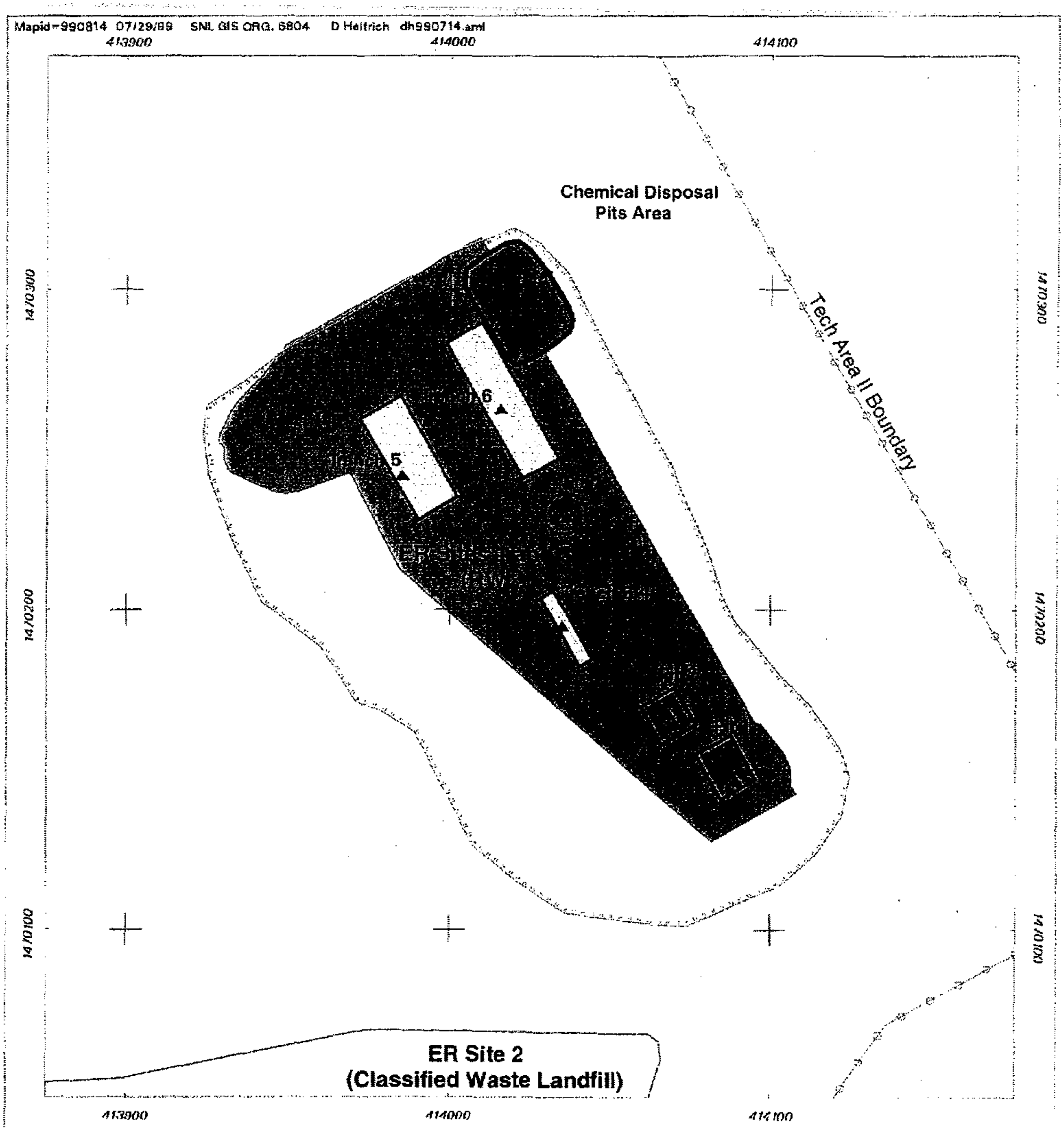
Table D-8
Summary of TCLP Pesticide and Herbicide Analytical Method Detection Limits
(EPA Method 8080 and 8150[a])
Used for ER Sites 1 and 3 Contaminated Soil Sampling, March 1998
(Off-Site Laboratory)

Analyte	MDL (µg/L)
Pesticides	
Chlordane	0.19
Endrin	0.0035
Heptachlor	0.0016
Heptaclor epoxide	0.0014
Lindane	0.0029
Methoxychlor	0.016
Toxaphene	0.12
Herbicides	
2,4-D	12
2,4,5-TP	1.7

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/L = Microgram(s) per liter.
TCLP = Toxicity Characteristic Leaching Procedure.

ATTACHMENT E

ER SITES 1 AND 3
SUPPLEMENTAL FIGURES



Legend

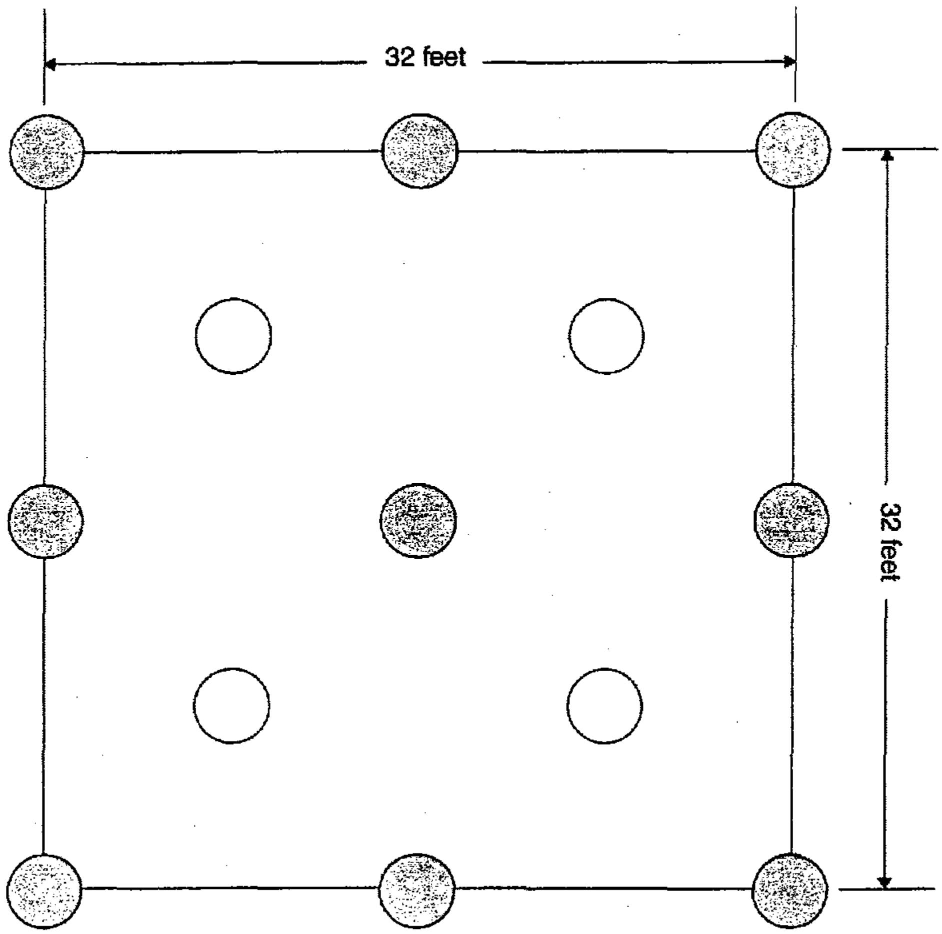
- ▲ 7/28/99 GPS Location
- Fence
- VCM Excavation Limit
- ER Sites 1 and 3
- ER Site 2
- **Historic Pit Location**
- **Historic Trench Location**

Figure 1
ER Sites 1 and 3
Historical Features and
VCM Excavation Limits

0 25 50
Scale in Feet

0 6 12
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



Final verification samples to be composited and analyzed for radiological and chemical analyses

Preliminary verification samples to be field analyzed individually for radiological parameters

Figure 2

ER Sites 1 and 3 Typical Excavation Verification Sampling Grid Cell

ATTACHMENT F

ER SITES 1 AND 3
SUPPLEMENTAL TABLES F-6 AND F-7

Table F-6
Summary of TCLP VOC Analytical Method Detection Limits (EPA Method 8240[a])
Used for ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling, July-August 1996
(Off-Site Laboratory)

Analyte	Aqueous Sample MDL (µg/L)
1,1-dichloroethylene	1–10.0
1,2-dichloroethane	1–10.0
1,4 dichlorobenzene	1–10.0
2-butanone	2–20.0
Benzene	1–10.0
Carbon tetrachloride	1–10.0
Chlorobenzene	1–10.0
Chloroform	1–10.0
Tetrachloroethylene	1–10.0
Trichloroethylene	1–10.0
Vinyl chloride	1–10.0

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/L = Microgram(s) per liter.
TCLP = Toxicity characteristic leaching procedure.
VOC = Volatile organic compound.

Table F-7
Summary of TCLP SVOC Analytical Method Detection Limits (EPA Method 8270[a])
Used for ER Sites 1 and 3 Potentially Contaminated Soil Stockpile Sampling, July-August 1996
(Off-Site Laboratory)

Analyte	Aqueous Sample MDL (µg/L)
2,4,5-trichlorophenol	5–50.0
2,4,6-trichlorophenol	5–50.0
2,4-dinitrotoluene	5–50.0
Hexachlorobenzene	5–50.0
Hexachlorobutadiene	5–50.0
Hexachloroethane	5–50.0
Nitrobenzene	5–50.0
Pentachlorophenol	5–50.0
Pyridine	5–50.0
m,p-cresol	5–11.3
o-cresol	5–50.0

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ER = Environmental restoration.
MDL = Method detection limit.
µg/L = Microgram(s) per liter.
SVOC = Semivolatile organic compound.
TCLP = Toxicity characteristic leaching procedure.

RSI

Department of Energy
National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

MAR 10 2003

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. John E. Kieling, Manager
Permits Management Program
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Rd., Building E
Santa Fe, NM 87505

Dear Mr. Kieling,

On behalf of the Department of Energy (DOE) and Sandia Corporation, DOE is submitting additional information to complete the response to the NMED Request for Supplemental Information (dated October 1999) for SWMUs 1 and 3.

This submittal includes additional information for responses to NMED comments for SWMUs 1 & 3, additional site characterization data, a description of the additional investigation, sample location map, and a revised risk assessment for the site.

The revised risk assessment, presented in the enclosed submittal, concludes: (1) that SWMUs 1 & 3 pose no significant risk to human health under the industrial land-use scenario, and (2) that there is insignificant ecological risk associated with SWMUs 1 & 3 if (as proposed) the VCM excavation is backfilled and covered with five-feet of fill.

DOE and Sandia are requesting a determination that SWMUs 1 & 3 are acceptable for No Further Action.

MAR 10 2003

If you have any questions, please contact John Gould at (505) 845-6089.

Sincerely,

Karen L Boardman

Karen L. Boardman
Manager

[redacted]
Paul

cc w/enclosure:
M. Gardipe, ERD
W. Moats, NMED-HWB (via Certified Mail)
L. King, USEPA, Region 6 (2 copies via Certified Mail)
J. Parker, NMED-OB
R. Kennett, NMED-OB

cc w/o enclosure:

J. Bearzi, NMED-HWB
J. Estrada, SSO-AIP
F. Nimick, SNL, MS 1087
D. Stockham, SNL, MS 1087
M. Davis, SNL, MS 1087
E. Krauss, SNL, MS 0141
E. Vinsant, SNL, MS 1087
C. Chocas, SNL, MS1087
SSO Legal File

MAR 12 2003

Sandia National Laboratories
Albuquerque, New Mexico
December 2002

Environmental Restoration Project
Additional Information for
NMED Request for Supplemental Information
(Dated October 1999) to
9th Round No Further Action Proposals
(Dated September 1997)

SWMUs 1 and 3
Radioactive Waste Landfill
and Chemical Disposal Pits

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LIST OF TABLES (Concluded)

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ACRONYMS AND ABBREVIATIONS

CDP	Chemical Disposal Pits
cy	cubic yards
DOE	U.S. Department of Energy
HWB	Hazardous Waste Bureau
NFA	No Further Action
NMED	New Mexico Environment Department
OU	Operable Unit
RSI	Request for Supplemental Information
RWL	Radioactive Waste Landfill
SGS	Segmented Gate System
SNL/NM	Sandia National Laboratories/New Mexico
SWMU	Solid Waste Management Unit
VCM	Voluntary Corrective Measure

1.0 INTRODUCTION

This document represents additional information to the New Mexico Environment Department (NMED) Request for Supplemental Information (RSI) on the 9th Round of No Further Action (NFA) proposals (SNL/NM 1997) for Solid Waste Management Units (SWMUs) 1 and 3, the Radioactive Waste Landfill (RWL) and the Chemical Disposal Pits (CDP), in Operable Unit (OU) 1303 (Kieling 1999). A document was submitted by the Department of Energy (DOE) and Sandia National Laboratories/New Mexico (SNL/NM) in October 1999 (SNL/NM 1999) responding to the RSI. The comments and responses contained in the October 1999 RSI response submittal are included in Attachment A for clarity and will be referred to in the additional information provided.

Subsequent to the submittal of the RSI Response (SNL/NM 1999), a meeting was conducted on October 12, 1999 between representatives of the NMED Hazardous Waste Bureau (HWB) and representatives of the SNL/NM Environmental Restoration Project for OU 1303. During these discussions, it was agreed that a new risk assessment would be performed for SWMUs 1 and 3 only, rather than waiting to include SWMU 2 (the Classified Waste Landfill). The NMED also requested that discrete verification samples be collected from the bottom of the excavation and a map be provided of the sampling locations for these verification samples. The NMED specified that the discrete verification samples be analyzed for a specific list of metals and radionuclides.

2.0 ADDITIONAL INFORMATION FOR RESPONSES TO NMED COMMENTS

This section provides additional information related to the comments originally submitted by NMED and responded to by DOE and SNL/NM. The comments are numbered as they were in the original RSI and are restated in bold for clarity, with the additional information highlighted in bold. A complete set of comments and the responses submitted in October 1999 is provided as Attachment A. Only those items for which additional information was requested are presented here.

The final risk assessment is provided in Attachment B. Subsequent to the voluntary corrective measure (VCM) in 1996, NMED requested discrete sampling of the excavated soil piles that had been previously analyzed using composite samples. Consequently, the results for the discrete samples collected from November 1999 through September 2001, with the exception of the tritium analysis for the verification samples, yield the data used for the risk screening assessment. The higher, more conservative, results for tritium from the composite verification samples are used in the risk assessment since the discrete sample results are questionable.

2. **The VCM included the excavation and removal of 96 cy [cubic yards] of debris, 700 cy of contaminated soil, 3,000 cy of potentially contaminated soil, and 5,000 cy of "clean" soil from various pits.**

a. **DOE/SNL must provide data that characterizes the nature of the contaminated soil.**

b. **DOE/SNL must provide information as to the disposition or future disposition of each soil stockpile (whether contaminated, potentially contaminated, or "clean").**

Additional Information for Specific Comment Response 2B

The final risk assessment for SWMUs 1 and 3, discussed later in this response and included as Attachment B, demonstrates that all the remaining soil piles from the RWL and CDP can be returned to the excavation as backfill to complete the VCM. The description and major activities associated with the backfill soil are summarized below.

Soil excavated from the RWL during the VCM excavation in 1996 was initially segregated into various stockpiles based upon field screening and excavation location. Laboratory analyses were used to verify the separation of the soil stockpile into twenty-six "potentially contaminated" soil piles and sixteen "potentially clean" soil piles.

Potentially contaminated soil piles 4,15, 20, 25, and the soil form the CDP area (soil pile 27), were identified as containing radiological constituents with activities well above the risk-based activities. These soil piles were segregated from the other potentially contaminated soils and were processed to remove debris and cobble. The Thermo NUtech Segmented Gate System (SGS) was then used to process these soil piles (Thermo NUtech 1997). Soil identified by the SGS as having elevated activities was characterized and disposed of as waste. The remaining soil was consolidated into a single SGS soil pile that included soil collected from around the SGS unit after it was removed from SWMUs 1 and 3. This soil pile was labeled "uncontaminated" in the earlier RSI. However, laboratory analysis identified low levels of radionuclides remaining in this soil. Consequently, the SGS soil pile is now designated as being "slightly contaminated."

The potentially contaminated soils from the RWL, excluding soil piles 4,15, 20, and 25, were processed to remove the debris and cobble. This process resulted in the potentially contaminated soil piles being consolidated into one consolidated slightly contaminated RWL soil.

Likewise, the potentially clean soil piles were processed in the same manner and were consolidated into one "clean" soil pile. Additional clean soil from bunkers that were decommissioned and demolished has been obtained for backfill of the excavation.

Three additional slightly contaminated soil piles will also be used to backfill the SWMUs 1 and 3 excavation. These soil piles include 1) berm soil used around the potentially contaminated soil piles to prevent runoff; 2) soil identified by the FIDLER® in-situ GPS-coupled survey as being greater than 1.3 times background activity (SNL/NM 2001); and 3) soil collected from around the boundary of SWMUs 1 and 3 to justify the unrestricted radiological release of the site (Fate 2000).

The backfill of SWMUs 1 and 3 excavation is planned as follows. The sorted cobble will be deposited in the bottom of the pits and trenches as a marker layer to define the furthest extent of the excavation. Then the slightly contaminated soil will be backfilled in 6- to 8-inch lifts and compacted. Five feet of the over burden soil will then be spread and compacted on top of the slightly contaminated soil fraction. The site will be plowed and seeded to renovate the area.

3. **Section 6.3, Tables 1, 2, and 3 – Data in these tables indicate that nearly all of the "clean" soil piles are contaminated with low levels of tritium (up to 78.9 pCi/g [picocuries per gram]), and some soil piles contain low concentrations of silver (up to 8.5 mg/kg [milligrams per kilogram]). If any contaminated soil was used to backfill any of the VCM pits, a risk assessment must be done to ensure that this soil does not pose an unacceptable risk to human health and the environment.**

Additional Information for Specific Comment Response 3

Pursuant to discussions with the NMED in meetings on October 12, 1999, it was agreed that discrete verification samples would be collected from the bottom of the SWMUs 1 and 3 pits and trenches. Then a final risk assessment would be performed only on SWMUs 1 and 3 rather than including SWMU 2, as had been stated in the original RSI response.

A complete discussion of the environmental and human health risk assessment performed for both metal and radiological constituents of concern detected at SWMUs 1 and 3 is included in Attachment B. This discussion provides a description of the sampling events and sampling densities. The analytical results for the data used in the risk assessment are presented in Attachments C through G as follows:

- Attachment C—Discrete Sampling of the Slightly Contaminated Discrete Soil Piles: January–March 1997
- Attachment D—Verification Sampling: August 1996 and 1999
- Attachment E—Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile: May–October 2000 and May 2001
- Attachment F—Discrete Sampling of the Consolidated Clean Soil Pile: April 2001
- Attachment G—Discrete Sampling of the Clean Bunker Soil Piles: September 2001

4. **Section 6.4, Tables 1, 2, 3, and 4 – Data in these tables indicate that all of the "potentially contaminated" soil piles are contaminated with low levels of various radionuclides…If any of these soil piles were used to backfill any of the VCM pits, a risk assessment must be done to ensure that this soil does not pose an unacceptable risk to human health and the environment."**

Additional Information for Specific Comment Response 4

Refer to the Additional Information for Specific Comment Response 3 and to Attachment B.

7. **DOE/SNL must provide a map showing where each verification sample was collected.**

Additional Information for Specific Comment Response 7

A revised site map for SWMUs 1 and 3 is attached as Figure 1, showing the final verification grab sample locations collected in November 1999. These locations were suggested by NMED/HWB representatives, and were agreed to by SNL/NM. Discrete soil samples were collected in November 1999.

10. **DOE/SNL must state whether the verification samples are discrete or composite samples.**

Additional Information for Specific Comment Response 10

Discrete verification samples were collected in the SWMUs 1 and 3 VCM in the bottom of the pits and trenches in November 1999. Sample locations, numbers, and analytes were selected through consultation with representatives of the NMED HWB on October 12, 1999.

11. **It is not clear in the risk assessment report...what activities and concentrations were used to calculate radiological and chemical risk to human health and the environment. The risk assessment must consider the levels of contaminants left on site (including backfilled soil). If this is not the case, then the risk assessment must be revised.**

Additional Information for Specific Comment Response 11

Refer to the Additional Information for Specific Comment Response 3 and to Attachment B.

3.0 NO FURTHER ACTION PROPOSAL

The data collected at SWMUs 1and 3 and the risk assessment support the recommendation of NFA for this site.

The risk assessment concluded that SWMUs 1 and 3 pose low risk to human health under both industrial and residential land use scenarios, and the site poses insignificant risk to the ecological receptors because of the burial of backfill material at a depth of greater than 5 feet below ground surface.

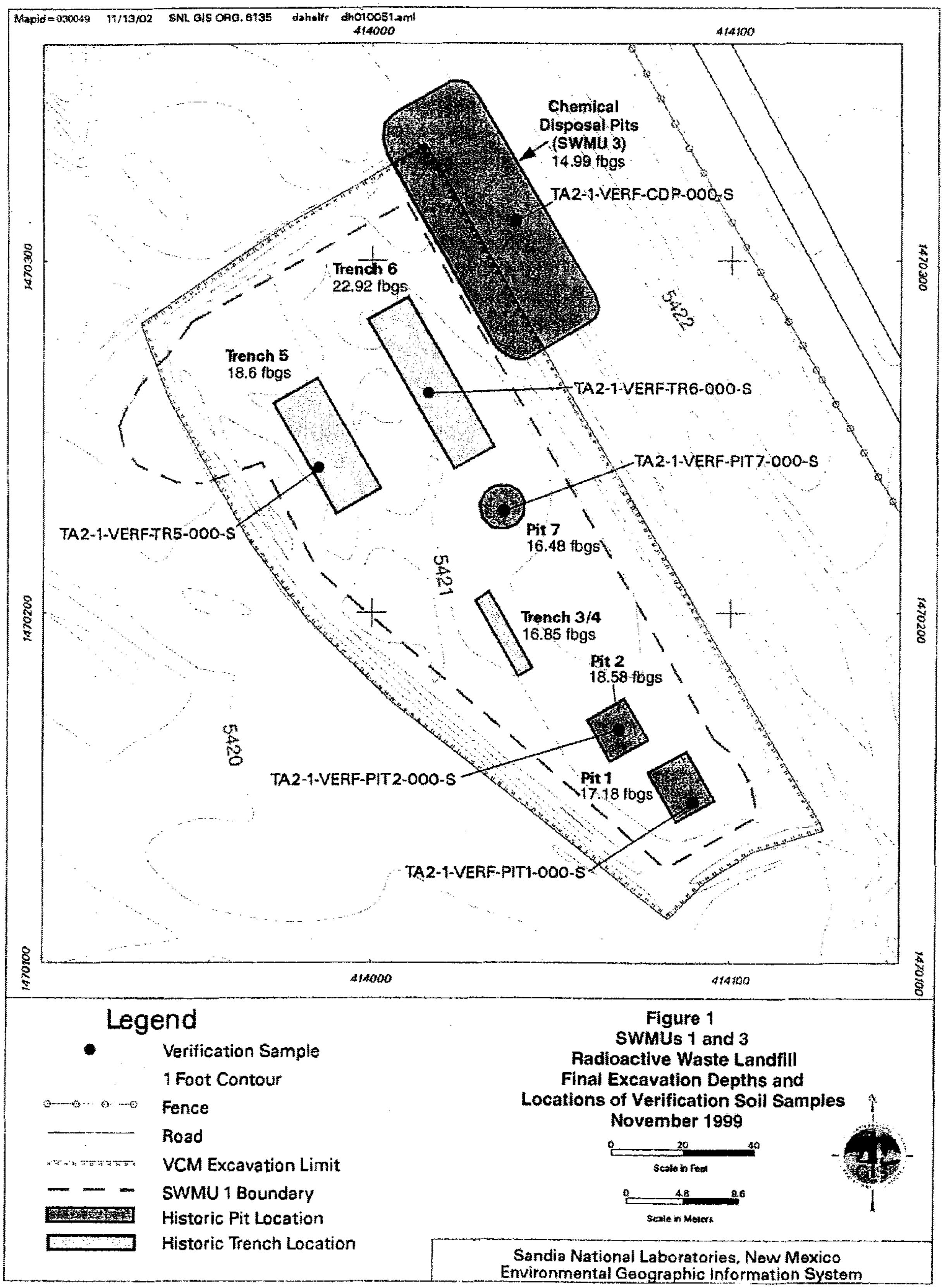

Figure 1
SWMUs 1 and 3
Radioactive Waste Landfill
Final Excavation Depths and
Locations of Verification Soil Samples
November 1999

Based upon the evidence provided above, SWMUs 1 and 3 are proposed for an NFA decision in conformance with Criterion 5 (NMED March 1998), which states "the SWMU/AOC [Area of Concern] has been characterized or remediated in accordance with current applicable state or federal regulations and that available data indicate that contaminants pose an acceptable level of risk under current and projected future land use."

4.0 REFERENCES

Environmental Restoration Group, May 2001. "Radiological Survey of SWMU-1 at TA-2." Environmental Restoration Group, Inc., Albuquerque, New Mexico.

Fate, Dick (Manager, SNL ER Project Closure Department). Letter to John Cormier (DOEKAO), "Justification for Removal of Radiological Restrictions at the Former Radioactive Waste Landfill (ER Sites 1 & 3)," April 5, 2000.

Kieling, John. (New Mexico Environment Department). Letter to Michael Zamorski (DOE) and Joan B. Woodward (SNL/NM), "Request for Supplemental Information – Proposals for No Further Action, September 1997, 9th Round," June 9, 1999.

New Mexico Environment Department (NMED), March 1998. "RPMP Document Requirement Guide," RCRA Permits Management Program, Hazardous and Radioactive Materials Bureau, New Mexico Environment Department, Santa Fe, New Mexico.

Tharp, T. (Sandia National Laboratories/New Mexico), February 1999. Memorandum to F.B. Nimick (Sandia National Laboratories), "Tritium Background Data Statistical Analysis for Site-Wide Surface Soils." Memorandum (unpublished), Albuquerque, New Mexico. February 25, 1999.

Thermo NUtech, September 1997. "Segmented Gate System, TA-II Remediation Project, Sandia National Laboratories, Final Report," Thermo NUtech, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1997. "Proposal for Risk-Based No Further Action, Environmental Restoration Sites 1 and 3, Radioactive Waste Landfill and Chemical Disposal Pits, Operable Unit 1303", Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1999. "Responses to NMED Request for Supplemental Information, No Further Action Proposals (9th Round), Dated September, 1997", Sandia National Laboratories, Albuquerque, New Mexico.

ATTACHMENT A

OCTOBER 1999 RSI RESPONSES

Sandia National Laboratories
Albuquerque, New Mexico
September 1999

Environmental Restoration Project
Responses to NMED Request for Supplemental Information
No Further Action Proposals (9th Round)
Dated September 1997

INTRODUCTION

This document responds to comments received in a letter from the State of New Mexico Environment Department (NMED) to the U.S. Department of Energy (DOE) (Kieling, June 9, 1999) documenting the review of 13 No Further Action (NFA) Proposals submitted in September 1997.

The following five operable units (OU) and thirteen environmental restoration (ER) sites were included in the September 1997 NFA proposals:

- OU 1303
  - ER Sites 1 & 3, Radioactive Waste Landfill and Chemical Disposal Pits
  - ER Site 44, Uranium Calibration Pits and Decontamination Area
- OU 1309
  - ER Site 45, Liquid Discharge
- OU 1332
  - ER Site 19, TRUPAK Boneyard Storage Area
- OU 1333
  - ER Site 59, Pendulum Site
  - ER Site 63A, Balloon Test Area: Plutonium Dispersal Studies Project Site
  - ER Site 64, Gun Site
  - ER Site 63B, Balloon Test Area: Balloon/Helicopter Site

- OU 1334
  - ER Site 11, Radioactive Explosives Burial Mounds
  - ER Site 21, Metal Scrap
  - ER Site 57B, Workman Site: Target Area
  - ER Site 70, Explosives Test Pit
  - ER Site 88B, Firing Site: Instrumentation Poles

Of these thirteen sites, three were designated appropriate for NFA: ER Site 19 (OU 1332) and ER Sites 59 and 63B (in OU 1333). The remaining ten sites have supplemental information included within this response document.

This response document is organized on the first level by OU number and on the second level by ER site number. Each OU section restates the New Mexico Environment Department comments (in **bold font**) in the same order in which they were provided in the call for response to comments. Following each comment, the word "Response" introduces the reply (in normal font style) of the U.S. Department of Energy/Sandia National Laboratories/New Mexico. Responses to general technical comments begin on page 5 and responses to site-specific technical comments begin on page 7. Additional supporting information for the site-specific comments is included in the attachments that follow each OU section. Changes to previously submitted text or tables are provided with redline/strikeout indicators and are labeled "Revised." Changes to previously submitted figures are not provided with redline/strikeout indicators but are labeled "Revised." Newly submitted information (including text, tables, and figures) is labeled "Supplemental."

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RESPONSES TO COMMENTS ON NO FURTHER ACTION PROPOSALS SEPTEMBER 1997 (9TH ROUND)

GENERAL COMMENTS

1. **Drafts of maps, supporting documents, appendices, and data tables are unfinished products. For the purpose of a No Further Action (NFA) proposal, final versions of these and other types of information must be submitted.**

   Response: Final versions of maps, supporting documents, appendices, and data tables will be submitted in this response or subsequent to any additional work.

2. **Tables of laboratory data supplied with some NFA proposals are incomplete. As applicable, data tables should include sample identification numbers, analytical methods, method detection limits (MDL's) or minimum detectable activities (MDA's), analytical results, maximum contaminant limits, and approved background levels. Also, offsite laboratory results must be included and clearly identified.**

   Response: All tables will be completed as requested.

3. **It is helpful to include analytical results for field and equipment blanks, and duplicates in data tables. Quality assurance/quality control (QA/QC) data should not be mixed with environmental data in the same tables. If applicable, the QA/QC data tables should also include comparisons of offsite and onsite laboratory results (e.g., RPD's). The text should include a discussion of field and laboratory quality control results (the good points as well as the not-so-good points) and should indicate whether the sampling results are generally acceptable.**

   Response: For those NFAs for which additional information is requested, the data presentation will be examined and the information requested will be provided in the recommended format.

4. **Many data tables for volatile organic compounds (VOC's), semi-volatile organic compounds (SVOC's), high explosives (HE), and polychlorinated biphenyls (PCB's) list only the constituents that were detected, or list just whether any constituent of a group was detected. While summary tables like these are acceptable (and preferred for review purposes), they provide only part of the information needed to fully evaluate a NFA proposal. To complete the data package, additional tables must be submitted listing all of the various constituents that were analyzed for and their MDL's. Please note that "J-coded" data must be reported as detected constituents.**

General Comments

Response: The additional information will be provided for those specific NFAs for which such information has been requested as part of this Request for Supplemental Information. J-coded data will be reported as detects, as previously agreed to between U.S. Department of Energy, Sandia National Laboratories/New Mexico and the Hazardous and Radioactive Materials Bureau.

5. **For many data tables, sample locations and depths must be inferred from the sample identification numbers. Notes describing how such information is encoded into the sample identification numbers must be added to the tables or to the text.**

Response: The data tables or text referring to the data tables will be revised so that map location, sample locations, and depth all correspond.

6. **To ensure that appropriate background levels are utilized, Area or Super Groups need to be specified for all NFA proposals.**

Response: The area or supergroup for approved background values will be clearly identified. Correct values will be used.

Site-Specific Comments

SPECIFIC COMMENTS

OU 1303

ER Sites 1 & 3, Radioactive Waste Landfill and Chemical Disposal Pits

ER Sites 1 &3 may be appropriate for NFA petition, pending review and approval of the information requested below:

Response: Based on General Comments 1 through 6, the analytical data summary tables from Annex 6.3 (Analytical Results for Stockpiled Suspect Clean Soil), Annex 6.4 (Analytical Results for Stockpiled Suspect Contaminated Soil), and Annex 6.5 (Analytical Results for Excavation Verification) of the original ER Sites 1 and 3 NFA Proposals have been revised and updated based on the current NFA Proposal format. Separate data summary tables have been developed for each analysis and data from both off- and on-site laboratories have been combined.

The revised analytical data summary tables from Annex 6.3 (Analytical Results for Stockpiled Suspect Clean Soil) are presented in Attachment A. Table A-1 summarizes gamma spectroscopy results, Table A-2 summarizes tritium results, and Table A-3 summarizes metals results.

The revised analytical data summary tables from Annex 6.4 (Analytical Results for Stockpiled Suspect Contaminated Soil) are presented in Attachment B. Table B-1 summarizes gamma spectroscopy results, Table B-2 summarizes alpha spectroscopy results, Table B-3 summarizes tritium results, Table B-4 summarizes isotopic strontium results, and Table B-5 summarizes metals results.

The revised analytical data summary tables from Annex 6.5 (Analytical Results for Excavation Verification) are presented in Attachment C. Table C-1 summarizes gamma spectroscopy results, Table C-2 summarizes alpha spectroscopy results, Table C-3 summarizes tritium results, and Table C-4 summarizes metals results.

1. **DOE/SNL must provide an inventory of the types and volumes (or mass) of wastes that were excavated and removed from the various pits as a result of the Voluntary Corrective Measure (VCM).**

Response: The types and volumes of material excavated from ER Sites 1 and 3 during the Voluntary Corrective Measure in 1996 are summarized below. The material consists of a heterogeneous mixture that includes depleted uranium fragments, transformers, neutron generators, a mechanical jack, spark gap tubes, wood, rubber, horse hair, thermal batteries, bomb bolsters, glass, scrap metal, cardboard, nose cone, telephone wire, cesium sources, forceps, gas cylinders, a B-53 weapon mock-up, crucibles, electronic components, glass bottles, some classified components, a fan, cable, iron pipe, plexiglass, a car spring, metal castings, metal tile, and a hydraulic pump. Some of the waste types listed below are tentative since waste disposal options for material suspected of being mixed radioactive and hazardous waste are not finalized. Treatment options for some of the material are also being considered. Most of the material has been shipped for disposal or is being staged at the Sandia National Laboratories/New Mexico Radioactive Mixed Waste Management Facility.

Radioactive Waste:
13 55-gallon drums of classified material
168 55-gallon drums of debris
1 lead pig containing a radium-226 source
2 radioactive sources
2 gallons of vacuum pump oil
1 55-gallon drum of concrete blocks

Potential Mixed Radioactive and Hazardous Waste:
2 55-gallon drums of potentially classified material
8 55-gallon drums of debris
2 20-gallon poly drums of debris
3 55-gallon drums of electrical/electronic components
1 5-gallon bucket of debris
2 744 (7- x 4- x 4-foot) steel boxes of thermal batteries
30 55-gallon drums of thermal batteries
14 55-gallon drums of spark gap tubes
1 55-gallon drum of lead scrap and lead pigs
1 55-gallon drum of potentially classified lead debris

Potential Radioactive/Toxic Substances Control Act Waste:
1 55-gallon drum of asbestos-containing material
1 20-gallon poly drum of asbestos-containing material

Recycled Scrap Metal:
10 pallets of scrap metal (primarily bomb bolsters)

Potential Hazardous Waste:
1.5 gallons of phosphoric acid
20 gallons of nitric acid

Approximately 400 cubic yards of soil were characterized as being radioactive waste and shipped to the Nevada Test Site for disposal in August and September of 1998.

2. **The VCM included the excavation and removal of 96 CY of debris, 700 CY of contaminated soil, 3000 CY of potentially contaminated soil, and 5000 CY of "clean" soil from various pits.**

Site-Specific Comments

A. **DOE/SNL must provide data that characterize the nature of the contaminated soil.**

B. **DOE/SNL must provide information as to the disposition or future disposition of each soil stockpile (whether contaminated, potentially contaminated, or "clean").**

Response A: Refer to Response B for clarification of soil designations "contaminated," "potentially contaminated," and "clean." Analytical results for contaminated soil are listed in Tables D-1 through D-8 of Attachment D for gamma spectroscopy, alpha spectroscopy, tritium, toxicity characteristic leaching procedure metals, volatile organic compounds, semivolatile organic compounds, high explosives, and herbicides and pesticides, respectively.

Because no volatile organic compounds, semivolatile organic compounds, herbicides, or pesticides were detected, Tables D-6, D-7, and D-8 present only the detection limits associated with these analyses.

Response B: "Contaminated" soil was separated from "potentially contaminated" Soil Piles 4, 15, 20, and 25 during processing (screening) through the Thermo NUtech Segmented Gate System in August and September 1997 (Thermo NUtech September 1997). In August and September 1997, additional contaminated soil was separated from potentially contaminated soil associated with the Chemical Disposal Pit area (previously staged on site in 2-cubic-yard "supersacks") by processing (screening) through the Thermo NUtech Segmented Gate System (Thermo NUtech September 1997). All soil characterized as "contaminated," or well above risk-based concentrations indicating the potential for redeposition, was shipped to the Nevada Test Site in August and September 1998.

Soil characterized as "clean" or proposed for redeposition was removed during excavation of the overburden surrounding the waste pits/trenches at the Radioactive Waste Landfill and the Chemical Disposal Pit area. This "clean" soil was initially staged at the Soil Stockpile Area in 16 soil piles. Since that time, these soil piles have all been consolidated into a single mound that remains on site. A second "clean" soil pile contains soil that was separated in August and September 1997 during the screening (processing) of potentially contaminated soil through the Segmented Gate System (Thermo NUtech September 1997). Concentrations of constituents of concern in this pile are believed to be below risk-based levels that would allow redeposition. Both soil piles will eventually be used as backfill for the excavation that remains at ER Sites 1 and 3, following completion and approval by the New Mexico Environment Department of a final risk assessment.

All "potentially contaminated" soil piles remain on site except potentially contaminated Soil Piles 4, 15, 20, and 25, which were processed through the Segmented Gate System in August and September 1997 (Thermo NUtech September 1997). Because of the presence of residual landfill debris in the "potentially contaminated" soil piles, these soils will be processed through the ER Site 2 screening plant for removal of debris before final disposition is determined. All soil processed during the screening activity will be used as backfill as determined by the final site risk assessment.

3. **Section 6.3, Tables 1, 2, and 3 – Data in these tables indicate that nearly all of the "clean" soil piles are contaminated with low levels of tritium (up to 78.9 pCi/g), and some soil piles contain low concentrations of silver (up to 8.5 mg/kg). If any contaminated soil was used to backfill any of the VCM pits, a risk assessment must be done to ensure that this soil does not pose an unacceptable risk to human health and the environment.**

   Response: None of the pits/trenches at ER Sites 1 and 3 have been backfilled. Because of the proximity of ER Sites 1 and 3 to ER Site 2, a final risk assessment covering all three sites will be performed when the excavation of ER Site 2 is complete. At that time, the current risk assessment methodology will be used (as set forth by the New Mexico Environment Department's March 1998 risk guidance) to evaluate the soil piles characterization data. The results of the risk assessment will then determine the level below grade at which the different piles must be redeposited, with soil from overburden or clean fill completing the backfill.

4. **Section 6.4, Tables 1,2,3, and 4 – Data in these tables indicate that all of the "potentially contaminated" soil piles are contaminated with low levels of various radionuclides. Radiological contaminants include Am-241 (up to 121 pCi/g), Cs-137 (up to 197 pCi/g), U-235 (up to 17.3 pCi/g), U-238 (up to 666 pCi/g), U-233/234 (up to 97.8 pCi/g), Pu-238 (up to 2.12 pCi/g), Pu-239/240 (up to 273 pCi/g), and tritium (up to 1600 pCi/g). Additionally, low concentrations of Hg (up to 7.8 mg/kg) and moderate levels of Cd (up to 190 mg/kg) are present in soil piles 9, 15, and 20-26. If any of these soil piles were used to backfill any of the VCM pits, a risk assessment must be done to ensure that this soil does not pose an unacceptable risk to human health and the environment.**

   Response: As stated in the response to Specific Comment 3, no backfilling of the excavation at ER Sites 1 and 3 has occurred. The final risk assessment will include the concentrations of contaminants in the "potentially contaminated" soil piles. Because of the presence of some landfill debris in these soil piles, the soil will be processed through the ER Site 2 screening plant for debris removal before performing the final risk assessment.

5. **DOE/SNL must provide information as to where the various VCM pits were located relative to the historical waste pits that make up ER Sites 1&3.**

   Response: The voluntary corrective measure conducted at ER Sites 1 and 3 did not involve a separate excavation for each historic waste pit/trench. Because of the proximity of the historic waste pits/trenches, the entire Radioactive Waste Landfill/Chemical Disposal Pit area was remediated as a single excavation. Figure 1 in Attachment E depicts the historic Radioactive Waste Landfill Pit/Trench locations relative to the voluntary corrective measure excavation. In addition, the location of the Chemical Disposal Pit area is also shown in Figure 1 (Attachment E), based on the discovery of the type of wastes in the Chemical Disposal Pit during excavation of the Radioactive Waste Landfill.

6. **DOE/ SNL must provide information on the final depth of each VCM pit.**

Response: As noted in the response to Specific Comment 5, the voluntary corrective measure conducted at ER Sites 1 and 3 did not involve a separate excavation for each . However, the final excavation depths at each historic waste pit/trench in ER Sites 1 and 3 are listed below in Table 1.

Table 1.
Final Excavation Depths at the Historic Waste Disposal Pits/Trenches in ER Sites 1 and 3

ER Sites 1 and 3 Pit/Trench Number[a]	Final Excavation Depth (feet)
Pit 1	17.18
Pit 2	18.58
Trench 3/4	16.85
Trench 5	18.6
Trench 6	22.92
Pit 7	16.48

[a]See Figure 1 of Attachment E for the historic waste disposal pit/trench locations.

7. **DOE/SNL must provide a map showing where each verification sample was collected.**

Response: As stated in the original NFA Proposal for ER Sites 1 and 3, verification sampling included collecting surface soil samples (at 0 to 6 inches) from four locations, each equidistant from the center and corner location within each sampling grid cell (SNL/NM September 1997). These surface soil samples were collected from the excavation floor (see response to Specific Comment 9) and then were composited into one sample for analysis for radionuclide and Resource Conservation and Recovery Act metals (see response to Specific Comment 10).

Figure 2 in Attachment E presents the typical sampling grid cell from the Excavation Sampling and Analysis Plan, based on guidance provided by NUREG CR-5849, *Manual for Conducting Radiological Surveys in Support of License Termination* (NRC 1992). Figure 2 (Attachment E) shows the preliminary verification survey locations and the final verification sample locations used to form the composite sample for that grid cell. Based on discussions with former site workers present at the time verification sampling took place, a typical grid cell would be expanded or contracted as necessary to conform to the final excavation dimensions of each historic waste pit/trench location. This approach was used because the final excavation for each historic waste pit/trench resulted in a smaller surface area than a typical sampling grid cell. Table 2 presents the final excavation surface area for each historical waste pit/trench.

Table 2.
Final Excavation Surface Areas at the Historic Waste Disposal Pits/Trenches in ER Sites 1 and 3

ER Site 1 and 3 Pit/Trench Number[a]	Final Excavation Dimensions (feet)	Final Excavation Surface Area ($feet^2$)
Pit 1	12 x 10	120
Pit 2	15 x 14	210
Trench 3/4	5 x 25	125
Trench 5	35 x 12	420
Trench 6	50 x 15	750
Pit 7	15 (diameter)	176
Typical Sampling Grid Cell	32 x 32	1024

[a]See Figure 1 of Attachment E for the historic waste disposal pit/trench locations.

8. **Page 3-4, Section 3.2.7, third paragraph – DOE/SNL must provide data tables showing the results for the analyses of VOC's, SVOC's, PCB's, and HE. See also general comments 2-4.**

   Response: Toxicity characteristic leaching procedure analysis results for volatile organic compounds and semivolatile organic compounds in the samples from the potentially contaminated soil piles are presented Tables F-6 and F-7, respectively, of Attachment F. Because no volatile organic compounds or semivolatile organic compounds were detected, Tables F-6 and F-7 present only the detection limits associated with these analyses.

   Larger debris items removed from the excavation at ER Sites 1 and 3 were field screened for high explosives using EXPRAY. In addition, soil and debris were visually examined for staining or other signs that may indicate the presence of liquids, metals, or high explosives. Based on these field-screening techniques, no high explosives or polychlorinated biphenyls contamination was suspected. As a result, no analyses for polychlorinated biphenyls or high explosives were conducted on the samples from the potentially contaminated soil piles.

9. **Page 3-5, Section 3.2.7, first and second paragraph – these paragraphs refer to "surface-soil samples". For clarification, DOE/SNL must state whether the samples truly represent "surface soil", or whether instead the samples were collected at depths of 0-6" starting at the bottom of the pits.**

Response: The samples depths referred to are from 0 to 6 inches starting at the bottom of the excavation.

10. **DOE/SNL must state whether the verification samples are discrete or composite samples.**

Response: The verification sample results summarized in Tables C-1 through C-4 of Attachment C are based on composite samples.

11. **It is not clear in the risk assessment report (Annex 6.1) what activities and concentrations were used to calculate radiological and chemical risk to human health and the environment. The risk assessment must consider the levels of contaminants left on site (including backfilled soil). If this is not the case, then the risk assessment must be revised.**

Response: When the excavation of ER Site 2 is complete, a final risk assessment (as set forth by the New Mexico Environment Department's March 1998 risk guidance) will be performed that will incorporate contaminant concentrations in verification samples and characterization of backfill soil from ER Sites 1 and 3, and ER Site 2. Therefore, the risk assessment presented in Annex 6.1 should be disregarded pending submittal of the final risk assessment.

ER Sites 1 and 3 References:

Dinwiddie, R.S. (New Mexico Environment Department). Letter to M.J. Zamorski (U.S. Department of Energy), "Request for Supplemental Information: Background Concentrations Report, SNL/KAFB," September 24, 1997.

New Mexico Environment Department (NMED), March 1998. "RPMP Document Requirement Guide," Resource Conservation and Recovery Act Permits Management Program, Hazardous and Radioactive Materials Bureau, New Mexico Environment Department, Santa Fe, New Mexico.

NMED, see New Mexico Environment Department.

Sandia National Laboratories/New Mexico (SNL/NM) September 1997. "Proposal for Risk-Based No Further Action Environmental Restoration Sites 1 and 3 Radioactive Waste Landfill and Chemical Disposal Pits Operable Unit 1303," Environmental Restoration Project, Albuquerque Operations Office, U.S. Department of Energy, Albuquerque New Mexico.

SNL/NM, see Sandia National Laboratories/New Mexico.

Site-Specific Comments

Thermo Nutech, September 1997. "Segmented Gate System, TA-II Remediation Project, Sandia National Laboratories, Final Report," Thermo NUtech, Albuquerque, New Mexico.

NRC, see U.S. Nuclear Regulatory Commission.

U.S. Nuclear Regulatory Commission (NRC), 1992. *Manual for Conducting Radiological Surveys in Support of License Termination*, NUREG/CR-5849, ORAU-92/C57, U.S. Nuclear Regulatory Commission, Washington, D.C.

ATTACHMENT B

FINAL RISK ASSESSMENT FOR SWMUS 1 AND 3

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SWMUs 1 AND 3: RISK SCREENING ASSESSMENT REPORT

I. Site Description and History

I.1 Site Description

Solid Waste Management Units (SWMUs) 1 and 3, the Radioactive Waste Landfill (RWL) and the Chemical Disposal Pits (CDPs), respectively, were located in the eastern portion of Sandia National Laboratories/New Mexico (SNL/NM) Technical Area (TA)-2, about 25 feet west of the eastern apex of the TA-2 perimeter fence. A barbed-wire fence posted with radiation warning signs enclosed the 0.3-acre RWL (Haines et al. August 1991). Information about the location of the CDPs was obtained from interviews with employees, aerial photographs, and regional geophysical survey data.

The regional aquifer in the vicinity of SWMUs 1 and 3 lies within the upper unit of the Santa Fe Group. The depth to groundwater in the nearest monitoring well (TA2-NW1-595) is approximately 520 feet below ground surface (bgs) or 4,889.3 feet above mean sea level. TA2-NW1-595 has a total depth of 598 feet bgs, with screens from 535 to 555 feet bgs and from 585 to 595 feet bgs. A shallow water-bearing zone also exists in the vicinity of SWMUs 1 and 3. The depth to the shallow zone ranges from approximately 267 to 320 feet bgs in the vicinity of SWMUs 1 and 3. Monitoring wells TA2-SW1-325, TA2-NW1-320, WYO-2, TA2-W-19, and TA2-W-01 are located in the vicinity of SWMUs 1 and 3 and are screened in the shallow water-bearing zone.

The essentially flat area gently slopes to the west at approximately 4 percent. The Tijeras Arroyo, the largest drainage feature at SNL/NM, is located directly east of TA-2. The surface geology at SWMUs 1 and 3 consists of unconsolidated alluvial and colluvial deposits derived from the Sandia and Manzanita Mountains. These deposits consist of sediments ranging from clay to gravel derived from the granitic rocks of the Sandia Mountains and greenstone, limestone, and quartzite derived from the Manzanita Mountains (SNL/NM 1996).

The upper unit of the Santa Fe Group underlies surficial deposits. Hawley and Haase (1992) estimate that in this area, the piedmont-slope alluvium may be up to 100 feet thick, and the upper Santa Fe Group unit is approximately 1,200 feet thick.

The piedmont-slope alluvium, which was deposited by the ancestral Tijeras Arroyo, is generally coarse-grained sand and gravel. The upper Santa Fe Group unit was deposited from 5 to 1 million years ago and consists of coarse- to fine-grained fluvial deposits from the ancestral Rio Grande that intertongues with coarse-grained alluvial-fan/piedmont-veneer facies, which extend westward from the Sandia and Manzanita Mountains. SWMUs 1 and 3 are near the easternmost limit of the ancestral Rio Grande deposits (Hawley and Haase 1992).

Several rift-bounding faults are located east of SWMUs 1 and 3. The nearest is the Sandia Fault zone, characterized by north-trending, west-dipping normal faults. The westernmost fault is located approximately 1.2 miles east of the site (Hawley and Haase 1992). The Sandia Fault zone merges with the Tijeras Fault zone and the Hubbell Springs Fault near the southern edge of Kirtland Air Force Base. These faults are discussed in the 1995 Site-Wide Hydrogeologic

Characterization Project Annual Report (SNL/NM 1996), as well as in Hawley and Haase (1992).

1.2 Historical Operations

RWL (SWMU 1)

Initial information about the RWL was obtained from employee interviews (Haines et al. August 1991). The RWL contained three pits and three trenches where low-level radioactive waste was disposed of from 1949 to 1959. After March 1959, all radioactive waste was supposed to have been disposed of at a separate facility in TA-3, although one item removed from the landfill was dated 1978.

The RWL pits were approximately 12 feet wide by 20 feet long by 25 feet deep. The trenches ranged from 5 to 15 feet wide, 25 to 50 feet long, and 15 feet deep. The pits and trenches were labeled Pits 1, 2, and 7 and Trenches 3/4, 5, and 6. The majority of the waste was not containerized before disposal. The pits and trenches were unlined and did not exhibit leachate containment or collection systems. The pits and trenches were filled with debris and then covered with native soil and capped with 3 feet of concrete.

No detailed records of waste material disposed of in the RWL are available. However, U.S. Department of Energy (DOE) Solid Waste Information Management System records showed that an estimated 11,110 cubic feet of radioactive waste was buried in the landfill, with an estimated total activity of 2,847 curies. This estimated volume reportedly referred to disposed material and did not include the backfilled native soil.

Further information on the landfill was acquired during excavation of the landfill and the subsequent characterization of the waste for disposal. The RWL primarily contained low-level waste, although a small amount of transuranic waste material was also present in the landfill. Most of the material buried in the RWL consisted of weapons components, irradiated and neutron-activated material, and radioactive sources. Chemical waste material included lead, thermal batteries, and nitric acid. The weapons components and waste material contained depleted uranium, thorium, tritium, cobalt, cesium, americium, and plutonium.

In 1954, tritiated waste, mainly from booster cylinders, was reportedly buried in the RWL. Other items buried in the RWL included neutron generator parts, irradiated material from nuclear rocket tests, radium-beryllium neutron sources, cobalt sources, cesium-containing gap tubes, and tracer materials collected on fallout plates.

Other waste material in the RWL consisted of laboratory-generated waste such as contaminated gloves, pipettes, absorbent pads, forceps, beakers, test tubes, paper, tools, and clothing. Some of the samples reportedly contained hydrochloric acid, toluene, possibly other solvents, and potentially a total of 2 to 3 grams of plutonium. Low-level waste material from nuclear reactor studies conducted at the Sandia Engineering Reactor Facility and Sandia Pulsed Reactor also were reportedly disposed of in the RWL.

CDPs (SWMU 3)

Initial information about the CDPs was obtained from employee interviews (Haines et al. August 1991). The CDPs reportedly were used in the late 1940s and 1950s to dispose of chemical waste. The CDPs may have been originally excavated with a backhoe, filled with waste, and backfilled with native soil. One former employee recalled that one disposal pit was approximately 10 by 30 feet of an unknown depth. It is not known whether chemicals were disposed of in bulk or in drums. The pits were unlined and were not constructed with leachate containment or monitoring devices. No records were maintained regarding the actual locations of the pits, the types or volumes of chemicals disposed of in the pits, how chemicals were treated, how the pits were excavated, or the exact length of time the pits were actually used.

Because they were co-located, SWMUs 1 and 3 were combined into one site in June 1995. Investigations included passive soil vapor surveys, geophysical surveys, surface soil sampling, and surface radiation surveys.

II. Data Quality Objectives

The soil pile and confirmatory sampling conducted at the RWL was designed to collect adequate samples in order to:

- Determine whether hazardous waste or hazardous constituents had been released at the site.
- Characterize the nature and extent of any releases.
- Provide analytical data of sufficient quality to support risk screening assessments.

Table B-1 summarizes the characterization strategy for the RWL to support the risk assessment. The primary source of constituents of concern (COCs) at the RWL was the radioactive materials buried in the landfill.

Sampling activities conducted from May 1996 through September 2001 are described below. Subsequent to the Voluntary Corrective Measure (VCM) in 1996, the New Mexico Environment Department (NMED) requested discrete sampling of the excavated soil piles that had been previously analyzed using composite samples. Consequently, the majority of the data from the 1996 composite soil sampling are not used in this risk assessment. The results for the discrete samples collected from November 1999 through September 2001, with the exception of the tritium analysis for the verification samples, yield the data used for the risk assessment. For tritium, the higher, more conservative results from the composite verification samples are used because the discrete sample results are questionable.

Composite Soil Pile Sampling: May–August 1996

Soil excavated from the RWL during the excavation VCM in 1996 was initially segregated into various stockpiles based upon field-screening and excavation location. The segregation of all soil stockpiles was verified using laboratory analysis. Excavated soil was segregated into one of two stockpile areas (suspect clean or suspect contaminated). Initial segregation was based

Table B-1
Summary of Soil Sampling Performed to Meet Data Quality Objectives for the RWL and CDPs (SWMUs 1 and 3)

RWL Sampling Components	Potential Source for Constituents of Concern	Number of Sampling Locations	Sample Density	Sampling Location Rationale
Bunker soil – discrete (grab) samples of clean soil	None	14	One sample from 14 discrete locations of soil obtained from bunkers that were decommissioned and demolished	To characterize the clean soil in order to provide data for environmental and human health risk assessment and support returning soil to the excavation site.
RWL consolidated soil pile – discrete (grab) samples of clean soil	Buried material	60	One sample from 60 discrete locations of the clean consolidated soil pile	To characterize the clean soil in order to provide data for environmental and human health risk assessment and support returning soil to the excavation site.
RWL discrete soil piles — discrete (grab) samples of slightly contaminated soil	Buried material	26	One sample per slightly contaminated soil pile	To characterize the slightly contaminated soil in order to provide data for human health risk assessment and support returning soil to the excavation site.
RWL and CDP consolidated soil pile – discrete (grab) samples of slightly contaminated soil	Buried material	103	One sample from 103 discrete locations of the slightly contaminated consolidated soil pile	To characterize the slightly contaminated soil in order to provide data for human health risk assessment and support returning soil to the excavation site.
RWL and CDP discrete verification sampling	Buried material	6	One sample per excavation feature (pit or trench)	To verify adequate cleanup measures for excavation prior to backfilling. Discrete samples collected from a depth of 0–6 inches below the bottom of the excavation. Conducted as requested by NMED.
RWL composite verification sampling	Buried material	5	One sample per excavation feature (pit or trench)	To verify adequate cleanup measures for excavation prior to backfilling. Composite samples collected from a depth of 0–6 inches below the bottom of the excavation.

CDP = Chemical Disposal Pit
NMED = New Mexico Environment Department.
RWL = Radioactive Waste Landfill.
SWMU = Solid Waste Management Unit.

upon field screening for volatile organic compounds (VOCs) and explosives, visual staining or unusual appearance, or radioactivity levels greater than three times background.

For suspect clean soil, approximately 100-gram grab samples were collected from each front-end loader bucket (approximately 5 cubic yards of soil) as it was placed into a stockpile. Each stockpile was kept to approximately 250 cubic yards. Approximately 50 aliquots (100 grams/aliquot) were combined to form one composite sample for each 250-cubic-yard stockpile. The composite samples were analyzed for both radiological and chemical parameters. Radiological analyses included 100 percent on-site analyses of gross alpha/beta, tritium, and gamma spectroscopy. Portions of 20 percent of the samples were also analyzed off site for gamma spectroscopy, tritium, and any isotopic analyses determined to be necessary.

For suspect contaminated soil, a grab sample of approximately 500 grams was collected from each front-end loader bucket as it was placed into a stockpile. Each stockpile was kept to less than 100 cubic yards. Approximately 10 aliquots (500 grams/aliquot) were combined to form one composite sample for each stockpile. Based upon suspected contaminants, the RWL composite samples were analyzed for radionuclides using gamma spectroscopy and alpha spectroscopy, and tritium, Resource Conservation and Recovery Act (RCRA) metals, Toxicity Characteristic Leaching Procedure (TCLP) metals, TCLP semivolatile organic compounds, TCLP VOCs, extractable organic halides, reactive cyanide and reactive sulfide. No data were identified for composite samples taken from the CDP area.

Based upon these analyses, the suspect contaminated soil is designated as slightly contaminated soil and suspect clean soil is designated clean soil.

Discrete Sampling of Slightly Contaminated Discrete Soil Piles: January–March 1997

Subsequent to the VCM in 1996, the NMED requested discrete sampling of the excavated soil piles that had been previously analyzed using composite samples. Therefore, the "grab," or discrete, samples were collected from the potentially contaminated soil piles from January through March 1997. These discrete samples were analyzed for radionuclides, using gamma spectroscopy and alpha spectroscopy, as well as tritium and RCRA metals.

Discrete Verification Sampling: November 1999

Pursuant to a request from the NMED, the bottom of the excavation was resampled in November 1999 to verify adequate cleanup measures. The original verification samples, collected in 1996, were composites. Because the NMED requested discrete samples, new soil samples were collected from the bottom of each pit and trench at the RWL following a sampling strategy approved by the NMED. The samples were analyzed for radionuclides, using gamma spectroscopy and alpha spectroscopy, tritium, and total cadmium, mercury, and silver.

Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile: May–October 2000 and May 2001

The discrete slightly contaminated soil piles were consolidated into a single pile during the process of removing debris and cobble. The consolidated soil pile also contained soil from the CDPs that had been processed through the Thermo NUtech Segregated Gate System (SGS) but not disposed of (Thermo NUtech 1997). Discrete samples were collected from this consolidated soil pile from May through August 2000 and analyzed for radionuclides using gamma spectroscopy. In October 2000 and May 2001, discrete samples were collected and analyzed for radionuclides, using gamma spectroscopy, and RCRA metals. Four of the samples collected in October 2000 were split with NMED and analyzed for tritium as well as radionuclides and metals.

Discrete Sampling of the Consolidated Clean Soil Pile: April 2001

Subsequent to the VCM in 1996, the sixteen discrete clean soil piles were consolidated into a single pile. Discrete samples were collected from the consolidated clean soil pile and analyzed for radionuclides, using gamma spectroscopy and alpha spectroscopy, as well as tritium and RCRA metals.

Discrete Sampling of Clean Bunker Soil Piles: September 2001

Soil obtained from bunkers that were decommissioned and demolished was sampled in September 2001. These discrete samples were analyzed for radionuclides using gamma spectroscopy and alpha spectroscopy, tritium, and RCRA metals.

Table B-2 summarizes the analytical methods and data quality requirements necessary to (1) provide adequate characterization of hazardous waste or hazardous constituents associated with the materials buried in the RWL and (2) support human health and ecological risk screening assessments.

All gamma spectroscopy data were reviewed by SNL/NM Department 7132 (Radiation Protection Sample Diagnostics Laboratory). The data review was conducted in accordance with "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). On-site and off-site laboratory results were reviewed and verified/validated according to "Data Verification/Validation Level 2–DV-2" in Attachment B or "Data Verification/Validation Level 3-DV3" in Attachment C of the Technical Operating Procedure 94-03, Rev. 0 (SNL/NM July 1994). The data quality objectives (DQOs) for SWMUs 1 and 3 have been met.

III. Determination of Nature, Rate, and Extent of Contamination

III.1 Introduction

The determination of the nature, rate, and extent of contamination at SWMUs 1 and 3 was based upon an initial conceptual model validated with confirmatory sampling at the site. The

Table B-2
Summary of Data Quality Requirements for the RWL and CDPs (SWMUs 1 and 3)

Analytical Requirement[a]	Data Quality	Number and Type of Soil Samples	Laboratory Performing Analysis
Composite Verification Sampling: August 1996			
Distillation for tritium	Definitive	5 verification samples	GEL
Slightly Contaminated Discrete Soil Piles: January–March 1997			
EPA Method 6010 for RCRA metals	Definitive	26 discrete samples	ERCL
Gamma spectroscopy	Definitive	4 discrete samples for americium-241 and cesium-137 3 discrete samples for plutonium-239 16 discrete samples for thorium-232, uranium-235 and uranium-238	LAS/RPSD Laboratory
Alpha spectroscopy for isotopic plutonium 238 and plutonium 239/240	Definitive	13 discrete samples	LAS
Distillation for tritium	Definitive	13 discrete samples	LAS
Verification Sampling: November 1999			
EPA Method 6010 for cadmium, and silver	Definitive	7 verification samples including 1 duplicate sample	GEL
EPA Method 7471 for mercury	Definitive	7 verification samples including 1 duplicate sample	GEL
Gamma spectroscopy	Definitive	7 verification samples including 1 duplicate sample	RPSD Laboratory
Alpha spectroscopy for isotopic plutonium-238 and plutonium-239/240	Definitive	7 verification samples including 1 duplicate sample	GEL
Distillation for tritium	Definitive	7 verification samples including 1 duplicate sample	GEL
Discrete Sampling of Slightly Contaminated Consolidated Soil Pile: May–October 2000 and May 2001			
EPA Method 6010 for arsenic, barium, cadmium, chromium, lead, selenium, and silver	Definitive	36 discrete samples including 2 duplicate samples	GEL
EPA Method 7471 for mercury	Definitive	36 discrete samples including 2 duplicate samples	GEL
Gamma spectroscopy	Definitive	105 samples including 2 duplicates for americium-241, cesium-127, thorium-232, uranium-235 and uranium-238 69 samples for plutonium-239	RPSD Laboratory
Distillation for tritium	Definitive	4 discrete samples	GEL
Discrete Sampling of Consolidated Clean Soil Pile: April 2001			
EPA Method 6010 for arsenic, barium, cadmium, chromium, lead, selenium, and silver	Definitive	62 discrete samples including 2 duplicate samples	GEL

Refer to footnotes at end of table.

Table B-2 (Concluded)
Summary of Data Quality Requirements for the RWL and CDPs (SWMUs 1 and 3)

Analytical Requirement[a]	Data Quality	Number and Type of Soil Samples	Laboratory Performing Analysis
EPA Method 7471 for mercury	Definitive	62 discrete samples including 2 duplicate samples	GEL
Gamma spectroscopy	Definitive	62 discrete samples including 2 duplicate samples	RPSD Laboratory
Alpha spectroscopy for isotopic plutonium-238 and plutonium-239/240	Definitive	62 discrete samples including 2 duplicate samples	GEL
Distillation for tritium	Definitive	62 discrete samples including 2 duplicate samples	GEL
Discrete Sampling of Clean Bunker Soil Piles: September 2001			
EPA Method 6010 for arsenic, barium, cadmium, chromium, lead, selenium, and silver	Definitive	15 discrete samples including 1 duplicate sample	GEL
EPA Method 7471 for mercury	Definitive	15 discrete samples including 1 duplicate sample	GEL
Gamma spectroscopy	Definitive	15 discrete samples including 1 duplicate sample	RPSD Laboratory
Alpha spectroscopy for isotopic plutonium-238 and plutonium-239/240	Definitive	15 discrete samples including 1 duplicate sample	GEL
Distillation for tritium	Definitive	15 discrete samples including 1 duplicate sample	GEL

[a]EPA November 1986.
CDP = Chemical Disposal Pit.
EPA = U.S. Environmental Protection Agency.
ERCL = Environmental Restoration Chemistry Laboratory.
GEL = General Engineering Laboratory, Inc.
LAS = Lockheed Analytical Services.
RCRA = Resource Conservation Recovery Act.
RPSD = Radiation Protection Sample Diagnostics.
RWL = Radioactive Waste Landfill.
SWMU = Solid Waste Management Unit.

initial conceptual model was developed from historical background information including site inspections, personal interviews, historical photographs, and numerous field surveys. The DQOs identified the sample locations, sample density, sample depth, and analytical requirements. The sample analytical data were subsequently used to develop the final conceptual model for SWMUs 1 and 3. The quality of the data used to specifically determine the nature, rate, and extent of contamination is described below.

III.2 Nature of Contamination

The nature of contamination at SWMUs 1 and 3 was determined through the analytical testing of soil media and the potential for degradation of relevant COCs (Section V). The analytical requirements included RCRA metals for characterization of nonradiological inorganic constituents potentially released at the site. Gamma and alpha spectroscopy analyses were performed to determine whether plutonium, thorium, or depleted uranium were released at the site. In addition, analyses were performed to determine the presence or absence of tritium. These analyses and methods are appropriate for characterizing the COCs associated with historical activities conducted at SWMUs 1 and 3.

III.3 Rate of Contaminant Migration

The RWL is inactive and has been excavated to remove all man-made materials; therefore, all primary sources of COCs (metals and radionuclides) have been eliminated. The rate of COC migration from surficial soil is, therefore, predominantly dependent upon site meteorological and surface hydrologic processes as described in Section V. Data available from the Site-Wide Hydrogeologic Characterization Project (SNL/NM 1996); numerous SNL/NM air, surface-water, and radiological monitoring programs; biological surveys; and other governmental atmospheric monitoring at Kirtland Air Force Base (i.e., National Oceanographic and Atmospheric Administration) are adequate for characterizing the rate of COC migration at the RWL.

III.4 Extent of Contamination

Surface-soil samples (from the 0- to 6-inch depth) were collected from the bottom(s) of the pits and trenches originally identified and were confirmed during excavation as the primary sources of material and COCs. These sample locations, chosen by the NMED for verification sampling, are deemed appropriate to determine the lateral extent of COC migration.

Because of the relatively low solubility of most metals and radionuclides, limited precipitation, and high evapotranspiration rates, the vertical rate of contamination migration is expected to be extremely low.

In summary, the design of the confirmatory sampling was appropriate and adequate to determine the nature, rate, and extent of contamination.

IV. Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. The SWMUs 1 and 3 proposal for No Further Action (NFA) describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs evaluated in this risk assessment include all pertinent radiological and all inorganic COCs for which samples were analyzed. In order to provide conservatism in this risk assessment, the calculation used only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screen listed in Tables B-3 through B-6. Human health nonradiological COCs were also compared to SNL/NM proposed Subpart S action levels (Table B-3) (IT July 1994).

Both radiological and nonradiological COCs were evaluated. The nonradiological COCs included inorganic compounds; however, nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment (EPA 1989). For the radiological COCs, plutonium-239/240 activities obtained using alpha spectrometry were used in lieu of plutonium-239 activities obtained using gamma spectrometry. Alpha spectrometry is a more appropriate method for measuring plutonium-239 activities as this isotope is an alpha emitter.

Table B-3 lists the nonradiological COCs and Table B-5 lists the radiological COCs for the human health risk screening assessment at SWMUs 1 and 3. Tables B-4 and B-6 list the nonradiological and radiological COCs for the ecological risk screening assessment, respectively. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section VI.4 discusses Tables B-3 and B-5, and Sections VII.2 and VII.3 discuss Tables B-4 and B-6.

V. Fate and Transport

The primary releases of COCs at SWMUs 1 and 3 occurred to the subsurface soil resulting from buried waste materials. Subsequent excavation and stockpiling of this soil as part of the VCM performed at this site in 1996 resulted in the exposure, movement, and mixing of these subsurface soils. Suspect clean soils were segregated into a separate stockpile from suspect contaminated soil during excavation. Man-made materials and soil with elevated levels of radiological COCs were removed for off-site disposal. The remaining soil that contains residual COCs will be used to backfill the excavation. Therefore, minimal amounts of COCs at this site will be exposed to the surficial transport mechanisms of wind, surface water, and biota.

The source of water at SWMUs 1 and 3 comes from approximately 8 to 10 inches of precipitation received annually (rain and occasionally snow). Precipitation will either evaporate at or near the point of contact, infiltrate into the soil, or form runoff. Infiltration at the site is enhanced by both the sandy nature of the soil (the soil in the area of the site is primarily Wink fine sandy [USDA June 1977]) and the generally flat terrain, which will limit the extent of lateral transport of soil particles by runoff. Only minimal amounts of COCs in the soil will be exposed to surface-water runoff after reburial of the excavated soil.

Table B-3
Nonradiological COCs for Human Health Risk Assessment at SWMUs 1 and 3 with Comparison to the Associated SNL/NM Background Screening Value, BCF, Log K_{ow}, and Subpart S Screening Value

COC Name	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF >40, log K_{ow} >4)	Subpart S Screening Value[c]	Is Individual COC less than 1/10 of the Action Level?
Arsenic	4.61	4.4	No	44[d]	NA	**Yes**	0.5	**No**
Barium	300 E	200	No	170[e]	NA	**Yes**	6,000	Yes
Cadmium	6.7	<1	No	64[d]	NA	**Yes**	80	Yes
Chromium, total[f]	19.2	12.8	No	16[d]	NA	No	400	Yes
Lead	81.7 J	11.2	No	49[d]	NA	**Yes**	–	–
Mercury	7.8 E	<0.1	No	5,500[d]	NA	**Yes**	20	Yes
Selenium	1.33	<1	No	800[g]	NA	**Yes**	400	Yes
Silver	1.8	<1	No	0.5[d]	NA	No	400	Yes

Note: **Bold** indicates the COCs that exceed the background and/or Subpart S screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), North Supergroup Soils.
[b]NMED (March 1998).
[c]IT Corporation (July 1994).
[d]Yanicak (March 1997).
[e]Neumann (1976).
[f]Assumed to be chromium VI for Subpart S screening procedure.
[g]Callahan et al. (1979).

BCF = Bioconcentration factor.
COC = Constituent of concern.
E = Calibration out of range.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table B-4
Nonradiological COCs for Ecological Risk Assessment at SWMUs 1 and 3 with Comparison to the Associated SNL/NM Background Screening Value, BCF, Log K_{ow}, and Subpart S Screening Value

COC Name	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF >40, log K_{ow} >4)	Subpart S Screening Value[c]	Is Individual COC less than 1/10 of the Action Level?
Arsenic	4.61	4.4	No	44[d]	NA	Yes	0.5	No
Barium	300	200	No	170[e]	NA	Yes	6000	Yes
Cadmium	6.7	<1	No	64[d]	NA	Yes	80	Yes
Chromium, total[f]	19.2	12.8	No	16[d]	NA	No	400	Yes
Lead	81.7 J	11.2	No	49[d]	NA	Yes	–	–
Mercury	0.178	<0.1	No	5,500[d]	NA	Yes	20	Yes
Selenium	1.04 JB	<1	No	800[g]	NA	Yes	400	Yes
Silver	0.527	<1	Unknown	0.5[d]	NA	No	400	Yes

Note: **Bold** indicates the COCs that exceed the background and/or Subpart S screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), North Supergroup Soils.
[b]NMED (March 1998).
[c]IT Corporation (July 1994).
[d]Yanicak (March 1997).
[e]Neumann (1976).
[f]Assumed to be chromium VI for Subpart S screening procedure.
[g]Callahan et al. (1979).

B = Analyte found in associated blank.
BCF = Bioconcentration factor.
COC = Constituent of concern.
J = Estimated value.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table B-5
Radiological COCs for Human Health Risk Assessment at SWMUs 1 and 3 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC Name	Maximum Concentration (pCi/g)	SNL/NM Background Concentration (pCi/g)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Th-232	3.47	1.54	**No**	3,000[c]	No[d]
U-235	3.05	0.18	**No**	900[c]	**Yes**
U-238	70.4	1.3	**No**	900[c]	**Yes**
Tritium	929	0.037[e]	**No**	None	No
Am-241	88.3	NA	**No**	8,000[f]	**Yes**
Pu-238	5.8	NA	**No**	6,000[g]	**Yes**
Pu-239/240	273	NA	**No**	6,000[g]	**Yes**
Cs-137	4,410	0.84	**No**	3,000[h]	**Yes**

Note: **Bold** indicates COCs that exceed background screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), North Supergroup Soils.
[b]NMED (March 1998).
[c]Baker and Soldat (1992).
[d]Yanicak (March 1997).
[e]Conversion of background activity for tritium of 420 pCi/L using 8.7% soil moisture and soil density of 1 g/cc.
[f]Morse and Choppin (1991).
[g]Joshi (1991).
[h]BCF from Whicker and Schultz (1982).

BCF = Bioconcentration factor.
cc = Cubic centimeter(s).
COC = Constituent of concern.
g = Gram(s).
L = Liter(s).
NA = Not applicable—no background values for anthropogenic nuclides.
NMED = New Mexico Environment Department.
pCi = Picocurie(s).
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table B-6
Radiological COCs for Ecological Risk Assessment at SWMUs 1 and 3 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC Name	Maximum Concentration (pCi/g)	SNL/NM Background Concentration (pCi/g)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Th-232	0.99	1.54	Yes	3,000[c]	No[d]
U-235	0.422	0.18	**No**	900[c]	**Yes**
U-238	25	1.3	**No**	900[c]	**Yes**
Tritium	0.2205	0.037[e]	**No**	None	No
Am-241	0.627 (ND)	NA	**No**	8,000[f]	**Yes**
Pu-238	0.184	NA	**No**	6,000[g]	**Yes**
Pu-239/240	2.55	NA	**No**	6,000[g]	**Yes**
Cs-137	0.203	0.84	**No**	3,000[h]	**Yes**

Note: **Bold** indicates COCs that exceed background screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), North Supergroup Soils.
[b]NMED (March 1998).
[c]Baker and Soldat (1992).
[d]Yanicak (March 1997).
[e]Conversion of background activity for tritium of 420 pCi/L using 8.7% soil moisture and soil density of 1 g/cc.
[f]Morse and Choppin (1991).
[g]Joshi (1991).
[h]BCF from Whicker and Schultz (1982).

BCF = Bioconcentration factor.
cc = Cubic centimeter(s).
COC = Constituent of concern.
g = Gram(s).
L = Liter(s).
NA = Not applicable—no background values for anthropogenic nuclides.
ND = Not detected.
NMED = New Mexico Environment Department.
pCi = Picocurie(s).
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Water that infiltrates into the soil will continue to percolate through the soil until field capacity is reached. The effective rooting depth of the natural (undisturbed) soil at SWMUs 1 and 3 is about 60 inches (USDA June 1977). This indicates the depth of the system's transient water cycling zone (the dynamic balance between percolation/infiltration and evapotranspiration). Residual COCs within this zone could be leached deeper into the subsurface soil with the percolation of water through the soil; however, in general, the COCs at this site are not prone to rapid leaching. Because groundwater at this site is greater than 300 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely limited.

COCs can enter the food chain through uptake by plant roots and be transported to aboveground tissues where they can be consumed by herbivores, which can, in turn, be eaten by predators. Once in the food web, COCs can be transported from the site by the movements of the organisms that contain them or other surficial transport mechanisms. However, because SWMUs 1 and 3 occupy only a very small area and the soil at these SWMUs accessible to biota will contain only residual amounts of COCs, food chain transport is expected to be negligible at this site.

The COCs at SWMUs 1 and 3 are all inorganic and elemental in form and are not considered to be degradable. Radiological COCs will undergo decay to stable isotopes or radioactive daughter elements. Other transformations of inorganic constituents could include changes in valence (oxidation/reduction reactions) or incorporation into organic forms (e.g., the conversion of selenite or selenate from soil to seleno-amino acids in plants). However, because of the long half-lives of the radionuclides, the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms is expected to result in significant losses or transformations of these COCs.

Table B-7 summarizes the fate and transport processes that can occur at SWMUs 1 and 3. COCs at this site include both inorganic constituents (metals) and radionuclides. Because the contaminated soil has been exposed only temporarily to surface conditions in stockpiles, and because the soil that has low levels of residual contamination will be reburied, the potential for transport of COCs by wind, surface-water runoff, and biota is low. Significant leaching in the subsurface soil is unlikely and leaching into the groundwater at this site is highly unlikely. The potential for transformation is low and loss through decay of radiological COCs is insignificant because of the long half-lives.

Table B-7
Summary of Fate and Transport at SWMUs 1 and 3

Transport and Fate Mechanism	Existence at Site	Significance
Wind	Yes	Low
Surface runoff	Yes	Low
Migration to groundwater	No	None
Food chain uptake	Yes	Low
Transformation/degradation	Yes	Low

SWMU = Solid Waste Management Unit.

VI. Human Health Risk Screening Assessment

VI.1 Introduction

The human health risk screening assessment of this site includes a number of steps that culminate in a quantitative evaluation of the potential adverse human health effects caused by constituents located at the site. The steps to be discussed include the following:

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach includes two screening procedures. One screening procedure compares the maximum concentration of the COC to an SNL/NM maximum background screening value. COCs that are not eliminated during the first screening procedure are subjected to a second screening procedure that compares the maximum concentration of the COC to the SNL/NM proposed Subpart S action level.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening steps.
Step 5.	Potential toxicity effects (specified as a hazard index [HI]) and estimated excess cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and incremental estimated cancer risk are calculated by subtracting applicable background concentrations directly from maximum on-site contaminant values. This background subtraction applies only when a radiological COC occurs both as contamination and exists as a natural background radionuclide.
Step 6.	These values are compared with guidelines established by the U.S. Environmental Protection Agency (EPA), the NMED, and the DOE to determine whether further evaluation and potential site cleanup are required. Nonradiological COC risk values are also compared to background risk so that an incremental risk can be calculated.
Step 7.	Uncertainties of the above steps are addressed.

VI.2 Step 1. Site Data

Section I of this risk screening assessment provides the site description and history for SWMUs 1 and 3. Section II presents comparison of results to DQOs. Section III describes the determination of the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

SWMUs 1 and 3 have been designated with a future land use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, for comparison, both industrial and residential land use scenarios are evaluated. The residential land use scenario is presented only to provide perspective of the potential risk to human health under the more restrictive conditions. Because of the location and the characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust. Soil ingestion is included for the radiological COCs as well. No water pathways to the groundwater are considered. Depth to groundwater at SWMUs 1 and 3 exceeds 300 feet bgs. Because of the lack of surface water or other significant mechanisms for dermal contact, the dermal exposure pathway is not considered to be significant. No intake routes through plant, meat, or milk ingestion are considered appropriate for the industrial land use scenario. However, plant uptake is considered for the residential land use scenario.

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust)	Inhalation (dust and volatiles)
Plant uptake (residential only)	Plant uptake (residential only)
	Direct gamma

VI.4 Step 3. COC Screening Procedures

This section discusses Step 3, which includes the two screening procedures. The first screening procedure compared the maximum COC concentration to the background screening level. The second screening procedure compared maximum COC concentrations to SNL/NM proposed Subpart S action levels. This second procedure was applied only to COCs that were not eliminated during the first screening procedure.

VI.4.1 Background Screening Procedure

VI.4.1.1 Methodology

Maximum concentrations of nonradiological COCs were compared to the approved SNL/NM maximum screening level for this area. The SNL/NM maximum background concentration was selected to provide the background screen in Table B-3 and was used to calculate risk attributable to background in Section VI.6.2. Only the COCs that either were detected above SNL/NM maximum background screening levels or did not have either a quantifiable or a calculated background screening level were considered in further risk assessment analyses.

For radiological COCs that exceeded the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that did not exceed these background levels were not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have a background value and were detected above the analytical minimum detectable activity were carried through the risk assessment at their maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

VI.4.1.2 Results

Tables B-3 and B-5 present the maximum COC concentrations at SWMUs 1 and 3 that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the nonradiological COCs, eight constituents were measured at concentrations greater than the background screening levels.

The maximum concentration value for lead is 81.7 J milligrams (mg)/kilogram (kg). The EPA intentionally does not provide human health toxicological data on lead; therefore, no risk parameter values could be calculated. However, NMED guidance for lead screening concentrations for construction and industrial land use scenarios is 750 and 1,500 mg/kg, respectively (Olson and Moats March 2000). The EPA lead screening guidance value for a residential land use scenario is 400 mg/kg (Laws July 1994). The maximum concentration value for lead at this site is less than all the screening values; therefore, lead is eliminated from further consideration in the human health risk assessment.

For the radiological COCs, eight constituents (Th-232, U-238, U-235, Am-241, Pu-238, Pu-239, Cs-137, and tritium) exhibited activity concentrations greater than background values. These COCs remain in the soil following treatment in the SGS operated by Thermo NUtech (Thermo NUtech 1997), but do not pose an unacceptable level of risk to human health or the environment, as documented below.

VI.4.2 Subpart S Screening Procedure

VI.4.2.1 Methodology

The maximum concentrations of nonradiological COCs not eliminated during the background screening process were compared with action levels (IT July 1994) calculated using methods and equations promulgated in the proposed RCRA Subpart S (EPA 1990) and RAGS (EPA 1989) documentation. Accordingly, all calculations were based upon the assumption that receptor doses from both toxic and potentially carcinogenic compounds result most significantly from ingestion of contaminated soil. Because all the samples were obtained from the surface and near-surface soil, this assumption is considered valid. If there were ten or fewer COCs, and each had a maximum concentration of less than 1/10 the action level, then the site was judged to pose no significant health hazard to humans. If there were more than ten COCs, then the Subpart S screening procedure was not performed.

VI.4.2.2 Results

Table B-3 presents the COCs and the associated proposed Subpart S action levels. The table compares the maximum concentration values to 1/10 the proposed Subpart S action level. This methodology was applied in accordance with guidance provided to SNL/NM by the EPA (EPA 1996a). One COC that failed the background screen (arsenic) is above 1/10 the Subpart S action level. Therefore, all constituents with maximum concentrations above background were carried forward in the risk assessment process, and an individual hazard quotient (HQ), cumulative HI, and excess cancer risk value were calculated for each COC.

Because radiological COCs have no predetermined action levels analogous to proposed Subpart S levels, this step in the screening process was not performed for radiological COCs.

VI.5 Step 4. Identification of Toxicological Parameters

Tables B-8 (nonradiological) and B-9 (radiological) list the COCs retained in the risk assessment and the values for the available toxicological information. The toxicological values used for nonradiological COCs in Table B-8 were obtained from the Integrated Risk Information System (IRIS) (EPA 1998a), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), and the Region 3 (EPA 1997b) and Region 9 (EPA 1996b) electronic databases. Dose conversion factors (DCF) used in determining the excess TEDE values for radiological COCs for the individual pathways were the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

- DCFs for ingestion and inhalation are from "Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" (EPA 1988).
- DCFs for surface contamination (contamination on the surface of the site) are from DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public" (DOE 1988).
- DCFs for volume contamination (exposure to contamination deeper than the immediate surface of the site) were calculated using the methods discussed in "Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil" (Kocher 1983) and in ANL/EAIS-8, *Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil* (Yu et al. 1993b).

VI.6 Step 5. Exposure Assessment and Risk Characterization

Section VI.6.1 describes the exposure assessment for this risk assessment. Section VI.6.2 provides the risk characterization, including the HI and the excess cancer risk for both the potential nonradiological COCs and the associated background for industrial and residential land uses. The incremental TEDE and incremental estimated cancer risk are provided for the background-adjusted radiological COCs for both industrial and residential land uses.

VI.6.1 Exposure Assessment

Appendix 1 provides the equations and parameter input values used in calculating intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The appendix presents parameters for both industrial and residential land use scenarios. The equations for nonradiological COCs are based upon the RAGS (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989) as well as other EPA guidance documents, and reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For radiological COCs, the coded equations provided in RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD* (Yu et al. 1993a).

Although the designated land use scenario for this site is industrial, risk and TEDE values for a residential land use scenario are also presented to provide perspective of the potential risk to human health under the more restrictive land use scenario.

Table B-8
Toxicological Parameter Values for Nonradiological COCs at SWMUs 1 and 3

COC Name	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o (mg/kg-day)$^{-1}$	SF_{inh} (mg/kg-day)$^{-1}$	Cancer Class[b]
Arsenic	3E-4[c]	M	–	–	1.5E+0[c]	1.5E+1[c]	A
Barium	7E-2[c]	M	1.4E-4[d]	–	–	–	–
Cadmium	5E-4[c]	H	5.7E-5[d]	–	–	6.3E+0[c]	B1
Chromium III	1E+0[c]	L	5.7E-7[e]	–	–	–	–
Chromium VI	5E-3[c]	L	–	–	–	4.2E+1[c]	A
Mercury	3E-4[f]	–	8.6E-5[c]	M	–	–	D
Selenium	5E-3[c]	H	–	–	–	–	D
Silver	5E-3[c]	L	–	–	–	–	D

[a]Confidence associated with IRIS (EPA 1998a) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 1998a):
A = Human Carcinogen.
B1 = Probable human carcinogen. Limited human data available.
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 1998a).
[d]Toxicological parameter values from EPA Region 9 electronic database (EPA 1996b).
[e]Toxicological parameter values from EPA Region 3 electronic database (EPA 1997b).
[f]Toxicological parameter values from HEAST database (EPA 1997a).

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram per day.
(mg/kg-day)$^{-1}$ = Per milligram per kilogram per day.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table B-9
Toxicological Parameter Values for Radiological COCs at SWMUs 1 and 3 Obtained from RESRAD Risk Coefficients[a]

COC Name	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
U-238	6.20E-11	1.20E-08	6.60E-08	A
U-235	4.70E-11	1.30E-08	2.70E-07	A
Th-232	3.30E-11	1.90E-08	2.00E-11	A
Tritium	7.20E-14	9.60E-14	0.0	A
Am-241	3.30E-10	3.90E-08	4.60E-09	A
Pu-238	3.00E-10	2.70E-08	1.90E-11	A
Pu-239/240	3.20E-10	2.80E-08	1.30E-11	A
Cs-137	3.20E-11	1.90E-11	2.10E-06	A

[a]From Yu et al. (1993a).
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.
1/pCi = One per picocurie.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
g/pCi-yr = Gram(s) per picocurie per year.
SF_{ev} = External volume exposure slope factor.
SF_{inh} = Inhalation slope factor.
SF_o = Oral (ingestion) slope factor.
SWMU = Solid Waste Management Unit.

VI.6.2 Risk Characterization

Table B-10 shows an HI of 0.06 and an estimated excess cancer risk of 2E-6 for the SWMUs 1 and 3 nonradiological COCs for the designated industrial land use scenario. The numbers presented included exposure from soil ingestion and dust inhalation for nonradiological COCs. Table B-11 shows an HI of 0.01 and an excess cancer risk of 2E-6, assuming the maximum background concentrations of the SWMUs 1 and 3 associated background constituents for the designated industrial land use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land use scenario with a 5-foot clean cover over the slightly contaminated soil (maximum observed), an incremental TEDE of 1.3E-2 millirem (mrem)/year (yr) was calculated. In accordance with EPA guidance found in Office of Solid Waste and Emergency Response Directive No. 9200.4-18 (EPA 1997c), an incremental TEDE of 15 mrem/yr is used for the probable land use scenario (industrial in this case); the calculated dose value for SWMUs 1 and 3 for the industrial land use is well below this guideline. The estimated excess cancer risk is 2.8E-7.

Table B-10
Risk Assessment Values for Nonradiological COCs at SWMUs 1 and 3

COC Name	Maximum Concentration (mg/kg)	Industrial Land Use Scenario[a]		Residential Land Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.61	0.02	2E-6	0.26	5E-5
Barium	300 E	0.00	–	0.04	–
Cadmium	6.7	0.01	2E-9	5.48	4E-9
Chromium, total[b]	19.2	0.00	4E-8	0.02	7E-8
Mercury	7.8 E	0.03	–	13.44	–
Selenium	1.33	0.00	–	0.47	–
Silver	1.8	0.00	–	0.07	–
Total	NA	**0.06**	**2E-6**	**20**	**5E-5**

[a]From EPA 1989.
[b]Total chromium is assumed to be chromium VI (most conservative).
COC = Constituent of concern.
E = Calibration out of range.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table B-11
Risk Assessment Values for Nonradiological Background Constituents at SWMUs 1 and 3

COC Name	Background Concentration[a] (mg/kg)	Industrial Land Use Scenario[b]		Residential Land Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.01	2E-6	0.25	5E-5
Barium	200	0.00	–	0.03	–
Cadmium	<1	–	–	–	–
Chromium, total[c]	12.8	0.00	–	0.00	–
Mercury	<0.1	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Total	NA	**0.01**	**2E-6**	**0.3**	**5E-5**

[a]From Dinwiddie (September 1997), North Supergroup Soils.
[b]From EPA 1989.
[c]Total chromium is assumed to be chromium III (most conservative).
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available.

For the residential land use scenario nonradiological COCs, the HI is 20, and the excess cancer risk is 5E-5 (Table B-10). The numbers in the table include exposure from soil ingestion, dust inhalation, and plant uptake. Although the EPA (EPA 1991) generally recommends that inhalation not be included in a residential land use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and, subsequently, for dust to be transported to predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Appendix 1). Table B-11 shows that for the SWMUs 1 and 3 associated background constituents, the HI is 0.3. Excess cancer risk is estimated at 5E-5.

For the radiological COCs, the incremental TEDE for the residential land use scenario with a 5-foot clean cover over the slightly contaminated soils (maximum observed) for SWMUs 1 and 3 is 40.0 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for SWMUs 1 and 3 for the residential land use scenario is well below this guideline. Consequently, SWMUs 1 and 3 are eligible for unrestricted radiological release because the residential land use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 1.3E-4. The excess cancer risk from the nonradiological COCs and the radiological COCs is not additive, as noted in the RAGS (EPA 1989).

VI.7 Step 6. Comparison of Risk Values to Numerical Guidelines

This human health risk assessment analysis evaluated the potential for adverse health effects for both an industrial land use scenario (the designated land use scenario for this site) and a residential land use scenario.

For the nonradiological COCs under an industrial land use scenario, the HI is 0.06 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). Excess cancer risk is estimated at 2E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (NMED March 2000), thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the industrial and the residential land use scenarios. Assuming the industrial land use scenario, for nonradiological COCs the HI is 0.01 and the excess cancer risk is 2E-6. Incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and, therefore, may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background concentrations are assumed to have an HQ or excess cancer risk of 0.00. Incremental HI is 0.05 and estimated incremental cancer risk is 4.20E-8 for the industrial land use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under an industrial land use scenario.

For radiological COCs under an industrial land use scenario, incremental TEDE is 1.3E-02 mrem/yr, which is significantly less than EPA's numerical guideline of 15 mrem/yr. Incremental estimated excess cancer risk is 2.8E-7.

The calculated HI for the nonradiological COCs under a residential land use scenario is 20, which is above the numerical guidance. Excess cancer risk is estimated at 5E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (NMED March 2000), thus the excess cancer risk for this site is above the suggested acceptable risk value. The HI for associated background constituents for the residential land use scenario is 0.3. Excess cancer risk is estimated at 5E-5. For conservatism, the background constituents that do not have quantified background concentrations are assumed to have an HQ or excess cancer risk of 0.00. The incremental HI is 19.50 and the estimated incremental cancer risk is 7.40E-8 for the residential land use scenario. The incremental HI and excess cancer risk are above proposed guidelines under the residential land use scenario.

The incremental TEDE from the radiological components for a residential land use scenario is 40.0 mrem/yr, which is significantly less than the numerical guideline of 75 mrem/yr suggested in the SNL/NM RESRAD Input Parameter Assumptions and Justification (SNL/NM February 1998). The estimated excess cancer risk 1.3E-4.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at SWMUs 1 and 3 was based upon an initial conceptual model validated with confirmatory sampling conducted at the site. The confirmatory sampling was implemented in accordance with the sampling plan approved by the NMED. The DQOs discussed in Section II are appropriate for use in risk screening assessments. The data collected, based upon sample location, density, and depth, are representative of the site. The analytical requirements and results satisfy the DQOs. Data quality was validated in accordance with SNL/NM procedures (SNL/NM July 1994, SNL/NM July 1996). Therefore, there is no uncertainty associated with the data quality used to perform the human health risk assessment at SWMUs 1 and 3.

Because of the location, history of the site, and future designated land use (DOE et al. September 1995), there is low uncertainty in the land use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Because the COCs are found in surface and near-surface soil and because of the location and physical characteristics of the site, there is little uncertainty in the exposure pathways relevant to the analysis.

An RME approach was used to calculate the risk assessment values. This means that the parameter values in the calculations are conservative and that calculated intakes are probably overestimates. Maximum measured values of COC concentrations are used to provide conservative results.

Table B-8 shows the uncertainties (confidence level) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS, HEAST, EPA Region 3 and Region 9 electronic databases. Where values are not provided, information is not available from the HEAST (EPA 1997a), the IRIS (EPA 1998a), or the EPA regions (EPA 1996b, 1997b). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

Risk assessment values for nonradiological COCs are within the acceptable human health range for the industrial land use scenario compared to established numerical guidance.

For radiological COCs, the conclusion of the risk assessment is that potential risk to human health for both industrial and residential land use scenarios is within acceptable guidelines and represents only a small fraction of the estimated 360 mrem/yr received by the average U.S. population from natural and anthropogenic sources (NCRP 1987). For the radiological COCs, eight constituents (Th-232, U-238, U-235, Am-241, Pu-238, Pu-239, Cs-137, and tritium) exhibited measured activity concentrations greater than background levels. These residual COCs remain in the soil following separation of soil and debris with higher activity levels through the SGS operated by Thermo NUtech (Thermo NUtech September 1997). Elevated levels of the radiological COCs were removed and shipped off site as radiological waste. The residual soil will be buried at the bottom of the original SWMUs 1 and 3 excavation and covered by 5 feet of uncontaminated soil. The additional measure of covering the backfilled soil with 5 feet of clean fill is being performed as a "best management practice." Due to the relatively low residual levels of radiological COCs, the soil could be deposited on the ground surface with no future radiological controls, as confirmed by a risk-based analysis (SNL/NM April 2000).

The overall uncertainty in all of the steps in the risk assessment process is considered not to be significant with respect to the conclusion reached.

VI.9 Summary

This risk assessment identified COCs consisting of some inorganic and radiological compounds at SWMUs 1 and 3. Because of the location of the site, the designated industrial land use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion and dust inhalation for chemical constituents, and soil ingestion, dust and volatiles inhalation, and direct gamma exposure for radionuclides. Plant uptake was included as an exposure pathway for the residential land use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the industrial land use scenario the HI (0.06) is significantly less than the accepted numerical guidance from the EPA. Excess cancer risk (2E-6) is also below the acceptable risk value provided by the NMED for an industrial land use scenario (NMED March 2000). For conservatism, the background constituents that do not have quantified background concentrations are assumed to have an HQ or excess cancer risk of 0.00. Thus, the incremental HI is 0.05, and the incremental cancer risk is 4.20E-8 for the industrial land use scenario. Incremental risk calculations indicate insignificant risk to human health under industrial land use scenario.

Incremental TEDE and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 1.3E-2 mrem/yr for the industrial land use scenario, which is much less than the numerical guidance of 15 mrem/yr in EPA guidance (EPA 1997c). The corresponding incremental estimated cancer risk value is 2.8E-7 for the industrial land use scenario. Furthermore, the incremental TEDE for the residential land use scenario that results from a complete loss of institutional control is only 40 mrem/yr, with an associated risk of 1.3E-4. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, SWMUs 1 and 3 are eligible for unrestricted radiological release, and have been so approved by the DOE (Soden, July 2000).

Uncertainties associated with the calculations are considered small relative to the conservatism of this risk screening assessment. Therefore, it is concluded that this site poses insignificant risk to human health under the industrial land use scenario.

VII. Ecological Risk Screening Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPEC) in soils at SWMUs 1 and 3. A component of the NMED Risk-Based Decision Tree (NMED march 1998) is to conduct an ecological screening assessment that corresponds with that presented in EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997d). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed screening assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation and fate-and-transport potential) are addressed in Sections II through V of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a screening assessment, whereby a more quantitative estimate of ecological risk is conducted. Although this assessment incorporates conservatisms in the estimation of ecological risks, ecological relevance and professional judgment also are used as recommended by the EPA (EPA 1998b) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

VII.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of biota at or adjacent to the site to be exposed to constituents associated with site activities. Included in this section are an evaluation of existing data and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate-and-transport potential. A Scoping Risk-Management Decision will involve a summary of the scoping results and a determination as to whether further examination of potential ecological impacts is necessary.

VII.2.1 Data Assessment

As indicated in Section IV (Tables B-4 and B-6), inorganic constituents in soil at SWMUs 1 and 3 that exceeded background concentrations were:

- Arsenic
- Barium
- Cadmium
- Chromium (total)
- Lead

- Mercury
- Selenium
- Silver
- Am-241
- Cs-137
- Pu-238
- Pu-239/240
- Tritium
- U-235
- U-238

VII.2.2 Bioaccumulation

Among the COPECs listed in Section VII.2.1, the following were considered to have bioaccumulation potential in aquatic environments (Section IV, Tables B-4 and B-6):

- Arsenic
- Barium
- Cadmium
- Lead
- Mercury
- Selenium
- Am-241
- Cs-137
- Pu-238
- Pu-239/240
- U-235
- U-238

It should be noted, however, that as directed by the NMED (NMED March 1998), bioaccumulation for inorganic constituents is assessed exclusively based upon maximum reported bioconcentration factors (BCF) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

VII.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section V. As noted in Table B-7 (Section V), wind, surface-water runoff, and food chain uptake are expected to be of low significance as transport mechanisms for COPECs at this site. Migration to groundwater is not expected. The potential for significant degradation or transformation of COPECs in the soil is low, and the decay of radionuclides is expected to be of low significance due to the long half-lives of the detected radionuclides.

VII.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it was concluded that complete ecological pathways may be associated with SWMUs 1 and 3 and that COPECs also exist at these SWMUs. As a consequence, a screening assessment was deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Screening Assessment

As concluded in Section VII.2.4, both complete ecological pathways and COPECs are associated with these SWMUs. The screening assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure ecological risks are not underpredicted.

Components within the screening assessment include:

- Problem Formulation—sets the stage for the evaluation of potential exposure and risk.
- Exposure Estimation—provides a quantitative estimate of potential exposure.
- Ecological Effects Evaluation—presents benchmarks used to gauge the toxicity of COPECs to specific receptors.
- Risk Characterization—characterizes the ecological risk associated with exposure of the receptors to environmental media at the site.
- Uncertainty Assessment—discusses uncertainties associated with the estimation of exposure and risk.
- Risk Interpretation—evaluates ecological risk in terms of HQs and ecological significance.
- Screening Assessment Scientific/Management Decision Point—presents the decision to risk managers based upon the results of the screening assessment.

VII.3.1 Problem Formulation

Problem Formulation is the initial stage of the screening assessment that provides the introduction to the risk evaluation process. Components that are addressed in this section include a discussion of ecological pathways and the ecological setting, identification of COPECs, and selection of ecological receptors. The conceptual model, ecological food webs, and ecological endpoints (other components commonly addressed in a screening assessment) are presented in the "Predictive Ecological Risk Assessment Methodology for SNL/NM Environmental Restoration Program" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

SWMUs 1 and 3 encompass an area of approximately 0.3 acre in size. The site is located in grassland habitat, approximately 25 feet east of the eastern apex of TA-2. The habitat at this site has been highly disturbed by excavation activities during the VCM. Wildlife use of the site is probably limited by the degree of habitat disturbance, and no sensitive species are expected to use the site.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in surface and subsurface soil. Direct uptake of COPECs from the soil was assumed to be the major route of exposure for plants. Exposure of plants to wind-blown soil was considered to be an insignificant pathway. Exposure modeling for the wildlife receptors was limited to the food and soil ingestion pathways. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water was considered to be insignificant. Inhalation and dermal contact were also considered insignificant pathways with respect to ingestion (Sample and Suter 1994). No groundwater pathways are expected to occur at this site for ecological receptors.

VII.3.1.2 COPECs

Radiological and chemical wastes buried at the RWL and CDPs are the source of COPECs at SWMUs 1 and 3. The RWL (SWMU 1) consisted of three pits and three trenches where low-level radioactive waste was disposed of from 1949 to 1959. The majority of the waste was not containerized before disposal, and the pits and trenches were unlined. The pits and trenches were later filled with debris and then covered with native soil and capped with 3 feet of concrete. The CDPs (SWMU 3) reportedly were used in the late 1940s and 1950s to dispose of chemical waste. The CDPs were unlined and may have been originally excavated with a backhoe, filled with waste, and backfilled with native soil. It is not known whether chemicals were disposed of in bulk or in drums. The site of the RWL and CDPs was excavated as part of the VCM for SWMUs 1 and 3. Residually contaminated soil will be used to backfill the excavation, which will be covered with 5 feet of clean fill. The COPECs evaluated in this assessment represent possible residual contamination in the backfill material.

In order to provide conservatism in this ecological risk screening assessment, the evaluation is based upon the maximum soil concentrations of the COPECs as measured in surface and subsurface soil samples. Both radiological and nonradiological COPECs are evaluated. The nonradiological COPECs consist of inorganic analytes (i.e., metals). The inorganic analytes and radionuclides were screened against background concentrations, and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. Maximum COPEC concentrations in soil are reported in Tables B-4 and B-6. Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment in accordance with the EPA guidance (EPA 1989).

VII.3.1.3 Ecological Receptors

A nonspecific perennial plant was selected as the receptor to represent plant species at the site (IT July 1998). Vascular plants are the principal primary producers at the site and are key to the diversity and productivity of the wildlife community associated with this site. A deer mouse (*Peromyscus maniculatus*) and burrowing owl (*Speotyto cunicularia*) were used to represent wildlife use. Because of its opportunistic food habits, the deer mouse was used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl was selected as the top predator. The burrowing owl is present at SNL/NM and is designated as a species of management concern by the U.S. Fish and Wildlife Service in Region 2, which includes the state of New Mexico (USFWS September 1995).

VII.3.2 Exposure Estimation

Direct uptake of COPECs from the soil was considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors was limited to food and soil ingestion pathways. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl was modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl was modeled with intake of omnivorous mice only. Both species were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table B-12 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment were modeled using an area use factor of 1.0, implying that all food items and soil ingested come from the site being investigated. The maximum measured COPEC concentrations from surface soil samples were used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose-rate calculations, the deer mouse was modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl was modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Both were modeled with soil ingestion comprising 2 percent of the total dietary intake. Receptors are exposed to radiation both internally and externally (note that the external dose from tritium was assumed to be negligible). Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose-rate models from DOE (DOE 1995) as presented in the ecological risk assessment methodology document (IT July 1998). Radionuclide-dependent data for the dose-rate calculations were obtained from Baker and Soldat (1992). The external-dose-rate model examines the total-body dose rate to a receptor residing in soil that is exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external-dose-rate model is the same for both the

Table B-12
Exposure Factors for Ecological Receptors at SWMUs 1 and 3

Receptor Species	Class/Order	Trophic Level	Body Weight (kg)[a]	Food Intake Rate (kg/day)[b]	Dietary Composition[c]	Home Range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Herbivore	2.39E-2[d]	3.72E-3	Plants: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	2.39E-2[d]	3.72E-3	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Insectivore	2.39E-2[d]	3.72E-3	Invertebrates: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	1.55E-1[f]	1.73E-2	Rodents: 100% (+ Soil at 2% of intake)	3.5E+1[g]

[a]Body weights are in kg wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kg dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2% of food intake.
[d]From Silva and Downing (1995).
[e]EPA 1993. Based upon the average home range measured in semiarid shrubland in Idaho.
[f]From Dunning (1993).
[g]From Haug et al. (1993).
EPA = U.S. Environmental Protection Agency.
kg = Kilogram(s).
kg/day = Kilogram(s) per day.
SWMU = Solid Waste Management Unit.

deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a "point" source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides transfer only a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose-rate results are summed to calculate a total dose rate from exposure to radionuclides in soil.

Table B-13 provides the transfer factors used in modeling the concentrations of COPECs through the food chain. Table B-14 presents maximum concentrations in soil and derived concentrations in tissues of the various food-chain elements that are used to model dietary exposures for each of the wildlife receptors.

VII.3.3 Ecological Effects Evaluation

Benchmark toxicity values for the plant and wildlife receptors are presented in Table B-15. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate a NOAEL for silver for the burrowing owl.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad per day should also protect other groups within the terrestrial habitat of SWMUs 1 and 3.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Results of these comparisons are presented in Table B-16. HQs are used to quantify the comparison with benchmarks for plants and wildlife exposure.

Analytes with HQs exceeding unity for plants included cadmium, chromium (total), and lead. Arsenic and barium exhibited HQs greater than unity for the omnivorous and insectivorous deer mice. Mercury showed an HQ greater than unity for the burrowing owl when it was assumed to be entirely in organic form, but not when the mercury was assumed to be in inorganic form. Bis(2-ethylhexyl) phthalate was the only organic COPEC that resulted in an HQ of greater than 1.0, which was limited to the burrowing owl. An HQ for the burrowing owl could not be determined for silver because of insufficient toxicity information. As directed by the NMED, HIs were calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). All receptors had total HIs greater than unity, with a maximum HI of 26 for plants.

Table B-13
Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at SWMUs 1 and 3

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Arsenic	4.0E-2[a]	1.0E+0[b]	2.0E-3[a]
Barium	1.5E-1[a]	1.0E+0[b]	2.0E-4[c]
Cadmium	5.5E-1[a]	6.0E-1[d]	5.5E-4[a]
Chromium (total)	4.0E-2[c]	1.3E-1[e]	3.0E-2[c]
Lead	9.0E-2[c]	4.0E-2[d]	8.0E-4[c]
Mercury	1.0E+0[c]	1.0E+0[b]	2.5E-1[a]
Selenium	5.0E-1[c]	1.0E+0[b]	1.0E-1[c]
Silver	1.0E+0[c]	2.5E-1[d]	5.0E-3[c]

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (January 1989).
[d]From Stafford et al. (1991).
[e]From IAEA (1994).
IAEA = International Atomic Energy Agency.
NCRP = National Council on Radiation Protection and Measurements.
SWMU = Solid Waste Management Unit.

Table B-14
Media Concentrations[a] for Constituents of Potential Ecological Concern at SWMUs 1 and 3

Constituent of Potential Ecological Concern	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Arsenic	4.6E+0	1.8E-1	4.6E+0	1.6E-2
Barium	3.0E+2	4.5E+1	3.0E+2	1.1E-1
Cadmium	6.7E+0	3.7E+0	4.0E+0	6.9E-3
Chromium (total)	1.9E+1	7.7E-1	2.5E+0	1.9E-1
Lead	8.2E+1[d]	7.4E+0	3.3E+0	1.7E-2
Mercury	1.8E-1	1.8E-1	1.8E-1	1.4E-1
Selenium	1.0E+0[d]	5.2E-1	1.0E+0	2.5E-1
Silver	5.3E-1	5.3E-1	1.3E-1	5.3E-3

[a]In milligrams per kilogram. All are based upon dry weight of the media.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration in food times the food-to-muscle transfer factor times the wet weight-dry weight conversion factor of 3.125 (EPA 1993).
[d]Estimated value.
EPA = U.S. Environmental Protection Agency.
SWMU = Solid Waste Management Unit.

Table B-15
Toxicity Benchmarks for Ecological Receptors at SWMUs 1 and 3

Constituent of Potential Ecological Concern	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Arsenic	10	Mouse	0.126	0.13	Mallard	5.14	5.14
Barium	500	Rat[h]	10.5	5.1	Chicks	20.8	20.8
Cadmium	4	Rat[i]	1.0	1.9	Mallard	1.45	1.45
Chromium (total)	1	Rat	2,737	5,354	Black duck	1.0	1.0
Lead	50	Rat	8.0	15.6	American kestrel	3.85	3.85
Mercury (inorganic)	0.3	Mouse	13.2	14.0	Japanese quail	0.45	0.45
Mercury (organic)	0.3	Rat	0.032	0.06	Mallard	0.0064	0.0064
Selenium	1	Rat	0.20	0.39	Screech owl	0.44	0.44
Silver	2	Rat	17.8[j]	34.8	–	–	–

[a]In milligrams per kilogram soil.
[b]From Efroymson et al. (1997).
[c]Body weights (in kilograms) for the NOAEL conversion are as follows: lab mouse, 0.030; lab rat, 0.350 (except where noted).
[d]From Sample et al. (1996), except where noted.
[e]In milligrams per kilogram body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kilogram and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.435 kilogram.
[i]Body weight: 0.303 kilogram.
[j]Based upon a rat LOAEL of 89 mg/kg/day (EPA 1998a) and an uncertainty factor of 0.2.

EPA = U.S. Environmental Protection Agency.
LOAEL = Lowest-observed-adverse-effect level.
mg/kg/day = Milligram(s) per kilogram per day.
NOAEL = No-observed-adverse-effect level.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

Table B-16
HQs for Ecological Receptors at SWMUs 1 and 3

Constituent of Potential Ecological Concern	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	4.6E-1	3.2E-1	**2.9E+0**	**5.5E+0**	2.3E-3
Barium	6.0E-1	7.5E-1	**2.6E+0**	**4.5E+0**	3.3E-2
Cadmium	**2.2E+0**	3.1E-1	3.3E-1	3.4E-1	1.1E-2
Chromium (total)	**1.9E+1**	3.3E-5	5.9E-5	8.4E-5	6.4E-2
Lead	**1.6E+0**	8.9E-2	6.9E-2	4.9E-2	4.8E-2
Mercury (organic)	5.9E-1	4.5E-1	4.5E-1	4.5E-1	**2.5E+0**
Mercury (inorganic)	5.9E-1	2.0E-3	2.0E-3	2.0E-3	3.6E-2
Selenium	1.0E+0	2.2E-1	3.2E-1	4.2E-1	6.9E-2
Silver	2.6E-1	2.4E-3	1.5E-3	6.4E-4	–
HI[b]	**2.6E+1**	**2.1E+0**	**6.7E+0**	**1.1E+1**	**2.8E+0**

[a]Values in **bold** indicate the HQ or HI exceeds unity.
[b]The HI is the sum of individual HQs using the value for organic mercury as a conservative estimate of the HI.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

Tables B-17 and B-18 summarize the dose-rate model results for the radiological COPECs. The total radiation dose rate was predicted to be 4.1E-3 rad/day to the deer mouse and 3.9E-3 rad/day to the burrowing owl. The dose rates for both the deer mouse and the burrowing owl are less than the benchmark of 0.1 rad/day.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at SWMUs 1 and 3 resulting from assumptions used in calculating risk that may overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size. Each of these uncertainties, which are consistent among each of the SWMU-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to radiological COPECs are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors, which are typically negligible. The dose-rate models used for these calculations are based upon conservative estimates of receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic, but conservative, estimate of a receptor's exposure to radionuclides in soil, both internally and externally.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. For several inorganic COPECs, conservatisms in the modeling of exposure and risk result in the prediction of risk to ecological receptors when exposed at background concentrations. As shown in Table B-19, HQs associated with exposures to background are greater than 1.0 for three of the COPECs that were predicted to pose potential risk to ecological receptors at SWMUs 1 and 3 (arsenic, barium, and chromium). In the case of arsenic, background-level exposure can be attributed to approximately 95 percent of the total exposure in the deer mice, indicating that the potential increased risk associated with the soil at the site is minimal. Similarly, background-level exposure can be attributed to approximately 67 percent of the total exposure for barium and chromium, again indicating that site-related increased risk for these COPECs is small. Therefore, because of the uncertainties associated with exposure and toxicity, it is unlikely that arsenic, barium, and chromium, with exposure concentrations largely attributable to background, present significant ecological risk.

The assumption of an area use factor of 1.0 is a source of uncertainty for the burrowing owl. Because SWMUs 1 and 3 encompass approximately 0.3 acre and the home range of the burrowing owl is 35 acres, an area use factor of approximately 0.0086 would be justified for this receptor. This is sufficient to reduce the burrowing owl HQ for organic mercury from 2.5 to 0.0021.

Table B-17
Internal and External Dose Rates for
Deer Mice Exposed to Radionuclides at SWMUs 1 and 3

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Am-241	0.627	5.5E-7	1.3E-6	1.9E-6
Cs-137	0.203	6.3E-6	9.3E-6	1.6E-5
Tritium	0.22	7.1E-7	NA[a]	7.1E-7
Pu-238	0.184	1.5E-7	2.3E-8	1.7E-7
Pu-239/240	2.55	1.9E-6	1.3E-7	2.0E-6
U-235	0.422	4.6E-6	6.9E-6	1.2E-5
U-238	25.0	2.5E-4	3.8E-3	4.1E-3
Total Dose	NA	2.7E-4	3.8E-3	4.1E-3

[a]External dose from tritium assumed to be insignificant.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table B-18
Internal and External Dose Rates for
Burrowing Owls Exposed to Radionuclides at SWMUs 1 and 3

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Am-241	0.627	1.3E-6	1.3E-6	2.6E-6
Cs-137	0.203	4.1E-6	9.3E-6	1.3E-5
Tritium	0.22	2.5E-7	NA[a]	2.5E-7
Pu-238	0.184	3.7E-7	2.3E-8	3.9E-7
Pu-239/240	2.55	4.9E-6	1.3E-7	5.0E-6
U-235	0.422	1.8E-6	6.9E-6	8.7E-6
U-238	25.0	1.0E-4	3.8E-3	3.9E-3
Total Dose	NA	1.1E-4	3.8E-3	3.9E-3

[a]External dose from tritium assumed to be insignificant.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table B-19
HQs for Ecological Receptors Exposed to Background Concentrations at SWMUs 1 and 3

Constituent of Potential Ecological Concern	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	4.4E-1	3.1E-1	**2.8E+0**	**5.2E+0**	2.2E-3
Barium	2.6E-1	3.3E-1	**1.1E+0**	**2.0E+0**	1.4E-2
Cadmium	1.7E-1	2.4E-2	2.5E-2	2.6E-2	8.1E-4
Chromium (total)	**1.6E+1**	2.8E-5	4.9E-5	6.9E-5	5.3E-2
Lead	2.4E-1	1.3E-2	1.0E-2	7.0E-3	6.9E-3
Mercury (inorganic)	1.7E-1	5.7E-4	5.7E-4	5.7E-4	1.0E-2
Mercury (organic)	1.7E-1	1.3E-1	1.3E-1	1.3E-1	7.1E-1
Selenium	5.0E-1	1.0E-1	1.5E-1	2.0E-1	3.3E-2
Silver	2.5E-1	2.3E-3	1.4E-3	6.0E-4	–
HI[b]	**1.5E+1**	**1.1E+0**	**4.8E+0**	**8.6E+0**	8.2E-1

[a]Values in **bold** indicate the HQ or HI exceeds unity.
[b]The HI is the sum of individual HQs using the value for organic mercury as a conservative estimate of the HI.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

For cadmium, total chromium, and lead, HQs greater than unity were limited to plants. It should be noted, however, that the plant toxicity benchmarks for these metals are conservatively based upon laboratory tests using soil amendments with highly available forms of the element (Efroymson et al. 1997). It is likely that only a small fraction of the cadmium, chromium, and lead in the soil at SWMUs 1 and 3 is in a form that is highly available for plant uptake. Therefore, the plant toxicity benchmarks for these metals probably overestimate risk to plants to a significant degree. In addition, it should be noted that the plant toxicity benchmark for chromium is based upon chromium VI, which may be more toxic to plants than the more common chromium III. Because the majority of the total chromium measured at SWMUs 1 and 3 is expected to be chromium III, it is uncertain whether the calculated HQ accurately predicts the potential risk to plants from exposure to chromium.

A significant source of uncertainty associated with the prediction of ecological risks at this site is the use of the maximum soil concentrations measured to evaluate risk. To assess the potential degree of overestimation due to the use of the maximum concentrations, 95 percent upper confidence limits (UCL) of the mean soil concentrations were calculated for arsenic, barium, cadmium, total chromium, and lead. Exposures and HQs were recalculated for these COPECs to determine whether the HQs above unity can be accounted for by the magnitude of the extreme measurement. For arsenic, barium, and total chromium, the 95 percent UCLs (3.62, 155, and 11.6 mg/kg, respectively) are all less than the corresponding background screening values for the these COPECs. Therefore, the corresponding HQs are less than the HQ values for background, as shown in Table B-19. For cadmium and lead, the 95 percent UCLs (1.26 and 17.7 mg/kg, respectively) were less than the corresponding plant toxicity benchmarks (Table B-15) for these COPECs. Because cadmium and lead HQs exceeded unity only for plants, basing exposure upon the 95 percent UCL rather than the maximum value is sufficient to explain all predicted risk for these elements. Therefore, in all of these cases, the use of the 95 percent UCL soil concentrations reduces the HQs to values either less than unity or less than the HQ derived from background concentrations.

Based upon this uncertainty analysis, ecological risks at SWMUs 1 and 3 are expected to be very low. HQs greater than unity were initially predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to exposure concentration, background risk, the depth of contamination, and the small size of the site.

VII.3.6 Risk Interpretation

Ecological risks associated with SWMUs 1 and 3 were estimated through a screening assessment that incorporated site-specific information when available. Overall, risks to ecological receptors are expected to be low due to the fact that predicted risks are based upon exposures to COPECs calculated from the maximum COPEC concentrations measured and other conservative assumptions. Predicted risks from exposure to arsenic, barium, cadmium, total chromium, and lead were attributed to using these maximum detected values. Potential risks associated with mercury were limited to the burrowing owl under the assumptions that all mercury is in organic form and that the area use factor for the owl is 1.0. The use of a more realistic area use factor for this receptor is sufficient to reduce the HQ to less than unity, regardless of the form of mercury present. Based upon this final analysis, ecological risks associated with SWMUs 1 and 3 are expected to be low.

VII.3.7 Screening Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for NFA or whether additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks are predicted to be low. The scientific/management decision is to recommend this site for NFA.

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APPENDIX 1
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

Sandia National Laboratories/New Mexico (SNL/NM) uses a default set of exposure routes and associated default parameter values developed for each future land use designation being considered for SNL/NM Environmental Restoration (ER) Project sites. This default set of exposure scenarios and parameter values are invoked for risk assessments unless site-specific information suggests other parameter values. Because many SNL/NM solid waste management units (SWMUs) have similar types of contamination and physical settings, SNL/NM believes that the risk assessment analyses at these sites can be similar. A default set of exposure scenarios and parameter values facilitates the risk assessments and subsequent review.

The default exposure routes and parameter values used are those that SNL/NM views as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the U.S. Environmental Protection Agency (EPA) Region VI and New Mexico Environment Department (NMED), SNL/NM will use these default exposure routes and parameter values in future risk assessments.

At SNL/NM, all SWMUs exist within the boundaries of the Kirtland Air Force Base. Approximately 240 potential waste and release sites have been identified where hazardous, radiological, or mixed materials may have been released to the environment. Evaluation and characterization activities have occurred at all of these sites to varying degrees. Among other documents, the SNL/NM ER draft Environmental Assessment (DOE 1996) presents a summary of the hydrogeology of the sites, the biological resources present and proposed land use scenarios for the SNL/NM SWMUs. At this time, all SNL/NM SWMUs have been tentatively designated for either industrial or recreational future land use. The NMED has also requested that risk calculations be performed based upon a residential land use scenario. All three land use scenarios will be addressed in this document.

The SNL/NM ER Project has screened the potential exposure routes and identified default parameter values to be used for calculating potential intake and subsequent hazard index (HI), excess cancer risk and dose values. The EPA (EPA 1989a) provides a summary of exposure routes that could potentially be of significance at a specific waste site. These potential exposure routes consist of:

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil
- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products

- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water
- Dermal contact with chemicals in soil
- Inhalation of airborne compounds (vapor phase or particulate)
- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water; and exposure from ground surfaces with photon-emitting radionuclides)

Based upon the location of the SNL/NM SWMUs and the characteristics of the surface and subsurface at the sites, we have evaluated these potential exposure routes for different land use scenarios to determine which should be considered in risk assessment analyses (the last exposure route is pertinent to radionuclides only). At SNL/NM SWMUs, there is currently no consumption of fish, shellfish, fruits, vegetables, meat, eggs, or dairy products that originate on site. Additionally, no potential for swimming in surface water is present due to the high-desert environmental conditions. As documented in the RESRAD computer code manual (ANL 1993), risks resulting from immersion in contaminated air or water are not significant compared to risks from other radiation exposure routes.

For the industrial and recreational land use scenarios, SNL/NM ER has, therefore, excluded the following four potential exposure routes from further risk assessment evaluations at any SNL/NM SWMU:

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming

That part of the exposure pathway for radionuclides related to immersion in contaminated air or water is also eliminated.

For the residential land use scenario, we will include ingestion of contaminated fruits and vegetables because of the potential for residential gardening.

Based upon this evaluation, for future risk assessments the exposure routes that will be considered are shown in Table B1-1. Dermal contact is included as a potential nonradiological organic constituents exposure pathway in all land use scenarios. However, the potential for dermal exposure to inorganic constituents is not considered significant and will not be included. In general, the dermal exposure pathway is generally considered not to be significant relative to water ingestion and soil ingestion pathways but will be considered for organic components. Because of the lack of toxicological parameter values for this pathway, the inclusion of this exposure pathway into risk assessment calculations may not be possible and may be part of the uncertainty analysis for a site where dermal contact is potentially applicable.

Table B1-1
Exposure Pathways Considered for Various Land Use Scenarios

Industrial	Recreational	Residential
Ingestion of contaminated drinking water	Ingestion of contaminated drinking water	Ingestion of contaminated drinking water
Ingestion of contaminated soil	Ingestion of contaminated soil	Ingestion of contaminated soil
Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)
Dermal contact (nonradiological organic constituents only)	Dermal contact (nonradiological organic constituents only)	Dermal contact (nonradiological organic constituents only)
External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces	Ingestion of fruits and vegetables
		External exposure to penetrating radiation from ground surfaces

Equations and Default Parameter Values for Identified Exposure Routes

In general, SNL/NM expects that ingestion of compounds in drinking water and soil will be the more significant exposure routes for chemicals; external exposure to radiation may also be significant for radionuclides. All of the above routes will, however, be considered for their appropriate land use scenarios. The general equation for calculating potential intakes via these routes is shown below. The equations are from the Risk Assessment Guidance for Superfund (RAGS): Volume 1 (EPA 1989a, 1991). These general equations also apply to calculating potential intakes for radionuclides. A more in-depth discussion of the equations used in performing radiological pathway analyses with the RESRAD code may be found in the RESRAD Manual (ANL 1993). RESRAD is the only code designated by the U.S. Department of Energy (DOE) in DOE Order 5400.5 for the evaluation of radioactively contaminated sites (DOE 1993). The Nuclear Regulatory Commission (NRC) has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff. RESRAD has been applied to more than 300 sites in the U.S. and other countries. EPA Science Advisory Board reviewed the RESRAD model. EPA used RESRAD in their rulemaking on radiation site cleanup regulations. RESRAD code has been verified, undergone several benchmarking analyses, and been included in the International Atomic Energy Agency's (IAEA) VAMP and BIOMOVS II projects to compare environmental transport models.

Also shown are the default values SNL/NM ER will use in RME risk assessment calculations for industrial, recreational, and residential land use scenarios, based upon EPA and other governmental agency guidance. The pathways and values for chemical contaminants are discussed first, followed by those for radionuclide contaminants. Certain site-specific input parameters have been pre-established by agreement between SNL and NMED (SNL/NM February 1998). RESRAD input parameters that are left as the default values provided with the code are not discussed. Further information relating to these parameters may be found in the RESRAD Manual (ANL 1993) or by directly accessing the RESRAD websites at: http://web.ead.anl.gov/resrad/home2/ or http://web.ead.anl.gov/resrad/documents/.

Generic Equation for Calculation of Risk Parameter Values

The equation used to calculate the risk parameter values (i.e., hazard quotients [HQs]/HI, excess cancer risk, or radiation total effective dose equivalent [dose]) is similar for all exposure pathways and is given by:

Risk (or Dose) = Intake x Toxicity Effect (either carcinogenic, noncarcinogenic, or radiological)

= C x (CR x EFD/BW/AT) x Toxicity Effect (1)

where

C = contaminant concentration (site specific)
CR = contact rate for the exposure pathway
EFD = exposure frequency and duration
BW = body weight of average exposure individual
AT = time over which exposure is averaged.

For nonradiological COCs, the total risk/dose (either cancer risk or HI) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants. For radionuclides, the calculated radiation exposure, expressed as Total Effective Dose Equivalent (TEDE) is compared directly to the exposure guidelines of 15 millirems (mrem)/year for industrial and recreational future use and 75 mrem/year for the unlikely event that institutional control of the site is lost and the site is used for residential purposes (EPA 1997).

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the constituents of concern (COCs) present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk of 1E-5 for nonradiological carcinogens. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the HI) for the toxicity resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of this quantitative estimate with the EPA standard HI of unity (1). The evaluation of the health hazard due to radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site. This estimated dose can be used to calculate an assumed risk. However, this calculated risk is presented for illustration purposes only, not to determine compliance with regulations.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989a) and are outlined below. The RESRAD Manual (ANL 1993) describes similar equations for the calculation of radiological exposures.

A receptor can ingest soil or dust directly by working in the contaminated soil. Indirect ingestion can occur from sources such as unwashed hands introducing contaminated soil to food that is then eaten. An estimate of intake from ingesting soil will be calculated as follows:

$$I_s = \frac{C_s * IR * CF * EF * ED}{BW * AT}$$

where:

- I_s = Intake of contaminant from soil ingestion (mg/kg/day)
- C_s = Chemical concentration in soil (mg/kg)
- IR = Ingestion rate (mg soil/day)
- CF = Conversion factor (1E-6 kg/mg)
- EF = Exposure frequency (days/years)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged—days)

Soil Inhalation

A receptor can inhale soil or dust directly by working in the contaminated soil. An estimate of intake from inhaling soil will be calculated as follows (EPA 1989b):

$$I_s = \frac{C_s * IR * EF * ED * \left(1/VF + 1/PEF \right)}{BW * AT}$$

where:

- I_s = Intake of contaminant from soil inhalation (mg/kg/day)
- C_s = Chemical concentration in soil (mg/kg)
- IR = Inhalation rate (m^3/day)
- EF = Exposure frequency (days/years)
- ED = Exposure duration (years)
- VF = soil-to-air volatilization factor (m^3/kg)
- PEF = particulate emission factor (m^3/kg)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged—days)

Groundwater Ingestion

A receptor can ingest water by drinking it or through using household water for cooking. An estimate of intake from ingesting water will be calculated as follows (EPA 1989b):

$$I_w = \frac{C_w * IR * EF * ED}{BW * AT}$$

where:

- I_w = Intake of contaminant from water ingestion (mg/kg/day)
- C_w = Chemical concentration in water (mg/liter)
- IR = Ingestion rate (liters/day)
- EF = Exposure frequency (days/years)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged—days)

Groundwater Inhalation

The amount of a constituent taken into the body via exposure to volatilization from showering or other household water uses will be evaluated using the concentration of the constituent in the water source (EPA 1991 and 1992). An estimate of intake from volatile inhalation from groundwater will be calculated as follows (EPA 1991):

$$I_w = \frac{C_w * K * IR_i * EF * ED}{BW * AT}$$

where:

- I_w = Intake of volatile in water from inhalation (mg/kg/day)
- C_w = Chemical concentration in water (mg/L)
- K = volatilization factor (0.5 L/m^3)
- IR_i = Inhalation rate (m^3/day)
- EF = Exposure frequency (days/years)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged—days)

For volatile compounds, volatilization from groundwater can be an important exposure pathway from showering and other household uses of groundwater. This exposure pathway will only be evaluated for organic chemicals with a Henry's Law constant greater than 1 X 10^{-5} and with a molecular weight of 200 grams/mole or less (EPA 1991).

Vegetable and Fruit Ingestion

A receptor may ingest contaminated vegetables and fruits. This pathway is only applicable to the residential land-use scenario. An estimate of intake from ingesting vegetables and fruits will be calculated as follows (EPA 1989b):

$$I_f = \frac{C_f * IR * FI * EF * ED}{BW * AT}$$

where:

- I_f = Intake of contaminant from food ingestion (mg/kg/day)
- C_f = Chemical concentration in food (mg/kg)
- IR = Ingestion rate (kg/meal)
- FI = Fraction ingested from contaminated source (unitless)
- EF = Exposure frequency (meals/years)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged—days)

Tables B1-2 and B1-3 show the default parameter values suggested for use by SNL/NM at SWMUs, based upon the selected land use scenarios for nonradiological and radiological COCs, respectively. References are given at the end of the table indicating the source for the chosen parameter values. SNL/NM uses default values that are consistent with both regulatory guidance and the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways, based upon the assumption that a particular site has no unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

SNL/NM will use the described default exposure routes and parameter values in risk assessments at sites that have an industrial, recreational, or residential future land use scenario. There are no current residential land use designations at SNL/NM ER sites, but NMED has requested this scenario to be considered to provide perspective of the risk under the more restrictive land use scenario. For sites designated as industrial or recreational land use, SNL/NM will provide risk parameter values based upon a residential land use scenario to indicate the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on SNL/NM ER sites. The parameter values are based upon EPA guidance and supplemented by information from other government sources. The values are generally consistent with those proposed by Los Alamos National Laboratory for use in their Environmental Restoration Program, with a few minor variations. If these exposure routes and parameters are acceptable, SNL/NM will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Table B1-2
Default Nonradiological Exposure Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	350 day/yr
Exposure duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body weight (kg)	70[a,b]	70 adult[a,b] 15 child	70 adult[a,b] 15 child
Averaging Time (days)			
for carcinogenic compounds (= 70 yr x 365 day/yr)	25,550[a]	25,550[a]	25,550[a]
for noncarcinogenic compounds (= ED x 365 day/yr)	9,125	10,950	10,950
Soil Ingestion Pathway			
Ingestion rate	100 mg/day[c]	200 mg/day child 100 mg/day adult	200 mg/day child 100 mg/day adult
Inhalation Pathway			
Inhalation rate (m^3/yr)	5,000[a,b]	260	7,000[a,b]
Volatilization factor (m^3/kg)	chemical specific	chemical specific	chemical specific
Particulate emission factor (m^3/kg)	1.32E9[a]	1.32E9[a]	1.32E9[a]
Water Ingestion Pathway			
Ingestion rate (liter/day)	2[a,b]	2[a,b]	2[a,b]
Food Ingestion Pathway			
Ingestion rate (kg/yr)	NA	NA	138[b]
Fraction ingested	NA	NA	0.25[b]
Dermal Pathway			
Surface area in water (m^2)	2[b,d]	2[b,d]	2[b,d]
Surface area in soil (m^2)	0.53[b,d]	0.53[b,d]	0.53[b,d]
Permeability coefficient	chemical specific	chemical specific	chemical specific

[a]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[b]Exposure Factors Handbook (EPA 1989b).
[c]EPA Region VI guidance (EPA 1996).
[d]Dermal Exposure Assessment (EPA 1992).
ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour.
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week.
yr = Year.

Table B1-3
Default Radiological Exposure Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	365 day/yr
Exposure duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body weight (kg)	70 adult[a,b]	70 adult[a,b]	70 adult[a,b]
Soil Ingestion Pathway			
Ingestion rate	100 mg/day[c]	100 mg/day[c]	100 mg/day[c]
Averaging Time (days) (= 30 yr x 365 day/yr)	10,950[d]	10,950[d]	10,950[d]
Inhalation Pathway			
Inhalation rate (m^3/yr)	7300[d,e]	10,950[e]	7300[d,e]
Mass loading for inhalation g/m^3	1.36 E-5[d]	1.36 E-5[d]	1.36 E-5[d]
Food Ingestion Pathway			
Ingestion rate, leafy vegetables (kg/yr)	NA	NA	16.5[c]
Ingestion rate, fruits, non-leafy vegetables & grain (kg/yr)	NA	NA	101.8[b]
Fraction ingested	NA	NA	0.25[b,d]

[a]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[b]Exposure Factors Handbook (EPA 1989b).
[c]EPA Region VI guidance (EPA 1996).
[d]For radionuclides, RESRAD (ANL, 1993).
[e]SNL/NM (February 1998).
EPA = U.S. Environmental Protection Agency.
g = Gram(s)
hr = Hour.
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not applicable.
wk = Week.
yr = Year.

References

ANL, see Argonne National Laboratory.

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U.S. Environmental Protection Agency (EPA), 1992. "Dermal Exposure Assessment: Principles and Applications," EPA/600/8-91/011B, Office of Research and Development, Washington, D.C.

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U.S. Environmental Protection Agency (EPA), 1997. (OSWER No. 9200.4-18) *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, U.S. EPA Office of Radiation and Indoor Air, Washington D.C, August 1997.

ATTACHMENT C

DISCRETE SAMPLING OF THE SLIGHTLY CONTAMINATED DISCRETE SOIL PILES: JANUARY–MARCH 1997

Table C-1
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles, Summary of Alpha Spectroscopy Analytical Results January–March 1997

Sample Attributes			Activity (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
6202	TA2-RWL-CONT. SP#010-S	NA	ND (0.0049)	--	0.064	0.025
6203	TA2-RWL-CONT. SP. #011-S	NA	0.022	0.013	0.575	0.068
6204	TA2-RWL-CONT. SP# 012-S	NA	0.01	0.01	0.154	0.038
6205	TA2-RWL-CONT. SP# 013-S	NA	2.23	0.18	113.5	5.8
6206	TA2-RWL-CONT. SP# 014-S	NA	0.346	0.058	14.56	0.81
6207	TA2-RWL-CONT. SP. #017-S	NA	0.213	0.047	9.11	0.54
6208	TA2-RWL-CONT. SP#018-S	NA	ND (0.0042)	--	0.038	0.019
6209	TA2-RWL-CONT. SP. #019-S	NA	0.011	0.011	0.069	0.026
6210	TA2-RWL-CONT. SP. #020-S	NA	5.8	0.84	273	15
6211	TA2-RWL-CONT. SP# 021-S	NA	0.06	0.026	3.32	0.25
6212	TA2-RWL-CONT. SP# 022-S	NA	0.5	0.072	25.5	1.4
6213	TA2-RWL-CONT. SP# 026-S	NA	NR	--	2.45	0.2
6214	TA2-RWL-CONT. SP# 001-S	NA	0.626	0.072	31.1	1.6
Background activity—North Area Subsurface[c]			NE	NA	NE	NA

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

CONT. = Contaminated.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
NE = Background not established for North Area.
NR = Not reported.
pCi/g = Picocurie(s) per gram.
RWL = Radioactive Waste Landfill.
S = Sample.
SP# (SP. #) = Soil pile number.
TA = Technical Area.
– = Error not calculated for nondetectable results.

Table C-2
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles,
Summary of Gamma Spectroscopy Analytical Results
February–March 1997

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
6214	TA2-RWL-CONT. SP# 001-S	NA	6.06	0.65	0.045	0.026	NR	--
6228	TA2-RWL-CONT.SP#021-S	NA	0.995	0.188	0.0398	0.0268	ND (317)	--
6229	TA2-RWL-CONT.SP#022-S	NA	1.85	0.402	ND (0.0354)	--	ND (604)	--
6230	TA2-RWL-CONT. SP# 026-S	NA	0.205	0.101	0.512	0.214	ND (341)	--
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	NE	NA

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
6202	TA2-RWL-CONT. SP#010-S	NA	0.954	0.099	0.066	0.032	1.65	0.18
6203	TA2-RWL-CONT. SP. #011-S	NA	0.96	0.11	0.071	0.039	1.17	0.16
6204	TA2-RWL-CONT. SP# 012-S	NA	1.1	0.12	0.045	0.018	4.13	0.272
6205	TA2-RWL-CONT. SP# 013-S	NA	3.47	0.28	0.46	0.13	13.6	0.95
6206	TA2-RWL-CONT. SP# 014-S	NA	1.08	0.12	0.176	0.053	4.19	0.33
6207	TA2-RWL-CONT. SP. #017-S	NA	0.83	0.11	0.169	0.058	1.8	0.2
6208	TA2-RWL-CONT. SP#018-S	NA	1.44	0.14	0.159	0.057	1.12	0.15
6209	TA2-RWL-CONT. SP. #019-S	NA	1.76	0.14	0.073	0.041	0.85	0.14
6210	TA2-RWL-CONT. SP. #020-S	NA	0.92	0.11	0.108	0.074	2.8	0.39
6211	TA2-RWL-CONT. SP# 021-S	NA	0.87	0.1	0.082	0.039	1.9	0.21
6212	TA2-RWL-CONT. SP# 022-S	NA	0.791	0.083	3.05	0.34	70.4	3.8
6213	TA2-RWL-CONT. SP# 026-S	NA	1.34	0.12	0.1	0.04	1.28	0.15
6214	TA2-RWL-CONT. SP# 001-S	NA	0.83	0.081	0.073	0.034	0.85	0.12
6228	TA2-RWL-CONT.SP#021-S	NA	0.546	0.275	ND (0.175)	--	ND (0.879)	--
6229	TA2-RWL-CONT.SP#022-S	NA	0.65	0.336	2.83	0.485	51.6	12.8
6230	TA2-RWL-CONT. SP# 026-S	NA	ND (0.156)	--	ND (0.196)	--	ND (1.37)	--
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Note: Data for record numbers 6228, 6229 and 6239 were acquired from an on-site laboratory. All other data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

Table C-2 (Concluded)
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles,
Summary of Gamma Spectroscopy Analytical Results
February–March 1997

CONT.	= Contaminated.
ER	= Environmental Restoration.
ft	= Foot (feet).
ID	= Identification.
NA	= Not applicable.
ND ( )	= Not detected. The result is below the minimum detection activity, shown in parentheses.
NE	= Background not established for North Area.
NR	= Not reported.
pCi/g	= Picocurie(s) per gram.
RWL	= Radioactive Waste Landfill.
S	= Sample.
SP# (SP. #)	= Soil pile number.
TA	= Technical Area.
–	= Error not calculated for nondetectable results.

Table C-3
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles, Summary of Analytical Results for Tritium January–March 1997

Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
6202	TA2-RWL-CONT. SP#010-S	NA	6.92	0.355
6203	TA2-RWL-CONT. SP. #011-S	NA	149	7.5
6204	TA2-RWL-CONT. SP# 012-S	NA	2.83	0.145
6205	TA2-RWL-CONT. SP# 013-S	NA	22.65	1.15
6206	TA2-RWL-CONT. SP# 014-S	NA	58.35	2.9
6207	TA2-RWL-CONT. SP. #017-S	NA	52.3	2.6
6208	TA2-RWL-CONT. SP#018-S	NA	3.61	0.185
6209	TA2-RWL-CONT. SP. #019-S	NA	3.055	0.16
6210	TA2-RWL-CONT. SP. #020-S	NA	159	8
6211	TA2-RWL-CONT. SP# 021-S	NA	85.05	4.25
6212	TA2-RWL-CONT. SP# 022-S	NA	929	46.5
6213	TA2-RWL-CONT. SP# 026-S	NA	42.25	2.1
6214	TA2-RWL-CONT. SP# 001-S	NA	0.073	0.009
Background activity[c]			0.021	NA

Note: Data were acquired from an off-site laboratory.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Tharp, February 1999.

CONT.	= Contaminated.
ER	= Environmental Restoration.
ft	= Foot (feet).
ID	= Identification.
NA	= Not applicable.
pCi/g	= Picocurie(s) per gram.
RWL	= Radioactive Waste Landfill.
S	= Sample.
SP# (SP. #)	= Soil pile number.
TA	= Technical Area.

Table C-4
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles,
Summary of Analytical Results for Metals
January–March 1997

Sample Attributes			Metals (EPA Method 6020) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium
6231	TA2-RWL-CONT.SP#001-S	NA	3.6	130	0.18	7.1
6232	TA2-RWL-CONT.SP#002-S	NA	2.5	190	0.45	11
6233	TA2-RWL-CONT.SP#003-S	NA	3	120	0.5	8.9
6234	TA2-RWL-CONT.SP#004-S	NA	2.6	130	0.35	7.7
6235	TA2-RWL-CONT.SP#005-S	NA	2.4	120	0.32	7.1
6236	TA2-RWL-CONT. SP#006-S	NA	2.4	170	4.1	8.5
6237	TA2-RWL-CONT. SP#007-S	NA	3.3	180	0.53	6.4
6238	TA2-RWL-CONT. SP#008-S	NA	1.3	200	0.6	11
6239	TA2-RWL-CONT. SP#009-S	NA	2	110	0.65	7.3
6240	TA2-RWL-CONT. SP#010-S	NA	2.4	120	0.2	6.8
6241	TA2-RWL-CONT. SP#011-S	NA	2.2	140	0.25	16
6242	TA2-RWL-CONT.SP#13-S	NA	2.2	240	0.44	11
6243	TA2-RWL-CONTAMINATED SP-#12-S	NA	1.8	150	0.32	8.4
6244	TA2-RWL-CONT.SP#14-S	NA	2	120	0.41	12
6245	TA2-RWL-CONT. SP#015-S	NA	2.6	140	3.6 B	9.8
6246	TA2-RWL-CONT.SP#016-S	NA	2.1	130	0.4	8.4
6247	TA2-RWL-CONT.SP#017-S	NA	2.6	300	0.35	6.6
6248	TA2-RWL-CONT.SP#018-S	NA	2.1	100	0.55	8
6249	TA2-RWL-CONT.SP#019-S	NA	2	110	0.41	8.2
6250	TA2-RWL-CONT. SP#020-S	NA	1.4	100	0.29	8.2
6251	TA2-RWL-CONT.SP#021-S	NA	4.2	200	0.2	7.3
6252	TA2-RWL-CONT.SP#022-S	NA	3.5	200	2.6	9.3
6253	TA2-RWL-CONT.SP#023-S	NA	1.9	89	3.6	12
6254	TA2-RWL-CONT. SP#024-S	NA	2.3	98	0.98	7.1
6255	TA2-RWL-CONT.SP#25-S	NA	2.4	110	6.5	12
6256	TA2-RWL-CONT.SP#026-S	NA	2	100	0.6	5.2
Background concentration—North Area Subsurface[c]			4.4	200	0.9	12.8

Refer to footnotes at end of table.

Table C-4 (Continued)
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles, Summary of Analytical Results for Metals
January–March 1997

Sample Attributes			Metals (EPA Method 6020) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
6231	TA2-RWL-CONT.SP#001-S	NA	6.8	ND (0.044)	0.9	0.067
6232	TA2-RWL-CONT.SP#002-S	NA	7.7	ND (0.043)	1	ND
6233	TA2-RWL-CONT.SP#003-S	NA	9.5	ND (0.043)	0.97	ND (0.043)
6234	TA2-RWL-CONT.SP#004-S	NA	6.3	ND (0.041)	0.82	0.068
6235	TA2-RWL-CONT.SP#005-S	NA	6.2 [A,A2,J,P]	ND (0.042)	0.69	ND (0.042)
6236	TA2-RWL-CONT. SP#006-S	NA	5.4	ND (0.042)	0.97	ND (0.042)
6237	TA2-RWL-CONT. SP#007-S	NA	4.6	ND (0.041)	0.58	ND (0.041)
6238	TA2-RWL-CONT. SP#008-S	NA	5.8	0.14	0.79	ND (0.04)
6239	TA2-RWL-CONT. SP#009-S	NA	6.6	1.8	0.48	ND (0.042)
6240	TA2-RWL-CONT. SP#010-S	NA	4.9	0.54	0.58	ND (0.046)
6241	TA2-RWL-CONT. SP#011-S	NA	8.4	0.074	0.66	ND (0.042)
6242	TA2-RWL-CONT.SP#13-S	NA	6.7	0.095	1.1	ND (0.041)
6243	TA2-RWL-CONTAMINATED SP-#12-S	NA	6.5	0.18	0.85	ND (0.04)
6244	TA2-RWL-CONT.SP#14-S	NA	7.3	0.19	1.3	ND (0.043)
6245	TA2-RWL-CONT. SP#015-S	NA	9.4	1.5	1.1	0.067
6246	TA2-RWL-CONT.SP#016-S	NA	41	0.12	0.71	ND (0.04)
6247	TA2-RWL-CONT.SP#017-S	NA	5.5	0.18	0.62	ND (0.04)
6248	TA2-RWL-CONT.SP#018-S	NA	4.7	0.13	0.43	ND (0.042)
6249	TA2-RWL-CONT.SP#019-S	NA	4.8	0.15	0.59	ND (0.042)
6250	TA2-RWL-CONT. SP#020-S	NA	9.4	1.3	0.42	0.28
6251	TA2-RWL-CONT.SP#021-S	NA	7.2	0.69	0.7	ND (0.046)
6252	TA2-RWL-CONT.SP#022-S	NA	20	1.2	0.73	0.048
6253	TA2-RWL-CONT.SP#023-S	NA	14	3	0.63	1.8
6254	TA2-RWL-CONT. SP#024-S	NA	7	0.77	0.52	ND (0.04)
6255	TA2-RWL-CONT.SP#25-S	NA	24	7.8	0.59	0.49
6256	TA2-RWL-CONT.SP#026-S	NA	6.7	0.5	0.79	ND (0.041)
Background concentration—North Area Subsurface[c]			11.2	<0.1	<1	<1

Refer to footnotes at end of table.

Table C-4 (Concluded)
Discrete Sampling of the Slightly Contaminated Discrete Soil Piles, Summary of Analytical Results for Metals
January–March 1997

Note: Data were acquired from an on-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

[A]	= Laboratory accuracy and/or bias measurements for the associated laboratory control sample and /or laboratory control sample duplicate do not meet acceptance criteria.
[A2]	= Laboratory accuracy and/or bias measurements for the associated surrogate spike do not meet acceptance criteria.
CONT.	= Contaminated.
EPA	= U.S. Environmental Protection Agency.
ER	= Environmental Restoration.
ft	= Foot (feet).
ID	= Identification.
[J]	= The associated value is an estimated quantity.
[P]	= Laboratory precision measurements for the LCS. LCSD do not meet acceptance criteria.
LCS	= Laboratory control sample.
LCSD	= Laboratory control sample duplicate.
NA	= Not applicable.
ND ( )	= Not detected. The result is below the minimum detection level, shown in parentheses.
mg/kg	= Milligrams per kilogram.
RWL	= Radioactive Waste Landfill.
S	= Sample.
SP# (SP-#)	= Soil pile number.
TA	= Technical Area.

ATTACHMENT D

VERIFICATION SAMPLING:
AUGUST 1996 AND 1999

Table D-1
Discrete Verification Sampling from the Bottom of the Excavation Pits/Trenches, Summary of Alpha Spectroscopy Analytical Results
November 1999

Sample Attributes			Activity (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
602935	TA2-1-VERF-CDP-000-S	0–0.5	0.0431	0.0256	1.18	0.206
602935	TA2-1-VERF-PIT1-000-S	0–0.5	ND (0.0131)	--	ND (0.0125)	0.0087
602935	TA2-1-VERF-PIT2-000-S	0–0.5	ND (0.0113)	--	0.189	0.0594
602935	TA2-1-VERF-PIT7-000-D	0–0.5	ND (0.0117)	--	0.0576	0.0333
602935	TA2-1-VERF-PIT7-000-S	0–0.5	ND (0.0228)	--	0.549	0.121
602935	TA2-1-VERF-TR5-000-S	0–0.5	0.074	0.033	3.98	0.574
602935	TA2-1-VERF-TR6-000-S	0–0.5	0.0622	0.0316	2.56	0.39
Background activity—North Area Subsurface[c]			NE	NA	NE	NA

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

CDP = Chemical Disposal Pit.
D = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
PIT = Pit.
S = Sample.
TA = Technical Area.
TR = Trench.
VERF = Verification.
-- = Error not calculated for nondetectable results.

Table D-2
Discrete Verification Sampling from the Bottom of the Excavation Pits/Trenches, Summary of Gamma Spectroscopy Analytical Results
November 1999

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
602934	TA2-1-VERF-CDP-000-S	NA	ND (0.467)	--	ND (0.0284)	--	ND (360)	--
602934	TA2-1-VERF-PIT1-000-S	NA	ND (0.387)	--	ND (0.0243)	--	ND (338)	--
602934	TA2-1-VERF-PIT2-000-S	NA	ND (0.428)	--	0.0152	0.0217	ND (349)	--
602934	TA2-1-VERF-PIT7-000-D	NA	ND (0.449)	--	0.0154	0.0166	ND (365)	--
602934	TA2-1-VERF-PIT7-000-S	NA	ND (0.46)	--	0.0569	0.0315	ND (369)	--
602934	TA2-1-VERF-TR5-000-S	NA	0.562	0.302	0.0397	0.0146	ND (355)	--
602934	TA2-1-VERF-TR6-000-S	NA	ND (0.376)	--	0.0377	0.0199	ND (367)	--
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	NE	NA

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
602934	TA2-1-VERF-CDP-000-S	0–0.5	0.573	1.03	0.0942	0.155	ND (0.694)	--
602934	TA2-1-VERF-PIT1-000-S	0–0.5	0.673	0.348	ND (0.179)	--	ND (0.599)	--
602934	TA2-1-VERF-PIT2-000-S	0–0.5	ND (0.123)	--	0.114	0.15	ND (0.643)	--
602934	TA2-1-VERF-PIT7-000-D	0–0.5	0.383	0.202	ND (0.196)	--	ND (0.678)	--
602934	TA2-1-VERF-PIT7-000-S	0–0.5	0.502	0.302	ND (0.191)	--	ND (0.673)	--
602934	TA2-1-VERF-TR5-000-S	0–0.5	0.732	0.34	ND (0.191)	--	ND (0.682)	--
602934	TA2-1-VERF-TR6-000-S	0–0.5	0.61	0.343	0.11	0.154	ND (0.708)	--
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Note: Data were acquired from an on-site laboratory.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Dinwiddie, September 1997.

CDP = Chemical Disposal Pit.
D = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
PIT = Pit.
S = Sample.
TA = Technical Area.
TR = Trench.
VERF = Verification.
-- = Error not calculated for nondetectable results.

Table D-3
Discrete Verification Sampling from the Bottom of the Excavation Pits/Trenches, Summary of Analytical Results for Tritium
August 1996 and November 1999

Discrete Sampling: August 1996				
Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
5686	VERIFICATION PIT 1	0–0.5	6.85	0.35
5686	VERIFICATION PIT 2	0–0.5	805	23.9
5686	VERIFICATION PIT 3/4	0–0.5	0.302	0.02845
5686	VERIFICATION PIT 6	0–0.5	110.5	5.1
5686	VERIFICATION PIT 7	0–0.5	5.85	0.3605
Background activity[c]			0.021	NA
Discrete Sampling: November 1999				
Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
602935	TA2-1-VERF-CDP-000-S	0–0.5	ND (0.0085)[R]	--
602935	TA2-1-VERF-PIT1-000-S	0–0.5	ND (0.0079)	--
602935	TA2-1-VERF-PIT2-000-S	0–0.5	0.0303	0.01105
602935	TA2-1-VERF-PIT7-000-D	0–0.5	ND (0.0079)[R]	--
602935	TA2-1-VERF-PIT7-000-S	0–0.5	ND (0.00795)[R]	--
602935	TA2-1-VERF-TR5-000-S	0–0.5	0.0357	0.0156
602935	TA2-1-VERF-TR6-000-S	0–0.5	ND (0.0079)	--
Background activity[c]			0.021	NA

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Tharp, February 1999.

CDP = Chemical Disposal Pit.
D = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
PIT = Pit.
[R] = The data are unusable for their intended purpose. The analyte may or may not be present.
S = Sample.
TA = Technical Area.
TR = Trench.
VERF = Verification.
-- = Error not calculated for nondetectable results.

Table D-4
Discrete Verification Sampling from the Bottom of the Excavation Pits/Trenches
Summary of Analytical Results for Metals
November 1999

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)		
Record Number[a]	ER Sample ID	Sample Depth (ft)	Cadmium	Mercury	Silver
602935	TA2-1-VERF-CDP-000-S	0–0.5	0.0936J	0.0165	ND (0.101)
602935	TA2-1-VERF-PIT1-000-S	0–0.5	ND (0.0382)	ND (0.0152)	ND (0.101)
602935	TA2-1-VERF-PIT2-000-S	0–0.5	ND (0.0382)	0.0232	ND (0.101)
602935	TA2-1-VERF-PIT7-000-D	0–0.5	0.0796	ND (0.0152)	ND (0.101)
602935	TA2-1-VERF-PIT7-000-S	0–0.5	0.175	0.0364	ND (0.101)
602935	TA2-1-VERF-TR5-000-S	0–0.5	0.223	0.137	ND (0.101)
602935	TA2-1-VERF-TR6-000-S	0–0.5	0.243	0.051	ND (0.101)
Background activity—North Area Subsurface[b]			0.9	<0.1	<1

Note: Data were acquired from an off-site laboratory.
[a]Analysis request/chain-of-custody record.
[b]Dinwiddie, September 1997.
CDP = Chemical Disposal Pit.
D = Duplicate.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
ND ( ) = Not detected. The result is below the minimum detection level, shown in parentheses.
mg/kg = Milligrams per kilogram.
PIT = Pit.
S = Sample.
TA = Technical Area.
TR = Trench.
VERF = Verification.

ATTACHMENT E

DISCRETE SAMPLING OF THE SLIGHTLY CONTAMINATED CONSOLIDATED SOIL PILE: MAY-OCTOBER 2000 AND MAY 2001

Table E-1
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Gamma Spectroscopy Analytical Results May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
603181	TA2-1-POSTGRZ-1	NA	9.36	1.75	0.106	0.0362	ND (396)	--
603181	TA2-1-POSTGRZ-2	NA	2.25	0.76	0.149	0.0499	ND (438)	--
603181	TA2-1-POSTGRZ-3	NA	9.26	1.75	0.334	0.0688	ND (413)	--
603181	TA2-1-POSTGRZ-4	NA	4.38	0.867	0.318	0.0502	ND (398)	--
603182	TA2-1-POSTGRZ-10	NA	3.53	0.779	0.601	0.085	ND (423)	--
603182	TA2-1-POSTGRZ-11	NA	88.3	13.1	1.2	0.172	ND (440)	--
603182	TA2-1-POSTGRZ-12	NA	1.69	0.536	0.609	0.0848	ND (383)	--
603182	TA2-1-POSTGRZ-5	NA	2.19	0.624	0.491	0.0841	ND (389)	--
603182	TA2-1-POSTGRZ-6	NA	6.26	1.26	0.627	0.103	ND (413)	--
603182	TA2-1-POSTGRZ-7	NA	4.72	0.993	0.348	0.0682	ND (401)	--
603182	TA2-1-POSTGRZ-8	NA	4.14	0.739	0.48	0.0716	ND (410)	--
603182	TA2-1-POSTGRZ-9	NA	4.92	1.11	0.644	0.314	ND (432)	--
603182	TA2-1-POSTGS-1	NA	12.9	2.04	0.444	0.0658	ND (479)	--
603182	TA2-1-POSTGS-2	NA	12.3	1.94	0.386	0.0575	ND (430)	--
603182	TA2-1-POSTGS-3	NA	30	4.6	0.0643	0.0332	ND (393)	--
603182	TA2-1-POSTGS-4	NA	12.1	2.01	0.347	0.0683	ND (437)	--
603184	TA2-1-POSTGRIZ-13	NA	1.09	0.638	ND (0.0189)	--	ND (390)	--
603184	TA2-1-POSTGRIZ-14	NA	0.914	0.557	0.0903	0.0328	ND (390)	--
603184	TA2-1-POSTGRIZ-15	NA	2	0.699	0.0961	0.0369	ND (396)	--
603184	TA2-1-POSTGRIZ-16	NA	1.3	0.703	0.141	0.0418	ND (411)	--
603184	TA2-1-POSTGRIZ-17	NA	3.41	0.877	0.068	0.0385	ND (460)	--
603184	TA2-1-POSTGRIZ-18	NA	8.99	1.62	0.128	0.0436	ND (411)	--
603184	TA2-1-POSTGRIZ-19	NA	1.97	0.804	ND (0.0236)	--	ND (437)	--
603184	TA2-1-POSTGRIZ-20	NA	2.55	0.801	0.0971	0.0589	ND (390)	--
603184	TA2-1-SGSCOB-15C	NA	6.61	1.24	0.231	0.0535	ND (444)	--
603184	TA2-1-SGSCOB-20C	NA	205	30.1	0.152	0.0571	ND (391)	--
603184	TA2-1-SGSCOB-25C	NA	3.3	2.22	2.29	0.309	ND (490)	--
603184	TA2-1-SGSCOB-27C	NA	19.6	3.08	0.231	0.0543	1,680	557
603184	TA2-1-SGSCOB-4C	NA	2.36	0.861	0.168	0.0474	ND (395)	--
603188	TA2-1-POST-GRIZ-SGS-1	NA	8.12	1.53	2.98	0.396	ND (557)	--
603188	TA2-1-POST-GRIZ-SGS-2	NA	10.4	2.14	4.64	0.613	ND (700)	--
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	1.54	NA

Refer to footnotes at end of table.

Table E-1 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Gamma Spectroscopy Analytical Results May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
603188	TA2-1-POST-GRIZ-SGS-3	NA	9.53	1.64	3.73	0.483	ND (560)	--
603188	TA2-1-POST-GRIZ-SGS-4	NA	9.91	1.75	1.67	0.233	ND (497)	--
603189	TA2-1-POSTGRIZ-21	NA	5.6	0.996	2.8	0.363	ND (427)	--
603189	TA2-1-POSTGRIZ-22	NA	11.9	1.97	0.823	0.119	ND (412)	--
603189	TA2-1-POSTGRIZ-23	NA	17.9	2.84	4.45	0.647	ND (467)	--
603189	TA2-1-POSTGRIZ-24	NA	7.91	1.45	0.566	0.0794	ND (401)	--
603189	TA2-1-POSTGRIZ-SGS-5	NA	1.78	0.295	0.137	0.0274	ND (172)	0.374
603189	TA2-1-POSTGRIZ-SGS-6	NA	0.862	0.174	0.0818	0.0233	ND (178)	--
603189	TA2-1-POSTGRIZ-SGS-7	NA	0.75	0.125	0.0748	0.0489	ND (192)	0.329
603189	TA2-1-POSTGRIZ-SGS-8	NA	0.943	0.206	0.103	0.0454	ND (367)	0.644
603194	TA2-1-POSTGRIZ-25	NA	1.94	0.671	0.0998	0.0356	ND (410)	0.39
603194	TA2-1-POSTGRIZ-26	NA	1.57	0.617	0.0777	0.0453	ND (409)	0.355
603194	TA2-1-POSTGRIZ-27	NA	ND (0.391)	--	0.194	0.0511	ND (392)	0.46
603194	TA2-1-POSTGRIZ-28	NA	2.97	0.824	0.183	0.0471	ND (389)	0.457
603198	TA2-2-POST-GRIZ-29	NA	3.07	0.549	0.245	0.104	ND (376)	0.375
603198	TA2-2-POST-GRIZ-30	NA	3.81	0.841	0.273	0.0643	ND (404)	0.447
603198	TA2-2-POST-GRIZ-31	NA	2.97	0.898	0.222	0.0356	ND (373)	0.368
603198	TA2-2-POST-GRIZ-32	NA	3.2	0.77	0.236	0.0322	ND (383)	1.05
603349	TA2-1-POST-GRIZ-33	NA	1.91	1.57	0.27	0.0682	ND (381)	0.471
603349	TA2-1-POST-GRIZ-34	NA	3.59	0.679	0.858	0.142	ND (368)	0.478
603349	TA2-1-POST-GRIZ-35	NA	2.29	0.53	0.282	0.0702	ND (366)	--
603349	TA2-1-POST-GRIZ-36	NA	2.39	1.67	0.811	0.129	ND (369)	0.528
603350	TA2-1-POST-GRIZ-37	NA	1.84	0.636	0.352	0.0676	ND (370)	--
603350	TA2-1-POST-GRIZ-38	NA	1.65	0.681	0.297	0.0606	ND (378)	0.512
603350	TA2-1-POST-GRIZ-39	NA	1.45	0.585	0.393	0.07	ND (381)	0.486
603350	TA2-1-POST-GRIZ-40	NA	1.8	2.18	0.321	0.0799	ND (381)	0.48
603350	TA2-1-POST-GRIZ-41	NA	3.81	0.97	0.208	0.057	ND (375)	0.466
603350	TA2-1-POST-GRIZ-42	NA	4.13	1.09	0.203	0.0585	ND (393)	0.449
603350	TA2-1-POST-GRIZ-43	NA	3.52	0.869	0.217	0.353	ND (600)	--
603350	TA2-1-POST-GRIZ-44	NA	3.27	0.791	0.376	0.0718	ND (383)	0.511
603361	TA2-1-POST-SGS-CS1-S	NA	ND (9.48)	--	2820	360	ND (7880)	--
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	1.54	NA

Refer to footnotes at end of table.

Table E-1 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
603361	TA2-1-POST-SGS-CS2-S	NA	16	5.85	1460	186	ND (5000)	--
603361	TA2-1-POST-SGS-CS3-S	NA	ND (11.1)	--	4410	564	ND (8800)	--
603361	TA2-1-POST-SGS-CS4-S	NA	ND (8.86)	--	2660	340	ND (7260)	--
603695	TA2-1-POST-GRIZ-46	NA	3.37	0.741	0.139	0.0222	ND (377)	--
603695	TA2-1-POST-GRIZ-47	NA	2.46	0.572	0.133	0.0536	ND (349)	0.444
603695	TA2-1-POST-GRIZ-48	NA	1.15	0.508	0.183	0.0562	ND (362)	0.469
603695	TA2-1-POST-GRIZ-49	NA	2.91	0.609	0.158	0.0547	ND (381)	0.495
603747	TA2-1-RET1-S	NA	3.37	0.565	0.125	0.0436	NR	NA
603747	TA2-1-RET2-S	NA	2.04	0.372	0.148	0.0338	NR	NA
603747	TA2-1-SGS1-S	NA	10.2	1.53	1.69	0.229	NR	NA
603747	TA2-1-SGS2-S	NA	12.7	1.88	1.57	0.21	NR	NA
604476	TA2-1-POST-GRIZ-001-S	NA	1.96	0.358	0.183	0.0414	NR	NA
604476	TA2-1-POST-GRIZ-002-S	NA	2.88	0.481	0.146	0.0383	NR	NA
604476	TA2-1-POST-GRIZ-005-S	NA	2.14	0.375	0.168	0.0385	NR	--
604476	TA2-1-POST-GRIZ-006-S	NA	2.29	0.394	0.172	0.041	NR	--
604476	TA2-1-POST-GRIZ-007-S	NA	1.71	0.323	0.126	0.0355	NR	--
604476	TA2-1-POST-GRIZ-008-S	NA	2.26	0.394	0.0867	0.0319	NR	--
604476	TA2-1-POST-GRIZ-009-S	NA	2.44	0.416	0.284	0.0537	NR	--
604476	TA2-1-POST-GRIZ-010-S	NA	2.59	0.447	0.449	0.0724	NR	--
604476	TA2-1-POST-GRIZ-011-S	NA	1.75	0.331	0.169	0.039	NR	--
604476	TA2-1-POST-GRIZ-012-S	NA	2.07	0.373	0.191	0.043	NR	--
604476	TA2-1-POST-GRIZ-013-S	NA	1.8	0.34	0.72	0.105	NR	--
604476	TA2-1-POST-GRIZ-014-S	NA	1.7	0.317	0.161	0.0367	NR	--
604476	TA2-1-POST-GRIZ-015-DUP	NA	4.15	0.8	0.211	0.0385	NR	--
604476	TA2-1-POST-GRIZ-015-S	NA	1.63	0.314	0.147	0.0363	NR	--
604476	TA2-1-POST-GRIZ-016-S	NA	1.95	0.584	0.188	0.035	NR	--
604476	TA2-1-POST-GRIZ-017-S	NA	2.31	0.685	0.147	0.0335	NR	--
604476	TA2-1-POST-GRIZ-018-S	NA	2.38	0.683	0.195	0.0332	NR	--
604476	TA2-1-POST-GRIZ-019-S	NA	2.51	0.635	0.206	0.0422	NR	--
604476	TA2-1-POST-GRIZ-020-S	NA	1.3	0.495	0.313	0.0518	NR	--
604476	TA2-1-POST-GRIZ-021-S	NA	2.79	0.736	0.2	0.0407	NR	--
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	1.54	NA

Refer to footnotes at end of table.

Table E-1 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604476	TA2-1-POST-GRIZ-022-S	NA	3.35	0.841	0.168	0.034	NR	NA
604476	TA2-1-POST-GRIZ-023-S	NA	2.77	0.715	0.314	0.0652	NR	NA
604476	TA2-1-POST-GRIZ-024-S	NA	3.71	0.837	0.357	0.0554	NR	NA
604476	TA2-1-POST-GRIZ-025-S	NA	3.02	0.92	0.291	0.0544	NR	NA
604476	TA2-1-POST-GRIZ-026-S	NA	1.34	0.379	0.142	0.028	NR	NA
604476	TA2-1-POST-GRIZ-027-S	NA	3.03	0.5	0.208	0.0426	NR	NA
604476	TA2-1-POST-GRIZ-028-S	NA	1.49	0.28	0.202	0.0413	NR	NA
604476	TA2-1-POST-GRIZ-029-S	NA	1.34	0.277	0.143	0.0363	NR	NA
604476	TA2-1-POST-GRIZ-030-DUP	NA	1.84	0.351	0.133	0.0381	NR	NA
604476	TA2-1-POST-GRIZ-030-S	NA	2.47	0.446	0.186	0.0486	NR	NA
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	1.54	NA

Refer to footnotes at end of table.

Table E-1 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
603181	TA2-1-POSTGRZ-1	NA	0.863	0.44	0.161	0.171	3.69	0.92
603181	TA2-1-POSTGRZ-2	NA	1.38	0.658	ND (0.228)	--	ND (0.911)	--
603181	TA2-1-POSTGRZ-3	NA	0.945	0.579	0.323	0.184	5.87	5.53
603181	TA2-1-POSTGRZ-4	NA	0.663	0.339	0.882	0.247	11.5	6.84
603182	TA2-1-POSTGRZ-10	NA	0.978	0.452	0.183	0.146	4.67	5.74
603182	TA2-1-POSTGRZ-11	NA	0.963	0.508	ND (0.176)	--	5.12	2.4
603182	TA2-1-POSTGRZ-12	NA	0.85	0.389	0.229	0.126	5.14	1.79
603182	TA2-1-POSTGRZ-5	NA	ND (0.128)	--	0.263	0.215	4.23	4.09
603182	TA2-1-POSTGRZ-6	NA	0.853	0.443	0.284	0.0799	6.81	5.64
603182	TA2-1-POSTGRZ-7	NA	0.856	0.448	0.215	0.244	6.62	3.08
603182	TA2-1-POSTGRZ-8	NA	0.817	0.392	0.358	0.171	6.6	6.7
603182	TA2-1-POSTGRZ-9	NA	ND (0.141)	--	0.386	0.244	7.12	4.01
603182	TA2-1-POSTGS-1	NA	1.96	0.876	ND (0.257)	--	1.68	0.979
603182	TA2-1-POSTGS-2	NA	1.29	0.586	ND (0.229)	--	ND (0.835)	--
603182	TA2-1-POSTGS-3	NA	0.827	0.438	0.146	0.165	ND (0.73)	--
603182	TA2-1-POSTGS-4	NA	1.62	2.06	0.0922	0.182	ND (0.826)	--
603184	TA2-1-POSTGRIZ-13	NA	0.698	0.322	ND (0.149)	--	11.1	5.58
603184	TA2-1-POSTGRIZ-14	NA	0.735	0.398	ND (0.162)	--	10.3	2.67
603184	TA2-1-POSTGRIZ-15	NA	0.705	0.361	ND (0.185)	--	9.26	2
603184	TA2-1-POSTGRIZ-16	NA	0.876	0.396	0.257	0.28	10.6	2.02
603184	TA2-1-POSTGRIZ-17	NA	0.807	0.444	0.303	0.197	11	5.74
603184	TA2-1-POSTGRIZ-18	NA	ND (0.144)	--	0.2	0.243	8.35	3.34
603184	TA2-1-POSTGRIZ-19	NA	0.882	0.457	0.347	0.214	12.7	6.1
603184	TA2-1-POSTGRIZ-20	NA	0.769	0.405	0.23	0.266	7.82	3.05
603184	TA2-1-SGSCOB-15C	NA	1	0.476	ND (0.212)	--	1.42	1.73
603184	TA2-1-SGSCOB-20C	NA	0.814	0.464	0.251	0.167	2.75	2.43
603184	TA2-1-SGSCOB-25C	NA	0.176	1.52	0.228	0.172	ND (0.751)	--
603184	TA2-1-SGSCOB-27C	NA	ND (0.116)	--	ND (0.212)	--	ND (0.737)	--
603184	TA2-1-SGSCOB-4C	NA	ND (0.126)	--	0.23	0.189	11.1	5.55
603188	TA2-1-POST-GRIZ-SGS-1	NA	ND (0.182)	--	ND (0.291)	--	ND (0.868)	--
603188	TA2-1-POST-GRIZ-SGS-2	NA	3.39	1.58	ND (0.364)	--	3.04	3.15
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table E-1 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Gamma Spectroscopy Analytical Results May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
603188	TA2-1-POST-GRIZ-SGS-3	NA	2.9	1.3	ND (0.294)	--	1.54	1.55
603188	TA2-1-POST-GRIZ-SGS-4	NA	1.82	1.69	0.248	0.207	ND (0.938)	--
603189	TA2-1-POSTGRIZ-21	NA	0.96	0.442	0.164	0.185	4.64	3.37
603189	TA2-1-POSTGRIZ-22	NA	ND (0.14)	--	ND (0.219)	--	3.13	1.37
603189	TA2-1-POSTGRIZ-23	NA	1.54	0.751	0.229	0.208	ND (0.755)	--
603189	TA2-1-POSTGRIZ-24	NA	ND (0.119)	--	0.225	0.279	3.39	6.25
603189	TA2-1-POSTGRIZ-SGS-5	NA	0.804	0.374	0.183	0.0509	5.75	0.926
603189	TA2-1-POSTGRIZ-SGS-6	NA	ND (0.0714)	--	0.329	0.134	14.3	2.04
603189	TA2-1-POSTGRIZ-SGS-7	NA	0.736	0.329	0.367	0.125	13.8	3.07
603189	TA2-1-POSTGRIZ-SGS-8	NA	0.867	0.644	0.313	0.163	10.7	4.15
603194	TA2-1-POSTGRIZ-25	NA	0.761	0.39	0.297	0.188	13	4.07
603194	TA2-1-POSTGRIZ-26	NA	0.783	0.355	0.243	0.248	9.42	2.91
603194	TA2-1-POSTGRIZ-27	NA	0.925	0.46	0.253	0.16	9.73	3.12
603194	TA2-1-POSTGRIZ-28	NA	0.902	0.457	0.288	0.196	10.1	1.91
603198	TA2-2-POST-GRIZ-29	NA	0.751	0.375	0.237	0.167	8.25	3.48
603198	TA2-2-POST-GRIZ-30	NA	0.901	0.447	0.226	0.158	8.11	3.64
603198	TA2-2-POST-GRIZ-31	NA	0.714	0.368	ND (0.12)	--	6.27	2.45
603198	TA2-2-POST-GRIZ-32	NA	0.853	1.05	0.253	0.183	7.59	7.02
603349	TA2-1-POST-GRIZ-33	NA	0.866	0.471	ND (0.212)	--	2.95	0.882
603349	TA2-1-POST-GRIZ-34	NA	0.929	0.478	ND (0.197)	--	2.14	0.738
603349	TA2-1-POST-GRIZ-35	NA	ND (0.155)	--	0.0972	0.181	3.4	0.852
603349	TA2-1-POST-GRIZ-36	NA	1.08	0.528	0.128	0.138	3.16	0.874
603350	TA2-1-POST-GRIZ-37	NA	ND (0.128)	--	ND (0.147)	--	3.05	2.96
603350	TA2-1-POST-GRIZ-38	NA	1.01	0.512	0.17	0.163	3.02	1.63
603350	TA2-1-POST-GRIZ-39	NA	0.928	0.486	0.152	0.168	4.27	2.31
603350	TA2-1-POST-GRIZ-40	NA	0.931	0.48	ND (0.203)	--	3.03	1.88
603350	TA2-1-POST-GRIZ-41	NA	0.938	0.466	ND (0.208)	--	ND (0.804)	--
603350	TA2-1-POST-GRIZ-42	NA	0.849	0.449	0.127	0.121	2.71	2.98
603350	TA2-1-POST-GRIZ-43	NA	ND (0.185)	--	0.702	0.34	25.2	4.83
603350	TA2-1-POST-GRIZ-44	NA	1.02	0.511	0.235	0.162	5.2	1.29
603361	TA2-1-POST-SGS-CS1-S	NA	ND (5.02)	--	ND (4.4)	--	ND (12)	--
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table E-1 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
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Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
603361	TA2-1-POST-SGS-CS2-S	NA	ND (3.21)	--	ND (2.78)	--	ND (7.66)	--
603361	TA2-1-POST-SGS-CS3-S	NA	ND (5.63)	--	ND (4.86)	--	ND (13.8)	--
603361	TA2-1-POST-SGS-CS4-S	NA	ND (4.69)	--	ND (4.01)	--	ND (11.2)	--
603695	TA2-1-POST-GRIZ-46	NA	ND (0.166)	--	ND (0.208)	--	ND (0.526)	--
603695	TA2-1-POST-GRIZ-47	NA	0.946	0.444	0.0966	0.165	1.19	1
603695	TA2-1-POST-GRIZ-48	NA	0.904	0.469	0.0935	0.178	2.23	0.65
603695	TA2-1-POST-GRIZ-49	NA	0.932	0.495	ND (0.214)	--	ND (0.597)	--
603747	TA2-1-RET1-S	NA	0.879	0.431	ND (0.191)	--	1.47	0.573
603747	TA2-1-RET2-S	NA	0.949	0.437	0.171	0.165	1.3	0.594
603747	TA2-1-SGS1-S	NA	1.99	0.905	0.249	0.213	2.97	0.949
603747	TA2-1-SGS2-S	NA	2.45	1.1	ND (0.257)	--	2.64	1.23
604476	TA2-1-POST-GRIZ-001-S	NA	0.931	0.45	ND (0.234)	--	ND (0.675)	--
604476	TA2-1-POST-GRIZ-002-S	NA	1.2	0.554	ND (0.235)	--	1.7	0.435
604476	TA2-1-POST-GRIZ-003-S	NA	1.22	0.572	ND (0.258)	--	ND (0.754)	--
604476	TA2-1-POST-GRIZ-004-S	NA	1.04	0.506	0.201	0.222	ND (0.805)	--
604476	TA2-1-POST-GRIZ-005-S	NA	0.994	0.47	0.136	0.153	1.34	0.375
604476	TA2-1-POST-GRIZ-006-S	NA	1.31	0.606	0.156	0.207	2.03	0.485
604476	TA2-1-POST-GRIZ-007-S	NA	1.06	0.499	0.134	0.191	ND (0.665)	--
604476	TA2-1-POST-GRIZ-008-S	NA	1.13	0.533	0.261	0.215	1.41	0.398
604476	TA2-1-POST-GRIZ-009-S	NA	1.05	0.498	ND (0.232)	--	1.77	0.426
604476	TA2-1-POST-GRIZ-010-S	NA	0.837	0.416	ND (0.284)	--	5.25	0.905
604476	TA2-1-POST-GRIZ-011-S	NA	1.16	0.541	ND (0.266)	--	1.54	0.409
604476	TA2-1-POST-GRIZ-012-S	NA	1.07	0.508	ND (0.243)	--	1.29	0.393
604476	TA2-1-POST-GRIZ-013-S	NA	0.982	0.475	ND (0.234)	--	1.21	0.37
604476	TA2-1-POST-GRIZ-014-S	NA	1.16	0.538	ND (0.213)	--	1.19	0.351
604476	TA2-1-POST-GRIZ-015-DUP	NA	0.998	0.459	ND (0.232)	--	1.47	0.408
604476	TA2-1-POST-GRIZ-015-S	NA	0.93	0.445	ND (0.215)	--	1.21	0.351
604476	TA2-1-POST-GRIZ-016-S	NA	1.22	0.564	0.143	0.169	2.85	0.576
604476	TA2-1-POST-GRIZ-017-S	NA	1.31	0.597	ND (0.245)	--	ND (0.882)	--
604476	TA2-1-POST-GRIZ-018-S	NA	1.17	0.547	0.218	0.21	2.06	0.501
604476	TA2-1-POST-GRIZ-019-S	NA	1.23	0.577	0.168	0.18	ND (0.992)	--
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table E-1 (Concluded)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Gamma Spectroscopy Analytical Results May 2000–Oct 2000 and May 2001

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604476	TA2-1-POST-GRIZ-020-S	NA	1.24	0.562	ND (0.259)	--	1.6	0.44
604476	TA2-1-POST-GRIZ-021-S	NA	1.37	0.637	ND (0.268)	--	ND (0.984)	--
604476	TA2-1-POST-GRIZ-022-S	NA	1.3	0.615	0.152	0.208	ND (0.956)	--
604476	TA2-1-POST-GRIZ-023-S	NA	1.02	0.47	ND (0.236)	--	3.93	0.719
604476	TA2-1-POST-GRIZ-024-S	NA	1.16	0.529	0.211	0.199	3.37	0.661
604476	TA2-1-POST-GRIZ-025-S	NA	1.43	0.683	ND (0.332)	--	2.97	0.668
604476	TA2-1-POST-GRIZ-026-S	NA	0.791	0.384	ND (0.193)	--	ND (0.713)	--
604476	TA2-1-POST-GRIZ-027-S	NA	0.991	0.474	ND (0.226)	--	1.47	0.406
604476	TA2-1-POST-GRIZ-028-S	NA	1.13	0.524	0.125	0.152	1.72	0.412
604476	TA2-1-POST-GRIZ-029-S	NA	1.08	0.505	0.202	0.19	1.44	0.381
604476	TA2-1-POST-GRIZ-030-DUP	NA	1.05	0.503	ND (0.248)	--	1.44	0.414
604476	TA2-1-POST-GRIZ-030-S	NA	1.26	0.599	0.195	0.235	1.24	0.417
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Note: Data were acquired from an on-site laboratory. Samples from Record Number 603747 were split with NMED.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

C = Cobble.
DUP = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
NE = Background not established for North Area.
NMED = New Mexico Environment Department.
NR = Not reported.
pCi/g = Picocurie(s) per gram.
POSTGRZ (POST-GRIZ), POST GRIZ, POST GS = Post-GRIZZLY sample taken after soil processed through the GRIZZLY screening system.
RET = Returned after being processed through the GRIZZLY screening system.
SGS = Segregated gate system.
SGSCOB = Segregated gate system cobble.
TA = Technical Area.
-- = Error not calculated for nondetectable results.

Table E-2
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Analytical Results for Tritium
October 2000

Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
603748	TA2-1-RET1-S	NA	0.95	0.03535
603748	TA2-1-RET2-S	NA	0.458	0.02265
603748	TA2-1-SGS1-S	NA	6.35	0.137
603748	TA2-1-SGS2-S	NA	4.625	0.1055
Background activity[c]			0.021	NA

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Tharp, February 1999.

ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
RET = Returned after being processed through the GRIZZLY screening system.
SGS = Segmented Gate System.
TA = Technical Area.

Table E-3
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Analytical Results for Metals
October 2000 and May 2001

Sample Attributes			Metals (EPA Method 6010/EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium
603748	TA2-1-RET1-S	NA	4.2	132	0.457	9.04 [J,P1]
603748	TA2-1-RET2-S	NA	3.55	136	0.178	8.55 [J,P1]
603748	TA2-1-SGS1-S	NA	3.11	140	1	7.12 [J,P1]
603748	TA2-1-SGS2-S	NA	2.89	119	0.851	5.42 [J,P1]
604477	TA2-1-POST-GRIZ-001-S	NA	4.55	126	0.596	13.9
604477	TA2-1-POST-GRIZ-002-S	NA	4.05	134	ND (0.013)	13.7
604477	TA2-1-POST-GRIZ-003-S	NA	4.54	137	ND (0.013)	13.7
604477	TA2-1-POST-GRIZ-004-S	NA	4.4	163	ND (0.013)	13.4
604477	TA2-1-POST-GRIZ-005-S	NA	4.49	140	0.116	14
604477	TA2-1-POST-GRIZ-006-S	NA	4.09	129	0.257	14.5
604477	TA2-1-POST-GRIZ-007-S	NA	3.92	126	0.443	13.3
604477	TA2-1-POST-GRIZ-008-S	NA	4.33	122	2.18	12
604477	TA2-1-POST-GRIZ-009-S	NA	4.34	142	0.458	13.5
604477	TA2-1-POST-GRIZ-010-S	NA	4.33	129	0.302	12.8
604477	TA2-1-POST-GRIZ-011-S	NA	4.13	138	1.12	14.8
604477	TA2-1-POST-GRIZ-012-S	NA	4.27	139	0.55	13.9
604477	TA2-1-POST-GRIZ-013-S	NA	4.33	140	ND (0.013)	13.4
604477	TA2-1-POST-GRIZ-014-S	NA	3.99	128	ND (0.013)	12.7
604477	TA2-1-POST-GRIZ-015-DUP	NA	4.18	120	0.0986	11.5
604477	TA2-1-POST-GRIZ-015-S	NA	4.25	120	0.0778	13.8
604477	TA2-1-POST-GRIZ-016-S	NA	3.96	132	0.141	12.5
604477	TA2-1-POST-GRIZ-017-S	NA	4.24	143	0.113	12.7
604477	TA2-1-POST-GRIZ-018-S	NA	4.41	139	0.0456	13.7
604477	TA2-1-POST-GRIZ-019-S	NA	4.18	131	0.0303	13.4
604477	TA2-1-POST-GRIZ-020-S	NA	3.48	126	0.744	9.72
604477	TA2-1-POST-GRIZ-021-S	NA	3.32	118	0.689	9.73
604477	TA2-1-POST-GRIZ-022-S	NA	3.22	113	0.685	9.05
604477	TA2-1-POST-GRIZ-023-S	NA	2.89	108	1.19	8.61
604477	TA2-1-POST-GRIZ-024-S	NA	2.87	109	1.11	8.33
604477	TA2-1-POST-GRIZ-025-S	NA	3.45	124	0.95	9.11
604477	TA2-1-POST-GRIZ-026-S	NA	3.34	129	1.19	10.2
604477	TA2-1-POST-GRIZ-027-S	NA	3.58	126	1.15	9.69
Background concentration—North Area Subsurface[b]			4.4	200	0.9	12.8

Refer to footnotes at end of table.

Table E-3 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile,
Summary of Analytical Results for Metals
October 2000 and May 2001

Sample Attributes			Metals (EPA Method 6010/EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium
604477	TA2-1-POST-GRIZ-028-S	NA	3.73	116	1.3	8.77
604477	TA2-1-POST-GRIZ-029-S	NA	3.33	123	1.27	10.1
604477	TA2-1-POST-GRIZ-030-DUP	NA	3.45	120	0.769	9.93
604477	TA2-1-POST-GRIZ-030-S	NA	3.55	120	0.688	10.1
Background concentration—North Area Subsurface[b]			4.4	200	0.9	12.8

Refer to footnotes at end of table.

Table E-3 (Continued)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Analytical Results for Metals October 2000 and May 2001

Sample Attributes			Metals (EPA Method 6010/EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
603748	TA2-1-RET1-S	NA	11.7 [J,P1]	0.261 [A2,J]	0.501	ND (0.101)
603748	TA2-1-RET2-S	NA	11.4 [J,P1]	0.237 [A2,J]	0.532	ND (0.101)
603748	TA2-1-SGS1-S	NA	17.7 [J,P1]	1.46 [A2,J]	0.441	0.332
603748	TA2-1-SGS2-S	NA	13.2 [J,P1]	1.62 [A2,J]	0.4	0.218
604477	TA2-1-POST-GRIZ-001-S	NA	10	0.248 [A2,J]	1.03	ND (0.0578)
604477	TA2-1-POST-GRIZ-002-S	NA	10.6	0.231 [A2,J]	1.01	ND (0.0578)
604477	TA2-1-POST-GRIZ-003-S	NA	10.2	0.284 [A2,J]	1.13	0.127
604477	TA2-1-POST-GRIZ-004-S	NA	9.75	0.26 [A2,J]	1	ND (0.0578)
604477	TA2-1-POST-GRIZ-005-S	NA	9.75	0.285 [A2,J]	1	ND (0.0578)
604477	TA2-1-POST-GRIZ-006-S	NA	10.1	0.357 [A2,J]	0.751	ND (0.0578)
604477	TA2-1-POST-GRIZ-007-S	NA	9.75	0.219 [A2,J]	0.71	0.245
604477	TA2-1-POST-GRIZ-008-S	NA	10.1	0.271 [A2,J]	0.997	ND (0.0578)
604477	TA2-1-POST-GRIZ-009-S	NA	10.4	0.44 [A2,J]	0.997	0.369
604477	TA2-1-POST-GRIZ-010-S	NA	9.64	0.323 [A2,J]	0.674	ND (0.0578)
604477	TA2-1-POST-GRIZ-011-S	NA	10.3	0.434 [A2,J]	1.03	0.272
604477	TA2-1-POST-GRIZ-012-S	NA	10.2	0.417 [A2,J]	0.866	0.328
604477	TA2-1-POST-GRIZ-013-S	NA	10	0.268 [A2,J]	0.85	ND (0.0578)
604477	TA2-1-POST-GRIZ-014-S	NA	9.36	0.255 [A2,J]	0.581 [B3,J]	ND (0.0578)
604477	TA2-1-POST-GRIZ-015-DUP	NA	9.09	0.235 [A2,J]	0.806	ND (0.0578)
604477	TA2-1-POST-GRIZ-015-S	NA	9.55	0.26 [A2,J]	1.33	ND (0.0578)
604477	TA2-1-POST-GRIZ-016-S	NA	11.1	0.263 [A2,J]	0.693	ND (0.0578)
604477	TA2-1-POST-GRIZ-017-S	NA	9.48	0.238 [A2,J]	0.546 [B3,J]	ND (0.0578)
604477	TA2-1-POST-GRIZ-018-S	NA	9.65	0.205 [A2,J]	0.6 [B3,J]	ND (0.0578)
604477	TA2-1-POST-GRIZ-019-S	NA	9.86	0.321 [A2,J]	1.09	ND (0.0578)
604477	TA2-1-POST-GRIZ-020-S	NA	9.9	0.318 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-021-S	NA	9.71	0.271 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-022-S	NA	9.17	0.241 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-023-S	NA	10.9	0.361 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-024-S	NA	9.68	0.485 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-025-S	NA	9.29	0.307 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-026-S	NA	11.9	0.421 [J]	ND (0.135)	0.206
604477	TA2-1-POST-GRIZ-027-S	NA	10.4	0.4 [J]	ND (0.135)	0.174
Background concentration—North Area Subsurface[b]			11.2	<0.1	<1	<1

Refer to footnotes at end of table.

Table E-3 (Concluded)
Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile, Summary of Analytical Results for Metals
October 2000 and May 2001

Sample Attributes			Metals (EPA Method 6010/EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
604477	TA2-1-POST-GRIZ-028-S	NA	41.2	0.294 [J]	ND (0.135)	0.174
604477	TA2-1-POST-GRIZ-029-S	NA	9.51	0.275 [J]	ND (0.135)	ND (0.0578)
604477	TA2-1-POST-GRIZ-030-DUP	NA	10.5	0.248 [J]	ND (0.135)	0.115
604477	TA2-1-POST-GRIZ-030-S	NA	9.27	0.227 [J]	ND (0.135)	ND (0.0578)
Background concentration—North Area Subsurface[b]			11.2	<0.1	<1	<1

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Dinwiddie, September 1997.

[A2] = Laboratory accuracy and/or bias measurements for the associated surrogate spike do not meet acceptance criteria.
[B3] = Analyte present in calibration blank.
DUP = Duplicate.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
[J] = The associated value is an estimated quantity.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection level, shown in parentheses.
NE = Background not established for North Area.
mg/kg = Milligrams per kilogram.
MS = Matrix spike.
MSD = Matrix spike duplicate.
[P1] = Laboratory precision measurements for the MS sample and associated MSD do not meet acceptance criteria.
POST-GRIZ = Post-GRIZZLY sample taken after soil processed through the GRIZZLY screening system.
RET = Returned after being processed through the GRIZZLY screening system.
S = Sample.
SGS = Segmented Gate System.
TA = Technical Area.

ATTACHMENT F

DISCRETE SAMPLING OF THE CONSOLIDATED CLEAN SOIL PILE: APRIL 2001

Table F-1
Discrete Sampling of the Consolidated Clean Soil Pile, Summary of Alpha Spectroscopy Analytical Results
April 2001

Sample Attributes			Activity (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
604427	TA2-1-OVER-SLPE-001-S	NA	0.0131	0.0139	0.0261	0.0731
604427	TA2-1-OVER-SLPE-002-S	NA	ND (0.00413)	--	0.324	0.0575
604427	TA2-1-OVER-SLPE-003-S	NA	ND (0.00458)	--	0.138	0.0367
604427	TA2-1-OVER-SLPE-004-S	NA	0.00754	0.00875	0.0344	0.0162
604427	TA2-1-OVER-SLPE-005-S	NA	0.01	0.0101	0.164	0.0389
604427	TA2-1-OVER-SLPE-006-S	NA	0.0418	0.0202	2.55	0.3
604427	TA2-1-OVER-SLPE-007-S	NA	0.0178	0.0118	0.61	0.0818
604427	TA2-1-OVER-SLPE-008-S	NA	0.019	0.0128	0.559	0.0825
604427	TA2-1-OVER-SLPE-009-S	NA	0.011	0.00903	0.427	0.0647
604427	TA2-1-OVER-SLPE-010-S	NA	ND (0.00545)	--	0.233	0.0458
604427	TA2-1-OVER-SLPE-011-S	NA	0.00812	0.00817	0.294	0.0516
604427	TA2-1-OVER-SLPE-012-S	NA	0.0069	0.00979	0.239	0.0555
604427	TA2-1-OVER-SLPE-013-S	NA	0.0127	0.0105	0.324	0.058
604427	TA2-1-OVER-SLPE-014-S	NA	ND (0.00397)	--	0.0345	0.0151
604427	TA2-1-OVER-SLPE-015-S	NA	ND (0.00429)	--	0.41	0.0709
604429	TA2-1-OVER-SLPE-016-S	NA	ND (0.0261)	--	0.322 [J]	0.101
604429	TA2-1-OVER-SLPE-017-S	NA	ND (0.00961)	--	0.225	0.0546
604429	TA2-1-OVER-SLPE-018-S	NA	ND (0.0096)	--	0.387	0.077
604429	TA2-1-OVER-SLPE-019-S	NA	0.0122	0.0158	0.268	0.0621
604429	TA2-1-OVER-SLPE-020-S	NA	ND (0.0248)	--	0.378	0.105
604429	TA2-1-OVER-SLPE-021-S	NA	0.0403[B,J]	0.0406	1.48	0.276
604429	TA2-1-OVER-SLPE-022-S	NA	ND (0.0267)	--	0.294	0.0939
604429	TA2-1-OVER-SLPE-023-S	NA	0.0115	0.0133	0.438	0.0855
604429	TA2-1-OVER-SLPE-024-S	NA	ND (0.0272)	--	0.251	0.0891
604429	TA2-1-OVER-SLPE-025-S	NA	ND (0.0294)	--	ND (0.0165)	--
604429	TA2-1-OVER-SLPE-026-S	NA	ND (0.023)	--	ND (0.0128)	--
604429	TA2-1-OVER-SLPE-027-S	NA	0.0281	0.0283	ND (0.0111)	--
604429	TA2-1-OVER-SLPE-028-S	NA	ND (0.022)	--	0.0526[	0.035
604429	TA2-1-OVER-SLPE-029-DU	NA	ND (0.00694	--	0.0637	0.0253
604429	TA2-1-OVER-SLPE-029-S	NA	ND (0.00637)	--	0.0619	0.0311
604429	TA2-1-OVER-SLPE-030-S	NA	ND (0.0223)	--	0.0611	0.036
604433	TA2-1-OVER-SLPE-031-S	NA	0.184	0.0446	0.475	0.0818
604433	TA2-1-OVER-SLPE-032-S	NA	ND (0.00814)	--	0.132	0.0367
604433	TA2-1-OVER-SLPE-033-S	NA	0.0138	0.0113	0.0396	0.0202
604433	TA2-1-OVER-SLPE-034-S	NA	0.01	0.0111	0.205	0.05
604433	TA2-1-OVER-SLPE-035-S	NA	0.00799	0.00881	0.29	0.0562
604433	TA2-1-OVER-SLPE-036-S	NA	0.0239	0.016	1.03	0.151
604433	TA2-1-OVER-SLPE-037-S	NA	0.00818	0.00823	0.458	0.0787
604433	TA2-1-OVER-SLPE-038-S	NA	ND (0.00661)	--	0.362	0.0703
604433	TA2-1-OVER-SLPE-039-S	NA	0.0199	0.0164	0.721	0.116
604433	TA2-1-OVER-SLPE-040-S	NA	ND (0.0055)	--	0.123	0.0352
604433	TA2-1-OVER-SLPE-041-S	NA	ND (0.009)	--	0.497	0.0883
604433	TA2-1-OVER-SLPE-042-S	NA	0.023	0.0189	0.414	0.0825
604433	TA2-1-OVER-SLPE-043-S	NA	0.0106	0.00959	0.309	0.0613
604433	TA2-1-OVER-SLPE-044-S	NA	ND (0.00271)	--	0.123	0.0343
604433	TA2-1-OVER-SLPE-045-S	NA	0.013	0.0144	0.645	0.103
604475	TA2-1-OVER-SLPE-046-S	NA	0.00636	0.00768	0.479	0.0712
604475	TA2-1-OVER-SLPE-047-S	NA	0.00632	0.006	0.35	0.053
604475	TA2-1-OVER-SLPE-048-S	NA	0.00499	0.00614	0.423	0.0645
Background activity—North Area Subsurface[c]			NE	NA	NE	NA

Refer to footnotes at end of table.

Table F-1 (Concluded)
Discrete Sampling of the Consolidated Clean Soil Pile, Summary of Alpha Spectroscopy Analytical Results
April 2001

Sample Attributes			Activity (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
604475	TA2-1-OVER-SLPE-049-S	NA	0.00522	0.00524	0.233	0.0425
604475	TA2-1-OVER-SLPE-050-S	NA	0.0806	0.0243	0.355	0.0599
604475	TA2-1-OVER-SLPE-051-S	NA	0.0189	0.0091	0.524	0.072
604475	TA2-1-OVER-SLPE-052-S	NA	ND (0.00246)	--	0.198	0.0355
604475	TA2-1-OVER-SLPE-053-S	NA	0.0564	0.0183	0.41	0.0631
604475	TA2-1-OVER-SLPE-054-S	NA	ND (0.00345)	--	0.0652	0.0195
604475	TA2-1-OVER-SLPE-055-S	NA	0.00726	0.00554	0.261	0.0426
604475	TA2-1-OVER-SLPE-056-S	NA	0.00932	0.00814	0.415	0.0622
604475	TA2-1-OVER-SLPE-057-S	NA	0.00513	0.00462	0.218	0.0375
604475	TA2-1-OVER-SLPE-058-S	NA	0.0096	0.00833	0.287	0.0479
604475	TA2-1-OVER-SLPE-059-S	NA	0.0116	0.0078	0.596	0.0785
604475	TA2-1-OVER-SLPE-060-DU	NA	0.00425	0.00523	0.105	0.024
604475	TA2-1-OVER-SLPE-060-S	NA	0.0111	0.00794	0.169	0.0356
Background activity—North Area Subsurface[c]			NE	NA	NE	NA

Note: Data were acquired from an off-site laboratory.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Dinwiddie, September 1997.

DU = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected.
NE = Background not established for North Area.
OVER-SLPE = Designates overslope soil to be used as backfill at 0 to 5 ft.
pCi/g = Picocurie(s) per gram.
S = Sample.
TA = Technical Area.
-- = Error not calculated for nondetectable results.

Table F-2
Discrete Sampling of the Consolidated Clean Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
April 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604426	TA2-1-OVER-SLPE-001-S	NA	ND (0.613)	--	0.0595	0.0235	ND (489)	--
604426	TA2-1-OVER-SLPE-002-S	NA	ND (0.565)	--	0.0433	0.0174	ND (467)	--
604426	TA2-1-OVER-SLPE-003-S	NA	ND (0.542)	--	0.123	0.029	ND (444)	--
604426	TA2-1-OVER-SLPE-004-S	NA	ND (0.557)	--	0.092	0.0401	ND (453)	--
604426	TA2-1-OVER-SLPE-005-S	NA	ND (0.541)	--	ND (0.0364)	--	ND (446)	--
604426	TA2-1-OVER-SLPE-006-S	NA	ND (0.516)	--	0.0205	0.0131	ND (398)	--
604426	TA2-1-OVER-SLPE-007-S	NA	ND (0.576)	--	0.0278	0.0262	ND (462)	--
604426	TA2-1-OVER-SLPE-008-S	NA	ND (0.545)	--	0.0456	0.0186	ND (442)	--
604426	TA2-1-OVER-SLPE-009-S	NA	ND (0.542)	--	0.13	0.0385	ND (460)	--
604426	TA2-1-OVER-SLPE-010-S	NA	ND (0.497)	--	ND (0.0322)	--	ND (406)	--
604426	TA2-1-OVER-SLPE-011-S	NA	ND (0.509)	--	0.0445	0.0161	ND (423)	--
604426	TA2-1-OVER-SLPE-012-S	NA	ND (0.532)	--	0.115	0.0277	ND (453)	--
604426	TA2-1-OVER-SLPE-013-S	NA	ND (0.586)	--	0.106	0.0289	ND (492)	--
604426	TA2-1-OVER-SLPE-014-S	NA	ND (0.558)	--	0.113	0.0302	ND (471)	--
604426	TA2-1-OVER-SLPE-015-S	NA	ND (0.519)	--	0.0125	0.0167	ND (422)	--
604428	TA2-1-OVER-SLPE-016-S	NA	ND (0.489)	--	ND (0.0169)	--	ND (397)	--
604428	TA2-1-OVER-SLPE-017-S	NA	ND (0.529)	--	ND (0.0339)	--	ND (458)	--
604428	TA2-1-OVER-SLPE-018-S	NA	ND (0.595)	--	ND (0.0378)	--	ND (496)	--
604428	TA2-1-OVER-SLPE-019-S	NA	ND (0.581)	--	0.0392	0.0199	ND (468)	--
604428	TA2-1-OVER-SLPE-020-S	NA	ND (0.517)	--	0.0139	0.014	ND (426)	--
604428	TA2-1-OVER-SLPE-021-S	NA	ND (0.542)	--	0.0193	0.0211	ND (447)	--
604428	TA2-1-OVER-SLPE-022-S	NA	ND (0.518)	--	ND (0.0352)	--	ND (445)	--
604428	TA2-1-OVER-SLPE-023-S	NA	ND (0.627)	--	0.0324	0.0209	ND (483)	--
604428	TA2-1-OVER-SLPE-024-S	NA	ND (0.545)	--	0.0334	0.0212	ND (445)	--
604428	TA2-1-OVER-SLPE-025-S	NA	ND (0.592)	--	0.0719	0.0182	ND (502)	--
604428	TA2-1-OVER-SLPE-026-S	NA	ND (0.525)	--	0.0747	0.0212	ND (424)	--
604428	TA2-1-OVER-SLPE-027-S	NA	ND (0.534)	--	0.083	0.0324	ND (445)	--
604428	TA2-1-OVER-SLPE-028-S	NA	ND (0.511)	--	0.0577	0.0199	ND (431)	--
604428	TA2-1-OVER-SLPE-029-DU	NA	ND (0.219)	--	0.104	0.0315	ND (399)	--
604428	TA2-1-OVER-SLPE-029-S	NA	ND (0.238)	--	0.0918	0.0337	ND (417)	--
604428	TA2-1-OVER-SLPE-030-S	NA	ND (0.217)	--	0.203	0.0418	ND (388)	--
Background concentration—North Area Subsurface[c]			NE	NA	0.084	NA	NE	NA

Refer to footnotes at end of table.

Table F-2 (Continued)
Discrete Sampling of the Consolidated Clean Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
April 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604432	TA2-1-OVER-SLPE-031-S	NA	ND (0.235)	--	0.0737	0.0314	ND (421)	--
604432	TA2-1-OVER-SLPE-032-S	NA	ND (0.231)	--	0.0435	0.0277	ND (418)	--
604432	TA2-1-OVER-SLPE-033-S	NA	ND (0.241)	--	0.0279	0.0239	ND (459)	--
604432	TA2-1-OVER-SLPE-034-S	NA	ND (0.213)	--	0.0624	0.0334	ND (370)	--
604432	TA2-1-OVER-SLPE-035-S	NA	ND (0.19)	--	0.0204	0.016	ND (348)	--
604432	TA2-1-OVER-SLPE-036-S	NA	ND (0.228)	--	ND (0.0427)	--	ND (406)	--
604432	TA2-1-OVER-SLPE-037-S	NA	ND (0.214)	--	ND (0.0407)	--	ND (390)	--
604432	TA2-1-OVER-SLPE-038-S	NA	ND (0.226)	--	0.102	0.0292	ND (402)	--
604432	TA2-1-OVER-SLPE-039-S	NA	ND (0.209)	--	ND (0.0393)	--	ND (367)	--
604432	TA2-1-OVER-SLPE-040-S	NA	ND (0.215)	--	0.0186	0.0227	ND (392)	--
604432	TA2-1-OVER-SLPE-041-S	NA	ND (0.198)	--	ND (0.0342)	--	ND (354)	--
604432	TA2-1-OVER-SLPE-042-S	NA	ND (0.208)	--	ND (0.0379)	--	ND (377)	--
604432	TA2-1-OVER-SLPE-043-S	NA	ND (0.232)	--	ND (0.0383)	--	ND (362)	--
604432	TA2-1-OVER-SLPE-044-S	NA	ND (0.214)	--	ND (0.0392)	--	ND (369)	--
604432	TA2-1-OVER-SLPE-045-S	NA	ND (0.425)	--	ND (0.0568)	--	ND (685)	--
604474	TA2-1-OVER-SLPE-046-S	NA	ND (0.233)	--	ND (0.0409)	--	ND (405)	--
604474	TA2-1-OVER-SLPE-047-S	NA	ND (0.2)	--	ND (0.0384)	--	ND (360)	--
604474	TA2-1-OVER-SLPE-048-S	NA	ND (0.232)	--	ND (0.043)	--	ND (391)	--
604474	TA2-1-OVER-SLPE-049-S	NA	ND (0.226)	--	ND (0.0395)	--	ND (396)	--
604474	TA2-1-OVER-SLPE-050-S	NA	ND (0.226)	--	ND (0.0438)	--	ND (409)	--
604474	TA2-1-OVER-SLPE-051-S	NA	ND (0.265)	--	ND (0.0435)	--	ND (454)	--
604474	TA2-1-OVER-SLPE-052-S	NA	ND (0.228)	--	0.0801	0.0313	ND (410)	--
604474	TA2-1-OVER-SLPE-053-S	NA	ND (0.252)	--	0.0594	0.0266	ND (468)	--
604474	TA2-1-OVER-SLPE-054-S	NA	ND (0.193)	--	ND (0.0298)	--	ND (359)	--
604474	TA2-1-OVER-SLPE-055-S	NA	ND (0.231)	--	ND (0.0472)	--	ND (400)	--
604474	TA2-1-OVER-SLPE-056-S	NA	ND (0.23)	--	0.0698	0.0375	ND (399)	--
604474	TA2-1-OVER-SLPE-057-S	NA	ND (0.477)	--	0.0367	0.0191	ND (390)	--
604474	TA2-1-OVER-SLPE-058-S	NA	ND (0.472)	--	0.0253	0.0158	ND (370)	--
604474	TA2-1-OVER-SLPE-059-S	NA	ND (0.484)	--	ND (0.0303)	--	ND (389)	--
604474	TA2-1-OVER-SLPE-060-DU	NA	ND (0.512)	--	ND (0.0189)	--	ND (425)	--
604474	TA2-1-OVER-SLPE-060-S	NA	ND (0.496)	--	ND (0.0242)	--	ND (398)	--
Background concentration—North Area Subsurface[c]			NE	NA	0.084	NA	NE	NA

Refer to footnotes at end of table.

Table F-2 (Continued)
Discrete Sampling of the Consolidated Clean Soil Pile, Summary of Gamma Spectroscopy Analytical Results
April 2001

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604426	TA2-1-OVER-SLPE-001-S	NA	1.12	0.516	ND (0.27)	--	ND (0.947)	--
604426	TA2-1-OVER-SLPE-002-S	NA	0.848	0.425	ND (0.25)	--	ND (0.888)	--
604426	TA2-1-OVER-SLPE-003-S	NA	0.871	0.411	ND (0.239)	--	ND (0.819)	--
604426	TA2-1-OVER-SLPE-004-S	NA	1.02	0.498	ND (0.254)	--	ND (0.871)	--
604426	TA2-1-OVER-SLPE-005-S	NA	0.946	0.436	ND (0.247)	--	ND (0.835)	--
604426	TA2-1-OVER-SLPE-006-S	NA	0.861	0.401	ND (0.221)	--	ND (0.749)	--
604426	TA2-1-OVER-SLPE-007-S	NA	1.13	0.532	ND (0.252)	--	ND (0.903)	--
604426	TA2-1-OVER-SLPE-008-S	NA	1.17	0.548	ND (0.235)	--	ND (0.872)	--
604426	TA2-1-OVER-SLPE-009-S	NA	0.988	0.464	ND (0.249)	--	ND (0.883)	--
604426	TA2-1-OVER-SLPE-010-S	NA	1.07	0.501	ND (0.218)	--	ND (0.798)	--
604426	TA2-1-OVER-SLPE-011-S	NA	0.835	0.388	ND (0.227)	--	ND (0.809)	--
604426	TA2-1-OVER-SLPE-012-S	NA	1.17	0.548	ND (0.239)	--	ND (0.833)	--
604426	TA2-1-OVER-SLPE-013-S	NA	1.2	0.549	ND (0.257)	--	ND (0.892)	--
604426	TA2-1-OVER-SLPE-014-S	NA	1.24	0.565	ND (0.245)	--	ND (0.708)	--
604426	TA2-1-OVER-SLPE-015-S	NA	0.89	0.416	ND (0.227)	--	ND (0.809)	--
604428	TA2-1-OVER-SLPE-016-S	NA	1	0.464	ND (0.218)	--	ND (0.767)	--
604428	TA2-1-OVER-SLPE-017-S	NA	1.06	0.498	ND (0.243)	--	ND (0.844)	--
604428	TA2-1-OVER-SLPE-018-S	NA	1.21	0.567	ND (0.266)	--	ND (0.946)	--
604428	TA2-1-OVER-SLPE-019-S	NA	0.968	0.456	ND (0.255)	--	ND (0.924)	--
604428	TA2-1-OVER-SLPE-020-S	NA	0.87	0.416	ND (0.232)	--	ND (0.815)	--
604428	TA2-1-OVER-SLPE-021-S	NA	0.756	0.365	ND (0.24)	--	ND (0.88)	--
604428	TA2-1-OVER-SLPE-022-S	NA	0.922	0.431	ND (0.235)	--	ND (0.854)	--
604428	TA2-1-OVER-SLPE-023-S	NA	1.24	0.583	ND (0.274)	--	ND (0.913)	--
604428	TA2-1-OVER-SLPE-024-S	NA	1.06	0.547	ND (0.242)	--	ND (0.848)	--
604428	TA2-1-OVER-SLPE-025-S	NA	0.98	0.467	ND (0.27)	--	ND (0.925)	--
604428	TA2-1-OVER-SLPE-026-S	NA	0.847	0.415	ND (0.228)	--	ND (0.803)	--
604428	TA2-1-OVER-SLPE-027-S	NA	1.05	0.487	ND (0.239)	--	ND (0.687)	--
604428	TA2-1-OVER-SLPE-028-S	NA	1.09	0.5	ND (0.234)	--	ND (0.826)	--
604428	TA2-1-OVER-SLPE-029-DU	NA	0.915	0.437	0.225	0.188	ND (0.615)	--
604428	TA2-1-OVER-SLPE-029-S	NA	0.968	0.465	ND (0.242)	--	ND (0.657)	--
604428	TA2-1-OVER-SLPE-030-S	NA	0.768	0.382	ND (0.219)	--	ND (0.606)	--
Background concentration—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table F-2 (Continued)
Discrete Sampling of the Consolidated Clean Soil Pile,
Summary of Gamma Spectroscopy Analytical Results
April 2001

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604432	TA2-1-OVER-SLPE-031-S	NA	0.914	0.441	ND (0.228)	--	ND (0.633)	--
604432	TA2-1-OVER-SLPE-032-S	NA	1.06	0.5	ND (0.226)	--	ND (0.65)	--
604432	TA2-1-OVER-SLPE-033-S	NA	0.891	0.441	ND (0.254)	--	1	0.344
604432	TA2-1-OVER-SLPE-034-S	NA	0.725	0.357	ND (0.134)	--	ND (0.573)	--
604432	TA2-1-OVER-SLPE-035-S	NA	0.879	0.416	ND (0.198)	--	0.742	0.268
604432	TA2-1-OVER-SLPE-036-S	NA	1.05	0.493	ND (0.229)	--	ND (0.638)	--
604432	TA2-1-OVER-SLPE-037-S	NA	0.849	0.401	ND (0.217)	--	0.793	0.285
604432	TA2-1-OVER-SLPE-038-S	NA	1	0.473	ND (0.221)	--	ND (0.615)	--
604432	TA2-1-OVER-SLPE-039-S	NA	0.835	0.401	ND (0.204)	--	0.699	0.271
604432	TA2-1-OVER-SLPE-040-S	NA	0.848	0.409	ND (0.218)	--	ND (0.599)	--
604432	TA2-1-OVER-SLPE-041-S	NA	0.754	0.364	0.228	0.17	ND (0.469)	--
604432	TA2-1-OVER-SLPE-042-S	NA	0.838	0.397	ND (0.203)	--	ND (0.568)	--
604432	TA2-1-OVER-SLPE-043-S	NA	0.89	0.423	ND (0.206)	--	0.999	0.308
604432	TA2-1-OVER-SLPE-044-S	NA	0.837	0.4	ND (0.201)	--	ND (0.579)	--
604432	TA2-1-OVER-SLPE-045-S	NA	0.831	0.442	ND (0.422)	--	25	4.88
604474	TA2-1-OVER-SLPE-046-S	NA	1.09	0.508	ND (0.228)	--	ND (0.61)	--
604474	TA2-1-OVER-SLPE-047-S	NA	0.976	0.454	ND (0.199)	--	ND (0.547)	--
604474	TA2-1-OVER-SLPE-048-S	NA	0.965	0.456	ND (0.223)	--	ND (0.618)	--
604474	TA2-1-OVER-SLPE-049-S	NA	0.994	0.47	0.272	0.191	ND (0.628)	--
604474	TA2-1-OVER-SLPE-050-S	NA	0.73	0.368	0.244	0.195	ND (0.623)	--
604474	TA2-1-OVER-SLPE-051-S	NA	0.826	0.413	ND (0.25)	--	ND (0.689)	--
604474	TA2-1-OVER-SLPE-052-S	NA	0.928	0.445	ND (0.108)	--	ND (0.628)	--
604474	TA2-1-OVER-SLPE-053-S	NA	1.19	0.557	ND (0.243)	--	ND (0.692)	--
604474	TA2-1-OVER-SLPE-054-S	NA	0.929	0.434	ND (0.198)	--	ND (0.534)	--
604474	TA2-1-OVER-SLPE-055-S	NA	0.887	0.429	ND (0.226)	--	ND (0.622)	--
604474	TA2-1-OVER-SLPE-056-S	NA	0.988	0.466	ND (0.215)	--	ND (0.594)	--
604474	TA2-1-OVER-SLPE-057-S	NA	1.04	0.484	ND (0.213)	--	ND (0.727)	--
604474	TA2-1-OVER-SLPE-058-S	NA	0.806	0.373	ND (0.203)	--	ND (0.704)	--
604474	TA2-1-OVER-SLPE-059-S	NA	0.828	0.384	ND (0.13)	--	ND (0.724)	--
604474	TA2-1-OVER-SLPE-060-DU	NA	1.02	0.481	ND (0.226)	--	ND (0.778)	--
604474	TA2-1-OVER-SLPE-060-S	NA	0.953	0.445	ND (0.218)	--	ND (0.739)	--
Background concentration—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table F-2 (Concluded)
Discrete Sampling of the Consolidated Clean Soil Pile, Summary of Gamma Spectroscopy Analytical Results April 2001

Note: Data were acquired from an on-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

DU	= Duplicate.
ER	= Environmental Restoration.
ft	= Foot (feet).
ID	= Identification.
NA	= Not applicable.
ND ( )	= Not detected. The result is below the minimum detection activity, shown in parentheses.
NE	= Background not established for North Area.
OVER-SLPE	= Designates overslope soil to be used as backfill at 0 to 5 ft.
pCi/g	= Picocurie(s) per gram.
S	= Sample.
TA	= Technical Area.
--	= Error not calculated for nondetectable results.

Table F-3
Discrete Sampling of the Consolidated Clean Soil Pile,
Summary of Analytical Results for Tritium
April 2001

Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
604427	TA2-1-OVER-SLPE-001-S	NA	ND (0.00925)	--
604427	TA2-1-OVER-SLPE-002-S	NA	ND (0.0095)	--
604427	TA2-1-OVER-SLPE-003-S	NA	ND (0.0093)	--
604427	TA2-1-OVER-SLPE-004-S	NA	ND (0.0096)	--
604427	TA2-1-OVER-SLPE-005-S	NA	0.01055	0.0108
604427	TA2-1-OVER-SLPE-006-S	NA	0.01755	0.01475
604427	TA2-1-OVER-SLPE-007-S	NA	0.03295	0.01225
604427	TA2-1-OVER-SLPE-008-S	NA	0.023	0.01195
604427	TA2-1-OVER-SLPE-009-S	NA	0.0279	0.0123
604427	TA2-1-OVER-SLPE-010-S	NA	0.0169	0.0117
604427	TA2-1-OVER-SLPE-011-S	NA	0.031	0.0123
604427	TA2-1-OVER-SLPE-012-S	NA	0.03105	0.0124
604427	TA2-1-OVER-SLPE-013-S	NA	0.01785	0.0121
604427	TA2-1-OVER-SLPE-014-S	NA	0.04895	0.0149
604427	TA2-1-OVER-SLPE-015-S	NA	0.0338	0.01255
604429	TA2-1-OVER-SLPE-016-S	NA	0.0307	0.0069
604429	TA2-1-OVER-SLPE-017-S	NA	0.099	0.00985
604429	TA2-1-OVER-SLPE-018-S	NA	0.0535	0.00865
604429	TA2-1-OVER-SLPE-019-S	NA	0.1015	0.0098
604429	TA2-1-OVER-SLPE-020-S	NA	0.03815	0.00685
604429	TA2-1-OVER-SLPE-021-S	NA	0.0309	0.0067
604429	TA2-1-OVER-SLPE-022-S	NA	0.0156	0.00655
604429	TA2-1-OVER-SLPE-023-S	NA	0.052	0.0085
604429	TA2-1-OVER-SLPE-024-S	NA	0.0222	0.00675
604429	TA2-1-OVER-SLPE-025-S	NA	0.0053	0.0061
604429	TA2-1-OVER-SLPE-026-S	NA	0.00745	0.0064
604429	TA2-1-OVER-SLPE-027-S	NA	ND (0.0052)	--
604429	TA2-1-OVER-SLPE-028-S	NA	0.00865	0.00615
604429	TA2-1-OVER-SLPE-029-DU	NA	0.00695	0.00725
604429	TA2-1-OVER-SLPE-029-S	NA	0.0575	0.00865
604429	TA2-1-OVER-SLPE-030-S	NA	0.00735	0.00655
604433	TA2-1-OVER-SLPE-031-S	NA	0.00407	0.00615
604433	TA2-1-OVER-SLPE-032-S	NA	0.063	0.00875
604433	TA2-1-OVER-SLPE-033-S	NA	0.0059	0.0063
604433	TA2-1-OVER-SLPE-034-S	NA	0.00565	0.00605
604433	TA2-1-OVER-SLPE-035-S	NA	0.0104	0.00615
604433	TA2-1-OVER-SLPE-036-S	NA	0.02005	0.00635
604433	TA2-1-OVER-SLPE-037-S	NA	0.02925	0.0066
604433	TA2-1-OVER-SLPE-038-S	NA	0.0126	0.00645
604433	TA2-1-OVER-SLPE-039-S	NA	0.0685	0.00895
604433	TA2-1-OVER-SLPE-040-S	NA	0.0955	0.0087
604433	TA2-1-OVER-SLPE-041-S	NA	0.072	0.009
604433	TA2-1-OVER-SLPE-042-S	NA	0.04045	0.00815
604433	TA2-1-OVER-SLPE-043-S	NA	0.018	0.0127
604433	TA2-1-OVER-SLPE-044-S	NA	0.02105	0.0129
604433	TA2-1-OVER-SLPE-045-S	NA	0.00835	0.0073
604475	TA2-1-OVER-SLPE-046-S	NA	0.0161 [B2,J]	0.0126
604475	TA2-1-OVER-SLPE-047-S	NA	0.0715	0.0151
Background activity[c]			0.021	NA

Refer to footnotes at end of table.

Table F-3 (Concluded)
Discrete Sampling of the Consolidated Clean Soil Pile, Summary of Analytical Results for Tritium April 2001

Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
604475	TA2-1-OVER-SLPE-048-S	NA	0.01605 [B2,J]	0.01255
604475	TA2-1-OVER-SLPE-049-S	NA	0.0159 [B2,J]	0.0074
604475	TA2-1-OVER-SLPE-050-S	NA	0.0137 [B2,J]	0.00745
604475	TA2-1-OVER-SLPE-051-S	NA	0.01115 [B2,J]	0.0123
604475	TA2-1-OVER-SLPE-052-S	NA	0.01845	0.01285
604475	TA2-1-OVER-SLPE-053-S	NA	0.01555 [B2,J]	0.0074
604475	TA2-1-OVER-SLPE-054-S	NA	0.0235	0.01285
604475	TA2-1-OVER-SLPE-055-S	NA	0.0459	0.01365
604475	TA2-1-OVER-SLPE-056-S	NA	0.0285	0.01315
604475	TA2-1-OVER-SLPE-057-S	NA	0.00795 [B2,J]	0.01225
604475	TA2-1-OVER-SLPE-058-S	NA	ND (0.00945)	--
604475	TA2-1-OVER-SLPE-059-S	NA	ND (0.00945	--
604475	TA2-1-OVER-SLPE-060-DU	NA	0.01185	0.01215
604475	TA2-1-OVER-SLPE-060-S	NA	ND (0.0094)	--
Background activity[c]			0.021	NA

Note: Data were acquired from an off-site laboratory.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Tharp, February 1999.

[B2] = Analyte present in equipment blank.
DU = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
[J] = The associated value is an estimated quantity.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
OVER-SLPE = Designates overslope soil to be used as backfill at 0 to 5 ft.
pCi/g = Picocurie(s) per gram.
S = Sample.
TA = Technical Area.
-- = Error not calculated for nondetectable results.

Table F-4
Discrete Sampling of the Consolidated Clean Soil Pile
Summary of Analytical Results for Metals
April 2001

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium
604427	TA2-1-OVER-SLPE-001-S	NA	4.31	125	0.0753 [J]	10.3
604427	TA2-1-OVER-SLPE-002-S	NA	3.25	169	0.139 [J]	8.74
604427	TA2-1-OVER-SLPE-003-S	NA	2.63	102	0.136 [J]	19.2
604427	TA2-1-OVER-SLPE-004-S	NA	3.14	128	0.093 [J]	15.7
604427	TA2-1-OVER-SLPE-005-S	NA	3.5	114	0.0722 [J]	8.47
604427	TA2-1-OVER-SLPE-006-S	NA	3.95	174	0.126 [J]	9.19
604427	TA2-1-OVER-SLPE-007-S	NA	3.53	146	0.174 [J]	10.1
604427	TA2-1-OVER-SLPE-008-S	NA	3.3	128	0.102 [J]	7.59
604427	TA2-1-OVER-SLPE-009-S	NA	3.51	186	0.121 [J]	8.62
604427	TA2-1-OVER-SLPE-010-S	NA	3.46	154	0.093 [J]	8.63
604427	TA2-1-OVER-SLPE-011-S	NA	3.16	143	0.108 [J]	7.67
604427	TA2-1-OVER-SLPE-012-S	NA	3.23	169	0.154 [J]	7.74
604427	TA2-1-OVER-SLPE-013-S	NA	3.11	113	0.0685 [J]	6.77
604427	TA2-1-OVER-SLPE-014-S	NA	3.66	100	0.0363 [J]	10.2
604427	TA2-1-OVER-SLPE-015-S	NA	4.14	194	0.0484 [J]	7.65
604429	TA2-1-OVER-SLPE-016-S	NA	2.82	206 [J]	0.51	7.48
604429	TA2-1-OVER-SLPE-017-S	NA	2.57	146 [J]	0.513	9.29
604429	TA2-1-OVER-SLPE-018-S	NA	2.83	111 [J]	0.601	8.26
604429	TA2-1-OVER-SLPE-019-S	NA	2.91	130 [J]	0.485 [J]	8.36
604429	TA2-1-OVER-SLPE-020-S	NA	2.65	164 [J]	0.485	7.88
604429	TA2-1-OVER-SLPE-021-S	NA	3.15	121 [J]	0.602	9.38
604429	TA2-1-OVER-SLPE-022-S	NA	3.04	122 [J]	0.543	10.3
604429	TA2-1-OVER-SLPE-023-S	NA	3.03	160	0.583	8.74
604429	TA2-1-OVER-SLPE-024-S	NA	2.97	166 [J]	0.577	8.6
604429	TA2-1-OVER-SLPE-025-S	NA	3.42	126 [J]	0.613	10.6
604429	TA2-1-OVER-SLPE-026-S	NA	2.8	104 [J]	0.525	9.45
604429	TA2-1-OVER-SLPE-027-S	NA	2.88	105 [J]	0.55	9.19
604429	TA2-1-OVER-SLPE-028-S	NA	3.53	100 [J]	0.613	9.38
604429	TA2-1-OVER-SLPE-029-DU	NA	2.52	88.7 [J]	0.624	9.25
604429	TA2-1-OVER-SLPE-029-S	NA	2.95	96.4 [J]	0.654	9.38
604429	TA2-1-OVER-SLPE-030-S	NA	2.54	103 [J]	0.679	10.6
Background concentration—North Area Subsurface[b]			4.4	200	0.9	12.8

Refer to footnotes at end of table.

Table F-4 (Continued)
Discrete Sampling of the Consolidated Clean Soil Pile
Summary of Analytical Results for Metals
April 2001

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium
604433	TA2-1-OVER-SLPE-031-S	NA	3.47	111	0.501	8.5
604433	TA2-1-OVER-SLPE-032-S	NA	4.04	119	0.646	11.1
604433	TA2-1-OVER-SLPE-033-S	NA	3.64	126	0.686	12.1
604433	TA2-1-OVER-SLPE-034-S	NA	4.08	145	0.852	12.1
604433	TA2-1-OVER-SLPE-035-S	NA	3.98	129	0.595	10.3
604433	TA2-1-OVER-SLPE-036-S	NA	4.5	140	0.642	10.3
604433	TA2-1-OVER-SLPE-037-S	NA	3.81	156	0.546	9.0
604433	TA2-1-OVER-SLPE-038-S	NA	4.14	145	0.653	9.96
604433	TA2-1-OVER-SLPE-039-S	NA	3.74	153	0.744	9.49
604433	TA2-1-OVER-SLPE-040-S	NA	3.93	153	6.7	9.8
604433	TA2-1-OVER-SLPE-041-S	NA	4.05	240	0.551	8.96
604433	TA2-1-OVER-SLPE-042-S	NA	3.83	109	0.726	9.16
604433	TA2-1-OVER-SLPE-043-S	NA	3.52	103	0.69	7.75
604433	TA2-1-OVER-SLPE-044-S	NA	3.42	108	0.831	8.41
604433	TA2-1-OVER-SLPE-045-S	NA	3.79	300	0.854	9.63
604475	TA2-1-OVER-SLPE-046-S	NA	3.04	159	0.0715	8.66
604475	TA2-1-OVER-SLPE-047-S	NA	3.36	157	0.0554	8.17
604475	TA2-1-OVER-SLPE-048-S	NA	3.39	147	0.143	7.64
604475	TA2-1-OVER-SLPE-049-S	NA	3.01	235	0.0424	7.15
604475	TA2-1-OVER-SLPE-050-S	NA	4.36	202	0.0514	8.62
604475	TA2-1-OVER-SLPE-051-S	NA	2.9	198	0.0367	8.49
604475	TA2-1-OVER-SLPE-052-S	NA	2.88	138	0.361	10.5
604475	TA2-1-OVER-SLPE-053-S	NA	3.76	156	0.026	11.8
604475	TA2-1-OVER-SLPE-054-S	NA	3.1	165	ND (0.013)	8.42
604475	TA2-1-OVER-SLPE-055-S	NA	3.31	123	ND (0.013)	9.89
604475	TA2-1-OVER-SLPE-056-S	NA	3.36	163	ND (0.013)	10.9
604475	TA2-1-OVER-SLPE-057-S	NA	3.2	137	ND (0.013)	8.46
604475	TA2-1-OVER-SLPE-058-S	NA	3.59	178	0.0284	9.57
604475	TA2-1-OVER-SLPE-059-S	NA	2.69	155	ND (0.013)	7.36
604475	TA2-1-OVER-SLPE-060-DU	NA	2.37	135	ND (0.013	7.48
604475	TA2-1-OVER-SLPE-060-S	NA	2.22	105	ND (0.013)	8.69
Background concentration—North Area Subsurface[b]			4.4	200	0.9	12.8

Refer to footnotes at end of table.

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Table F-4 (Continued)
Discrete Sampling of the Consolidated Clean Soil Pile
Summary of Analytical Results for Metals
April 2001

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
604427	TA2-1-OVER-SLPE-001-S	NA	7.76	0.014 [B3,J]	0.295 [J]	0.527
604427	TA2-1-OVER-SLPE-002-S	NA	7.82	0.0231	0.308 [J]	0.196 [J]
604427	TA2-1-OVER-SLPE-003-S	NA	81.7 [J]	0.0143 [B3,J]	ND (0.135)	0.116 [J]
604427	TA2-1-OVER-SLPE-004-S	NA	7.26	0.0184 [B3,J]	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-005-S	NA	5.85	0.0247	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-006-S	NA	7.06	0.0256	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-007-S	NA	6.49	0.0221	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-008-S	NA	7.06	0.0259	ND (0.135)	0.137 [J]
604427	TA2-1-OVER-SLPE-009-S	NA	8.84	0.0266	ND (0.135)	0.137 [J]
604427	TA2-1-OVER-SLPE-010-S	NA	5.48	0.0259	0.382 [J]	ND (0.0578)
604427	TA2-1-OVER-SLPE-011-S	NA	7.24	0.0789	0.301 [J]	ND (0.0578)
604427	TA2-1-OVER-SLPE-012-S	NA	8.14	0.0314	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-013-S	NA	5.51	0.0181 [B3,J]	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-014-S	NA	8.65	0.0261	ND (0.135)	ND (0.0578)
604427	TA2-1-OVER-SLPE-015-S	NA	4.96	0.0382	0.553	ND (0.0578)
604429	TA2-1-OVER-SLPE-016-S	NA	5.2	0.0611	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-017-S	NA	4.87	0.0427	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-018-S	NA	5.32	0.0323	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-019-S	NA	5.82	0.0299 [B3,J]	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-020-S	NA	5.4	0.0313 [B3,J]	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-021-S	NA	6.19	0.036	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-022-S	NA	6.1	0.0454	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-023-S	NA	6.18	0.0339	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-024-S	NA	5.64	0.0328	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-025-S	NA	8.02	0.0246 [B3,J]	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-026-S	NA	7.47	0.0148	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-027-S	NA	18	0.0141	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-028-S	NA	6.9	0.0159	1.04 [B3,J]	ND (0.0578)
604429	TA2-1-OVER-SLPE-029-DU	NA	9.15	0.019	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-029-S	NA	8.06	0.0145	ND (0.135)	ND (0.0578)
604429	TA2-1-OVER-SLPE-030-S	NA	10.5	0.0154	ND (0.135)	ND (0.0578)
Background concentration—North Area Subsurface[b]			11.2	<0.1	<1	<1

Refer to footnotes at end of table.

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Table F-4 (Continued)
Discrete Sampling of the Consolidated Clean Soil Pile
Summary of Analytical Results for Metals
April 2001

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
604433	TA2-1-OVER-SLPE-031-S	NA	7.31	0.0147	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-032-S	NA	8.17	0.0208	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-033-S	NA	7.46	0.0173	0.869 [J]	ND (0.0578)
604433	TA2-1-OVER-SLPE-034-S	NA	10.3	0.0169	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-035-S	NA	6.89	0.0132	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-036-S	NA	6.36	0.0266	ND (0.135)	ND 0.0578)
604433	TA2-1-OVER-SLPE-037-S	NA	5.61	0.029	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-038-S	NA	7.83	0.021	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-039-S	NA	5.68	0.178	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-040-S	NA	5.7	0.0579	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-041-S	NA	5.3	0.0837	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-042-S	NA	7.41	0.0441	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-043-S	NA	5.37	0.0855	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-044-S	NA	5.09	0.133	ND (0.135)	ND (0.0578)
604433	TA2-1-OVER-SLPE-045-S	NA	6.4	0.0439	ND (0.135)	ND (0.0578)
604475	TA2-1-OVER-SLPE-046-S	NA	5.53 [J]	0.0239 [B3,J]	ND (0.135)	ND (0.0578)
604475	TA2-1-OVER-SLPE-047-S	NA	4.89 [J]	0.0204 [B3,J]	0.498	ND (0.0578)
604475	TA2-1-OVER-SLPE-048-S	NA	8.6 [J]	0.0254 [B3,J]	ND (0.135)	ND (0.0578)
604475	TA2-1-OVER-SLPE-049-S	NA	6.55 [J]	0.0227 [B3,J]	0.302	ND (0.0578
604475	TA2-1-OVER-SLPE-050-S	NA	6.14 [J]	0.0281 [B3,J]	0.423	ND (0.0578)
604475	TA2-1-OVER-SLPE-051-S	NA	6.18 [J]	0.0227 [B3,J]	ND	ND (0.0578)
604475	TA2-1-OVER-SLPE-052-S	NA	8.18 [J]	0.108	0.361	ND (0.0578)
604475	TA2-1-OVER-SLPE-053-S	NA	7.61 [J]	0.0376 [B3,J]	0.307	ND (0.0578)
604475	TA2-1-OVER-SLPE-054-S	NA	5.73 [J]	0.0221 [B3,J]	0.455	ND (0.0578)
604475	TA2-1-OVER-SLPE-055-S	NA	6.59 [J]	0.0221 [B3,J]	0.407	ND (0.0578)
604475	TA2-1-OVER-SLPE-056-S	NA	7.48 [J]	0.0255 [B3,J]	0.422	ND
604475	TA2-1-OVER-SLPE-057-S	NA	6.03 [J]	0.0275 [B3,J]	0.432	ND
604475	TA2-1-OVER-SLPE-058-S	NA	6.09 [J]	0.0202	0.306	ND
604475	TA2-1-OVER-SLPE-059-S	NA	4.72 [J]	0.00455	ND (0.135)	ND
604475	TA2-1-OVER-SLPE-060-DU	NA	3.78 [J]	ND (0.00455)	0.444	ND
604475	TA2-1-OVER-SLPE-060-S	NA	3.63 [J]	ND (0.00455)	0.507	ND
Background concentration—North Area Subsurface[b]			11.2	<0.1	<1	<1

Refer to footnotes at end of table.

Table F-4 (Concluded)
Discrete Sampling of the Consolidated Clean Soil Pile
Summary of Analytical Results for Metals
April 2001

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Dinwiddie, September 1997.

[B3]	= Analyte present in the calibration blank.
DU	= Duplicate.
EPA	= U.S. Environmental Protection Agency.
ER	= Environmental Restoration.
ft	= Foot (feet).
ID	= Identification.
[J]	= The associated value is an estimated quantity.
NA	= Not applicable.
ND ( )	= Not detected. The result is below the minimum detection level, shown in parentheses.
mg/kg	= Milligrams per kilogram.
OVER-SLPE	= Designates overslope soil to be used as backfill at 0 to 5 ft.
TA	= Technical Area.
S	= Sample.

ATTACHMENT G

DISCRETE SAMPLING OF THE CLEAN BUNKER SOIL PILES: SEPTEMBER 2001

Table G-1
Discrete Sampling of the Clean Bunker Soil Piles, Summary of Alpha Spectroscopy Analytical Results September 2001

Sample Attributes			Activity (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
604736	TA2-2-BLDG-901-001-S	NA	0.00255	0.00374	0.0561	0.0152
604736	TA2-2-BLDG-901-002-S	NA	ND (0.00193)	--	0.0232	0.00948
604736	TA2-2-BLDG-901-003-S	NA	0.0042	0.0037	0.021	0.00879
604736	TA2-2-BLDG-901-004-S	NA	0.0134	0.0074	0.515	0.0692
604736	TA2-2-BLDG-901-005-S	NA	ND (0.00263)	--	0.0213	0.00992
604736	TA2-2-BLDG-901-006-S	NA	ND (0.00263)	--	0.0136	0.00773
604736	TA2-2-BLDG-901-007-DU	NA	ND (0.00267)	--	ND (0.00324)	--
604736	TA2-2-BLDG-901-007-S	NA	ND (0.00627)	--	ND (0.00343)	--
604740	TA2-XPLO-SIVE-001-S	NA	ND (0.00227)	--	ND (0.00275)	--
604740	TA2-XPLO-SIVE-002-S	NA	ND (0.00159)	--	ND (0.00526)	--
604740	TA2-XPLO-SIVE-003-S	NA	ND (0.00228)	--	ND (0.00478)	--
604740	TA2-XPLO-SIVE-004-S	NA	ND (0.00242)	--	0.0117	0.00714
604740	TA2-XPLO-SIVE-005-S	NA	0.00294	0.00289	0.0066	0.00777
604740	TA2-XPLO-SIVE-006-S	NA	ND (0.00229)	--	ND (0.00229)	--
604740	TA2-XPLO-SIVE-007-DU	NA	ND (0.00199)	--	0.00428	0.00446
604740	TA2-XPLO-SIVE-007-S	NA	0.00317	0.0036	ND (0.00286)	--
Background activity—North Area Subsurface[c]			NE	NA	NE	NA

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

BLDG = Building.
DU = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
S = Sample.
TA = Technical Area.
XPLO-SIVE = Designates sample obtained from a demolished bunker used to store explosive materials.
-- = Error not calculated for nondetectable results.

Table G-2
Discrete Sampling of the Clean Bunker Soil Piles, Summary of Gamma Spectroscopy Analytical Results September 2001

Sample Attributes			Activity (pCi/g)					
			Americium-241		Cesium-137		Plutonium-239	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604735	TA2-2-BLDG-901-001-S	NA	ND (0.182)	--	ND (0.0381)	--	ND (384)	--
604735	TA2-2-BLDG-901-002-S	NA	ND (0.18)	--	ND (0.0356)	--	ND (376)	--
604735	TA2-2-BLDG-901-003-S	NA	ND (0.18)	--	ND (0.0352)	--	ND (373)	--
604735	TA2-2-BLDG-901-004-S	NA	ND (0.201)	--	ND (0.0375)	--	ND (407)	--
604735	TA2-2-BLDG-901-005-S	NA	ND (0.173)	--	ND (0.0228)	--	ND (368)	--
604735	TA2-2-BLDG-901-006-S	NA	ND (0.195)	--	ND (0.0403)	--	ND (410)	--
604735	TA2-2-BLDG-901-007-DU	NA	ND (0.177)	--	ND (0.0374)	--	ND (379)	--
604735	TA2-2-BLDG-901-007-S	NA	ND (0.174)	--	ND (0.0355)	--	ND (366)	--
604739	TA2-XPLO-SIVE-001-S	NA	ND (0.181)	--	ND (0.0293)	--	ND (384)	--
604739	TA2-XPLO-SIVE-002-S	NA	ND (0.193)	--	ND (0.0397)	--	ND (396)	--
604739	TA2-XPLO-SIVE-003-S	NA	ND (0.186)	--	ND (0.0382)	--	ND (380)	--
604739	TA2-XPLO-SIVE-004-S	NA	ND (0.183)	--	0.0313	0.0123	ND (394)	--
604739	TA2-XPLO-SIVE-005-S	NA	ND (0.171)	--	ND (0.0314)	--	ND (380)	--
604739	TA2-XPLO-SIVE-006-S	NA	ND (0.176)	--	ND (0.048)	--	ND (365)	--
604739	TA2-XPLO-SIVE-007-S	NA	ND (0.19)	--	ND (0.0414)	--	ND (388)	--
Background activity—North Area Subsurface[c]			NE	NA	0.084	NA	NE	NA

Refer to footnotes at end of table.

Table G-2 (Concluded)
Discrete Sampling of the Clean Bunker Soil Piles,
Summary of Gamma Spectroscopy Analytical Results
September 2001

Sample Attributes			Activity (pCi/g)					
			Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]
604735	TA2-2-BLDG-901-001-S	NA	0.883	0.437	ND (0.213)	--	ND (0.551)	--
604735	TA2-2-BLDG-901-002-S	NA	1.09	0.519	ND (0.211)	--	ND (0.543)	--
604735	TA2-2-BLDG-901-003-S	NA	0.836	0.392	ND (0.203)	--	ND (0.528)	--
604735	TA2-2-BLDG-901-004-S	NA	1.03	0.473	ND (0.226)	--	ND (0.568)	--
604735	TA2-2-BLDG-901-005-S	NA	1.08	0.516	ND (0.212)	--	ND (0.533)	--
604735	TA2-2-BLDG-901-006-S	NA	0.977	0.458	ND (0.233)	--	ND (0.567)	--
604735	TA2-2-BLDG-901-007-DU	NA	0.806	0.394	ND (0.209)	--	ND (0.537)	--
604735	TA2-2-BLDG-901-007-S	NA	0.981	0.466	ND (0.208)	--	ND (0.514)	--
604739	TA2-XPLO-SIVE-001-S	NA	0.995	0.472	ND (0.208)	--	ND (0.525)	--
604739	TA2-XPLO-SIVE-002-S	NA	0.958	0.445	ND (0.222)	--	ND (0.568)	--
604739	TA2-XPLO-SIVE-003-S	NA	0.847	0.403	ND (0.211)	--	ND (0.538)	--
604739	TA2-XPLO-SIVE-004-S	NA	0.971	0.471	ND (0.214)	--	ND (0.532)	--
604739	TA2-XPLO-SIVE-005-S	NA	0.92	0.443	ND (0.204)	--	0.57	0.263
604739	TA2-XPLO-SIVE-006-S	NA	0.816	0.383	ND (0.203)	--	ND (0.502)	--
604739	TA2-XPLO-SIVE-007-S	NA	0.978	0.479	ND (0.223)	--	ND (0.574)	--
Background activity—North Area Subsurface[c]			1.54	NA	0.18	NA	1.3	NA

Note: Data were acquired from an on-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie, September 1997.

BLDG = Building.
DU = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
NE = Background not established for North Area.
pCi/g = Picocurie(s) per gram.
S = Sample.
TA = Technical Area.
XPLO-SIVE = Designates sample obtained from a demolished bunker used to store explosive materials.
-- = Error not calculated for nondetectable results.

Table G-3
Discrete Sampling of the Clean Bunker Soil Piles, Summary of Analytical Results for Tritium September 2001

Sample Attributes			Activity (pCi/g)	
			Tritium	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]
604738	TA2-2-BLDG-901-003-S	NA	ND (0.0058)	--
604738	TA2-2-BLDG-901-004-S	NA	0.2205	0.027
604738	TA2-2-BLDG-901-005-S	NA	ND (0.00585)	--
604738	TA2-2-BLDG-901-006-S	NA	0.0416	0.0101
604738	TA2-2-BLDG-901-007-DU	NA	ND (0.00585)	--
604738	TA2-2-BLDG-901-007-S	NA	ND (0.0058)	--
604740	TA2-XPLO-SIVE-001-S	NA	ND (0.00595)	--
604740	TA2-XPLO-SIVE-002-S	NA	ND (0.0059)	--
604740	TA2-XPLO-SIVE-003-S	NA	ND (0.00585)	--
604740	TA2-XPLO-SIVE-004-S	NA	ND (0.00595)	--
604740	TA2-XPLO-SIVE-005-S	NA	ND (0.006)	--
604740	TA2-XPLO-SIVE-006-S	NA	ND (0.00595)	--
604740	TA2-XPLO-SIVE-007-DU	NA	ND (0.00595)	--
604740	TA2-XPLO-SIVE-007-S	NA	ND (0.00595)	--
Background activity[c]			0.021	NA

Note: Data were acquired from an off-site laboratory.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Tharp, February 1999.

BLDG = Building.
DU = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
S = Sample.
TA = Technical Area.
XPLO-SIVE = Designates sample obtained from a demolished bunker used to store explosive materials.
-- = Error not calculated for nondetectable results.

Table G-4
Discrete Sampling of the Clean Bunker Soil Piles, Summary of Analytical Results for Metals
September 2001

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium
604736	TA2-2-BLDG-901-001-S	NA	4.12	167	0.161	10.6
604736	TA2-2-BLDG-901-002-S	NA	4.43	154	0.152	10.7
604736	TA2-2-BLDG-901-003-S	NA	4.1	159	0.153	10.2
604736	TA2-2-BLDG-901-004-S	NA	4.1	186	0.134	11.4
604736	TA2-2-BLDG-901-005-S	NA	3.77	153	0.133	8.76
604736	TA2-2-BLDG-901-006-S	NA	4.27	170	0.171	11.9
604736	TA2-2-BLDG-901-007-DU	NA	4.61	182	0.15	10.2
604736	TA2-2-BLDG-901-007-S	NA	4.04	138	0.147	9.47
604740	TA2-XPLO-SIVE-001-S	NA	3.65	175	0.178	9.72
604740	TA2-XPLO-SIVE-002-S	NA	4.41	152	0.151	10.7
604740	TA2-XPLO-SIVE-003-S	NA	4.09	149	0.186	9.64
604740	TA2-XPLO-SIVE-004-S	NA	4.39	163	0.168	9.69
604740	TA2-XPLO-SIVE-005-S	NA	4.34	169	0.179	10.4
604740	TA2-XPLO-SIVE-006-S	NA	3.7	134	0.158	10.5
604740	TA2-XPLO-SIVE-007-DU	NA	4.36	169	0.175	10.4
604740	TA2-XPLO-SIVE-007-S	NA	4.59	160	0.182	10.4
Background concentration—North Area Subsurface[b]			4.4	200	0.9	12.8

Refer to footnotes at end of table.

Table G-4 (Concluded)
Discrete Sampling of the Clean Bunker Soil Piles, Summary of Analytical Results for Metals September 2001

Sample Attributes			Metals (EPA Method 6010 / EPA Method 7471) (mg/kg)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
604736	TA2-2-BLDG-901-001-S	NA	7.4 [J]	0.0057	0.943	ND (0.112)
604736	TA2-2-BLDG-901-002-S	NA	7.13 [J]	0.00936	0.895	ND (0.112)
604736	TA2-2-BLDG-901-003-S	NA	9.86 [J]	0.0108	0.563	ND (0.109)
604736	TA2-2-BLDG-901-004-S	NA	7.83 [J]	0.0183	0.779	ND (0.108)
604736	TA2-2-BLDG-901-005-S	NA	6.21 [J]	0.0101	0.905	ND (0.113)
604736	TA2-2-BLDG-901-006-S	NA	8.17 [J]	0.0114	0.804	ND (0.105)
604736	TA2-2-BLDG-901-007-DU	NA	7.26 [J]	0.00895	0.646	ND (0.113)
604736	TA2-2-BLDG-901-007-S	NA	7.06 [J]	0.0105	0.849	ND (0.108)
604740	TA2-XPLO-SIVE-001-S	NA	7.8 [J]	0.0116	0.733	ND (0.116)
604740	TA2-XPLO-SIVE-002-S	NA	7.29 [J]	0.0174	0.732	ND (0.111)
604740	TA2-XPLO-SIVE-003-S	NA	7.29 [J]	0.011	0.804	ND (0.111)
604740	TA2-XPLO-SIVE-004-S	NA	7.22 [J]	0.0128	0.898	ND (0.108)
604740	TA2-XPLO-SIVE-005-S	NA	7.75 [J]	0.0145	0.578	ND (0.105)
604740	TA2-XPLO-SIVE-006-S	NA	6.76 [J]	0.0115	0.82	ND (0.107)
604740	TA2-XPLO-SIVE-007-DU	NA	7.79 [J]	0.0115	0.593	ND (0.109)
604740	TA2-XPLO-SIVE-007-S	NA	7.73 [J]	0.0082	0.868	ND (0.116)
Background concentration—North Area Subsurface[b]			11.2	<0.1	<1	<1

Note: Data were acquired from an off-site laboratory.

[a]Analysis request/chain-of-custody record.

[b]Dinwiddie, September 1997.

EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
[J] = The associated value is an estimated quantity.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detection level, shown in parentheses.
mg/kg = Milligrams per kilogram.

NFA/RSI Addendum

tran

National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

NOV 1 2 2004

CC: Peter Davies
Paul Freshour
Eric Larsen
Stacey Griffith
C. Daniel
ESH Records

CERTIFIED MAIL--RETURN RECEIPT REQUESTED

Mr. James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Road East, Building 1
Santa Fe, NM 87505

Dear Mr. Bearzi:

On behalf of the Department of Energy (DOE) and Sandia Corporation, DOE is submitting additional information to complete responses to the New Mexico Environment Department (NMED) for the Solid Waste Management Units (SWMUs) identified below:

OU 1303, SWMUs 1 and 3: This submittal documents the final backfilling of the Voluntary Corrective Measure excavation and provides a risk assessment. It is an addendum to the No Further Action (NFA) proposal of September 1997 and provides additional information in response to the three NMED Requests for Supplemental Information (RSIs) of January, June, and December 1999.

OU 1306, SWMU 78: This submittal completes the response to the NMED RSI of May 2000. It includes results of additional sampling, a geophysical survey, an NFA proposal, and a risk assessment.

OU 1306, SWMU 196: This submittal completes the response to the NMED RSI of May 2000. It includes the results of additional sampling, an NFA proposal, and a risk assessment.

OU 1309, SWMU 45: This submittal completes the response to the three NMED RSIs of January, June, and December 1999. It provides results of the additional requested fieldwork and evaluates newly identified information that was not available at the time of the initial response in September1999. It also includes a risk assessment.

OU 1309, SWMU 46: This submittal completes the response to the NMED Notice of Deficiency of October 1999 and provides the final results for the Voluntary Corrective Action (VCA) conducted at the site in 2003. In addition to the results of the VCA, it includes a risk assessment.

Review and analyses of all relevant data for these SWMUs indicate that concentrations of constituents of concern are lower than applicable risk assessment action levels. Based upon confirmatory sampling data, constituents of concern that could have been released from each site to the environment pose an acceptable level of risk under current and projected land use. Therefore, a determination of Corrective Action Complete without controls is recommended for all these SWMUs.

If you have any questions regarding this submittal, please contact John Gould of my staff at (505) 845-6089.

Sincerely,

Patty Wagner
Manager

Enclosures

cc w/enclosures:
W. Moats, NMED (Via Certified Mail)
M. Gardipe, DOE/SC/ERD
C. Voorhees, NMED-OB, Santa Fe
D. Bierley, NMED-OB

cc w/o enclosures:
L. King, EPA Region 6 (Via Certified Mail)
F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
B. Langkopf, SNL, MS 1087
C. Chocas, SNL, MS 1120
J. Copland, SNL, MS 1087
D. Miller, SNL, MS 1088
R. E. Fate, SNL, MS 1089
M. J. Davis, SNL, MS 1089
A. Blumberg, SNL, MS 0141

Sandia National Laboratories/New Mexico
Environmental Restoration Project

NO FURTHER ACTION PROPOSAL ADDENDUM AND BACKFILL REPORT FOR SOLID WASTE MANAGEMENT UNIT 1-RADIOACTIVE WASTE LANDFILL AND CHEMICAL DISPOSAL PITS AT TECHNICAL AREA II

October 2004

United States Department of Energy
Sandia Site Office

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
bgs	below ground surface
CDP	Chemical Disposal Pit
CGI	combustible gas indicator
COC	constituent of concern
COPEC	constituent of potential ecological concern
CSM	Conceptual Site Model
cy	cubic yard(s)
DOE	U.S. Department of Energy
DU	depleted uranium
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FIDLER	field instrument detector for low energy radiation
GM	Geiger-Mueller
HI	hazard index
HQ	hazard quotient
KAFB	Kirtland Air Force Base
mrem	millirem
NaI	sodium iodide
NFA	no further action
NMED	New Mexico Environment Department
PID	photoionization detector
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RME	reasonable maximum exposure
RSI	request for supplemental information
RWL	Radioactive Waste Landfill
SGS	Segmented Gate System
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TCLP	Toxicity Characteristic Leaching Procedure
TEDE	total effective dose equivalent
VCM	Voluntary Corrective Measure
VOC	volatile organic compound
yr	year(s)

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1.0 INTRODUCTION

Sandia National Laboratories/New Mexico (SNL/NM) has prepared this document as a no further action (NFA) proposal addendum and backfill report for Solid Waste Management Unit (SWMU) 1, the Radioactive Waste Landfill (RWL) and the Chemical Disposal Pits (CDPs). SWMU 1 is located in the eastern portion of Technical Area (TA)-II. Because the site boundary for SWMU 1 encompasses SWMU 3, the two sites were administratively combined in 2004 (NMED April 2004). SWMU 1 covers approximately 0.3 acres on land that the U.S. Department of Energy (DOE) leases from Kirtland Air Force Base (KAFB).

SWMU 1 was excavated in 1996 as a Voluntary Corrective Measure (VCM). An NFA proposal was submitted to the New Mexico Environment Department (NMED) in September 1997 (SNL/NM September 1997). Due to uncertainty associated with the SWMU 1 backfilling operations and the risk assessment process, the NMED issued three requests for supplemental information (RSIs) in 1999 (Dinwiddie January 1999, Kieling June 1999, Moats December 1999). Interactions with the NMED relative to backfilling the RWL have been addressed in two responses to NMED RSIs (SNL/NM September 1999, SNL/NM December 2002) as well as verbal communications. The Backfill and Compaction Plan for the RWL (SNL/NM August 2003) integrated NMED guidance and interactions. The risk assessment report (Annex A) provides updated information that supplements the previous version presented in the December 2002 RSI response (SNL/NM December 2002).

This report includes the following:

- A chronology of environmental activities conducted at SWMU 1
- A description of the materials and processes used to complete the backfill operations
- Human health risk assessment based upon the actual placement of the soil in the excavation
- Ecological risk assessment based upon the actual placement of the soil in the excavation

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2.0 DESCRIPTION OF SWMU 1

SWMU 1 encompasses approximately 0.3 acres in the eastern portion of SNL/NM TA-II (Figures 2-1 and 2-2). TA-II is located on land owned by the DOE within the boundaries of KAFB. Prior to the 1996 VCM excavation activities, SWMU 1 consisted of the six RWL disposal cells (Pits 1, 2, and 7 and Trenches 3/4, 5, and 6) and the CDPs (SNL/NM September 1999). The total surface area for the disposal cells and the CDPs was approximately 2,400 square feet (0.06 acres).

2.1 Physical Setting

TA-II is located at the southeastern edge of the East Mesa on a broad pediment that gently slopes west toward the Rio Grande. The topography at TA-II is nearly flat with elevations ranging from 5,427 feet above mean sea level (amsl) at the northeastern boundary to about 5,410 feet amsl at the southwestern boundary. SWMU 1 is situated approximately 60 feet in elevation above the Tijeras Arroyo floodplain and approximately 1,400 feet northwest of the active channel of Tijeras Arroyo, which typically flows only several times each year. Tijeras Arroyo, the most significant surface-water drainage feature on KAFB, originates in Tijeras Canyon, which is bounded by the Sandia Mountains to the north and the Manzanita Mountains to the south. The arroyo trends southwest along the southern edge of TA-II, eventually draining into the Rio Grande, located approximately 8.5 miles west of SWMU 1.

The annual precipitation for the area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). No springs or perennial surface-water bodies are located within 4 miles of the site. During most rainfall events, rainfall quickly infiltrates the soil at TA-II. However, virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration rates for the KAFB area range from 95 to 99 percent of the annual rainfall (Thompson and Smith 1985, SNL/NM February 1998a). The land surrounding SWMU 1 is unpaved, and no storm sewers are used to direct surface water.

2.2 Operational and Environmental History

From 1949 through 1959, the RWL and CDPs (SWMU 1) were used for the disposal of weapons-related debris and chemicals resulting from the research, development, and manufacture of nuclear weapons at TA-II. Until remediation activities were begun in 1996, a barbed-wire fence served as an effective perimeter and visual marker for the RWL. Magnetometer surveys conducted in 1993 (Geo-Centers 1994, Lamb Associates 1994) and a review of historic aerial photographs for the period of 1951 through 1992 (Ebert and Associates, Inc. 1994) documented the disposal cells. Soil-vapor surveys conducted in late 1993 across the eastern half of TA-II did not identify any volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs) in the vicinity of SWMU 1 (NERI June 1994).

In 1996, a VCM was conducted at SWMU 1 (SNL/NM 1996) that involved the excavation of the entire SWMU 1 area. Magnetometer and radiation surveys were conducted during the 1996 VCM operation to identify and subsequently verify that all waste material was removed from the pits and trenches. The excavated soil and debris were field-screened, sorted, and sampled for radioactive and hazardous constituents of concern (COCs). Approximately 96 cubic yards (cy)

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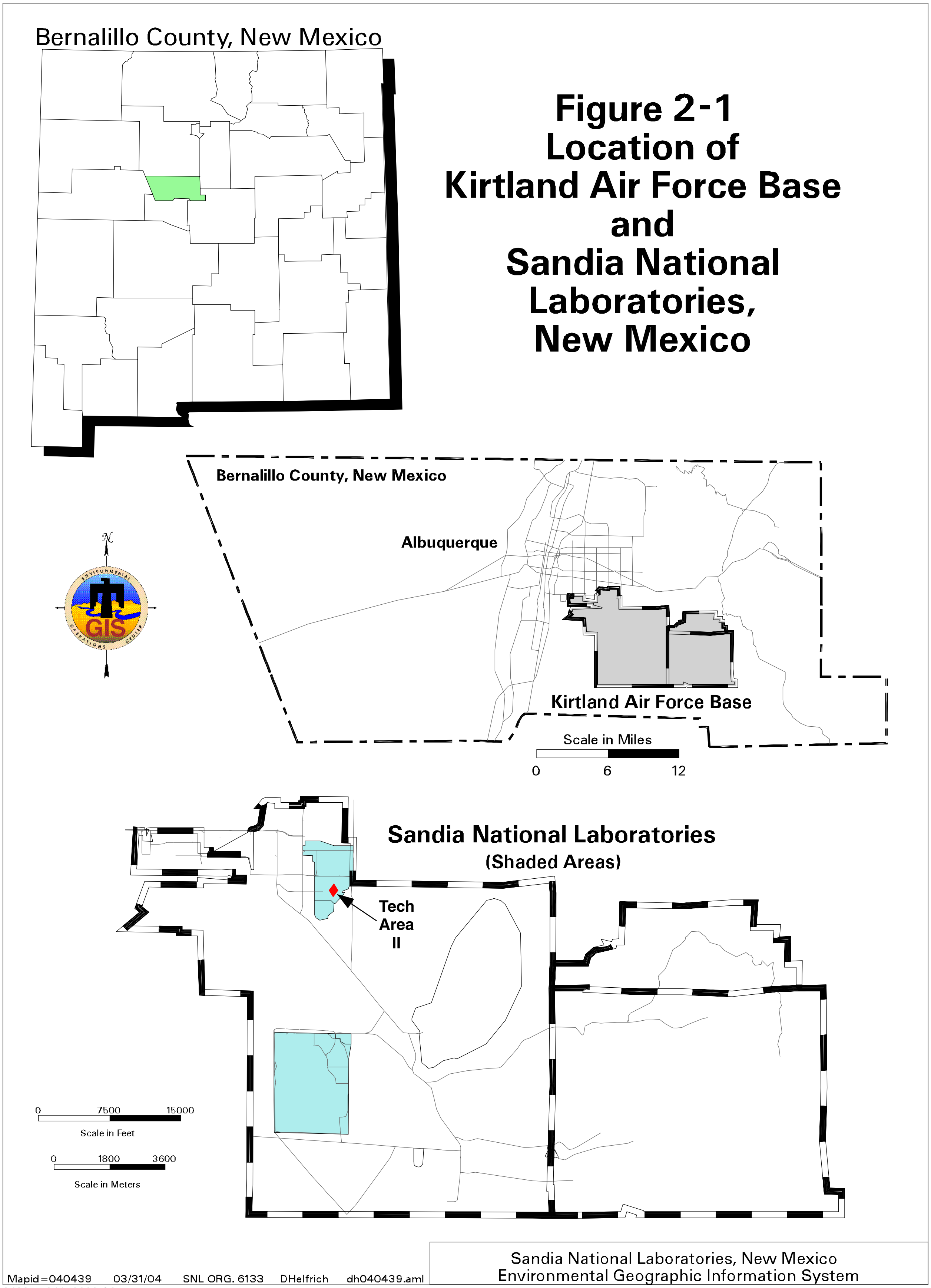

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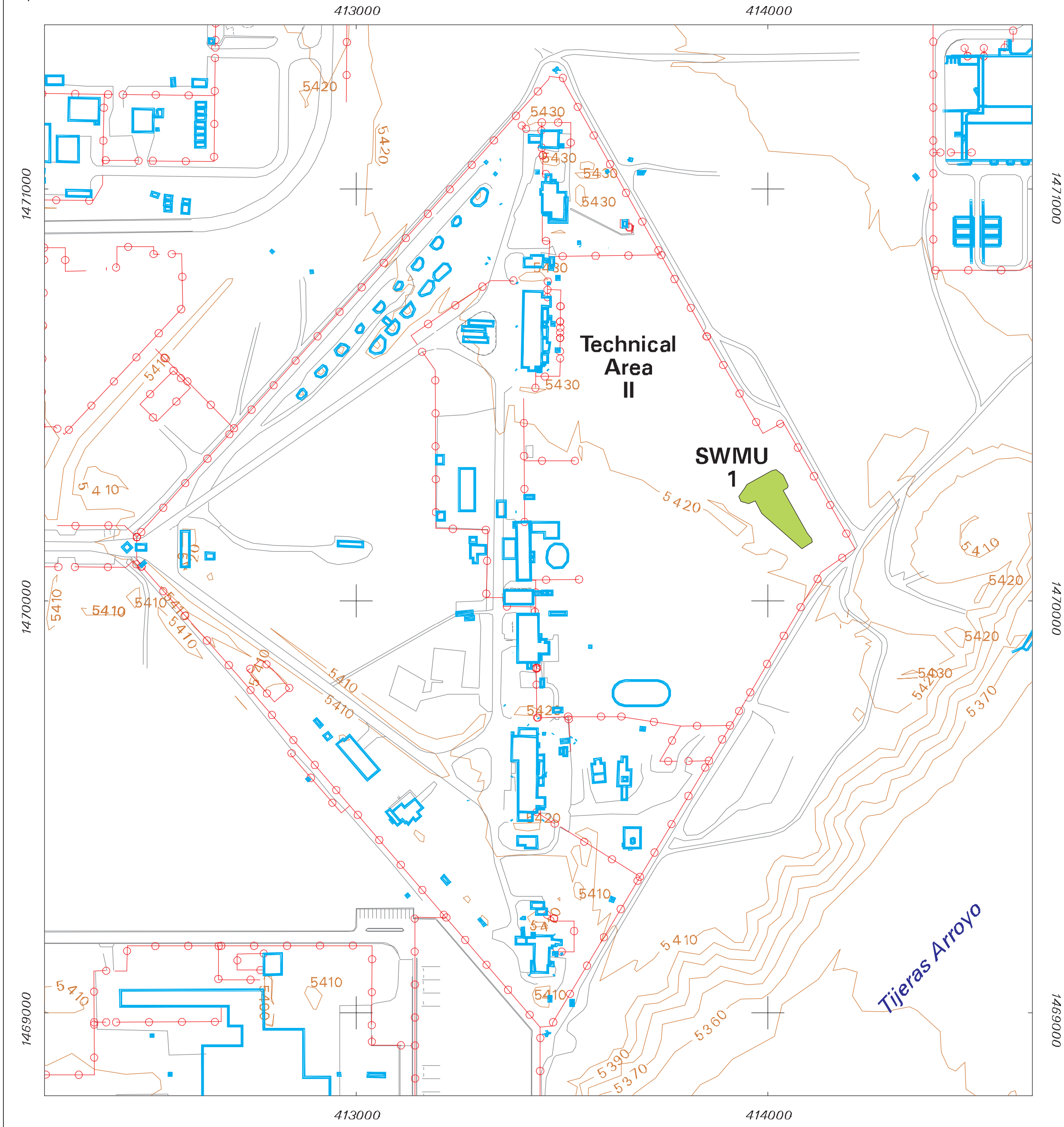

Legend

Road
Fence
10 Foot Contour
Building / Structure
SWMU 1

Figure 2-2
Location of SWMU 1
TA-II

0 200 400
Scale in Feet

0 48 96
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.04170000 A3

of weapons-related debris were shipped to SNL/NM waste management and off-site waste disposal facilities (SNL/NM September 1999). Approximately 5,000 cy of uncontaminated soil were stockpiled at the site. Approximately 400 cy of radioactively contaminated soil containing depleted uranium (DU) and tritium were shipped off site. Another 4,000 cy of "slightly contaminated soil" were stockpiled at the site. The term "slightly contaminated soil" was coined during the VCM to refer to soil which was potentially contaminated. The slightly contaminated soil contained metal and radionuclide COCs exceeding NMED-approved background levels.

Extensive field screening of soil and debris was conducted during the VCM because numerous hazards, such as radiation sources, thermal batteries, and compressed gas cylinders were potentially present. The field screening was conducted with various radiation meters including NaI (sodium-iodide) detectors for measuring high-energy gamma radiation, Geiger-Mueller (GM) pancake probes for screening beta/gamma radiation, and a FIDLER (field instrument detector for low energy radiation) for measuring low levels of gamma radiation. Field screening for organic vapors was conducted with a photoionization detector (PID) and a combustible gas indicator (CGI). Explosives screening was conducted with an EXPRAY test kit. Metal detectors (magnetometers) sensitive to both ferrous and nonferrous debris were used.

Because the primary radiation hazard at the CDPs was plutonium-239, the FIDLER was used to guide the excavation work there. Plutonium-239 is an alpha particle emitter and difficult to detect in the field. The FIDLER measured americium-241, which is a more easily detected decay product of plutonium-239. The principal radioactive contaminant at the RWL disposal cells was DU, which was evaluated using NaI detectors and GM pancake probes.

Magnetometer and radiation surveys were conducted during the 1996 VCM operation to identify and subsequently verify that all waste material was removed from the pits and trenches. Verification soil sampling was conducted in 1996 and 1999 at the floor of the VCM excavation and is discussed in Chapter 3.0. After sampling results for the stockpiled soil were evaluated using quantitative risk assessments, the stockpiled soil was used in 2003 for backfilling the VCM excavation (Chapters 4.0, 5.0, and 6.0). Verification soil sampling results for the restored ground surface are discussed in Chapter 4.0. The human health and ecological risk assessments for the final configuration of the backfill lifts are discussed in Chapter 10.0.

2.2.1 RWL Design and Contents

The RWL consisted of six disposal cells (three pits and three trenches) where weapons-related material was disposed of from 1949 to 1959. Historical records identified three of the disposal cells as Pits 1, 2, and 7. Pits 1 and 2 ranged in width from 10 to 14 feet and varied in length from 12 to 15 feet. Pit 7 had a diameter of 15 feet. The maximum depth of the three pits was approximately 19 feet. The other three RWL disposal cells were identified as Trenches 3/4, 5, and 6. These trenches ranged in width from 5 to 15 feet and varied in length from 25 to 50 feet. The maximum depth of the trenches was approximately 23 feet. The majority of the RWL waste was not containerized before disposal. The pits and trenches were unlined and did not utilize a leachate collection system. After the pits and trenches were filled with debris, each cell was covered with native soil and capped with concrete. The concrete caps (slabs) varied in thickness from 0.5 to 3 feet.

In 1996, excavation and subsequent characterization of the landfill contents showed that the RWL material consisted of weapons components, calibration sources, DU fragments, lead shielding, thermal batteries, gas cylinders, spark gap tubes, weapon mockups, electronic components, asbestos insulation, aircraft debris, and tritiated waste from booster cylinders. Radionuclides associated with the contents primarily consisted of DU, thorium-232, tritium, and cesium-137. Buried material also consisted of wire, scrap metal, wood, rubber, horse hair, Plexiglas, cardboard, and laboratory-generated waste such as gloves, pipettes, absorbent pads, forceps, beakers, test tubes, paper, glass bottles, and clothing. No drums or metal containers for liquid storage were found at the RWL.

2.2.2 CDP Design and Contents

The CDPs consisted of a few earthen pits located at the northeast corner of SWMU 1. The CDPs had been used concurrently with the RWL for the disposal of chemicals that consisted of nitric acid, hydrochloric acid, and phosphoric acid. Historical records did not cite a numbering scheme for the CDPs. Unlike the six RWL disposal cells, concrete was not used in the 1950s to cover the CDPs. During the 1996 VCM excavation work, the CDPs were found to contain several dozen, broken, 1-gallon, glass jugs at depths ranging from approximately 1 to 3 feet (Copland August 2004a). The lateral dimensions of the CDPs were approximately 25 by 25 feet. After laboratory analyses of soil samples identified elevated levels of plutonium-239, a FIDLER radiation detector was used to guide the excavation work at the CDPs. Plutonium-contaminated soil and glass bottles were subsequently containerized for off-site disposal. No organic vapors were detected with a PID or CGI. The glass jugs had apparently contained acid and plutonium-239.

2.3 Chronology of Significant Environmental Activities for SWMU 1

Field activities conducted by the SNL/NM Environmental Restoration (ER) Project began at SWMU 1 in 1993. Table 2.3-1 lists the significant field and regulatory-compliance events that have been associated with the site.

2.4 Summary of Excavation Activities Prior to Backfilling

During the VCM debris removal activities in 1996, the RWL disposal cells (pits 1, 2, and 7 and trenches 3/4, 5, and 6), were excavated to depths ranging from approximately 16 to 23 feet bgs (SNL/NM September 1999). At the conclusion of the VCM activities in September 1996, the VCM excavation was approximately 220 feet long and 120 feet wide. The excavation sidewalls were sloped at approximately 30 to 45 degrees. The surface of the excavation floor was irregular because of the construction of setbacks and egress slopes. For example, the setback for trench 6 undercut the CDPs to a depth of approximately 15 feet below ground surface (bgs). As a result, the VCM excavation in September 1996 had a undulating floor with a depth varying from about 15 to 23 feet bgs. Because the native soil at TA-II is quite competent due to a high level of carbonate cement (caliche), the trenches and pits were still open in November 1999 when soil samples were collected from the floors of the disposal cells.

Table 2.3-1
Chronology of Significant SNL/NM ER Project and NMED Activities for SWMU 1

Timeframe	Activity
December 1993	Soil-vapor survey conducted across the eastern half of TA-II detects no VOCs or SVOCs at SWMU 1 (NERI June 1994).
December 1993	Magnetometer surveys conducted over the eastern half of TA-II identifies several buried metallic anomalies at SWMU 1 (Lamb Associates 1994 and Geo-Centers 1994).
1994	Review of historical aerial photographs identifies disposal cells within SWMU 1.
August 1994	SNL/NM submits administrative NFA proposal for SWMU 3 (the CDPs) to NMED.
March 1995	NMED recommends administrative merger of SWMUs 1 and 3. SWMU 1 to be known as "Radioactive Waste Landfill and Chemical Disposal Pits" (Garcia March 1995).
1996	SNL/NM submits VCM plan to NMED (SNL/NM 1996).
May–August 1996	VCM is conducted with both the RWL and CDPs being excavated. Field-screening includes metals analysis by x-ray fluorescence, soil headspace analysis for VOCs using a PID, and radionuclide characterization with portable beta-gamma detectors. The final dimensions for the VCM excavation are approximately 120 ft wide and 220 ft long. Depth of VCM excavation ranges from 15 to 23 ft bgs. The excavated soil is stockpiled.
August 1996	Final round of verification surveys (walkover radiation and geophysical) identify no radioactive or metallic anomalies in VCM excavation.
June–August 1996	VCM confirmatory soil sampling is conducted at floor of excavation.
1996	Sampling of Slightly Contaminated Soil Piles is performed.
1997	Sampling of Slightly Contaminated Soil Piles is performed.
1997	SGS is used to reduce volume of radioactively contaminated soil (Thermo NUtech September 1997).
September 1997	SNL/NM submits risk-based NFA proposal to NMED (SNL/NM September 1997).
1998	Sampling of SGS soil piles and CDP pile is performed.
1999	Sampling of Slightly Contaminated Soil Piles is performed.
January 1999	NMED sends RSI to SNL/NM requesting supplemental information, but no details are specified (Dinwiddie January 1999).
June 1999	NMED sends second RSI to SNL/NM requesting supplemental information that focuses on waste details, soil sampling locations, and revised risk assessments (Kieling June 1999).
September 1999	SNL/NM submits RSI response to NMED. Response includes waste details and revised risk assessments (SNL/NM September 1999).
October 1999	Meeting is held between SNL/NM staff and NMED regulators during which sampling locations and risk assessments are discussed.
November 1999	Verification soil samples are collected at VCM excavation floor.
December 1999	NMED sends third RSI to SNL/NM requesting additional sampling locations and revised risk assessment. No other details are specified (NMED December 1999).
2000	Concrete rubble and rock from VCM activities are placed into VCM excavation. Depth of excavation is raised to approximately 8 ft bgs.
May–October 2000	Sampling of Slightly Contaminated Consolidated Soil Piles 32 and 34 is performed.

Refer to footnotes at end of table.

Table 2.3-1 (Concluded)
Chronology of Significant SNL/NM ER Project and NMED Activities for SWMU 1

Timeframe	Activity
September–October 2000	Sampling of RWL Pile 36 is performed.
May 2001	Sampling of Slightly Contaminated Consolidated Soil Piles 32 and 34 is performed.
April 2001	Sampling of Consolidated Clean Soil Pile (RWL Slope/Overburden Pile) is performed.
September 2001	Sampling of Clean Bunker Soil Pile is performed.
March–April 2001	Walkover radiation survey identifies radioactive anomalies (elevated Am-241) where soil piles had been stockpiled (ERG May 2001). These anomalies are subsequently excavated.
December 2002	SNL/NM submits the Additional Information RSI response to NMED in reply to the October 12, 1999, meeting. Soil sampling results and risk assessments are presented (SNL/NM December 2002).
May 2003	Soil sampling of Soil Piles 33, 35, and 36 is performed.
May 2003	Soil sampling of undisturbed over-excavation area is performed. This area is subsequently excavated and the soil used as clean fill for the 0- to 5-ft-bgs backfill lifts.
April–July 2003	Backfill operations are conducted. Over-excavation trench is dug to approximately 20 ft bgs to obtain clean fill soil and to create excavation for "slightly contaminated soil" (stockpiled soil requiring burial at depths exceeding 5 ft bgs). Over-excavation is backfilled with Lifts 1 through 17. RWL/CDP excavation backfilled with Lifts 10 through 17. Ground surface is restored to original grade.
August 2003	SNL/NM submits Backfill and Compaction Plan to NMED (SNL/NM August 2003).
November 2003	Final verification soil samples are collected at 15 locations across the SWMU 1 area.
January–March 2004	During a pair of comprehensive walkover radiation surveys conducted across SWMU 1 and the associated waste-handling area, a few small, radioactive anomalies are identified and removed (ERG April 2004a, ERG April 2004b).
April 2004	NMED formally combines SWMUs 1 and 3. SWMU 1 is the RWL and CDPs (NMED April 2004).

bgs = Below ground surface.
CDP = Chemical Disposal Pit.
ER = Environmental Restoration.
ft = Foot (feet).
NFA = No Further Action.
NMED = New Mexico Environment Department.
PID = Photoionization detector.
RSI = Request for Supplemental Information.
RWL = Radioactive Waste Landfill.
SGS = Segmented Gate System.
SNL/NM = Sandia National Laboratories/New Mexico.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
VCM = Voluntary Corrective Measure.
VOC = Volatile organic compound.

In 2000, the SWMU 1 excavation was filled with concrete rubble and rock to a depth ranging from 6 to 9 feet bgs. (SNL/NM August 2003 and Copland August 2004b). The concrete rubble was derived from the pneumatic-hammering and breakup of the RWL concrete caps. The rock consisted of large gravel and cobbles produced by the mechanical sorting and screening of the stockpiled soil. Backfilling of the VCM excavation with the stockpiled soil is discussed in Chapter 6.0.

2.5 COCs

The COCs for SWMU 1 consist of radionuclides (principally cesium-137, cobalt-60, plutonium-239, uranium-235, uranium-238, and tritium) and metals (arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, and uranium). No organic compounds are considered to be COCs because none were detected in soil samples collected during the VCM activities. In 1996, 22 soil samples were collected from the RWL disposal cells and the CDPs; the samples were analyzed at an off-site laboratory for Toxicity Characteristic Leaching Procedure (TCLP) VOCs using U.S. Environmental Protection Agency (EPA) Method 8240 and for TCLP SVOCs using EPA Method 8270. No VOCs or SVOCs were detected in the soil samples (SNL/NM September 1999).

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3.0 SWMU 1 SAMPLING ACTIVITIES

3.1 Sampling Activities

This section summarizes the SWMU 1 sampling activities. Analytical results are discussed in Chapter 4.0. Chapter 10.0 summarizes the results of the updated risk assessment, which incorporates the analytical results for the soil used as backfill as well as the analytical results for discrete (not composite) verification soil samples.

3.2 Verification Sampling History of Soil Piles

Soil excavated from the landfill during the VCM excavation in 1996 was initially segregated into potentially uncontaminated and potentially contaminated soil piles based upon field-screening data and the location of the soil within the RWL. These soil piles, along with berm soil and soil scraped from the surface of SWMU 1, were stockpiled and sampled according to the "Project-Specific Sampling and Analysis Plan" (SNL/NM December 1995). Additional soil obtained from non-SWMU locations within TA-II was also stockpiled and sampled. Samples from the stockpiled soil were analyzed for radionuclides using alpha and gamma spectroscopy (to identify isotopic plutonium), tritium, Resource Conservation and Recovery Act (RCRA) metals plus beryllium, nickel, and total uranium. Based upon the laboratory analyses and preliminary risk assessment evaluations, the stockpiled soil was identified as fill material (replaceable soil). The potentially contaminated soil was designated as "slightly contaminated soil," and the potentially uncontaminated soil was designated as "clean fill."

A brief explanation of each soil pile used as backfill material, along with its sampling history, is provided in Sections 3.2.1 and 3.2.2.

3.2.1 Slightly Contaminated Soil Piles

The term "slightly contaminated soil" refers to soil piles that contain COCs (radionuclides and/or metals) with activities or concentrations that meet ER Project human-health and ecological risk criteria for depths greater than 5 feet below ground surface (bgs). A brief explanation of each slightly contaminated soil pile identified for use as fill material, along with its sampling history, is provided as follows:

- Soil Pile 32—RWL Returns Soil Pile: Soil resulting from the excavated RWL soil piles after that soil was processed through the on-site soil screening plant to remove residual rocks and debris. Estimated volume of the pile was 3,000 cy. Composite samples were collected from the potentially contaminated soil piles during May and July 1996. Discrete samples were collected from these piles following NMED direction in January and February 1997. The soil piles were then processed through the on-site soil screening plant to remove debris and rocks greater than 2 inches in diameter. The mechanical screening process resulted in the consolidation of these soil piles into Soil Pile 32. From May through August 2000, discrete samples were collected from Soil Pile 32 and analyzed for radionuclides following NMED direction. In October 2000, additional samples from this pile were collected and analyzed for radionuclides, including tritium, and metals. Additional discrete samples were collected from Soil Pile 32 in May 2001 and analyzed for radionuclides and metals.

- Soil Pile 33—RWL Berm Soil Pile: Soil resulting from the removal and consolidation of the soil berm that surrounded the original location of the RWL soil piles as a surface-water control. Estimated volume of the pile was 75 cy. Discrete samples were collected from Soil Pile 33 in May 2003.

- Soil Pile 34—RWL Segmented Gate System (SGS) Soil Pile: Soil resulting from operations associated with the SGS. Estimated volume of the pile was 270 cy. Five of the potentially contaminated soil piles were identified as having radiological activities that exceeded risk criteria. These piles were processed through the SGS in 1997 to separate radioactively contaminated soil requiring off-site disposal. The processed soil that did not require disposal was designated as potentially contaminated soil, screened to remove debris and rocks greater than 2 inches in diameter, and consolidated into Soil Pile 34. Composite samples from Soil Pile 34 were analyzed for radionuclides in March 1998. Discrete samples were collected from May through June 2000 and analyzed for radionuclides. Samples from this pile were also collected in October 2000 and were analyzed for radiological constituents and metals.

- Soil Pile 35—RWL Scraped Surface Soil: Soil generated from initial scraping of the areas identified during radiation surveys (conducted using a FIDLER® detector) as having radiological activity greater than 1.3 times corresponding background values. Confirmatory radiological surveys were performed to document removal of the soil. Estimated volume of the pile was 90 cy. Discrete samples from Soil Pile 35 were collected during May 2003.

- Soil Pile 36—RWL Scrapings: Soil scraped from around the boundary of the RWL. Estimated volume of the pile was 335 cy. Discrete samples for radiological constituents using gamma spectroscopy were collected during September and October 2000. Discrete samples to obtain analytical results for metals, tritium, and isotopic plutonium were collected during May 2003.

3.2.2 Clean Fill Soil

The term "clean fill" refers to soil piles that contained COCs (radionuclides and/or metals) with activities or concentrations that meet ER Project risk criteria for the most restrictive depth range of 0 to 5 feet bgs. This includes soil excavated from the RWL outside of disposal cells and soil originating from non-SWMU locations within TA-II. These soil piles were originally designated as "potentially uncontaminated" soil. A brief explanation of each soil pile identified as clean fill material, along with its sampling history, is provided as follows:

- RWL Slope/Overburden Soil: This single large soil pile consisted of soil consolidated from the clean soil piles excavated from uncontaminated areas of the RWL during the 1996 VCM. Estimated volume of the pile was 4,700 cy. Composite samples were collected from the potentially uncontaminated soil piles from January through July 1997. Discrete samples were collected from these piles in April 2001 and analyzed for metals and radionuclides, following NMED direction.

- Clean Bunker Soil: This soil was obtained from locations within TA-II, but outside of any identified SWMU boundaries. Estimated volume of the soil was 3,150 cy. Discrete samples of clean bunker soil were collected in September 2001, following NMED direction.
- Over-Excavation Soil: This soil was obtained from an undisturbed area located immediately west of the VCM excavation and outside the SWMU 1 boundary (Figure 3.2-1). Soil samples were collected with a backhoe. Estimated volume of the soil was 3,600 cy. Discrete samples (TA2-1-GRAB1 through TA2-1-GRAB9) were collected in May 2003 at depths ranging from 1 to 20 feet bgs. The samples were analyzed for metals and radionuclides.

3.2.3 VCM Excavation Verification Samples

The first verification soil samples for the VCM excavation consisted of composite samples collected from the excavation floor from June through August 1996 (SNL/NM September 1997). In 1999, the NMED requested "grab" (discrete) samples for verification purposes (Kieling June 1999). In November 1999, the discrete soil samples were collected using a hand trowel from the floor of the SWMU 1 pits and trenches. The floor depths ranged from 15 to 23 feet bgs (Figure 3.2-1). These discrete samples (TA2-1-VERF-PIT1, TA2-1-VERF-PIT2, TA2-1-VERF-PIT7, TA2-1-VERF-TR5, TA2-1-VERF-TR6, and TA2-1-VERF-CDP) were collected using verbal NMED guidance for the locations and analytes (SNL/NM December 2002). The discrete samples were analyzed for radionuclides and metals. The analytical results for the November 1999 samples are incorporated into the risk assessment summarized in Chapter 10.0 and presented in Annex A.

3.2.4 Restored Grade Verification Samples

In 2003, after the backfilling operations were completed and the final grade was established across the SWMU 1 area, 15 verification surface-soil (0 to 0.5 feet bgs) samples were collected using a sampling grid that the NMED had verbally approved. The samples were collected during November 2003 to characterize locations where soil had been stockpiled (Figure 3.2-2). These discrete samples (TA2-FINL-VER-001-S through TA2-1-FINL-VER-015-S) were analyzed for radionuclides and metals (Section 6.3.2). The analytical results are incorporated into the risk assessment summarized in Chapter 10.0 and presented in Annex A.

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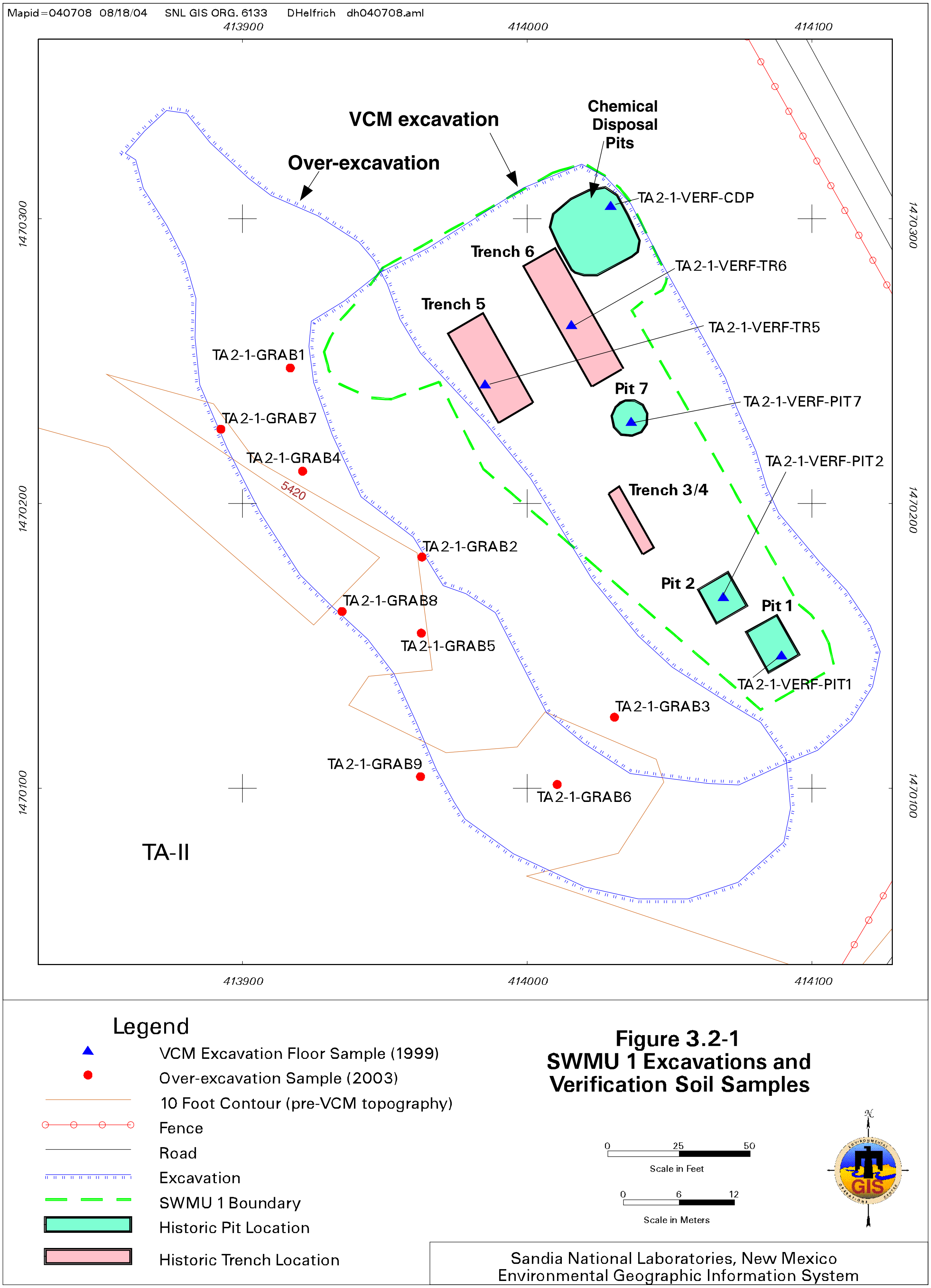

Figure 3.2-1
SWMU 1 Excavations and Verification Soil Samples

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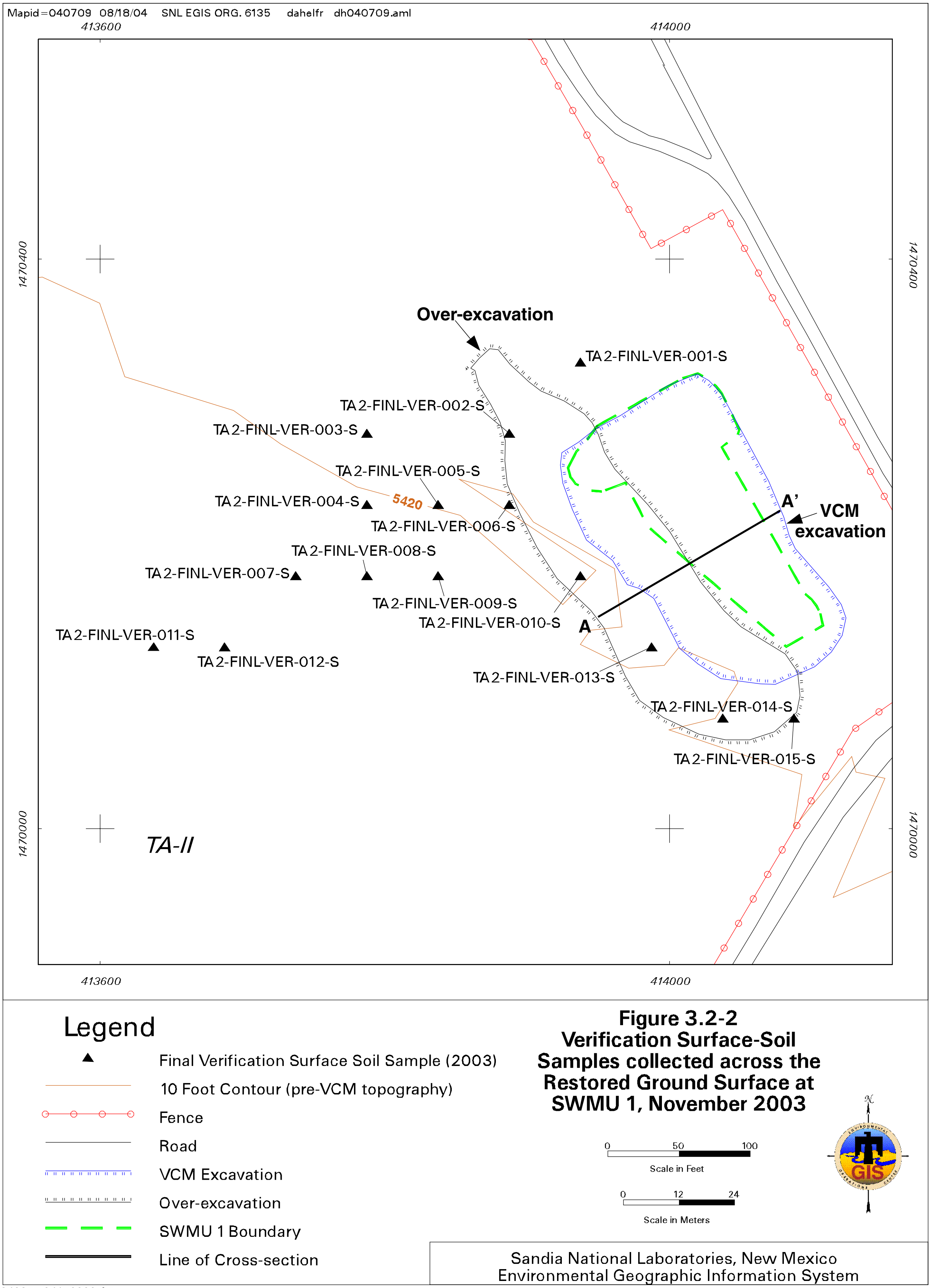

Figure 3.2-2
Verification Surface-Soil Samples collected across the Restored Ground Surface at SWMU 1, November 2003

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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4.0 SWMU 1 BACKFILL MATERIAL CHARACTERIZATION

The analytical data for the SWMU 1 soil samples are presented in Annex B. The soil samples were used for:

- Characterizing the stockpiled soil and the clean fill (over-excavation) soil
- Determining the appropriate backfill depth for both types of soil
- Verification of the VCM excavation floor
- Verification of the restored ground surface after the backfilling activities were complete

Table 4-1 lists the analytical data tables with respect to characterization purpose. The sampling events are discussed in Chapter 3.0. Annex C presents an index for sampling events, sample locations, and the corresponding analytical request/chain-of-custody records.

Table 4-1
List of SWMU 1 Analytical Data Tables with Respect to Characterization Purpose

Analytical Data Tables	Characterization Purpose
B-1 through B-4	Soil used for Lift 1 (the deepest backfill lift)
B-5 through B-8	Soil used for Lifts 2 through 7
B-9 through B-12	Soil used for Lifts 8 through 14
B-13 through B-16	Soil used for Lifts 14 through 17
B-17 through B-20	Verification soil samples collected from the floor of the VCM excavation
B-21 through B-24	Verification soil samples collected from the restored ground surface

VCM = Voluntary Corrective Measure.

Selection of soil piles to be used for each backfill lift was based upon analytical results for the stockpiled soil. Clean fill (Section 3.2.2) was used to construct the 0- to 5-foot-bgs interval. Scoping risk assessments had shown that a 5-foot-thick uppermost layer of clean fill would preclude contact between the COCs and biota. Pre-backfill evaluations of the existing SWMU 1 analytical data for the stockpiled soil were performed to identify the clean fill that could be used to construct the 0- to 5-foot bgs interval. In addition, these evaluations were also critical to determine the optimum sequence for placing the backfill material in the excavation when considering both field logistics and risk-based criteria. The order in which the soil was placed into the excavation during the backfill operations is detailed in Section 6.2.

The ecological risk assessment discussed in Chapter 10.0 and Annex A is based upon the COCs present in soil comprising the uppermost 0- to 5-foot overlying layer. The human health risk assessment discussed in Chapter 10.0 and presented in Annex A is based upon the COCs in the soil comprising the entire 0- to 20-foot interval. The maximum concentrations of inorganic analytes in the 0- to 5-foot-bgs interval and the 0- to 20-foot-bgs interval are listed in Table 4-2. Eleven metals and eight radionuclides are the predominant risk drivers.

Table 4-2
Maximum Concentrations of Inorganic and Radionuclide Analytes in the 0- to 5-ft-bgs Backfill Interval and the 0- to 20-ft-bgs Backfill Interval at SWMU 1

Metals	Maximum Concentration in 0- to 5-ft-bgs Backfill Material (mg/kg, ppm)	Maximum Concentration in 0- to 20-ft-bgs backfill material (mg/kg, ppm)
Arsenic	6.99	6.99
Barium	479	479
Beryllium	0.613	0.671
Cadmium	6.7	6.7
Chromium-total	19.2	19.2
Lead	81.7	81.7
Mercury	0.178	7.8
Nickel	10.4	15.5
Selenium	2.005	2.005
Silver	1.95	1.95
Uranium	58.6	58.6
Americium-241	0.352	205
Cesium-137	0.203	4,410
Plutonium-238	0.184	5.8
Plutonium-239/240	2.55	273
Thorium-232	1.24	3.47
Tritium	4.49	929
Uranium-235	0.351	3.05
Uranium-238	25	70.4

bgs = Below ground surface.
ft = Foot (feet).
mg/kg = Milligram(s) per kilogram.
pCi/g = Picocurie(s) per gram.
ppm = Part(s) per million.
SWMU = Solid Waste Management Unit.

Data quality objectives such as sampling frequency, duplicates, equipment blanks, and analytical methods are summarized in Section III of the Risk Assessment Report (Annex A). Soil samples were analyzed for RCRA metals plus beryllium, nickel, and total uranium by EPA Methods 6010/7000 and 6020; gamma spectroscopy by EPA Method 901.1 (or equivalent); and tritium by EPA Method 906.0. On-site qualitative tritium measurements also were performed using liquid scintillation counting. The analytical laboratories are listed in Section III of Annex A.

5.0 SWMU 1 BACKFILL MATERIAL

5.1 Criteria for Use of Material as Backfill

According to the VCM Plan (SNL/NM 1996), excavated soil that passed standard ER Project risk-based criteria would be used as a source of fill material to backfill the SWMU 1 excavation. The December 2002 risk assessment (SNL/NM December 2002) demonstrated that SWMU 1 would meet risk-based criteria when a 5-foot layer of clean fill was placed to grade within the excavation. Due to residual radionuclides and metals, an uppermost 5-foot layer of clean soil was necessary to preclude contact between the COCs and biota. As a conservative measure, 10 feet of clean fill soil was actually used (see Chapter 6.0).

The SWMU 1 analytical data were evaluated prior to initiating the backfill operations to identify which soil piles met the criteria as clean fill for use in the 0- to 5-foot-bgs depth interval. The results of the ecological risk assessment presented in Chapter 10.0 demonstrate that the soil used as clean fill meets the most restrictive risk criteria for construction of the uppermost 5-foot layer.

5.2 Description of Backfill Material

During June and July 2003, soil and rock were used to bring the SWMU 1 excavation up to the original grade. The slightly contaminated soil was mechanically screened with a 2-inch diameter screen; the clean fill was mechanically screened with a 4-inch diameter screen. The rocks (mostly cobbles) screened out during this process were used as marker layers. A list of the backfill material is provided as follows:

- Slightly Contaminated Soil Piles (total estimated volume of 3,770 cy placed at depths greater than 10 feet bgs) are composed of the following soil piles:
  - Soil Pile 32: RWL Returns Soil Pile (estimated volume of 3,000 cy)
  - Soil Pile 33: RWL Berm Soil Pile (estimated volume of 75 cy)
  - Soil Pile 34: RWL SGS Soil Pile (estimated volume of 270 cy)
  - Soil Pile 35: RWL Scrapings (estimated volume of 90 cy)
  - Soil Pile 36: RWL Scrapings (estimated volume of 335 cy)
- Clean Fill Soil (total estimated volume of 11,450 cy placed at depths of 0 to 10 feet bgs) consists of uncontaminated soil obtained from the following sources:
  - RWL Slope/Overburden Soil (estimated volume of 4,700 cy)
  - Clean Bunker Soil (estimated volume of 3,150 cy)
  - Overburden Soil from over-excavated area (estimated volume of 3,600 cy)

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6.0 SWMU 1 BACKFILL OPERATIONS

Backfill operations at SWMU 1 were conducted between June 11 and July 17, 2003 (Table 6-1). The activities are briefly described in the following sections.

6.1 Pre-Backfill Activities

Activities performed prior to commencing the backfill operations consisted of the following:

- Consolidating and mechanically screening the soil piles
- Preparing access ramps
- Compiling and evaluating existing analytical data

To illustrate the backfilling operation at SWMU 1, a series of oblique figures were generated using digital elevation data and interpretations of low-altitude aerial photographs. Figure 6.1-1 illustrates the January 2003 configuration of the pre-backfill excavation and the soil piles. Figure 6.1-2 shows the over-excavation trench that was completed in June 2003. Figure 6.1-3 depicts the site in July 2003 when the backfill had reached 8 feet bgs (Lift 10). The following sections discuss the pre-backfill activities.

6.1.1 Mechanical Screening of Soil Piles

Backfill soil was mechanically screened to remove rocks greater than 4 inches in diameter. This was done to permit adequate soil compaction and ensure the engineered properties of the soil would mitigate the probability of subsidence. Details of the mechanical screening efforts are provided in Table 6-1.

6.1.2 Excavation Preparation

In early 2003, the SWMU 1 excavation floor averaged approximately 8 feet in depth. In June 2003, ramps were constructed in the northwest corner of the excavation to ensure safe access and egress of heavy equipment during the backfill operations. An earthen berm, approximately 1.5 feet in height, was constructed around the outer perimeter of the excavation to prevent surface water from entering or leaving the excavation area. Table 6-1 lists other preparatory work.

Table 6-1
Chronology of SWMU 1 Backfill Activities

Date(s)	Activity
04-09-03 to 04-15-03	Conduct site preparation activities.
04-16-03 to 04-28-03	Screen overburden soil pile.
04-28-03 to 05-05-03	Consolidate/screen bunker soil piles.
05-01-03 to 05-06-03	Develop sampling plan for over-excavation soil.
05-07-03 to 05-08-03	Move Soil Piles 32-35 from area of over-excavation.
05-06-03 to 06-02-03	Prepare City of Albuquerque Surface Disturbance Permit.
05-08-03	Resample verification locations TA2-1-VERF-CDP-15.0-S and TA2-1-VERF-PIT7-16.5-S for tritium analysis (AR/COC 606385).
05-09-03 to 05-13-03	Complete radiological decontamination of heavy equipment; survey and scrape radiation "hot spots" (>1.3 times background) from area of soil piles.
05-14-03	Begin sampling over-excavation soil using Geoprobe™, which encounters refusal at 15 ft bgs in first borehole. Revise sampling plan to take samples using backhoe.
05-15-03 to 05-16-03	Sample over-excavation soil at 9 locations using 5-ft intervals. Total depth is 20 ft bgs. Approximately 3,600 cy of soil is excavated with samples obtained from every 100 cy of soil. Analyze samples for metals and radionuclides (AR/COC 606386, 606387, 606388, and 606389).
05-19-03	Sample Soil Piles 33, 35, and 36. Analyze soil samples for metals and radionuclides (AR/COC 606391 and 606392).
05-28-03	Construct over-excavation to accommodate placement of slightly contaminated soil at depths greater than 5 ft bgs. The over-excavation, located on southwest side of the VCM excavation, is approximately 25 ft wide, 200 ft long, and 20 ft deep.
06-04-03	City of Albuquerque approves Surface Disturbance Permit.
06-10-03	Complete over-excavation. Evaluate analytical data from over-excavation to ensure acceptable ecological risk.
06-11-03	Begin backfill operations. Place rock/cobbles in bottom of over-excavation. Place slightly contaminated soil from Soil Pile 34 on top of rock layer.
06-12-03	Place slightly contaminated soil from Soil Piles 33, 34, and 35 on top of the rock/cobbles in the over-excavation area. Complete Lift 1 using soil from Soil Piles 33, 36, and 32.
06-12-03 to 06-13-03	Place RWL soil samples into Soil Pile 32.
06-13-03 to 06-19-03	Complete Lifts 2 through 7 using soil from Soil Pile 32. This completes placement of soil piles with elevated radiological contamination.
06-19-03	Begin radiological decontamination of heavy equipment. Begin performing radiological survey of SWMU 1. Place soil scrapings from contaminated areas where soil had been stockpiled (>1.3 background) on top of Lift 7.
06-20-03	Complete radiological decontamination of heavy equipment.
06-23-03	Begin screening clean soil from over-excavation.
06-26-03	Complete radiological survey and scraping of SWMU 1.
06-27-03	Complete Lift 8 using clean soil from over-excavation (great care taken to not disturb Lift 7).
06-30-03	Complete Lift 9 using rock/cobbles and clean soil from over-excavation.
07-01-03 to 07-07-03	Complete Lifts 10, 11, and 12 using clean soil from over-excavation.
07-09-03	Complete screening clean soil from over-excavation. Complete Lift 13 using clean soil from over-excavation.
07-10-03	Complete Lift 14 using clean soil from over-excavation and slope/overburden pile.

Refer to footnotes at end of table.

Table 6-1 (Concluded)
Chronology of SWMU 1 Backfill Activities

Date(s)	Activity
07-11-03	Complete Lift 15 using clean soil from slope/overburden pile.
07-14-03	Complete Lift 16 using clean soil from slope/overburden pile and TA-II bunker pile.
07-16-03	Complete Lift 17 using clean soil from TA-II bunker pile, which completes RWL backfill activities.
07-17-03	Complete blade/final grading.

AR/COC = Analysis request/chain of custody record.
bgs = Below ground surface.
cy = Cubic yard(s).
ft = Foot (feet).
RWL = Radioactive Waste Landfill.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
VCM = Voluntary Corrective Measure.

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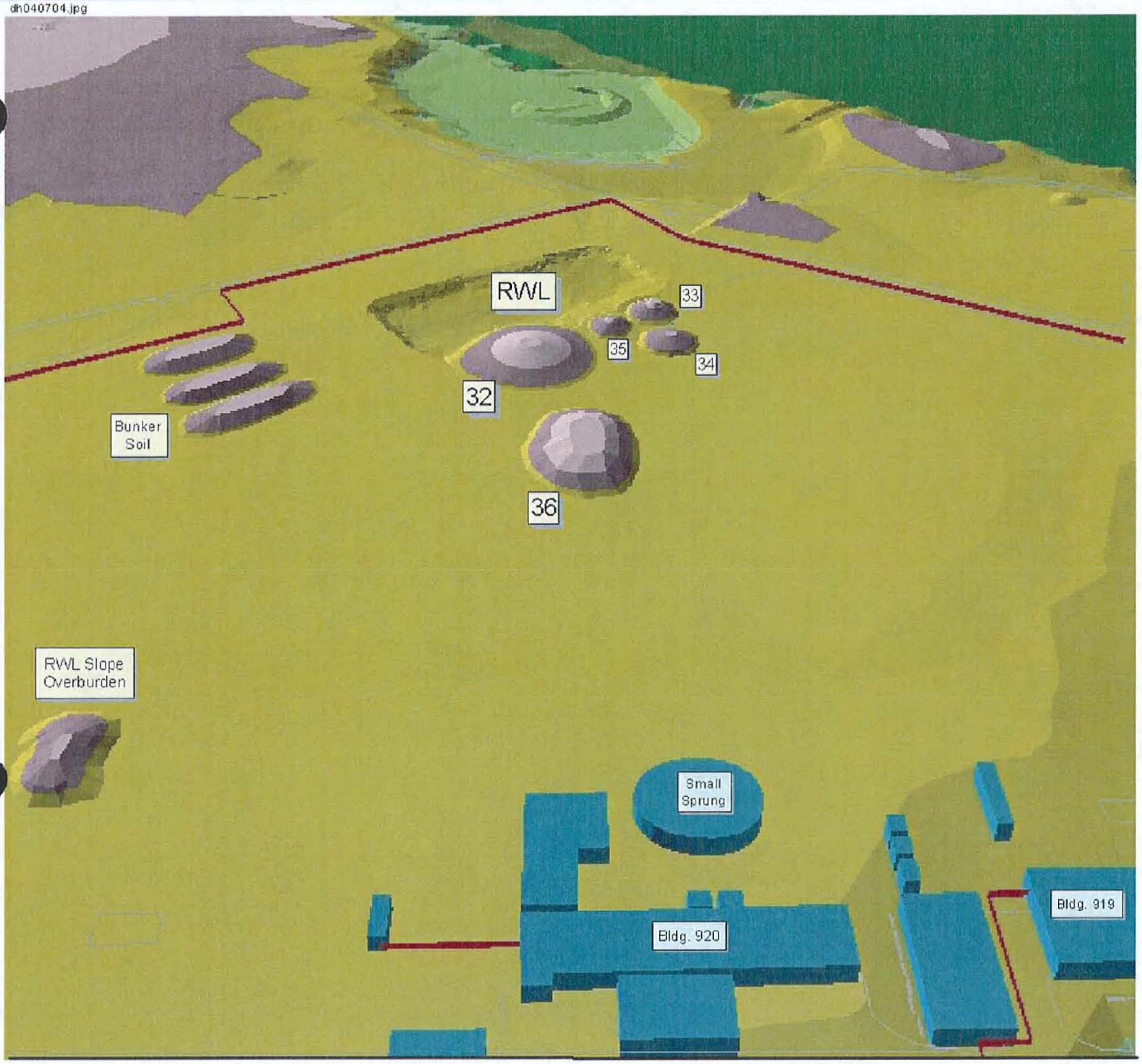

Figure 6.1-1
SWMU 1
VCM Excavation and
Soil Pile Configuration
January 2003
(oblique view to East)

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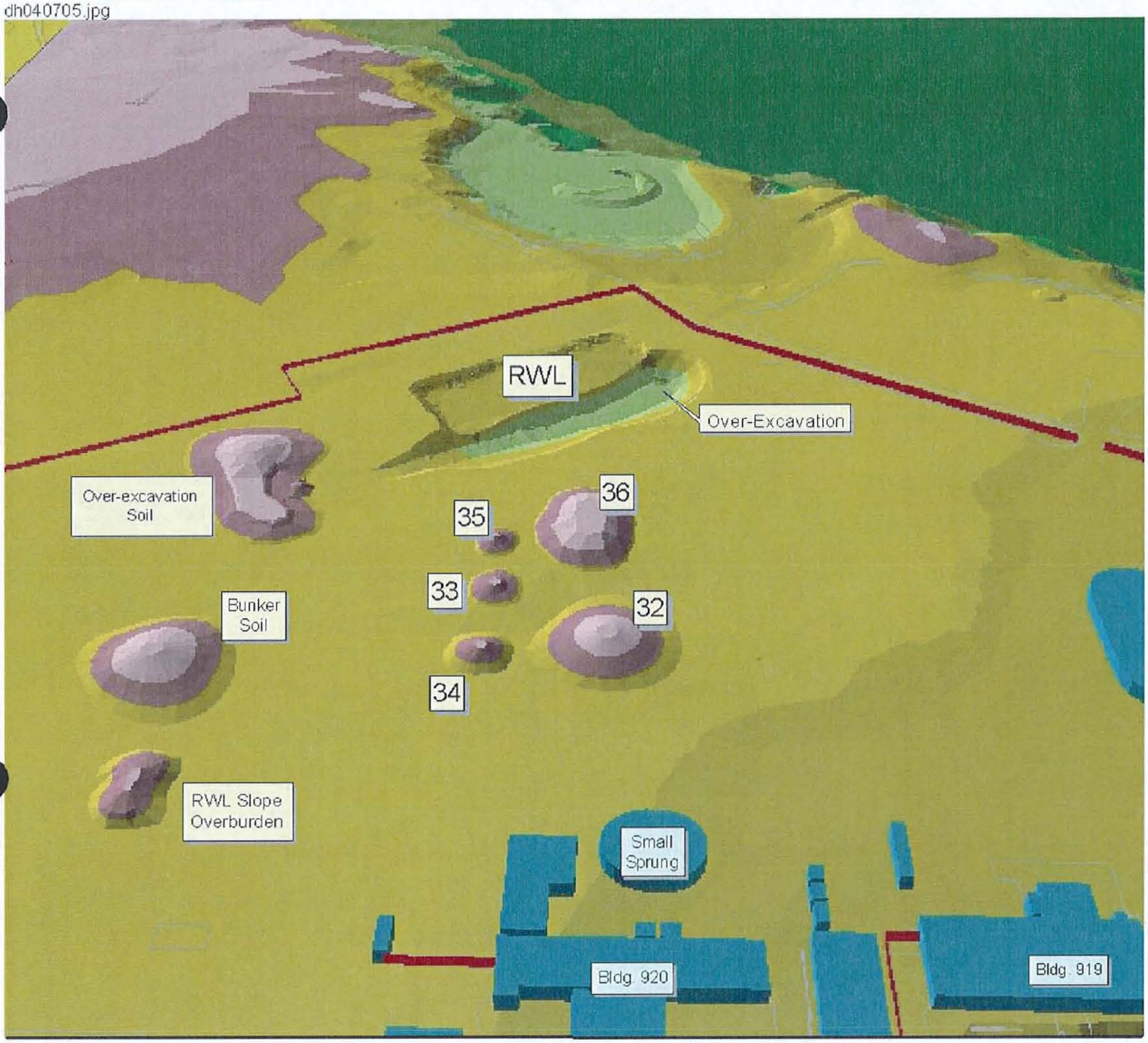

Unpaved Road
Fence
Building / Structure

Elevation Range
5430 - 5440
5425 - 5430
5420 - 5425
5414 - 5420
5400 - 5414
5385 - 5400
5370 - 5385
5354 - 5370
5342 - 5354

Figure 6.1-2
SWMU 1
Over-Excavation and
Soil Pile Configuration
June 2003
(oblique view to East)

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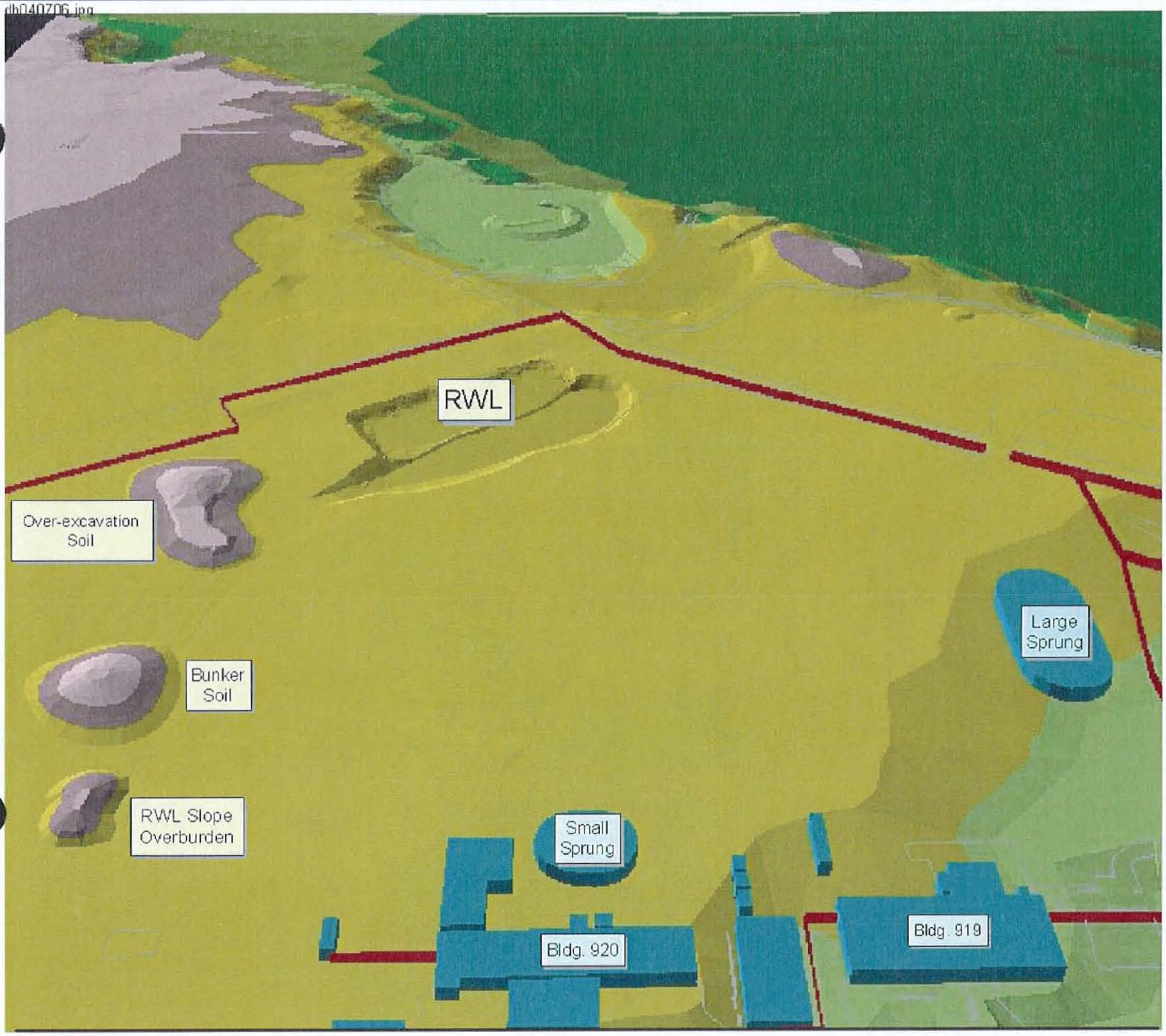

Unpaved Road
Fence
Building / Structure

Elevation Range
5430 - 5440
5425 - 5430
5420 - 5425
5414 - 5420
5400 - 5414
5385 - 5400
5370 - 5385
5354 - 5370
5342 - 5354

Figure 6.1-3
SWMU 1
Backfilled at 8-ft. Depth (Lift 10)
July 2003
(oblique view to East)

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6.2 Placement and Compaction of Backfill Material

As outlined in the backfill and compaction plan for SWMU 1 (SNL/NM August 2003), the rock that was mechanically screened from the excavated soil was placed on the floor of the over-excavation as a marker layer. The soil having the highest radionuclide and metal concentrations from the slightly contaminated soil piles was placed and compacted on top of the rock layer. Relatively less contaminated material from the clean fill soil piles was then placed at shallower depths and compacted. The following sections provide details of the backfill material placement and compaction.

6.2.1 Placement of Backfill Material

Table 6.2-1 lists each lift with a corresponding description of the backfill material. The installation of the backfill material began with a rock marker layer at a depth of approximately 20 feet bgs. Additional lifts were then placed on top of the marker layer and compacted. A photograph of the typical SWMU 1 backfill process is shown as Figure 6.2-1. The cross section in Figure 6.2-2 depicts the final lift configuration. Figure 3.2-2 depicts the line of cross-section.

6.2.2 Soil Compaction

The placement and compaction of fill followed the same general procedures and compaction specifications that were approved by the NMED (Bearzi June 2002) for the Chemical Waste Landfill (SNL/NM July 2002). After consultation with SNL/NM Organization 10827 (Construction Inspection and Acceptance), the ER Project determined that 12-inch lifts with 90 percent compaction would comply with SNL/NM Construction Standard Specification, Section 02200 (SNL/NM September 1995).

Prior to the backfilling operation, compaction studies were conducted at a geotechnical laboratory to determine the optimum percent moisture and maximum dry density for SWMU 1 soil (Kleinfelder April 2003). The optimum percent moisture was 9 percent with a corresponding maximum dry density of 126 pounds per cubic foot.

In June 2003, the first marker layer of rock was placed on the floor of the over-excavation at approximately 20 feet bgs. This marker layer was covered by approximately 8 inches of soil. A compaction test was not performed on this initial layer because the testing procedure requires a 12-inch layer of soil. Subsequent layers of soil were placed in approximate 12-inch loose lifts while water was applied for dust suppression and to achieve the specified moisture content. These lifts were initially compacted in place by the heavy equipment used to haul and move the soil. Additional compaction was achieved using a sheepsfoot roller.

A compaction goal of 90 percent with a moisture content of 9 ± 3% was used. Nuclear gauge measurements for density and moisture content were collected for each lift. These measurements were randomly spaced to represent the lift (i.e., measurements were not next to each other for an individual lift). A nuclear gauge instrument (i.e., density probe) manufactured by California Pacific Nuclear International was used to determine the in-place compaction and moisture measurements.

Table 6.2-1
Summary of SWMU 1 Backfill Lifts

Lift	Completion Date	Average Depth of Uppermost Surface (bgs)	Description of Soil
17	07-16-03	0 ft	Soil from TA-II bunker
16	07-14-03	1 ft	Soil from slope/overburden pile and TA-II bunker
15	07-11-03	2 ft	Soil from slope/overburden
14	07-10-03	3 ft	Soil from over-excavation and slope/overburden
13	07-09-03	4 ft	Soil from over-excavation
12	07-07-03	5 ft	Soil from over-excavation
11	07-02-03	6 ft	Clean soil from over-excavation
10	07-01-03	7 ft	Soil from over-excavation
9	06-30-03	8 ft	Rock/cobbles and soil from over-excavation, placed level with original excavation
8	06-27-03	10 ft	Soil from over-excavation
Lift 7 completes placement of soil piles with elevated radionuclide and metal contamination			
7	06-19-03	11 ft	Soil from Pile 32, scrapings from underneath slightly contaminated soil piles
6	06-17-03	12 ft	Soil from Pile 32
5	06-16-03	13 ft	Soil from Pile 32
4	06-14-03	15 ft	Soil from Pile 32
3	06-13-03	16 ft	Soil from Pile 32
2	06-13-03	17 ft	Soil from Pile 32
1	06-12-03	18 ft	Soil from Piles 33, 36, and 32
NA	06-12-03	19 ft	Soil from Piles 34, 35, and 33
NA	06-11-03	19.5 ft	Rock/cobbles from over-excavation
Average Depth of Over-Excavation = 20 ft			

bgs = Below ground surface.
ft = Foot (feet).
NA = Not applicable.
RWL = Radioactive Waste Landfill.
SWMU = Solid Waste Management Unit.
TA = Technical Area.

Figure 6.2-1
Photograph showing the SWMU 1 backfill operation on July 27, 2003.
(The sheepsfoot roller in the foreground is compacting Lift 8 at an approximate depth of 10 ft bgs. Heavy equipment in the background consists of excavators, loaders, a screen plant, a water truck, and a dump truck. View is to the northwest.)

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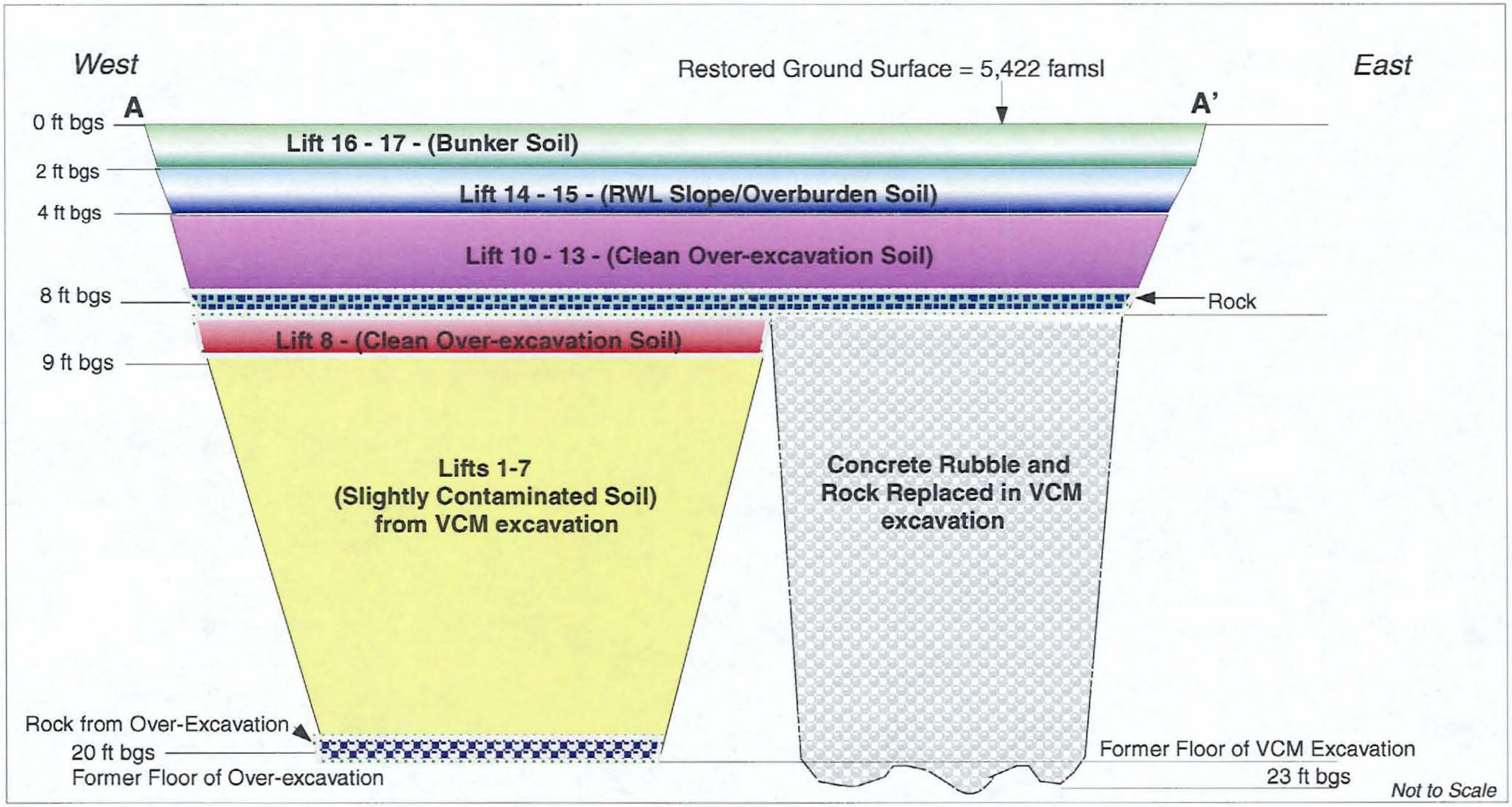

Figure 6.2-2
Cross-Section of SWMU 1 after Backfilling

ft bgs = Feet below ground surface
famsl = Feet above mean sea level
RWL = Radioactive Waste Landfill

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Table 6.2-2 provides the results of the SWMU 1 compaction tests. Except for the uppermost lift (17), the compaction goal was achieved for each lift. Therefore, no subsidence is anticipated.

6.3 Post-Backfill Activities

Post-backfill activities were performed from August through November 2003. The post-backfill activities included site grading, verification sampling and analysis, waste disposal, and final radiological inspection. The following sections describe these activities in further detail.

6.3.1 Site Grading

The surface of the backfilled excavation and adjacent areas were graded to conform to pre-excavation contours of the local area. The restored ground surface for SWMU 1 varied from approximately 5,421 to 5,422 feet amsl. The grading ensures proper surface-water drainage across the area to the southwest. Subsidence is not anticipated to occur based upon the fact that no volumetrically significant buried debris, organic material, or void spaces will exist, combined with the consistent engineered properties of the mechanically screened fill materials used for backfilling. Disturbed portions of the site were watered down to form a stable crust to minimize erosion and wind abrasion of the site surface. A mixture of water and magnesium chloride was applied to the site haul roads to further stabilize these areas. As documented in the Surface Soil Disturbance Permit approved by the City of Albuquerque, revegetation of the site by the ER Project was not required.

6.3.2 Verification Surface-Soil Sampling and Analysis

After the backfilling operations were complete and the final grade was established across the SWMU 1 area, 15 verification surface-soil samples were collected where soil had been stockpiled at locations that the NMED had verbally approved. The sample locations are shown on Figure 3.2-2. The samples were collected during November 2003. No significant contamination was detected in the soil samples. The analytical results are incorporated into the risk assessment.

6.3.3 Final Radiological Inspection

From January through March 2004, a pair of comprehensive walkover radiation surveys were conducted across SWMU 1 and the associated waste-handling area. Sixteen off-site reference areas were surveyed to establish the background count rates for the radiation detectors. A few small radioactive anomalies were identified and removed from the area between SWMU 1 and Building 920 (ERG April 2004a, ERG April 2004b). No corrective action was necessary at SWMU 1.

Table 6.2-2
SWMU 1 Compaction Test Results for Lifts 1 through 17

Test Date	Lift	Approximate Depth (bgs)	Density Probe	Location	Wet Density (pcf)	Moisture (pcf)	Dry Density (pcf)	% Compaction	% Moisture
06-12-03	1	18 ft	CPNI Model MC-3	Over-Excavation–Northwest End	136.5	11.3	125.2	99.4	9.0
				Over-Excavation–Southeast End	137.1	10.4	126.7	100.6	8.2
06-13-03	2	17 ft	CPNI Model MC-3	Over-Excavation–Northwest End	139.2	12.1	127.1	100.9	9.5
				Over-Excavation–Southeast End	135.4	9.2	126.2	100.2	7.3
06-13-03	3	16 ft	CPNI Model MC-3	Over-Excavation–Northwest End	136.2	12.1	124.1	98.5	9.8
				Over-Excavation–Southeast End	135.9	13.0	122.9	97.5	10.6
06-16-03	4	15 ft	CPNI Model MC-3	Over-Excavation–Southeast End	133.9	10.6	123.3	97.9	8.6
				Over-Excavation–Northwest End	136.7	11.8	124.9	99.1	9.4
06-16-03	5	13 ft	CPNI Model MC-3	Over-Excavation–Southeast End	137.5	13.2	124.3	98.7	10.6
				Over-Excavation–Northwest End	137.3	14.4	122.9	97.5	11.7
06-17-03	6	12 ft	CPNI Model MC-3	Over-Excavation–Northwest End	137.8	14.9	122.9	97.5	12.1
				Over-Excavation–Southeast End	139.6	13.6	126.0	100.0	10.8
06-19-03	7	11 ft	CPNI Model MC-1DR-P	Over-Excavation–Northwest End	136.8	13.3	123.5	98.0	10.8
				Over-Excavation–Southeast End	132.3	13.8	118.5	94.0	11.6

Refer to footnotes at end of table.

Table 6.2-2 (Continued)
SWMU 1 Compaction Test Results for Lifts 1 through 17

Test Date	Lift	Approximate Depth (bgs)	Density Probe	Location	Wet Density (pcf)	Moisture (pcf)	Dry Density (pcf)	% Compaction	% Moisture
06-27-03	8	10 ft	CPNI Model MC-1DR-P	Over-Excavation	139.5	13.00	126.5	100.4	10.3
				VCM Excavation	141.5	11.75	129.75	103.0	9.1
06-30-03	9	8 ft	CPNI Model MC-1DR-P	Over-Excavation	137.5	8.75	128.75	102.2	6.8
				VCM Excavation	136.5	11.50	125.00	99.2	9.2
07-01-03	10	7 ft	CPNI Model MC-1DR-P	Over-Excavation	139.5	15.75	123.75	98.2	12.7
				VCM Excavation	139.0	13.75	125.25	99.4	11.0
07-02-03	11	6 ft	CPNI Model MC-1DR-P	Over-Excavation	140.0	13.25	126.75	100.6	10.5
				VCM Excavation	141.0	11.50	129.5	102.8	8.9
07-07-03	12	5 ft	CPNI Model MC-1DR-P	Over-Excavation	140.5	11.00	129.5	102.8	8.5
				VCM Excavation	142.5	11.25	131.25	104.2	8.6
07-09-03	13	4 ft	CPNI Model MC-1DR-P	Over-Excavation	134.0	9.75	124.25	98.6	7.8
				VCM Excavation	138.5	12.25	126.25	100.2	9.7
07-10-03	14	3 ft	CPNI Model MC-1DR-P	Over-Excavation	137.8	14.4	123.4	97.9	11.7
				VCM Excavation	135.4	9.6	125.8	99.8	7.6

Refer to footnotes at end of table.

Table 6.2-2 (Concluded)
SWMU 1 Compaction Test Results for Lifts 1 through 17

Test Date	Lift	Approximate Depth (bgs)	Density Probe	Location	Wet Density (pcf)	Moisture (pcf)	Dry Density (pcf)	% Compaction	% Moisture
07-11-03	15	2 ft	CPNI Model MC-1DR-P	Over-Excavation	140.0	11.7	128.3	101.8	9.1
				VCM Excavation	132.3	12.5	119.8	95.1	10.4
07-16-03	16	1 ft	CPNI Model MC-1DR-P	Over-Excavation	130.7	11.2	119.5	94.8	9.4
				VCM Excavation	129.6	14.4	115.2	91.4	12.5
07-16-03	17	0 ft	CPNI Model MC-1DR-P	Over-Excavation	130.3	11.4	118.9	94.4	9.6
				VCM Excavation	121.3	12.3	109.0	86.5	11.3

Note: The maximum dry density was calculated to be 126.0 pcf with an optimal moisture content of 9.0 pcf.
bgs = Below ground surface.
CPNI = California Pacific Nuclear International.
ft = Foot (feet).
pcf = Pounds per cubic foot.
SWMU = Solid Waste Management Unit.

7.0 BEST MANAGEMENT PRACTICES

The following best management practices were used during the backfill operations at SWMU 1:

- Earthen berms were constructed and maintained around the excavation as a control measure for surface water. Although occasional rain and thunderstorms occurred during the backfill operations, the severity of the storms did not warrant the use of additional surface-water controls.
- Water was applied to soil piles, haul roads, and other operational areas to control fugitive (nuisance) dust emissions.
- Heavy equipment activity was reduced during high wind events to limit dust generation.

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8.0 CONSTRUCTION QUALITY CONTROL

During the backfill and compaction effort, field activities and decisions were documented in ER logbooks. Information documented in these logbooks includes, but is not limited to, the following:

- Daily weather conditions, including temperature and precipitation events
- Daily work activities
- Visual observations of conditions that affected the backfilling operations, such as excessively wet soil and high wind events
- Spreading and distribution of rocks on the excavation floor
- Lifts completed in each area, the depth bgs, and the origin of the backfill material
- Nuclear gauge measurements for density and moisture content for each lift
- Daily safety inspections for heavy equipment

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9.0 HEALTH AND SAFETY

Field operations at SWMU 1 were conducted in accordance with the "Site Health and Safety Plan, Technical Area II Remediation Project, Classified Waste Landfill, Technical Area II, SNL/NM, Revision 1" (SNL/NM December 1998). Remediation and backfilling of the nearby Classified Waste Landfill (SWMU 2) has involved many of the same health and safety issues as SWMU 1.

Daily planning and safety meetings at SWMU 1 were conducted prior to beginning work activities. These meetings discussed tasks, personal protective equipment requirements, analytical results for previous personnel monitoring, and other operational and safety issues. The Site Safety Officer performed daily field inspections and periodically monitored the air quality for (1) heavy metals using laboratory analyses of filters from breathing zone monitors; (2) carbon monoxide, oxygen, and explosive limits using a CGI; and (3) organic vapors using a PID. Throughout the backfill operation, no COCs were detected above the action levels. Because SWMU 1 was designated by SNL/NM as a Radioactive Materials Management Area, field activities were conducted in accordance with an SNL/NM Radiological Work Permit. Radiological Control Technicians (RCTs) routinely surveyed work areas for radioactive contamination. All equipment, sample containers, and other materials leaving the site were surveyed and released by the RCT prior to exiting the site.

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10.0 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) was developed for the residual COCs identified in both the excavated soil piles and the VCM excavation samples. The CSM is a schematic representation of the chemical source areas, chemical release mechanisms, environmental transport media, potential exposure routes, and potential receptors (Figure 10-1). The purpose of the CSM is to represent chemical sources and exposure pathways that may result in human health/ecological risks and to aid in identifying remediation alternatives that target significant contaminant sources and exposure pathways. The following sections summarize the nature and extent of contamination and the environmental fate of the COCs.

10.1 Nature and Extent of Contamination

The potential COCs at SWMU 1 included metals and radionuclides resulting from the disposal of weapons-related materials. Concentrations of metal and radionuclide COCs in SWMU 1 soil samples were compared to background levels established for the North Area Supergroup (Dinwiddie September 1997).

Metals or radionuclides found to exceed background levels in any sample were considered to be potential COCs for the site. Metal COCs included the eight RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) plus beryllium, nickel, and total uranium. Radionuclides included cesium-137, thorium-232, uranium-235, uranium-238, plutonium-238, plutonium-239/240, and tritium.

10.2 Environmental Fate

The primary source for COCs at SWMU 1 was the disposal of weapons-related materials in the RWL and CDPs. Based upon the data concerning the nature and extent of contamination at the site (Section 10.1), the excavation and excavated soil contained residual metals and radionuclides.

Because the VCM removed the primary contaminant source (weapon components and other material), only secondary sources of COCs remained in the form of residual metals and radionuclides in the subsurface of the excavation, as well as in the excavated soil that was used as backfill material. Because the uppermost 5 feet of the backfilled excavation consists of clean fill soil, the secondary release mechanisms at SWMU 1 include dissolution of COCs and percolation through the soil, direct contact with soil (radionuclides only), dust emissions, and uptake of COCs by biota (Figure 10-1).

Section VI of Annex A discusses the fate and transport of COCs at SWMU 1. The primary releases of COCs at SWMU 1 were to the subsurface soil resulting from buried materials. Subsequent excavation of this site and reburial of excavated soil has resulted in COCs being confined to the subsurface soil underneath a 5-foot (1.5-meter) layer of clean fill soil. Therefore, the COCs in the soil are not exposed to surficial transport mechanisms of wind, surface water, and biota at this site.

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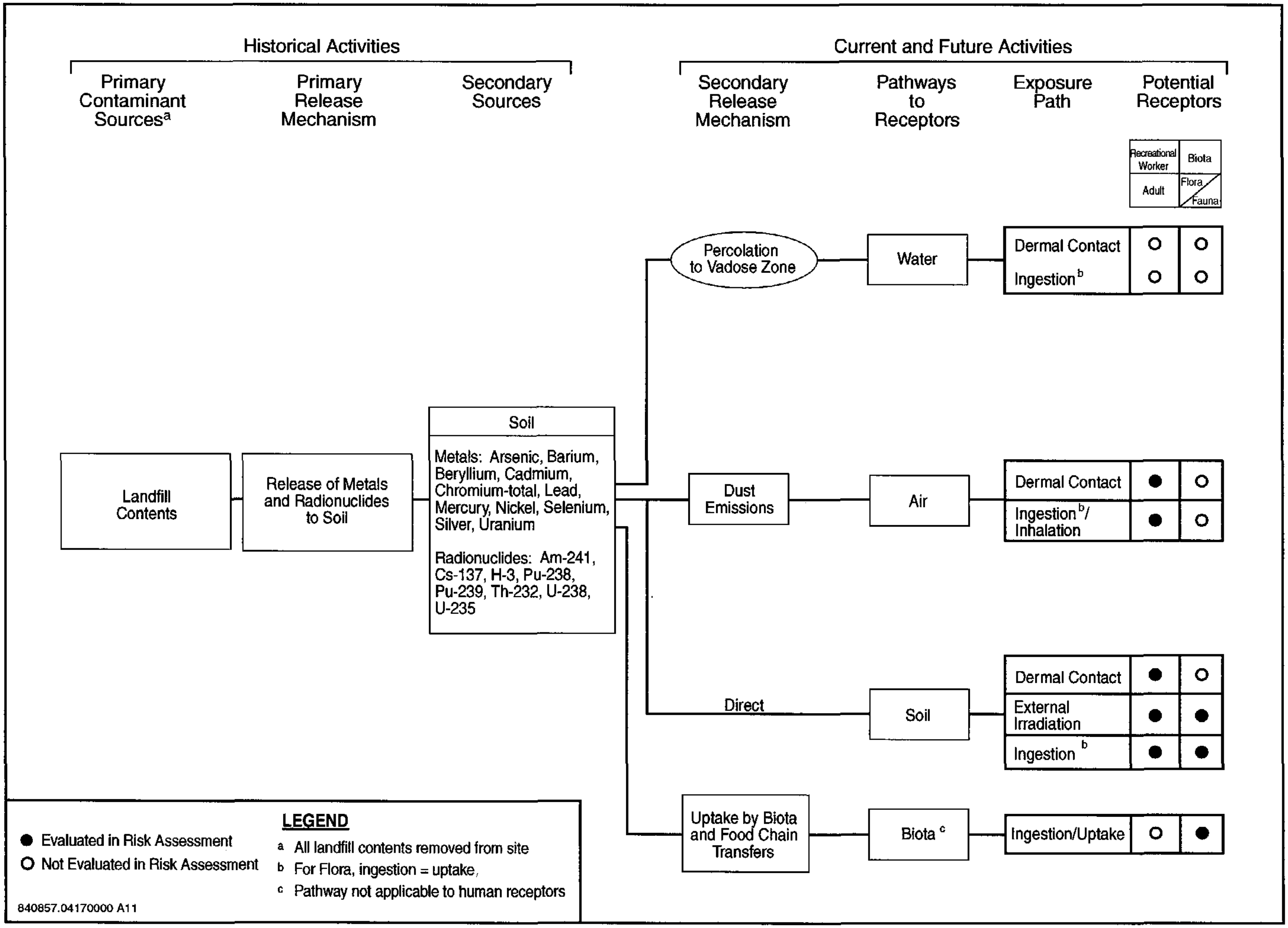

Figure 10-1

Conceptual Site Model Flow Diagram for SWMU 1, Radioactive Waste Landfill

The current and designated future land use for SWMU 1 is industrial (DOE et al. September 1995). Therefore, the potential human receptor at the site is an industrial worker. For all applicable pathways, the exposure routes for the industrial worker include dermal contact, external irradiation from soil, and ingestion/inhalation of air. Because of the depth of the clean soil layer for the backfilled excavation, wildlife is considered the only potential ecological receptor at the site. Wildlife exposure can result from the ingestion of COCs through food chain transfers and the incidental ingestion of soil from the site. Section VI of Annex A discusses the exposure routes and potential receptors at SWMU 1.

10.3 Site Assessments

The site assessment process includes risk assessments followed by baseline risk assessments (as required) for both human health and ecological risk. This section briefly summarizes the SWMU 1 assessment results.

10.3.1 Summary

The site assessment concludes that SWMU 1 presents no potential to adversely affect human health or ecological resources under an industrial land-use scenario. After considering the uncertainties associated with the available data and the modeling assumptions, ecological risks associated with SWMU 1 were found to be low. Section 10.3.2 summarizes the human health and ecological risk assessments, which are contained in Annex A.

10.3.2 Risk Assessments

The site assessment process includes risk assessments followed by baseline risk assessments (as required) for both human health and ecological risk. Annex A provides a complete discussion of the risk assessment process, results, and uncertainties. This risk assessment evaluated metals and radionuclides, detected above either background and/or minimum detectable activity levels. Although SWMU 1 has been recommended for industrial land use (DOE et al. September 1995), the risk assessment calculated risk for both residential and industrial land-use scenarios. The residential land-use scenario for this site is presented to provide perspective on the potential risk to human health under the more restrictive land-use scenario.

The data set used for the risk assessment is provided in Annex B and is based upon analyses for the June–July 2003 placement of backfill material in the SWMU 1 excavation and verification soil samples collected from the SWMU 1 excavation, the over-excavation area, bunker soil, and restored ground surface. The data for the 0- to 5-foot interval were used in the ecological risk assessment, while the entire data set (0 to depth) was used for the human health risk assessment.

It should be noted that the analyses for the metals and radiological constituents resulted in the excavated soil being placed in the potentially uncontaminated soil piles. However, the traceability of specific soil samples to the various soil piles was not always maintained. Therefore, the risk assessment assumes that the excavated soil was placed in the 0- to 5-foot interval unless documentation indicates that the soil was included in the potentially contaminated piles that were placed at depths greater than 5 feet bgs.

10.3.2.1 Human Health

SWMU 1 contains identified COCs consisting of inorganic and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site include soil ingestion, dermal contact, and dust inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways are applied to the residential land-use scenario.

Using conservative assumptions and a reasonable maximum exposure (RME) approach to risk assessment, calculations for the nonradiological COCs show that for the industrial land-use scenario the hazard index (HI) of 0.10 is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 4E-6. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.08 and the incremental excess cancer risk is 1.67E-6 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the residential land-use scenario the HI (1.27) is above the accepted numerical guidance from the EPA. The estimated excess cancer risk is 2E-5. Thus, excess cancer risk is slightly above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 1.02 and the incremental excess cancer risk is 6.76E-6 for the residential land-use scenario.

Although both the HI and estimated excess cancer risk values are above the NMED guidelines for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the 95% upper confidence limit of the mean concentration for arsenic, the main contributor to excess cancer risk and hazards, which at 3.40 milligrams per kilogram is below background (Annex A, Appendix 2), reduces the total HI and estimated excess cancer risk to 0.95 and 9E-8, respectively and eliminates arsenic from further evaluation. The incremental HI and excess cancer risk are reduced to 0.70 and 9.29E-8, respectively. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total and incremental risks are below NMED guidelines for the residential land-use scenario.

The incremental total effective dose equivalent (TEDE) and corresponding estimated cancer risk from the radiological COCs are much lower than EPA guidance values. The estimated TEDE is 2.9E-2 millirem (mrem)/year (yr) for the industrial land-use scenario, which is much lower than the numerical guidance of 15 mrem/yr in EPA guidance (EPA 1997a). The corresponding incremental estimated cancer risk value is 9.0E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is only 15.2 mrem/yr, with an associated risk of 5.1E-5. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998b). Therefore, SWMU 1 is eligible for unrestricted radiological release, and radiological restrictions have been removed by the DOE (Soden July 2000).

The incremental nonradiological and radiological carcinogenic risks are tabulated and summed in Table 10-1.

Table 10-1
Summation of Incremental Nonradiological and Radiological Risks from SWMU 1

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.67E-6	9.0E-7	2.5E-6
Residential	9.29E-8[a]	5.1E-5	5.1E-5

[a]Incremental excess cancer risk based upon UCL of the mean concentration for significant risk drivers.
SWMU = Solid Waste Management Unit.
UCL = Upper confidence limit.

Uncertainties associated with the calculations are considered small relative to the conservatism of the risk assessment analysis. Therefore, it is concluded that this site poses insignificant risk to human health under the industrial land-use scenario.

10.3.2.2 Ecological

An ecological risk assessment that corresponds with the screening procedures in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997b) was performed as set forth by the NMED Risk-Based Decision Tree in the "RPMP [RCRA Permits Management Program] Document Requirement Guide" (NMED March 1998).

Based upon the uncertainty analysis, the potential for ecological risks at SWMU 1 is generally expected to be low. Hazard quotients (HQs) greater than unity were initially predicted; however, closer examination of the exposure assumptions reveal an overestimation of risk primarily attributed to conservative toxicity benchmarks; the use of maximum concentrations, maximum bioavailability, and maximum area use to estimate exposure; and the contribution of background risk. The incorporation of more realistic assumptions in the estimation of ecological risk results in predictions of potential risk that are low and within the acceptable range of numerical guidance.

Ecological risks associated with SWMU 1 are estimated through a risk assessment that incorporates site-specific information when available. Overall, risks to ecological receptors are expected to be low due to the fact that predicted risks are based upon exposures to constituents of potential ecological concern (COPECs) calculated from the maximum measured COPEC concentrations and other conservative assumptions. Predicted risks from exposure to arsenic, barium, cadmium, total chromium, and lead were attributed to using these maximum detected values. Potential risks associated with mercury were limited to the burrowing owl under the assumption that all mercury is in organic form and that the area use factor for the owl is 1.0. The assumption of a more realistic area use factor for this receptor is sufficient to reduce the HQ to less than unity regardless of the form of mercury present. Based upon this final analysis, ecological risks associated with SWMU 1 are expected to be low.

10.4 Baseline Risk Assessments

This section discusses the baseline risk assessments for human health and ecological risk.

10.4.1 Human Health

Because the human health risk assessment summarized in Section 10.3.2.1 indicates that SWMU 1 presents no potential to affect human health under an industrial land-use scenario, a baseline human health risk assessment is not required for the site.

10.4.2 Ecological

Because the ecological risk assessment summarized in Section 10.3.2.2 indicates that ecological risks at SWMU 1 are expected to be low, a baseline ecological risk assessment is not required for the site.

10.4.3 Other Applicable Assessments

A preliminary Surface-Water Assessment was conducted at SWMU 1 using the surface-water assessment guidance developed jointly by Los Alamos National Laboratory and the NMED Surface Water Quality Bureau (LANL August 1998). Because the area surrounding SWMU 1 is relatively flat and the site is situated at more than 60 feet in elevation above the Tijeras Arroyo floodplain, the erosion potential is low.

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Annex A

ANNEX A
SWMU 1 Risk Assessment Report

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I. Site Description

Solid Waste Management Unit (SWMU) 1, the Radioactive Waste Landfill (RWL) and Chemical Disposal Pits (CDPs), is located in the eastern portion of Technical Area (TA)-II at Sandia National Laboratories/New Mexico (SNL/NM). Because the site boundary for SWMU 1 encompasses SWMU 3, the two sites were administratively combined in 2004 (NMED April 2004). SWMU 1 covers 0.3 acres on land that the U.S. Department of Energy (DOE) leases from Kirtland Air Force Base (KAFB).

II. Operational History

From 1949 through 1959, SWMU 1 was used for the disposal of weapons-related debris and chemicals resulting from the research, development, and manufacture of nuclear weapons at TA-II. Until remediation activities were begun in 1996, a barbed-wire fence served as an effective perimeter and visual marker for SWMU 1. Magnetometer surveys conducted in 1993 and a review of historic aerial photographs for the period of 1951 through 1992 demonstrated that the CDPs were located within the RWL boundary. Soil-vapor surveys conducted in 1993 did not identify any volatile organic compounds (VOCs) in the vicinity of SWMU 1.

In 1996, a Voluntary Corrective Measure (VCM) was conducted at SWMU 1 (SNL/NM 1996). The VCM involved the excavation of the SWMU 1 area. The excavated soil and debris were field-screened, sorted, and sampled for radioactive and hazardous constituents of concern (COCs). Approximately 96 cubic yards (cy) of weapons-related debris were shipped to SNL/NM waste management and off-site waste disposal facilities. Approximately 5,000 cy of uncontaminated soil were stockpiled at the site. Approximately 400 cy of radioactively contaminated soil containing depleted uranium (DU) and H-3 were shipped off site. Another 4,000 cy of "slightly contaminated" soil were stockpiled at the site. This slightly contaminated soil contained metal and radionuclide COCs exceeding background levels. Magnetometer and radiation surveys were conducted during the VCM to verify that all debris was removed from the pits and trenches. Verification soil sampling was conducted in 1999 and 2003 and is discussed in Section III.

After sampling results for the stockpiled soil were evaluated using quantitative risk assessment criteria, the slightly contaminated soil was used in 2003 for backfilling the VCM excavation. Details concerning soil sampling and the risk assessment are discussed in Sections III through VIII.

II.1 RWL Design and Contents

The RWL consisted of six disposal cells (three pits and three trenches) where weapons-related material was disposed of from 1949 to 1959. Historical records identified three of the disposal cells as Pits 1, 2, and 7. Pits 1 and 2 ranged in width from 10 to 14 feet and varied in length from 12 to 15 feet. Pit 7 had a diameter of 15 feet. The maximum depth of the three pits was approximately 19 feet. The other three RWL disposal cells were identified as Trenches 3/4, 5, and 6. The trenches ranged in width from 5 to 15 feet and varied in length from 25 to 50 feet.

The maximum depth of the trenches was approximately 23 feet. The majority of the RWL waste was not containerized before disposal. The pits and trenches were unlined and did not utilize a leachate collection system. After the pits and trenches were filled with debris, each cell was covered with native soil and capped with 0.5 to 3 feet of concrete.

Excavation and subsequent characterization of the landfill contents showed that the RWL material consisted of weapons components, calibration sources, DU fragments, lead shielding, thermal batteries, gas cylinders, spark gap tubes, weapon mockups, electronic components, asbestos insulation, aircraft debris, and tritiated waste from booster cylinders. Radionuclides associated with the contents included DU, Th-232, H-3, and Cs-137. Buried material also consisted of wire, scrap metal, wood, rubber, horse hair, Plexiglas, cardboard, and laboratory-generated waste such as gloves, pipettes, absorbent pads, forceps, beakers, test tubes, paper, glass bottles, and clothing. No drums or metal containers for liquid storage were found at the RWL.

II.2 CDP Design and Contents

The CDPs consisted of a few earthen pits located at the northeastern corner of SWMU 1. The CDPs had been used concurrently with the RWL for the disposal of chemicals that consisted of nitric acid, hydrochloric acid, and phosphoric acid. Historical records did not cite a numbering scheme for the CDPs. Unlike the six RWL disposal cells, concrete was not used in the 1950s to cover the CDPs. During the 1996 VCM excavation work, the CDPs were found to contain several dozen, broken, 1-gallon, glass jugs at a depth ranging from approximately 1 to 3 feet bgs (Copland August 2004). The lateral dimensions of the CDPs were approximately 25 by 25 feet. After laboratory analyses of soil samples identified elevated levels of plutonium-239, a field instrument detector for low energy radiation (FIDLER) radiation detector was used to guide the excavation work at the CDPs. Plutonium-contaminated soil and glass bottles were subsequently containerized for off-site disposal. No organic vapors were detected with a photoionization detector or combustible gas indiator. The glass jugs had apparently contained acid and plutonium-239.

II.3 Physical Setting

The area around SWMU 1 originally consisted of desert grassland habitat, but has been highly disturbed by historic TA-II operations and by the VCM remediation activities. The ground elevation is approximately 5,424 feet above mean sea level. The vicinity of SWMU 1 is unpaved. During most rainfall events, rain quickly infiltrates the soil. However, virtually all of the moisture undergoes evapotranspiration. Estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall (SNL/NM February 1998a).

The annual precipitation at KAFB is 8.1 inches (NOAA 1990). No springs or perennial surface-water bodies are located within 2 miles of SWMU 1. The site is situated approximately 60 feet in elevation above the Tijeras Arroyo floodplain and approximately 1,300 feet northwest of the active channel. Tijeras Arroyo is the most significant storm-water drainage feature on KAFB and originates in Tijeras Canyon, which is bounded by the Sandia Mountains to the north and the Manzano Mountains to the south. The arroyo contains a drainage basin that captures runoff from Tijeras Canyon and various storm-water channels at KAFB, SNL/NM, and southeast

Albuquerque. The arroyo eventually drains into the Rio Grande, approximately 8.5 miles west of SWMU 1.

The soil at SWMU 1 is poorly developed with high alkalinity. The subsurface geology consists of unconsolidated alluvial and colluvial deposits derived from the Sandia and Manzanita Mountains. These upper Santa Fe Group deposits consist of sediment ranging from clay to gravel derived from the granitic rocks of the Sandia Mountains and greenstone, limestone, and quartzite derived from the Manzanita Mountains. The depth to Pennsylvanian strata and/or Precambrian basement beneath TA-II is approximately 3,000 feet below ground surface (bgs).

Groundwater data for SWMU 1 was obtained from the Tijeras Arroyo Groundwater (TAG) investigation. The hydrogeologic setting of the TAG study area is dominated by two water-bearing zones, the perched system and the regional aquifer, both of which are present within the upper Santa Fe Group. The perched system is not used as a water supply source. However, the City of Albuquerque, KAFB, and the Veterans Administration use the regional aquifer as a water supply.

At SWMU 1, the depth to the perched system is approximately 320 feet bgs. The perched system covers approximately 3.5 square miles in the central part of the TAG study area. The direction of groundwater flow in the perched system is to the southeast. Discontinuous, yet overlapping multiple lenses of unsaturated alluvial fan sediment serve as a perching horizon beneath the perched system and above the regional aquifer. The depth to the regional aquifer is approximately 520 feet bgs at the site. The direction of groundwater flow in the regional aquifer is principally to the northwest towards several water-supply wells. The nearest water-supply well (KAFB-1) is located approximately 1.3 miles northwest of the site. Groundwater from the perched system merges with the regional aquifer southeast of Tijeras Arroyo. The regional aquifer extends across the entire TAG study area and the Albuquerque Basin.

No threatened or endangered species, nor any other species of concern, have been identified in the vicinity of SWMU 1. No riparian or wetland habitats are present within 4 miles of the site. No significant archaeological artifacts or cultural resources have been identified in the vicinity.

II.4 COCs

The COCs for SWMU 1 consist of radionuclides (primarily DU, Pu-239, and H-3) and metals (primarily cadmium and lead).

III. Data Quality Objectives

The soil pile and verification sampling conducted at SWMU 1 was designed to collect adequate samples in order to:

- Determine whether hazardous or radioactive COCs have been released at the site
- Characterize the nature and extent of any releases
- Monitor COC levels for health and safety decisions

- Evaluate COC levels for waste management processing
- Provide analytical data of sufficient quality to support risk assessments and to justify using the excavated soil and other off-site soil as backfill material for the landfill excavation

The primary source of COCs at SWMU 1 was the burial of weapons-related materials. Table A-1 summarizes the characterization strategy and data quality objectives (DQOs) used to support the risk assessments. The DQOs were initially specified in the SWMU 1 VCM Plan (SNL/NM 1996), the Project-Specific Sampling and Analysis Plan [SAP] (SNL/NM December 1995), two Request for Supplemental Information responses (SNL/NM September 1999, SNL/NM December 2002), and the Backfill and Compaction Plan (SNL/NM August 2003).

Sampling activities were conducted from May 1996 through November 2003 and are described in this section. Subsequent to the VCM in 1996, the New Mexico Environment Department (NMED) requested discrete sampling of the excavated soil piles that had been previously analyzed using composite samples. Consequently, analytical data from the 1996 composite soil samples are not used in the risk assessment. This risk assessment is based upon the results for discrete samples collected from January 1997 through November 2003.

Composite Soil Pile Sampling: May–August 1996

Soil excavated from SWMU 1 during the 1996 VCM was initially segregated into various stockpiles based upon field-screening and excavation location. The segregation of all soil stockpiles was verified using laboratory analysis. Excavated soil was segregated into one of two stockpile areas (potentially uncontaminated or potentially contaminated). Initial segregation was based upon field-screening for VOCs and explosives, visual staining or unusual appearance, or radioactivity levels greater than three times background.

For potentially uncontaminated soil, approximately 100-gram grab samples were collected from each front-end loader bucket (approximately 5 cy of soil) as the soil was placed into a stockpile. Each stockpile was composed of approximately 250 cy of soil. Approximately 50 aliquots (100 grams/aliquot) were combined to form one composite sample for each 250-cy stockpile. The composite samples were analyzed for both radiological and chemical parameters. Radiological analyses included 100-percent on-site analyses for gross alpha/beta activity, H-3, and radionuclides by gamma spectroscopy. Portions of 20 percent of the samples were also analyzed off site for radionuclides by gamma spectroscopy, H-3, and any isotopic analyses determined to be necessary.

For potentially contaminated soil, an approximate 500-gram grab sample was collected from each front-end loader bucket as the soil was placed into a stockpile. Each stockpile was composed of less than 100 cy of soil. Approximately 10 aliquots (500 grams/aliquot) were combined to form one composite sample for each stockpile. Based upon suspected contaminants, the SWMU 1 composite samples were analyzed for radionuclides by gamma spectroscopy and alpha spectroscopy, H-3, Resource Conservation and Recovery Act (RCRA) metals, Toxicity Characteristic Leaching Procedure (TCLP) metals, TCLP semivolatile organic compounds, TCLP VOCs, extractable organic halides, reactive cyanide, and reactive sulfide.

Table A-1
Summary of SWMU 1 Soil Sampling DQOs for Soil Samples

SWMU 1 Sampling Components	Potential Source of COCs	Number of Sampling Locations	Sample Density	Sampling Location Rationale
RWL Soil Piles – Discrete (grab) samples of slightly contaminated soil (January–March 1997)	Landfill contents	26	One sample per slightly contaminated soil pile	Characterize soil for risk assessment and backfilling decisions.
RWL and CDP Discrete Verification Sampling (November 1999)	Landfill contents	6	One sample per excavation feature (pit or trench)	Verify remediation of excavation prior to backfilling. Discrete samples collected from a depth of 0–6 inches below bottom of excavation. Conducted as requested by NMED.
RWL Discrete Verification Sampling (November 1999)	Landfill contents	5	One sample per excavation feature (pit or trench)	Verify remediation of excavation prior to backfilling. Composite samples collected from a depth of 0–6 inches below bottom of excavation.
RWL and CDP Consolidated Soil Piles 32 and 34 – Discrete (grab) samples of slightly contaminated soil (May–October 2000, May 2001)	Landfill contents	103	One sample from 103 discrete locations of the slightly contaminated consolidated soil pile	Characterize soil for risk assessment and backfilling decisions.
RWL Consolidated Soil Pile – Discrete (grab) samples of clean soil (April 2001)	Landfill contents	60	One sample from 60 discrete locations of the clean consolidated soil pile	Characterize soil for risk assessment and backfilling decisions.
Bunker Soil – Discrete (grab) samples of clean soil (September 2001)	None	14	One sample from 14 discrete locations of soil obtained from bunkers that were decommissioned and demolished	Characterize soil for risk assessment and backfilling decisions.
Discrete Sampling of Consolidated Soil Pile 33 (May 2003)	Landfill contents	4	One sample per 100 cy of soil	Characterize soil for risk assessment and backfilling decisions.
Discrete Sampling of Consolidated Soil Pile 35 (May 2003)	Landfill contents	4	One sample per 100 cy of soil	Characterize soil for risk assessment and backfilling decisions.

Refer to footnotes at end of table.

Table A-1 (Concluded)
Summary of SWMU 1 Soil Sampling DQOs for Soil Samples

SWMU 1 Sampling Components	Potential Source of COCs	Number of Sampling Locations	Sample Density	Sampling Location Rationale
Discrete Sampling of Consolidated Soil Pile 36 (May 2003)	Landfill contents	12	One sample per 100 cy of soil	Characterize soil for risk assessment and backfilling decisions.
Discrete Sampling of Over-Excavation Soil (May 2003)	None - Undisturbed soil sampled prior to excavation	9	One sample per 100 cy of soil	Characterize soil for risk assessment and backfilling decisions. Soil used for the 0–5-ft-bgs backfill lifts.
Discrete Sampling – Final verification of restored ground surface (November 2003)	None (clean fill)	15	One sample per 100 square feet	Verification of restored ground surface. Conducted as requested by NMED.

bgs = Below ground surface.
CDP = Chemical Disposal Pits.
COC = Constituent of concern.
cy = Cubic yard(s).
DQO = Data Quality Objective.
ft = Foot (feet).
NMED = New Mexico Environment Department.
RWL = Radioactive Waste Landfill.
SWMU = Solid Waste Management Unit.

Based upon these analyses, the potentially contaminated soil was designated as slightly contaminated soil and the potentially uncontaminated soil was designated as clean soil.

Discrete Sampling of Slightly Contaminated Discrete Soil Piles: January–March 1997

Subsequent to the VCM in 1996, the NMED requested discrete sampling of the excavated soil piles that had been previously analyzed using composite samples. Therefore, the "grab," or discrete, samples were collected from the potentially contaminated soil piles from January through March 1997. These discrete samples were analyzed for radionuclides by gamma spectroscopy and alpha spectroscopy, H-3, and RCRA metals.

Discrete Verification Sampling: November 1999

Pursuant to a request from the NMED, the bottom of the excavation was resampled in November 1999 to verify adequate cleanup measures. The original verification samples, collected in 1996, were composites. Because the NMED requested discrete samples, new soil samples were collected from the bottom of each pit and trench at SWMU 1 following a sampling strategy approved by the NMED. The samples were analyzed for radionuclides by gamma spectroscopy and alpha spectroscopy, H-3, total cadmium, mercury, and silver.

Discrete Sampling of the Slightly Contaminated Consolidated Soil Pile: May–October 2000 and May 2001

The discrete slightly contaminated soil piles were consolidated into a single pile during the process of removing debris and cobble. The consolidated soil pile also contained soil from the CDPs that was processed through the Thermo NUtech segregated gate system (SGS) (Thermo NUtech September 1997). Discrete samples were collected from this consolidated soil pile from May through August 2000 and were analyzed for radionuclides by gamma spectroscopy. In October 2000 and May 2001, discrete samples were collected and analyzed for radionuclides by gamma spectroscopy and RCRA metals. Four of the samples collected in October 2000 were split with the NMED and analyzed for H-3 as well as radionuclides and metals.

Discrete Sampling of Consolidated Clean Soil Pile (RWL Slope and Overburden): April 2001

Subsequent to the VCM in 1996, the 16 discrete clean soil piles were consolidated into a single pile. Discrete samples were collected from the consolidated clean soil pile and analyzed for radionuclides by gamma spectroscopy and alpha spectroscopy, H-3, and RCRA metals.

Discrete Sampling of Clean Bunker Soil Piles: September 2001

Clean fill soil was obtained from the decommissioning and demolition of TA-II buildings such as Bunker 901. Discrete samples of this soil were collected in September 2001 and analyzed for radionuclides, RCRA metals, and mercury.

Discrete Sampling of Consolidated Soil Pile 33: May 2003

Discrete soil samples were collected from Consolidated Soil Pile 33 in May 2003. The samples were analyzed for radionuclides, RCRA metals, beryllium, nickel, and total uranium.

Discrete Sampling of Consolidated Soil Pile 35: May 2003

Discrete soil samples were collected from Consolidated Soil Pile 35 in May 2003. The samples were analyzed for radionuclides, RCRA metals, beryllium, nickel, and total uranium.

Discrete Sampling of Consolidated Soil Pile 36: May 2003

Discrete soil samples were collected from Consolidated Soil Pile 36 in May 2003. The samples were analyzed for radionuclides, RCRA metals, beryllium, nickel, and total uranium.

Discrete Sampling of Over-Excavation Soil: May 2003

Discrete soil samples were collected in May 2003 from undisturbed soil located west of SWMU 1. After sampling efforts with the Geoprobe™ were unsuccessful, a backhoe was used to collect the soil samples. The samples were analyzed for radionuclides, RCRA metals, beryllium, nickel, and total uranium.

Discrete Sampling – Final Verification of Restored Ground Surface: November 2003

After Backfill Lifts 1 through 17 were installed and the original grade restored, 15 final verification soil samples were collected in November 2003 at a grid spacing of approximately 100 feet. These discrete samples were analyzed for radionuclides, RCRA metals, beryllium, nickel, and total uranium.

Table A-2 summarizes the analytical methods and data quality requirements necessary to provide adequate characterization of radioactive and hazardous constituents associated with the materials that were buried in SWMU 1 and to support human health and ecological risk assessments.

Quality Assurance/Quality Control

The characterization and verification analytical data were reviewed and verified/validated according to "Data Validation Procedure for Chemical and Radiochemical Data," in SNL/NM Environmental Restoration Project Administrative Operating Procedure (AOP) 00-03 (SNL/NM December 1999). In addition, the Radiation Protection Sample Diagnostics (RPSD) Laboratory reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996). Data qualifiers from the verification/validation process are incorporated into the analytical tables that are presented in Annex B of the SWMU 1 No Further Action (NFA) Proposal Addendum and Backfill Report.

Table A-2
Summary of Data Quality Requirements for SWMU 1 Soil Samples

Analytical Method[a]	Data Quality	Number and Type of Soil Samples	Laboratory Performing Analysis
Composite Verification Sampling: August 1996			
EPA Method 906.0 H-3 Scintillation	Not used for risk	5 verification samples	GEL
Slightly Contaminated Discrete Soil Piles: January–March 1997			
EPA Method 6010 RCRA Metals	Definitive	26 discrete samples	ERCL
EPA Method 901.1 Gamma Spectroscopy	Definitive	16 discrete samples	LAS/RPSD
Alpha Spectroscopy Isotopic Plutonium	Definitive	13 discrete samples	LAS
EPA Method 906.0 H-3 Scintillation	Definitive	13 discrete samples	LAS
Verification Sampling: November 1999			
EPA Method 6010 RCRA Metals	Definitive	7 verification samples including 1 duplicate	GEL
EPA Method 7141 Mercury	Definitive	7 verification samples including 1 duplicate	GEL
EPA Method 901.1 Gamma Spectroscopy	Definitive	7 verification samples including 1 duplicate	RPSD
Alpha Spectroscopy Isotopic Plutonium	Definitive	7 verification samples including 1 duplicate	GEL
EPA Method 906.0 H-3 Scintillation	Definitive	7 verification samples including 1 duplicate	GEL
Discrete Sampling of Slightly Contaminated Consolidated Soil Piles 32 and 34: May–October 2000 and May 2001			
EPA Method 6010 RCRA Metals	Definitive	36 discrete samples including 2 duplicates	GEL
EPA Method 7141 Mercury	Definitive	36 verification samples including 1 duplicate	GEL
EPA Method 901.1 Gamma Spectroscopy	Definitive	105 samples including 2 duplicates	RPSD
EPA Method 906.0 H-3 Scintillation	Definitive	4 discrete samples	GEL
Discrete Sampling of Consolidated Clean Soil Pile: April 2001			
EPA Method 6010 RCRA Metals	Definitive	62 discrete samples including 2 duplicates	GEL
EPA Method 7141 Mercury	Definitive	62 discrete samples including 1 duplicate	GEL
Gamma Spectroscopy	Definitive	62 discrete samples including 2 duplicates	RPSD
Alpha Spectroscopy Isotopic Plutonium	Definitive	62 discrete samples including 2 duplicates	GEL
EPA Method 906.0 H-3 Scintillation	Definitive	62 discrete samples including 2 duplicates	GEL

Refer to footnotes at end of table.

Table A-2 (Continued)
Summary of Data Quality Requirements for SWMU 1 Soil Samples

Analytical Method[a]	Data Quality	Number and Type of Soil Samples	Laboratory Performing Analysis
Discrete Sampling of Clean Bunker Soil Piles: September 2001			
EPA Method 6010 RCRA Metals	Definitive	15 discrete samples including 1 duplicates	GEL
EPA Method 7141 Mercury	Definitive	15 discrete samples including 1 duplicate	GEL
EPA Method 901.1 Gamma Spectroscopy	Definitive	15 discrete samples including 1 duplicates	RPSD
Alpha Spectroscopy Isotopic Plutonium	Definitive	15 discrete samples including 1 duplicates	GEL
EPA Method 906.0 H-3 Scintillation	Definitive	15 discrete samples including 1 duplicates	GEL
Discrete Sampling of Consolidated Soil Piles 33, 35, and 36: May 2003			
EPA Method 6010 RCRA Metals plus Beryllium, Nickel, and Total Uranium	Definitive	6 discrete samples	GEL
EPA Method 7141 Mercury	Definitive	6 discrete samples	GEL
EPA Method 901.1 Gamma Spectroscopy	Definitive	6 discrete samples	RPSD
Alpha Spectroscopy Isotopic Plutonium	Definitive	6 discrete samples	GEL
EPA Method 906.0 H-3 Scintillation	Definitive	6 discrete samples	RPSD
Discrete Sampling of Over-Excavation Soil: May 2003			
EPA Method 6010 RCRA Metals plus Beryllium, Nickel, and Total Uranium	Definitive	36 discrete samples	GEL
EPA Method 7141 Mercury	Definitive	36 discrete samples	GEL
EPA Method 901.1 Gamma Spectroscopy	Definitive	36 discrete samples	RPSD
Alpha Spectroscopy Isotopic Plutonium	Definitive	36 discrete samples	GEL
EPA Method 906.0 H-3 Scintillation	Definitive	36 discrete samples	RPSD
Discrete Sampling – Final Verification of Restored Ground Surface: November 2003			
EPA Method 6010 RCRA Metals plus Beryllium, Nickel, and Total Uranium	Definitive	15 discrete samples	GEL
EPA Method 7141 Mercury	Definitive	15 discrete samples	GEL
EPA Method 901.1 Gamma Spectroscopy	Definitive	15 discrete samples	GEL

Refer to footnotes at end of table.

Table A-2 (Concluded)
Summary of Data Quality Requirements for SWMU 1 Soil Samples

Analytical Method[a]	Data Quality	Number and Type of Soil Samples	Laboratory Performing Analysis
Alpha Spectroscopy Isotopic Plutonium	Definitive	15 discrete samples	GEL
EPA Method 906.0 H-3 Scintillation	Definitive	15 discrete samples	GEL

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
ERCL = Environmental Restoration Chemistry Laboratory.
GEL = General Engineering Laboratories, Inc.
LAS = Lockheed Analytical Services.
RCRA = Resource Conservation Recovery Act.
RPSD = Radiation Protection Sample Diagnostics.
SWMU = Solid Waste Management Unit.

Except for the H-3 results associated with two November 1999 soil samples (TA2-1-VERF-CDP-S and TA2-1-VERF-PIT7-S), no significant quality assurance/quality control issues were identified. The corresponding locations were resampled in 2003. In summary, the DQOs for SWMU 1 have been met.

IV. Determination of Nature, Rate, and Extent of Contamination

IV.1 Introduction

The determination of the nature, rate, and extent of contamination at SWMU 1 is based upon an initial conceptual model validated with verification (confirmatory) soil sampling at the site. The initial conceptual model was developed from historical background information including site inspections, personal interviews, historical aerial photographs, radiation surveys, soil-vapor surveys, and geophysical surveys. Excavation of SWMU 1 during the 1996 VCM identified the types and amounts of material that were previously buried. The DQOs identified the sample locations, sample density, sample depth, and analytical requirements. The sample analytical data were subsequently used to develop the final conceptual site model for SWMU 1 that is presented in Chapter 10.0 of the SWMU 1 NFA Proposal Addendum and Backfill Report. The quality of the data specifically used to determine the nature, rate, and extent of contamination is described in the following sections.

IV.2 Nature of Contamination

The nature of contamination at SWMU 1 was determined through the analytical testing of soil media and the potential for degradation of relevant COCs (Section VI). The analytical requirements included RCRA metals and other select metals for characterization of nonradiological inorganic constituents potentially released at the site. Gamma and alpha spectroscopy analyses were performed to determine whether any Pu, Th, Cs, or DU were released at the site. In addition, analyses were performed to determine the presence or absence of H-3. These analyses and methods are appropriate to characterize the COCs associated with historical activities conducted at SWMU 1.

IV.3 Rate of Contaminant Migration

SWMU 1 is an inactive landfill that has been excavated to remove all man-made materials; therefore, all primary sources of COCs (metals and radionuclides) have been eliminated. Minor amounts of subsurface COCs remain. The VCM excavation was backfilled with previously excavated soil that is covered with a 5-foot layer of clean fill. The rate of COC migration from surficial soil is, therefore, predominantly dependent upon site meteorological and surface hydrologic processes as described in Section VI. Data available from the Site-Wide Hydrogeologic Characterization Project (SNL/NM March 1996); numerous SNL/NM air, surface-water, and radiological monitoring programs; biological surveys; and other governmental atmospheric monitoring at KAFB (i.e., National Oceanographic and Atmospheric Administration) are adequate to characterize the rate of COC migration at SWMU 1.

IV.4 Extent of Contamination

Verification soil samples were collected from the floor of the excavation features (pits and trenches) to assess the adequacy of the VCM remediation. These sample locations, chosen by the NMED for verification sampling, are deemed appropriate to determine the lateral extent of COC migration. Because none of the samples indicate metal concentrations above background values, samples from deeper intervals were not deemed necessary.

Because of the relatively low solubility of most metals and radionuclides, limited precipitation, and high evapotranspiration rates, the vertical rate of contamination migration is expected to be extremely low. Extensive sampling conducted of backfill soil is considered to be representative of the soil constituting the backfill lifts.

In summary, the design of the verification and backfill sampling activities is appropriate and adequate to determine the nature, rate, and extent of contamination.

V. Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. The SWMU 1 NFA Proposal Addendum and Backfill Report describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs evaluated in this risk assessment include all detected organic, inorganic, and radiological COCs for which samples were analyzed. When the detection limit of an organic compound is too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound is retained. Nondetected organic compounds not included in this assessment were determined to have detection limits low enough to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screen listed in Tables A-3 through A-6.

Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, are not included in this risk assessment (EPA 1989). Both radiological and nonradiological COCs are evaluated. The nonradiological COCs included in the risk assessment consist of both inorganic and organic compounds; however, only inorganic compounds are included in this risk assessment as no organic compounds were detected.

Tables A-3 and A-4 list the nonradiological COCs for the human health and ecological risk assessments at SWMU 1, respectively. Tables A-5 and A-6 list the radiological COCs for the human health and ecological risk assessments, respectively. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section VII.4 discusses the results presented in Tables A-3 and A-5; Sections VIII.2 and VIII.3 discuss the results presented in Tables A-4 and A-6.

Table A-3
Nonradiological COCs for Human Health Risk Assessment at SWMU 1 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (All Samples) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Log K_{ow} (for Organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	6.99	4.4	**No**	44[c]	NA	**Yes**
Barium	479	200	**No**	170[d]	NA	**Yes**
Beryllium	0.671	0.8	Yes	19[c]	NA	No
Cadmium	6.7	0.9	**No**	64[c]	NA	**Yes**
Chromium, total	19.2	12.8	**No**	16[c]	NA	No
Lead	81.7 J	11.2	**No**	49[c]	NA	**Yes**
Mercury	7.8	<0.1	**No**	5,500[c]	NA	**Yes**
Nickel	15.5	25.4	Yes	47[c]	NA	**Yes**
Selenium	2.0[e]	<1	**No**	800[f]	NA	**Yes**
Silver	1.95	<1	**No**	0.5[c]	NA	No
Uranium	58.6	2.3	**No**	20[d]	NA	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, North Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Parameter was not detected. Concentration is one-half the maximum detection limit.
[f]Callahan et al. 1979.

BCF = Bioconcentration factor.
COC = Constituent of concern.
J = Estimated concentration.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table A-4
Nonradiological COCs for Ecological Risk Assessment at SWMU 1 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (Samples ≤ 5 ft bgs) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Log K_{ow} (for Organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	6.99	4.4	**No**	44[c]	NA	**Yes**
Barium	479	200	**No**	170[d]	NA	**Yes**
Beryllium	0.613	0.8	Yes	19[c]	NA	No
Cadmium	6.7	0.9	**No**	64[c]	NA	**Yes**
Chromium, total	19.2	12.8	**No**	16[c]	NA	No
Lead	81.7 J	11.2	**No**	49[c]	NA	**Yes**
Mercury	0.178	<0.1	**No**	5500[c]	NA	**Yes**
Nickel	10.4	25.4	Yes	47[c]	NA	**Yes**
Selenium	2.00[e]	<1	**No**	800[f]	NA	**Yes**
Silver	1.95	<1	**No**	0.5[c]	NA	No
Uranium	58.6	2.3	**No**	20[d]	NA	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, North Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Parameter was not detected. Concentration is one-half the maximum detection limit.
[f]Callahan et al. 1979.

BCF = Bioconcentration factor.
bgs = Below ground surface.
COC = Constituent of concern.
ft = Foot (feet).
J = Estimated concentration.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table A-5
Radiological COCs for Human Health Risk Assessment at SWMU 1 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (pCi/g) (All Samples)	SNL/NM Background Activity (pCi/g)[a]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Am-241	205	NA	**No**	8,000[c]	**Yes**
Cs-137	4,410	0.84	**No**	3,000[d]	**Yes**
H-3	929	0.037[e]	**No**	None	No
Pu-238	5.8	NA	**No**	6,000[f]	**Yes**
Pu-239/240	273	NA	**No**	6,000[f]	**Yes**
Th-232	3.47	1.54	**No**	3,000[g]	No[h]
U-235	3.05	0.18	**No**	900[g]	**Yes**
U-238	70.4	1.3	**No**	900[g]	**Yes**

Note: **Bold** indicates the COCs that exceed background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, North Area Supergroup.
[b]NMED March 1998.
[c]Morse and Choppin 1991.
[d]Whicker and Schultz 1982.
[e]Conversion of background activity for H-3 of 420 pCi/L using 8.7% soil moisture and soil density of 1 g/cc (Tharp February 1999).
[f]Joshi 1991.
[g]Baker and Soldat 1992.
[h]Yanicak March 1997.
BCF = Bioconcentration factor.
COC = Constituent of concern.
g/cc = Gram(s) per cubic centimeter.
NA = Not applicable—no background values for anthropogenic nuclides.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table A-6
Radiological COCs for Ecological Risk Assessment at SWMU 1
with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (Samples ≤ 5 ft bgs) (pCi/g)	SNL/NM Background Activity (pCi/g)[a]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Am-241	ND (0.352)	NA	**No**	8,000[c]	**Yes**
Cs-137	0.203	0.84	Yes	3,000[d]	**Yes**
H-3	0.2205	0.037[e]	**No**	None	No
Pu-238	0.184	NA	**No**	6,000[f]	**Yes**
Pu-239/240	2.55	NA	**No**	6,000[f]	**Yes**
Th-232	1.24	1.54	Yes	3,000[g]	No[h]
U-235	0.351	0.18	**No**	900[g]	**Yes**
U-238	25	1.3	**No**	900[g]	**Yes**

Note: **Bold** indicates the COCs that exceed background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, North Area Supergroup.
[b]NMED March 1998.
[c]Morse and Choppin 1991.
[d]Whicker and Schultz 1982.
[e]Conversion of background activity for H-3 of 420 pCi/L using 8.7% soil moisture and soil density of 1 g/cc (Tharp February 1999).
[f]Joshi 1991.
[g]Baker and Soldat 1992.
[h]Yanicak March 1997.

BCF = Bioconcentration factor.
bgs = Below ground surface.
COC = Constituent of concern.
ft = Foot (feet)
g/cc = Gram(s) per cubic centimeter.
MDA = Minimum detectable activity.
NA = Not applicable—no background values for anthropogenic nuclides.
ND ( ) = Not detected above the MDA, shown in parentheses.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

VI. Fate and Transport

The primary releases of COCs at SWMU 1 were to the subsurface soil resulting from the waste storage in the RWL. Wind, water, and biota are natural mechanism of COC transport from the primary release point; however, because the discharge was to subsurface soil, none of these mechanisms are considered to be of potential significance as transport mechanisms at this site. Infiltration of precipitation is essentially nonexistent at SWMU 1, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 520 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

The COCs at SWMU 1 include both radiological and nonradiological inorganic COCs that are elemental in form and are not considered to be degradable. Transformations of these inorganic constituents could include changes in valence (oxidation/reduction reactions) or incorporation into organic forms (e.g., the conversion of selenite or selenate from soil to seleno-amino acids in plants). Radiological COCs will undergo decay to stable isotopes or radioactive daughter elements. However, because of the long half-lives of the radiological COCs, the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms are expected to result in significant losses or transformations of the inorganic COCs.

Table A-7 summarizes the fate and transport processes that can occur at SWMU 1. COCs at this site include radiological and nonradiological inorganic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of COCs is low, and loss through decay of the radiological COCs is insignificant because of their long half-lives.

Table A-7
Summary of Fate and Transport at SWMU 1

Transport and Fate Mechanism	Existence at Site	Significance
Wind	Yes	Low
Surface runoff	Yes	Low
Migration to groundwater	No	None
Food chain uptake	Yes	Low
Transformation/degradation	Yes	Low

SWMU = Solid Waste Management Unit.

VII. Human Health Risk Assessment

VII.1 Introduction

The human health risk assessment of this site includes a number of steps that culminate in a quantitative evaluation of the potential adverse human health effects caused by constituents located at the site. The steps to be discussed include the following:

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach is a screening procedure that compares the maximum concentration of the COC to an SNL/NM maximum background screening value. COCs that are not eliminated during the first screening procedure are carried forward in the risk assessment process.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening procedure.
Step 5.	Potential toxicity effects (specified as a hazard index [HI]) and estimated excess cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and incremental estimated cancer risk are calculated by subtracting applicable background concentrations directly from maximum on-site contaminant values. This background subtraction applies only when a radiological COC occurs as contamination and exists as a natural background radionuclide.
Step 6.	These values are compared with guidelines established by the U.S. Environmental Protection Agency (EPA), NMED, and the DOE to determine whether further evaluation and potential site cleanup are required. Nonradiological COC risk values also are compared to background risk so that an incremental risk can be calculated.
Step 7.	Uncertainties of the above steps are addressed.

VII.2 Step 1. Site Data

Sections I and II of this risk assessment report provide the site description and operational history for SWMU 1. Section III presents a comparison of results to DQOs. Section IV discusses the nature, rate, and extent of contamination.

VII.3 Step 2. Pathway Identification

SWMU 1 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust. Soil ingestion is included for the radiological COCs as well. The dermal pathway is included for the nonradiological COCs because of the potential for the receptor to be exposed to contaminated soil. No water pathways to the groundwater are considered; depth to groundwater at SWMU 1 is approximately 520 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure A-1 shows the conceptual site model flow diagram for SWMU 1.

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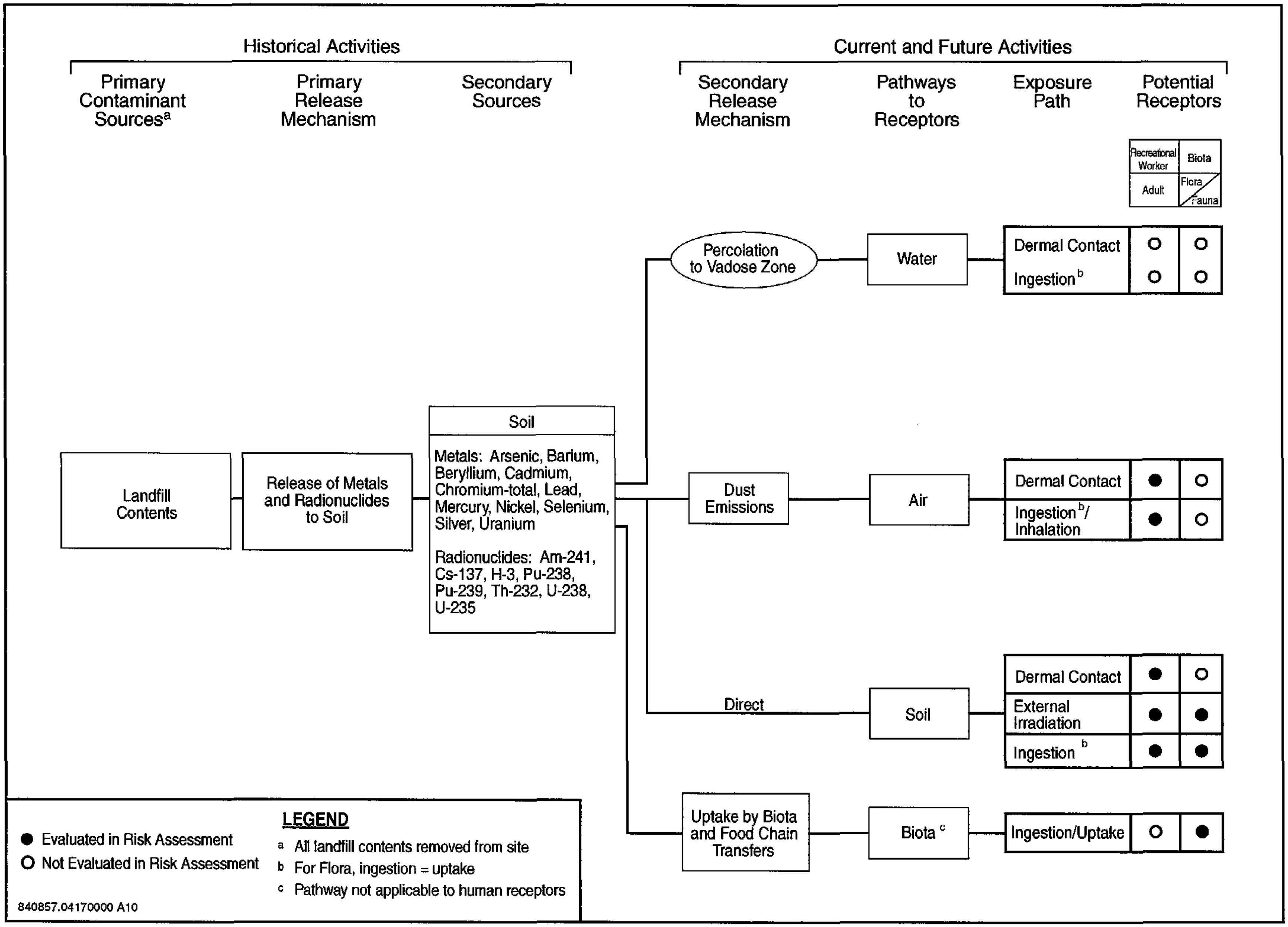

Figure A-1

Conceptual Site Model Flow Diagram for SWMU 1, Radioactive Waste Landfill

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust)	Inhalation (volatile and dust)
Dermal contact	Direct gamma

VII.4 Step 3. Background Screening Procedure

This section discusses Step 3, the background screening procedure, which compares the maximum COC concentration to the background screening level. The methodology and results are described in the following sections.

VII.4.1 Methodology

Maximum concentrations of nonradiological COCs were compared to the approved SNL/NM maximum screening levels for this area. The SNL/NM maximum background concentration was selected to provide the background screen in Table A-3 and used to calculate risk attributable to background in Section VII.6.2. Only the COCs that were detected above the corresponding SNL/NM maximum background screening levels or did not have either a quantifiable or calculated background screening level are considered in further risk assessment analyses.

For the radiological COCs that exceed the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have background screening values and were detected above the analytical minimum detectable activity (MDA) are carried through the risk assessment at the maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

VII.4.2 Results

Tables A-3 and A-5 show the SWMU 1 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the nonradiological COCs, nine constituents were measured at concentrations greater than the background screening values.

The maximum concentration value for lead is 81.7 milligrams (mg)/kilogram (kg). The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. However, the NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1,500 mg/kg, respectively (Olson and Moats March 2000). The EPA screening guidance value for a residential land-use scenario is 400 mg/kg (Laws July 1994). The maximum concentration value for lead at this site is less than all the screening values; therefore, lead is eliminated from further consideration in the human health risk assessment.

For the radiological COCs, eight constituents had detections greater than the background screening levels. The greater of either the maximum detection or the highest MDA is conservatively used in the risk assessment.

VII.5 Step 4. Identification of Toxicological Parameters

Tables A-8 and A-9 list the COCs retained in the risk assessment and provide the values for the available toxicological information. The toxicological values for the nonradiological COCs presented in Table A-8 were obtained from the Integrated Risk Information System (IRIS) (EPA 2004a), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), and the EPA Region 6 electronic database (EPA 2004b). Dose conversion factors (DCFs) used in determining the excess TEDE values for radiological COCs for the individual pathways are the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

- DCFs for ingestion and inhalation were taken from "Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" (EPA 1988).
- DCFs for surface contamination of the site were taken from DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public" (DOE 1988).
- DCFs for volume contamination (exposure to contamination deeper than the immediate surface of the site) were calculated using the methods discussed in "Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil" (Kocher 1983) and in ANL/EAIS-8, "Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil" (Yu et al. 1993b).

VII.6 Step 5. Exposure Assessment and Risk Characterization

Section VII.6.1 describes the exposure assessment for this risk assessment. Section VII.6.2 provides the risk characterization, including the HI and excess cancer risk for both the potential nonradiological COCs and associated background for the industrial and residential land-use scenarios. The incremental TEDE and incremental estimated cancer risk are provided for the background-adjusted radiological COCs for both industrial and residential land-use scenarios.

VII.6.1 Exposure Assessment

Appendix 1 provides the equations and parameter input values used to calculate intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The appendix shows parameters for both industrial and residential land-use scenarios. The equations for the nonradiological COCs are based upon the Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989), the Technical Background Document for Development of Soil Screening Levels (NMED

Table A-8
Toxicological Parameter Values for SWMU 1 Nonradiological COCs

COC	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o $(mg/kg\text{-}d)^{-1}$	SF_{inh} $(mg/kg\text{-}d)^{-1}$	Cancer Class[b]	ABS
Arsenic	3E-4[c]	M	–	–	1.5E+0[c]	1.5E+1[c]	A	0.03[d]
Barium	7E-2[c]	M	1.4E-4[e]	–	–	–	D	0.01[d]
Cadmium	5E-4[c]	H	5.7E-5[f]	–	–	6.3E+0[c]	B1	0.001[d]
Chromium III	1.5E+0[c]	L	–	–	–	–	D	0.01[d]
Chromium VI	3E-3[c]	L	2.3E-6[c]	L	–	4.2E+1[c]	A	0.01[d]
Mercury	3E-4[e]	–	8.6E-5[c]	M	–	–	D	0.01[d]
Selenium	5E-3[c]	H	–	–	–	–	D	0.01[d]
Silver	5E-3[c]	L	–	–	–	–	D	0.01[d]
Uranium	3E-3[c]	M	–	–	–	–	–	0.001[d]

[a]Confidence associated with IRIS (EPA 2004a) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2004a):
A = Human Carcinogen.
B1 = Probable human carcinogen. Limited human data available.
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2004a).
[d]Toxicological parameter values from NMED (December 2000).
[e]Toxicological parameter values from HEAST (EPA 1997a).
[f]Toxicological parameter values from EPA Region 6 electronic database (EPA 2004b).

ABS = Gastrointestinal absorption coefficient.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram-day.
$(mg/kg\text{-}d)^{-1}$ = Per milligram per kilogram-day.
NMED = New Mexico Environment Department.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table A-9
Toxicological Parameter Values for SWMU 1 Radiological COCs Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Am-241	3.30E-10	3.90E-08	4.60E-09	A
Cs-137	3.20E-11	1.90E-11	2.10E-06	A
H-3	7.20E-14	9.60E-14	0.0	A
Pu-238	3.00E-10	2.70E-08	1.90E-11	A
Pu-239	3.20E-10	2.80E-08	1.30E-11	A
Th-232	3.30E-11	1.90E-08	2.00E-11	A
U-238	6.20E-11	1.20E-08	6.60E-08	A
U-235	4.70E-11	1.30E-08	2.70E-07	A

[a]Yu et al. 1993a.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.
1/pCi = One per picocurie.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
g/pCi-yr = Gram(s) per picocurie-year.
SF_{ev} = External volume exposure slope factor.
SF_{inh} = Inhalation slope factor.
SF_o = Oral (ingestion) slope factor.
SWMU = Solid Waste Management Unit.

December 2000), as well as other EPA and NMED guidance documents, and reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For the radiological COCs, the coded equations provided in RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD" (Yu et al. 1993a). Although the designated land-use scenario for this site is industrial, risk and TEDE values for a residential land-use scenario are also presented.

VII.6.2 Risk Characterization

Table A-10 shows an HI of 0.10 for the SWMU 1 nonradiological COCs and an estimated excess cancer risk of 4E-6 for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table A-11 shows an HI of 0.02 and an estimated excess cancer risk of 3E-6 for the SWMU 1 associated background constituents under the designated industrial land-use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario with a 5-foot layer of clean fill soil over the slightly contaminated soil (maximum reported activity), an incremental TEDE of 2.9E-2 millirem (mrem)/year (yr) was calculated. In accordance with EPA guidance found in Office

Table A-10
Risk Assessment Values for SWMU 1 Nonradiological COCs

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	6.99	0.03	4E-6	0.32	2E-5
Barium	479	0.01	–	0.09	–
Cadmium	6.7	0.01	2E-9	0.17	5E-9
Chromium, total	19.2	0.01	4E-8	0.09	9E-8
Mercury	7.8	0.03	–	0.34	–
Selenium	2.0	0.00	–	0.01	–
Silver	1.95	0.00	–	0.01	–
Uranium	58.6	0.02	–	0.25	–
Total		**0.10**	**4E-6**	**1.28**	**2E-5**

[a]EPA 1989.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit
– = Information not available.

Table A-11
Risk Assessment Values for SWMU 1 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land-Use Scenario[b]		Residential Land-Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.02	3E-6	0.20	1E-5
Barium	200	0.00	–	0.04	–
Cadmium	0.9	–	–	–	–
Chromium, total	12.8	0.00	–	0.00	–
Mercury	<0.1	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Uranium	2.3	0.00	–	0.01	–
Total		**0.02**	**3E-6**	**0.26**	**1E-5**

[a]Dinwiddie September 1997, North Area Supergroup.
[b]EPA 1989.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available.

of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18 (EPA 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (industrial in this case); the calculated dose value for SWMU 1 for the industrial land use is well below this guideline. The estimated excess cancer risk is 9.0E-7.

The HI is 1.28 with an estimated excess cancer risk of 2E-5 for the nonradiological COCs under the residential land-use scenario (Table A-10). The numbers in the table include exposure from soil ingestion, dermal contact, and dust inhalation. Although the EPA (1991) guidelines generally recommend that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and for dust to be present in predominantly residential areas. Based upon the nature of local soil, other exposure pathways are not evaluated (see Appendix 1). Table A-11 shows an HI of 0.26 and an estimated excess cancer risk of 1E-5 for the associated background constituents at SWMU 1 under the residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario with a 5-foot layer of clean fill soil over the contaminated soil (maximum reported activity) for SWMU 1 is 15.2 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998b) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for SWMU 1 for the residential land-use scenario is well below this guideline. Consequently, SWMU 1 is eligible for unrestricted radiological release because the residential land-use scenario results in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 5.1E-5. The excess cancer risk from the nonradiological and radiological COCs should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants, as noted in OSWER Directive No. 9200.4-18, "Establishment of Cleanup Levels for CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] Sites with Radioactive Contamination" (EPA 1997b). This summation is tabulated in Section VII.9, "Summary."

VII.7 Step 6. Comparison of Risk Values to Numerical Guidelines

The human health risk assessment analysis evaluates the potential for adverse health effects for both the industrial (the designated land-use scenario for this site) and residential land-use scenarios.

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.10 (lower than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The excess cancer risk is 4E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determines risks by evaluating background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.08 and the estimated incremental cancer risk is 1.67E-6 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 2.9E-02 mrem/yr, which is significantly lower than the EPA's numerical guideline of 15 mrem/yr. The incremental estimated excess cancer risk is 9.0E-7.

For the nonradiological COCs under the residential land-use scenario, the calculated HI is 1.28, which is above the numerical guidance. The excess cancer risk is 2E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is above the suggested acceptable risk value. The incremental HI is 1.02 and the estimated incremental cancer risk is 6.67E-6 for the residential land-use scenario. For the estimated cancer risk, the incremental risk calculation indicated insignificant risk to human health from nonradiological COCs under a residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological components is 15.2 mrem/yr, which is significantly lower than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998b). The estimated excess cancer risk 5.1E-5.

VII.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at SWMU 1 is based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with the VCM Plan (SNL/NM 1996) and the SAP (SNL/NM December 1995). The DQOs contained in these two documents are appropriate for use in risk assessments. The data from soil samples collected from excavated soil piles and clean backfill material are representative of potential COCs at the site. The analytical requirements and results satisfy the DQOs, and data quality was verified/validated in accordance with SNL/NM procedures. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at SWMU 1.

Because of the location, history, and future land use, there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Based upon the COCs found in near-surface soil and the location and physical characteristics of the site, there is low uncertainty in the exposure pathways relevant to the analysis.

An RME approach is used to calculate the risk assessment values. Specifically, the parameter values in the calculations are conservative and calculated intakes may be overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table A-8 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a combination of estimated values and values from the IRIS (EPA 2004a), HEAST (EPA 1997a), EPA Region 6 (EPA 2004b), and the Technical Background Document for Development of Soil Screening Levels (NMED December 2000). Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2004a), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), Risk Assessment Information System (ORNL 2003), or the EPA regions (EPA 2004b, EPA 2002a, EPA 2002b). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

Although both the HI and estimated excess cancer risk values are above the NMED guidelines for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the upper confidence limit (UCL) of the mean concentration for arsenic, the main contributor to excess cancer risk and hazards, which at 3.40 mg/kg is below background (Appendix 2), reduces the total HI and estimated excess cancer risk to 0.95 and 9E-8, respectively, and eliminates arsenic from further evaluation. The incremental HI and excess cancer risk are reduced to 0.70 and 9.29E-8, respectively. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total and incremental risks are below NMED guidelines for the residential land-use scenario.

Risk assessment values for the nonradiological COCs are within the acceptable range for human health under an industrial land-use scenario compared to established numerical guidance.

For the radiological COCs, the conclusion of the risk assessment is that potential effects on human health for both the industrial and residential land-use scenarios are within guidelines and represent only a small fraction of the estimated 360 mrem/yr received by the average U.S. population from natural and anthropogenic sources (NCRP 1987). For the radiological COCs, eight constituents (Am-241, Cs-137, H-3, Pu-238, Pu-239, Th-232, U-235, and U-238) had measured activity at levels greater than the corresponding background values. These residual COCs remain in the soil following separation of soil and debris with higher activity levels through the SGS operated by Thermo NUtech (September 1997). Soil with elevated levels of the radiological COCs was removed and shipped off site as radiological waste. The residual soil is buried at the bottom of the original SWMU 1 VCM excavation and covered with an overlying layer of 5 feet of clean fill soil. The additional measure of covering the backfilled soil with 5 feet of clean fill is a "best management practice" because the relatively low residual levels of radiological COCs could be deposited on the ground surface with no future radiological controls, as confirmed by a risk-based analysis (SNL/NM April 2000).

The overall uncertainty in all of the steps in the risk assessment process is not considered to be significant with respect to the conclusion reached.

VII.9 Summary

SWMU 1 contains identified COCs consisting of some inorganic and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site include soil ingestion, dermal contact, and dust inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways are applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the industrial land-use scenario the HI (0.10) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 4E-6. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.08 and the incremental excess cancer risk is 1.67E-6 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the residential land-use scenario the HI (1.28) is above the accepted numerical guidance from the EPA. The estimated excess cancer risk is 2E-5. Thus, excess cancer risk is slightly above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 1.02 and the incremental excess cancer risk is 6.76E-6 for the residential land-use scenario.

Although both the HI and estimated excess cancer risk values are above the NMED guidelines for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the UCL of the mean concentration for arsenic, the main contributor to excess cancer risk and hazards, which at 3.40 mg/kg is below background (Appendix 2), reduces the total HI and estimated excess cancer risk to 0.95 and 9E-8, respectively, and eliminates arsenic from further evaluation. The incremental HI and excess cancer risk are reduced to 0.70 and 9.29E-8, respectively. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total and incremental risks are below NMED guidelines for the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from the radiological COCs are much lower than EPA guidance values. The estimated TEDE is 2.9E-2 mrem/yr for the industrial land-use scenario, which is much lower than the numerical guidance of 15 mrem/yr in EPA guidance (EPA 1997b). The corresponding incremental estimated cancer risk value is 9.0E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is only 15.2 mrem/yr, with an associated risk of 5.1E-5. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998b). Therefore, SWMU 1 is eligible for unrestricted radiological release, and radiological restrictions have been removed by the DOE (Soden July 2000).

The summation of the incremental nonradiological and radiological carcinogenic risks is tabulated in Table A-12.

Table A-12
Summation of Incremental Nonradiological and Radiological Risks from SWMU 1, Radioactive Waste Landfill and Chemical Disposal Pits Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.67E-6	9.0E-7	2.6E-6
Residential	9.29E-8[a]	5.1E-5	5.1E-5

[a]Incremental risk using UCL concentrations.
SWMU = Solid Waste Management Unit.
UCL = Upper confidence limit.

Uncertainties associated with the calculations are considered small relative to the conservatism of this risk assessment analysis. Therefore, it is concluded that this site poses insignificant risk to human health under both the industrial and residential land-use scenarios.

VIII. Ecological Risk Assessment

VIII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at SWMU 1. A component of the NMED Risk-Based Decision Tree (NMED March 1998) is to conduct an ecological assessment that corresponds with that presented in EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in Sections III through VI of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this assessment incorporates conservatisms into the estimation of ecological risks, ecological relevance and professional judgment are also used as recommended by the EPA (1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

VIII.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of exposure of biota at, or adjacent to, the site to constituents associated with site activities. Included in this section are an evaluation of existing data and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate and transport potential. A scoping risk-management decision summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

VIII.2.1 Data Assessment

As indicated in Section V (Tables A-4 and A-6), inorganic constituents in the soil at SWMU 1 that exceed background concentrations include the following:

- Arsenic
- Barium
- Cadmium
- Chromium (total)
- Lead
- Mercury
- Selenium

- Silver
- Uranium
- Am-241
- Cs-137
- H-3
- Pu-238
- Pu-239/240
- U-235
- U-238

VIII.2.2 Bioaccumulation

Among the COPECs listed in Section VIII.2.1, the following are considered to have bioaccumulation potential in aquatic environments (Section V, Tables A-4 and A-6):

- Arsenic
- Barium
- Cadmium
- Lead
- Mercury
- Selenium
- Am-241
- Cs-137
- Pu-238
- Pu-239/240
- U-235
- U-238

However, as directed by the NMED (March 1998), bioaccumulation for inorganic constituents is assessed exclusively based upon maximum reported bioconcentration factors (BCFs) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

VIII.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section VI. As noted in Table A-7 (Section VI), wind, surface-water runoff, and food chain uptake are expected to be of low significance as transport mechanisms for COPECs at SWMU 1. Migration to groundwater is not expected. The potential for significant degradation or transformation of COPECs in the soil is low, and the decay of radionuclides is expected to be of low significance due to the long half-lives of the detected radionuclides.

VIII.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it was concluded that complete ecological pathways may be associated with SWMU 1 and that COPECs also exist at the site. As a consequence, a risk assessment was deemed necessary to predict the potential level of ecological risk associated with the site.

VIII.3 Risk Assessment

As concluded in Section VIII.2.4, both complete ecological pathways and COPECs are associated with SWMU 1. The risk assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure ecological risks are not underpredicted.

Components within the screening assessment include:

- Problem Formulation—sets the stage for the evaluation of potential exposure and risk.
- Exposure Estimation—provides a quantitative estimate of potential exposure.
- Ecological Effects Evaluation—presents benchmarks used to gauge the toxicity of COPECs to specific receptors.
- Risk Characterization—characterizes the ecological risk associated with exposure of the receptors to environmental media at the site.
- Uncertainty Assessment—discusses uncertainties associated with the estimation of exposure and risk.
- Risk Interpretation—evaluates ecological risk in terms of HQs and ecological significance.
- Risk Assessment Scientific/Management Decision Point—presents the decision to risk managers based upon the results of the risk assessment.

VIII.3.1 Problem Formulation

Problem formulation is the initial stage of the risk assessment that provides the introduction to the risk evaluation process. Components that are addressed in this section include a discussion of ecological pathways and the ecological setting, identification of COPECs, and selection of ecological receptors. The conceptual model, ecological food webs, and ecological endpoints (other components commonly addressed in a risk assessment) are presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program" (IT July 1998) and are not duplicated here.

VIII.3.1.1 Ecological Pathways and Setting

SWMU 1 encompasses an area of approximately 0.3 acres in size. The site is located in grassland habitat, approximately 25 feet east of the eastern apex of TA-II. The habitat at this site has been highly disturbed by excavation activities during the VCM. Wildlife use of the site is probably limited by the degree of habitat disturbance. No sensitive species are expected to use the site due to the degree of habitat disturbance.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in surface and subsurface soil. Direct uptake of COPECs from soil is assumed to be the major route of exposure for plants; exposure of plants to wind-blown soil is assumed to be minor. Exposure modeling for the wildlife receptors is limited to the food and soil ingestion pathways. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water is considered insignificant. Inhalation and dermal contact are also considered insignificant pathways with respect to ingestion (Sample and Suter 1994). No groundwater pathways are expected to occur at this site for ecological receptors.

VIII.3.1.2 COPECs

The burial of radiological and chemical wastes at the RWL and CDPs are the source of COPECs at SWMU 1. The RWL (SWMU 1) consisted of three pits and three trenches where weapon-related debris was disposed of from 1949 to 1959. The majority of the waste was not containerized before disposal, and the pits and trenches were unlined. The pits and trenches were later filled with debris and then covered with native soil and capped with 3 feet of concrete. The CDPs reportedly were used concurrently to dispose of chemical waste. The CDPs were unlined and may have been originally excavated with a backhoe, filled with waste, and backfilled with native soil. One-gallon glass bottles of acid and plutonium were disposed of in the CDPs. The site of the RWL and CDPs was excavated as part of the VCM for SWMU 1 (SNL/NM 1996). Residually contaminated soil from the excavation was replaced and covered with 5 feet of clean fill soil. The COPECs evaluated in this assessment represent possible residual contamination in the underlying backfill material.

In order to provide conservatism in this ecological risk assessment, the assessment is based upon the maximum soil concentrations of the COPECs as measured in surface and subsurface soil samples. Both radiological and nonradiological COPECs are evaluated. The nonradiological COPECs consist of inorganic analytes (i.e., metals). The inorganic analytes and radionuclides were screened against background concentrations, and those that exceed the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area are considered to be COPECs. Maximum COPEC concentrations in soil are reported in Tables A-4 and A-6. Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, are not included in this risk assessment (EPA 1989).

VIII.3.1.3 Ecological Receptors

A nonspecific perennial plant was selected as the receptor to represent plant species at the site (IT July 1998). Vascular plants are the principal primary producers at the site and are key to the diversity and productivity of the wildlife community associate with the site. The deer mouse

(*Peromyscus maniculatus*) and burrowing owl (*Speotyto cunicularia*) are used to represent wildlife use. Because of its opportunistic food habits, the deer mouse is used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl represents the top predator. The burrowing owl is present at SNL/NM and is designated as a species of management concern by the U.S. Fish and Wildlife Service in Region 2, which includes the state of New Mexico (USFWS September 1995).

VIII.3.2 Exposure Estimation

Direct uptake of COPECs from the soil is considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors is limited to food and soil ingestion pathways. Inhalation and dermal contact are considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water is also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse is modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl is modeled with intake of omnivorous mice only. Both species are modeled with soil ingestion comprising 2 percent of the total dietary intake. Table A-13 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment are modeled using an area use factor of 1.0, implying that all food items and soil ingested come from the site being investigated. The maximum COPEC concentrations measured in surface soil samples are used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose-rate calculations, the deer mouse is modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Both are modeled with soil ingestion comprising 2 percent of the total dietary intake. Receptors are exposed to radiation both internally and externally (note that the external dose from H-3 is assumed to be negligible). Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose-rate models from the DOE (1995) as presented in the ecological risk assessment methodology document (IT July 1998). Radionuclide-dependent data for the dose-rate calculations were obtained from Baker and Soldat (1992). The external dose-rate model examines the total-body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate of absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a "point" source. Radiation emitted from this point source is absorbed by the

Table A-13
Exposure Factors for Ecological Receptors at SWMU 1

Receptor Species	Class/Order	Trophic Level	Body Weight (kg)[a]	Food Intake Rate (kg/day)[b]	Dietary Composition[c]	Home Range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Herbivore	2.39E-2[d]	3.72E-3	Plants: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	2.39E-2[d]	3.72E-3	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Insectivore	2.39E-2[d]	3.72E-3	Invertebrates: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	1.55E-1[f]	1.73E-2	Rodents: 100% (+ Soil at 2% of intake)	3.5E+1[g]

[a]Body weights are in kg wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kg dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2% of food intake.
[d]Silva and Downing 1995.
[e]EPA (1993), based upon the average home range measured in semiarid shrubland in Idaho.
[f]Dunning 1993.
[g]Haug et al. 1993.
EPA = U.S. Environmental Protection Agency.
kg = Kilogram(s).
SWMU = Solid Waste Management Unit.

body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides transfer only a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose rate results are summed to calculate a total dose rate from exposure to radionuclides in soil.

Table A-14 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table A-15 presents the maximum concentrations in soil and derived concentrations in tissues of the various food-chain elements that are used to model dietary exposures for each of the wildlife receptors.

VIII.3.3 Ecological Effects Evaluation

Benchmark toxicity values for the plant and wildlife receptors are presented in Table A-16. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level. For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate a NOAEL for silver for the burrowing owl.

The benchmark used for exposure of terrestrial receptors to radiation is 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should also protect other groups within the terrestrial habitat of SWMU 1.

VIII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. The results of these comparisons are presented in Table A-17. HQs are used to quantify the comparison with benchmarks for plant and wildlife exposure.

Analytes with HQs exceeding unity for plants were cadmium, chromium (total), lead, selenium, and uranium. Arsenic, barium, and uranium exhibited HQs greater than unity for the omnivorous and insectivorous deer mouse. Barium exhibited HQs greater than unity for the herbivorous deer mouse. Mercury showed an HQ greater than unity for the burrowing owl when it is assumed to be entirely in organic form, but not when the mercury is assumed to be in inorganic form. An HQ for the burrowing owl could not be determined for silver because of insufficient toxicity information. As directed by the NMED, HI values are calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). All receptors had total HIs greater than unity, with a maximum HI of 40 for plants.

Tables A-18 and A-19 summarize the dose-rate model results for the radiological COPECs. The total radiation dose rate for the deer mouse is predicted to be 4.1E–3 rad/day, and that for the burrowing owl is predicted to be 3.9E-3 rad/day. The dose rates for the deer mouse and the burrowing owl are less than the benchmark of 0.1 rad/day.

Table A-14
Transfer Factors Used in Exposure Models for COPECs at SWMU 1

COPEC	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Arsenic	4.0E-2[a]	1.0E+0[b]	2.0E-3[a]
Barium	1.5E-1[a]	1.0E+0[b]	2.0E-4[c]
Cadmium	5.5E-1[a]	6.0E-1[d]	5.5E-4[a]
Chromium (total)	4.0E-2[c]	1.3E-1[e]	3.0E-2[c]
Lead	9.0E-2[c]	4.0E-2[d]	8.0E-4[c]
Mercury	1.0E+0[c]	1.0E+0[b]	2.5E-1[a]
Selenium	5.0E-1[c]	1.0E+0[b]	1.0E-1[c]
Silver	1.0E+0[c]	2.5E-1[d]	5.0E-3[c]
Uranium	2.3E-2[e]	1.0E+0[b]	1.0E-2[c]

[a]Baes et al. 1984.
[b]Default value.
[c]NCRP January 1989.
[d]Stafford et al. 1991.
[e]IAEA 1994.
COPEC = Constituent of potential ecological concern.
SWMU = Solid Waste Management Unit.

Table A-15
Media Concentrations[a] for COPECs at SWMU 1

COPEC	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Arsenic	6.9E+0	2.8E-1	7.0E+0	1.3E-2
Barium	4.8E+2	7.2E+1	4.8E+2	8.9E-1
Cadmium	6.7E+0	3.7E+0	4.0E+0	7.5E-3
Chromium (total)	1.9E+1	7.7E-1	2.5E+0	4.6E-3
Lead	8.2E+1[d]	7.4E+0	3.3E+0	6.1E-3
Mercury	1.8E-1	1.8E-1	1.8E-1	3.3E-4
Selenium	2.0E+0	1.0E+0	2.0E+0	3.7E-3
Silver	1.9E+0	2.0E+0	4.9E-1	9.1E-4
Uranium	5.9E+1	1.3E+0	5.9E+1	1.1E-1

[a]In milligrams per kilogram. All are based upon dry weight of the media.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration in food times the food-to-muscle transfer factor times the wet weight-dry weight conversion factor of 3.125 (EPA 1993).
[d]Estimated value.
COPEC = Constituent of potential ecological concern.
SWMU = Solid Waste Management Unit.

Table A-16
Toxicity Benchmarks for Ecological Receptors at SWMU 1

COPEC	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Arsenic	10	mouse	0.126	0.13	mallard	5.14	5.14
Barium	500	rat[h]	10.5	5.1	chicks	20.8	20.8
Cadmium	4	rat[i]	1.0	1.9	mallard	1.45	1.45
Chromium (total)	1	rat	2,737	5,354	black duck	1.0	1.0
Lead	50	rat	8.0	15.6	American kestrel	3.85	3.85
Mercury (inorganic)	0.3	mouse	13.2	14.0	Japanese quail	0.45	0.45
Mercury (organic)	0.3	rat	0.032	0.06	mallard	0.0064	0.0064
Selenium	1	rat	0.20	0.39	screech owl	0.44	0.44
Silver	2	rat	17.8[j]	34.8	–	–	–
Uranium	5	mouse[k]	3.07	3.19	black duck	16	16

[a]In mg/kg soil.
[b]Efroymson et al. 1997.
[c]Body weights (in kg) for the NOAEL conversion are as follows: lab mouse, 0.030; lab rat, 0.350 (except where noted).
[d]Sample et al. 1996, except where noted.
[e]In mg/kg body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kg and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.435 kg.
[i]Body weight: 0.303 kg.
[j]Based upon a rat LOAEL of 89 mg/kg/d (EPA 2004a) and an uncertainty factor of 0.2.
[k]Body weight: 0.028 kg.

COPEC = Constituent of potential ecological concern.
kg = Kilogram(s).
LOAEL = Lowest-observed-adverse-effect level.
mg = Milligram(s).
mg/kg/d = Milligram(s) per kilogram per day.
NOAEL = No-observed-adverse-effect level.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data.

Table A-17
HQs for Ecological Receptors at SWMU 1

COPEC	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	7.0E-1	4.9E-1	**4.4E+0**	**8.3E+0**	3.5E-3
Barium	9.6E-1	**1.2E+0**	**4.2E+0**	**7.2E+0**	5.2E-2
Cadmium	**2.2E+0**	3.1E-1	3.3E-1	3.4E-1	1.1E-2
Chromium (total)	**1.9E+1**	3.3E-5	5.9E-5	8.4E-5	6.4E-2
Lead	**1.6E+0**	8.9E-2	6.9E-2	4.9E-2	4.8E-2
Mercury (organic)	5.9E-1	4.5E-1	4.5E-1	4.5E-1	**2.5E+0**
Mercury (inorganic)	5.9E-1	2.0E-3	2.0E-3	2.0E-3	3.6E-2
Selenium	**2.0E+0**	4.1E-1	6.1E-1	8.1E-1	1.3E-1
Silver	9.8E-1	8.9E-3	5.6E-3	2.4E-3	–
Uranium	**1.2E+1**	1.2E-1	**1.5E+0**	**2.9E+0**	1.5E-2
HI[b]	**4.0E+1**	**3.1E+0**	**1.2E+1**	**2.0E+1**	**2.9E+0**

[a]**Bold** values indicate the HQ or HI exceeds unity.
[b]The HI is the sum of individual HQs using the value for organic mercury as a conservative estimate of the HI.
COPEC = Constituent of potential ecological concern.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

Table A-18
Internal and External Dose Rates for
Deer Mice Exposed to Radionuclides at SWMU 1

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Am-241	0.352	3.1E-7	7.6E-7	1.1E-6
Cs-137	0.203	6.3E-6	9.3E-6	1.6E-5
H-3	0.22	7.1E-7	NA[a]	7.1E-7
Pu-238	0.184	1.5E-7	2.3E-8	1.7E-7
Pu-239/240	2.55	1.9E-6	1.3E-7	2.0E-6
U-235	0.351	3.8E-6	5.7E-6	9.5E-6
U-238	25.0	2.5E-4	3.8E-3	4.1E-3
Total Dose		2.7E-4	3.8E-3	4.1E-3

[a]External dose from H-3 assumed to be insignificant.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table A-19
Internal and External Dose Rates for
Burrowing Owls Exposed to Radionuclides at SWMU 1

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Am-241	0.352	7.1E-7	7.6E-7	1.5E-6
Cs-137	0.203	4.1E-6	9.3E-6	1.3E-5
H-3	0.22	2.5E-7	NA[a]	2.5E-7
Pu-238	0.184	3.7E-7	2.3E-8	3.9E-7
Pu-239/240	2.55	4.9E-6	1.3E-7	5.0E-6
U-235	0.351	1.5E-6	5.7E-6	7.3E-6
U-238	25.0	1.0E-4	3.8E-3	3.9E-3
Total Dose		1.1E-4	3.8E-3	3.9E-3

[a]External dose from H-3 assumed to be insignificant.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

VIII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at SWMU 1. These uncertainties result from assumptions used in calculating risk that may overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil samples to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse, and the assumption of an area use factor of 1.0 for wildlife receptors regardless of seasonal use or home range size. Each of these uncertainties, which are consistent among each of the SWMU-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to radiological COPECs are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors, which are typically negligible. The dose-rate models used for these calculations are based upon conservative estimates of receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic, but conservative, estimate of a receptor's exposure to radionuclides in soil, both internally and externally.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. For several inorganic COPECs, conservatisms in the modeling of exposure and risk result in the prediction of risk to ecological receptors when exposed at background concentrations. As shown in Table A-20, HQs associated with exposures to background are greater than 1.0 for three of the COPECs that were predicted to pose potential risk to ecological receptors at SWMU 1 (arsenic, barium, and chromium). In the case of arsenic, background level exposure contributes approximately 67 percent of the total exposure in the deer mouse, indicating that the potential increased risk associated with the soil at the site is minimal. Similarly, background level exposure contributes approximately 67 percent of the total exposure for barium and 42 percent of the total exposure for chromium, again indicating that site-related increased risk for these COPECs is small. Therefore, because of the uncertainties associated with exposure and toxicity, it is unlikely that arsenic, barium, and chromium, with exposure concentrations largely attributable to background, present significant ecological risk.

The assumption of an area use factor of 1.0 is a source of uncertainty for the burrowing owl. Because SWMU 1 is approximately 0.3 acres in size and the home range of the burrowing owl is 35 acres, an area use factor of approximately 0.0086 would be justified for this receptor. This is sufficient to reduce the burrowing owl HQ for organic mercury from 2.5 to 0.0021.

For cadmium, total chromium, lead, and selenium, HQs greater than unity are limited to plants. It should be noted, however, that the plant toxicity benchmarks for these metals are conservatively based upon laboratory tests using soil amendments with highly available forms of the element (Efroymson et al. 1997). It is likely that only a small fraction of the cadmium, chromium, lead, and selenium in the soil at SWMU 1 is in a form that is highly available for

Table A-20
HQs for Ecological Receptors Exposed to Background Concentrations for SWMU 1

COPEC	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	4.4E-1	3.1E-1	**2.8E+0**	**5.2E+0**	2.2E-3
Barium	2.6E-1	3.3E-1	**1.1E+0**	**2.0E+0**	1.4E-2
Cadmium	1.7E-1	2.4E-2	2.5E-2	2.6E-2	8.1E-4
Chromium (total)	**1.6E+1**	2.8E-5	4.9E-5	6.9E-5	5.3E-2
Lead	2.4E-1	1.3E-2	1.0E-2	7.0E-3	6.9E-3
Mercury (inorganic)	1.7E-1	5.7E-4	5.7E-4	5.7E-4	1.0E-2
Mercury (organic)	1.7E-1	1.3E-1	1.3E-1	1.3E-1	7.1E-1
Selenium	5.0E-1	1.0E-1	1.5E-1	2.0E-1	3.3E-2
Silver	2.5E-1	2.3E-3	1.4E-3	6.0E-4	–
Uranium	6.8E-1	7.2E-3	8.9E-2	1.7E-1	8.7E-4
HI[b]	**1.5E+1**	**1.1E+0**	**4.8E+0**	**8.6E+0**	8.2E-1

[a]**Bold** values indicate the HQ or HI exceeds unity.
[b]The HI is the sum of individual HQs using the value for organic mercury as a conservative estimate of the HI.
COPEC = Constituent of potential ecological concern.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

plant uptake; therefore, the plant toxicity benchmarks for these metals probably overestimate risk to plants to a significant degree. In addition, the plant toxicity benchmark for chromium is based upon chromium VI, which may be more toxic to plants than the more common chromium III. Because the majority of the total chromium measured at SWMU 1 is expected to be chromium III, it is uncertain whether the calculated HQ accurately predicts the potential risk to plants from exposure to chromium.

A significant source of uncertainty associated with the prediction of ecological risks at this site is the use of the maximum concentrations measured in soil samples to evaluate risk. To assess the potential degree of overestimation due to the use of the maximum concentrations, UCLs of the mean soil concentrations were calculated for arsenic, barium, cadmium, total chromium, lead, selenium, and uranium. Exposures and HQs were recalculated for these COPECs to determine whether the HQs above unity can be accounted for by the magnitude of the extreme measurement. For arsenic, cadmium, total chromium, and selenium, the UCLs (3.46, 0.52, 8.96, and 0.59 mg/kg, respectively) (Appendix 2) are all less than the corresponding background screening values for the these COPECs. Therefore, the corresponding HQs are less than the HQ values for background as shown in Table A-20. For barium, lead, and uranium, the UCLs (218, 12.7, and 6.8 mg/kg, respectively) (Appendix 2) are less than the corresponding plant toxicity benchmarks (Table A-16) for these COPECs and only slightly exceed the corresponding background concentrations. Therefore, in all of these cases, the use of the UCL soil concentrations reduces the HQs to values either less than unity or less than the HQ derived from background concentrations.

Based upon this uncertainty analysis, ecological risks at SWMU 1 are expected to be very low. HQs greater than unity were initially predicted; however, closer examination of the exposure assumptions reveal an overestimation of risk primarily attributed to exposure concentration, background risk, the depth of contamination, and the small size of the site.

VIII.3.6 Risk Interpretation

Ecological risks associated with SWMU 1 are estimated through a risk assessment that incorporates site-specific information when available. Overall, risks to ecological receptors are expected to be low due to the fact that predicted risks are based upon exposures to COPECs calculated from the maximum measured COPEC concentrations and other conservative assumptions. Predicted risks from exposure to arsenic, barium, cadmium, total chromium, lead, selenium, and uranium were attributed to using these maximum detected values. Potential risks associated with mercury were limited to the burrowing owl under the assumption that all mercury is in organic form and that the area use factor for the owl is 1.0. The use of a more realistic area use factor for this receptor is sufficient to reduce the HQ to less than unity regardless of the form of mercury present. Based upon this final analysis, ecological risks associated with SWMU 1 are expected to be low.

VIII.3.7 Risk Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for NFA or whether additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks are predicted to be low. The scientific/management decision is to recommend this site for NFA.

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APPENDIX 1
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

Sandia National Laboratories/New Mexico (SNL/NM) uses a default set of exposure routes and associated default parameter values developed for each future land-use designation being considered for SNL/NM Environmental Restoration (ER) Project sites. This default set of exposure scenarios and parameter values are invoked for risk assessments unless site-specific information suggests other parameter values. Because many SNL/NM solid waste management units (SWMUs) have similar types of contamination and physical settings, SNL/NM believes that the risk assessment analyses at these sites can be similar. A default set of exposure scenarios and parameter values facilitates the risk assessments and subsequent review.

The default exposure routes and parameter values used are those that SNL/NM views as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the U.S. Environmental Protection Agency (EPA) Region VI and New Mexico Environment Department (NMED), SNL/NM will use these default exposure routes and parameter values in future risk assessments.

At SNL/NM, all SWMUs exist within the boundaries of the Kirtland Air Force Base. Approximately 240 potential waste and release sites have been identified where hazardous, radiological, or mixed materials may have been released to the environment. Evaluation and characterization activities have occurred at all of these sites to varying degrees. Among other documents, the SNL/NM ER draft Environmental Assessment (DOE 1996) presents a summary of the hydrogeology of the sites and the biological resources present. When evaluating potential human health risk the current or reasonably foreseeable land use negotiated and approved for the specific SWMU/AOC, aggregate, or watershed will be used. The following references generally document these land uses: *Workbook: Future Use Management Area 2 (DOE et al. September 1995); Workbook: Future Use Management Area 1 (DOE et al. October 1995); Workbook: Future Use Management Areas 3, 4, 5, and 6 (DOE and USAF January 1996); Workbook: Future Use Management Area 7 (DOE and USAF March 1996)*. At this time, all SNL/NM SWMUs have been tentatively designated for either industrial or recreational future land use. The NMED has also requested that risk calculations be performed based upon a residential land-use scenario. Therefore, all three land-use scenarios will be addressed in this document.

The SNL/NM ER Project has screened the potential exposure routes and identified default parameter values to be used for calculating potential intake and subsequent hazard index (HI), excess cancer risk and dose values. The EPA (EPA 1989) provides a summary of exposure routes that could potentially be of significance at a specific waste site. These potential exposure routes consist of:

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water
- Dermal contact with chemicals in soil
- Inhalation of airborne compounds (vapor phase or particulate)
- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water; and exposure from ground surfaces with photon-emitting radionuclides)

Based upon the location of the SNL/NM SWMUs and the characteristics of the surface and subsurface at the sites, we have evaluated these potential exposure routes for different land-use scenarios to determine which should be considered in risk assessment analyses (the last exposure route is pertinent to radionuclides only). At SNL/NM SWMUs, there is currently no consumption of fish, shellfish, fruits, vegetables, meat, eggs, or dairy products that originate on site. Additionally, no potential for swimming in surface water is present due to the high-desert environmental conditions. As documented in the RESRAD computer code manual (ANL 1993), risks resulting from immersion in contaminated air or water are not significant compared to risks from other radiation exposure routes.

For the industrial and recreational land-use scenarios, SNL/NM ER has, therefore, excluded the following five potential exposure routes from further risk assessment evaluations at any SNL/NM SWMU:

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water

That part of the exposure pathway for radionuclides related to immersion in contaminated air or water is also eliminated.

Based upon this evaluation, for future risk assessments the exposure routes that will be considered are shown in Table 1.

Table 1
Exposure Pathways Considered for Various Land-Use scenarios

Industrial	Recreational	Residential
Ingestion of contaminated drinking water	Ingestion of contaminated drinking water	Ingestion of contaminated drinking water
Ingestion of contaminated soil	Ingestion of contaminated soil	Ingestion of contaminated soil
Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)	Inhalation of airborne compounds (vapor phase or particulate)
Dermal contact (nonradiological constituents only) soil only	Dermal contact (nonradiological constituents only) soil only	Dermal contact (nonradiological constituents only) soil only
External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces

Equations and Default Parameter Values for Identified Exposure Routes

In general, SNL/NM expects that ingestion of compounds in drinking water and soil will be the more significant exposure routes for chemicals; external exposure to radiation may also be significant for radionuclides. All of the above routes will, however, be considered for their appropriate land-use scenarios. The general equation for calculating potential intakes via these routes is shown below. The equations are taken from "Assessing Human Health Risks Posed by Chemicals: Screening-Level Risk Assessment" (NMED March 2000) and "Technical Background Document for Development of Soil Screening Levels" (NMED December 2000). Equations from both documents are based upon the "Risk Assessment Guidance for Superfund" (RAGS): Volume 1 (EPA 1989, 1991). These general equations also apply to calculating potential intakes for radionuclides. A more in-depth discussion of the equations used in performing radiological pathway analyses with the RESRAD code may be found in the RESRAD Manual (ANL 1993). RESRAD is the only code designated by the U.S. Department of Energy (DOE) in DOE Order 5400.5 for the evaluation of radioactively contaminated sites (DOE 1993). The Nuclear Regulatory Commission (NRC) has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff. EPA Science Advisory Board reviewed the RESRAD model. EPA used RESRAD in their rulemaking on radiation site cleanup regulations. RESRAD code has been verified, undergone several benchmarking analyses, and been included in the International Atomic Energy Agency's VAMP and BIOMOVS II projects to compare environmental transport models.

Also shown are the default values SNL/NM ER will use in RME risk assessment calculations for industrial, recreational, and residential land-use scenarios, based upon EPA and other governmental agency guidance. The pathways and values for chemical contaminants are discussed first, followed by those for radionuclide contaminants. RESRAD input parameters that are left as the default values provided with the code are not discussed. Further information relating to these parameters may be found in the RESRAD Manual (ANL 1993) or by directly accessing the RESRAD websites at: http://web.ead.anl.gov/resrad/home2/ or http://web.ead.anl.gov/resrad/documents/.

Generic Equation for Calculation of Risk Parameter Values

The equation used to calculate the risk parameter values (i.e., hazard quotients/HI, excess cancer risk, or radiation total effective dose equivalent [TEDE] [dose]) is similar for all exposure pathways and is given by:

Risk (or Dose) = Intake x Toxicity Effect (either carcinogenic, noncarcinogenic, or radiological)

$$= C \times (CR \times EFD/BW/AT) \times \text{Toxicity Effect} \qquad (1)$$

where;

C = contaminant concentration (site specific)
CR = contact rate for the exposure pathway
EFD= exposure frequency and duration
BW = body weight of average exposure individual
AT = time over which exposure is averaged.

For nonradiological constituents of concern (COCs), the total risk/dose (either cancer risk or HI) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants. For radionuclides, the calculated radiation exposure, expressed as TEDE is compared directly to the exposure guidelines of 15 millirem per year (mrem/year) for industrial and recreational future use and 75 mrem/year for the unlikely event that institutional control of the site is lost and the site is used for residential purposes (EPA 1997).

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk of 1E-5 for nonradiological carcinogens. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the HI) for the toxicity resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of this quantitative estimate with the EPA standard HI of unity (1). The evaluation of the health hazard from radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site. This estimated dose is used to calculate an assumed risk. However, this calculated risk is presented for illustration purposes only, not to determine compliance with regulations.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989) and are outlined below. The RESRAD Manual (ANL 1993) describes similar equations for the calculation of radiological exposures.

Soil Ingestion

A receptor can ingest soil or dust directly by working in the contaminated soil. Indirect ingestion can occur from sources such as unwashed hands introducing contaminated soil to food that is then eaten. An estimate of intake from ingesting soil will be calculated as follows:

$$I_s = \frac{C_s * IR * CF * EF * ED}{BW * AT}$$

where:

- I_s = Intake of contaminant from soil ingestion (milligrams [mg]/kilogram [kg]-day)
- C_s = Chemical concentration in soil (mg/kg)
- IR = Ingestion rate (mg soil/day)
- CF = Conversion factor (1E-6 kg/mg)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged) (days)

It should be noted that it is conservatively assumed that the receptor only ingests soil from the contaminated source.

Soil Inhalation

A receptor can inhale soil or dust directly by working in the contaminated soil. An estimate of intake from inhaling soil will be calculated as follows (EPA August 1997):

$$I_s = \frac{C_s * IR * EF * ED * \left(\frac{1}{VF} \text{ or } \frac{1}{PEF}\right)}{BW * AT}$$

where:

- I_s = Intake of contaminant from soil inhalation (mg/kg-day)
- C_s = Chemical concentration in soil (mg/kg)
- IR = Inhalation rate (cubic meters [m^3]/day)
- EF = Exposure frequency (days/year)
- ED = Exposure duration (years)
- VF = soil-to-air volatilization factor (m^3/kg)
- PEF = particulate emission factor (m^3/kg)
- BW = Body weight (kg)
- AT = Averaging time (period over which exposure is averaged) (days)

Soil Dermal Contact

$$D_a = \frac{C_s * CF * SA * AF * ABS * EF * ED}{BW * AT}$$

where:

- D_a = Absorbed dose (mg/kg-day)
- C_s = Chemical concentration in soil (mg/kg)
- CF = Conversion factor (1E-6 kg/mg)
- SA = Skin surface area available for contact (cm^2/event)
- AF = Soil to skin adherence factor (mg/cm^2)
- ABS = Absorption factor (unitless)
- EF = Exposure frequency (events/year)

ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Ingestion

A receptor can ingest water by drinking it or through using household water for cooking. An estimate of intake from ingesting water will be calculated as follows (EPA August 1997):

$$I_w = \frac{C_w * IR * EF * ED}{BW * AT}$$

where:

I_w = Intake of contaminant from water ingestion (mg/kg/day)
C_w = Chemical concentration in water (mg/liter [L])
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Inhalation

The amount of a constituent taken into the body via exposure to volatilization from showering or other household water uses will be evaluated using the concentration of the constituent in the water source (EPA 1991 and 1992). An estimate of intake from volatile inhalation from groundwater will be calculated as follows (EPA 1991):

$$I_w = \frac{C_w * K * IR_i * EF * ED}{BW * AT}$$

where:

I_w = Intake of volatile in water from inhalation (mg/kg/day)
C_w = Chemical concentration in water (mg/L)
K = volatilization factor (0.5 L/m^3)
IR_i = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged—days)

For volatile compounds, volatilization from groundwater can be an important exposure pathway from showering and other household uses of groundwater. This exposure pathway will only be evaluated for organic chemicals with a Henry's Law constant greater than $1x10^{-5}$ and with a molecular weight of 200 grams/mole or less (EPA 1991).

Tables 2 and 3 show the default parameter values suggested for use by SNL/NM at SWMUs, based upon the selected land-use scenarios for nonradiological and radiological COCs, respectively. References are given at the end of the table indicating the source for the chosen parameter values. SNL/NM uses default values that are consistent with both regulatory guidance and the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways, based upon the assumption that a particular site has no unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

SNL/NM will use the described default exposure routes and parameter values in risk assessments at sites that have an industrial, recreational, or residential future land-use scenario. There are no current residential land-use designations at SNL/NM ER sites, but NMED has requested this scenario to be considered to provide perspective of the risk under the more restrictive land-use scenario. For sites designated as industrial or recreational land use, SNL/NM will provide risk parameter values based upon a residential land-use scenario to indicate the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on SNL/NM ER sites. The parameter values are based upon EPA guidance and supplemented by information from other government sources. If these exposure routes and parameters are acceptable, SNL/NM will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Table 2
Default Nonradiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency (day/yr)	250[a,b]	8.7 (4 hr/wk for 52 wk/yr)[a,b]	350[a,b]
Exposure Duration (yr)	25[a,b,c]	30[a,b,c]	30[a,b,c]
Body Weight (kg)	70[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]
Averaging Time (days) for Carcinogenic Compounds (= 70 yr x 365 day/yr)	25,550[a,b]	25,550[a,b]	25,550 [a,b]
for Noncarcinogenic Compounds (= ED x 365 day/yr)	9,125 [a,b]	10,950[a,b]	10,950 [a,b]
Soil Ingestion Pathway			
Ingestion Rate (mg/day)	100[a,b]	200 Child[a,b] 100 Adult[a,b]	200 Child [a,b] 100 Adult [a,b]
Inhalation Pathway			
Inhalation Rate (m^3/day)	20[a,b]	15 Child[a] 30 Adult[a]	10 Child[a] 20 Adult[a]
Volatilization Factor (m^3/kg)	Chemical Specific	Chemical Specific	Chemical Specific
Particulate Emission Factor (m^3/kg)	1.36E9[a]	1.36E9[a]	1.36E9[a]
Water Ingestion Pathway			
Ingestion Rate (liter/day)	2.4[a]	2.4[a]	2.4[a]
Dermal Pathway			
Skin Adherence Factor (mg/cm^2)	0.2[a]	0.2 Child[a] 0.07 Adult[a]	0.2 Child[a] 0.07 Adult[a]
Exposed Surface Area for Soil/Dust (cm^2/day)	3,300[a]	2,800 Child[a] 5,700 Adult[a]	2,800 Child[a] 5,700 Adult[a]
Skin Adsorption Factor	Chemical Specific	Chemical Specific	Chemical Specific

[a]Technical Background Document for Development of Soil Screening Levels (NMED 2000).
[b]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[c]Exposure Factors Handbook (EPA August 1997).
ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week(s).
yr = Year(s).

Table 3
Default Radiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	365 day/yr
Exposure Duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body Weight (kg)	70 Adult[a,b]	70 Adult[a,b]	70 Adult[a,b]
Soil Ingestion Pathway			
Ingestion Rate	100 mg/day[c]	100 mg/day[c]	100 mg/day[c]
Averaging Time (days) (= 30 yr x 365 day/yr)	10,950[d]	10,950[d]	10,950[d]
Inhalation Pathway			
Inhalation Rate (m^3/yr)	7,300[d,e]	10,950[e]	7,300[d,e]
Mass Loading for Inhalation g/m^3	1.36 E-5[d]	1.36 E-5 [d]	1.36 E-5 [d]
Food Ingestion Pathway			
Ingestion Rate, Leafy Vegetables (kg/yr)	NA	NA	16.5[c]
Ingestion Rate, Fruits, Non-Leafy Vegetables & Grain (kg/yr)	NA	NA	101.8[b]
Fraction Ingested	NA	NA	0.25[b,d]

[a]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[b]Exposure Factors Handbook (EPA August 1997).
[c]EPA Region VI guidance (EPA 1996).
[d]For radionuclides, RESRAD (ANL 1993).
[e]SNL/NM (February 1998).
EPA = U.S. Environmental Protection Agency.
g = Gram(s)
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not applicable.
wk = Week(s).
yr = Year(s).

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APPENDIX 2
CALCULATION OF THE UPPER CONFIDENCE LIMITS OF MEAN CONCENTRATIONS

For conservatism, Sandia National Laboratories/New Mexico uses the maximum concentration of the constituents of concern (COCs) for initial risk calculation. If the maximum concentrations produce risk above New Mexico Environment Department (NMED) guidelines, conservatism with this approach is evaluated and, if appropriate, a more realistic approach is applied. When the site has been adequately characterized, an estimate of the mean concentration of the COCs is more representative of actual site conditions. The NMED has proposed the use of the 95, 97.5, or 99% upper confidence limit (UCL) of the mean (depending upon the variants of the data set) to represent average concentrations at a site (NMED December 2000). The UCL is calculated according to NMED guidance (Tharp June 2002) using the U.S. Environmental Protection Agency ProUCL program (EPA April 2002). Attached are the outputs from that program and the calculated UCLs used in the risk analysis.

References

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ATTACHMENT

SWMUs 1 Human Health		
Summary Statistics for	Arsenic	
Number of Samples	198	
Minimum	0.936	
Maximum	6.99	
Mean	3.295737	
Median	3.335	
Standard Deviation	0.902388	
Variance	0.814304	
Coefficient of Variation	0.273805	
Skewness	-0.015096	
Lilliefors Test Statisitic	0.103362	
Lilliefors 5% Critical Value	0.062965	
Data not Lognormal at 5% Significance Level		
Data are Normal: Use Student's-t UCL		
95 % UCL (Assuming Normal Data)		
Student's-t	3.40172	
95 % UCL (Adjusted for Skewness)		
Adjusted-CLT	3.401148	
Modified-t	3.401709	
95 % Non-parametric UCL		
CLT	3.401222	
Jackknife	3.40172	
Standard Bootstrap	3.400875	
Bootstrap-t	3.401381	
Chebyshev (Mean, Std)	3.575273	

SWMU 1 Ecological		
Summary Statistics for	Arsenic	
Number of Samples	129	
Minimum	0.936	
Maximum	6.990	
Mean	3.329	
Median	3.360	
Standard Deviation	0.915	
Variance	0.838	
Coefficient of Variation	0.275	
Skewness	0.086	
Lilliefors Test Statisitic	0.120	
Lilliefors 5% Critical Value	0.078	
Data not Lognormal at 5% Significance Level		
Data are Normal: Use Student's-t UCL		
95 % UCL (Assuming Normal Data)		
Student's-t	3.462	
95 % UCL (Adjusted for Skewness)		
Adjusted-CLT	3.462	
Modified-t	3.462	
95 % Non-parametric UCL		
CLT	3.461	
Jackknife	3.462	
Standard Bootstrap	3.459	
Bootstrap-t	3.463	
Chebyshev (Mean, Std)	3.680	

SWMU 1 Ecological	
Summary Statistics for	Barium
Number of Samples	129
Minimum	42.2
Maximum	479
Mean	159.236
Median	146
Standard Deviation	66.822
Variance	4465.223
Coefficient of Variation	0.420
Skewness	2.242
Lilliefors Test Statisitic	0.122
Lilliefors 5% Critical Value	0.078
Data not Lognormal at 5% Significance Level	
Data not Normal: Try Non-parametric UCL	
99 % UCL (Assuming Normal Data)	
Student's-t	173.097
99 % UCL (Adjusted for Skewness)	
Adjusted-CLT	175.212
Modified-t	173.290
99 % Non-parametric UCL	
CLT	172.923
Jackknife	173.097
Standard Bootstrap	172.961
Bootstrap-t	176.073
Chebyshev (Mean, Std)	217.775

SWMU 1 Ecological		
Summary Statistics for	Cadmium	
Number of Samples	129	
Minimum	0.0065	
Maximum	6.7000	
Mean	0.2766	
Median	0.1210	
Standard Deviation	0.6243	
Variance	0.3897	
Coefficient of Variation	2.2569	
Skewness	8.6818	
Lilliefors Test Statisitic	0.1228	
Lilliefors 5% Critical Value	0.0780	
Data not Lognormal at 5% Significance Level		
Data not Normal: Try Non-parametric UCL		
95 % UCL (Assuming Normal Data)		
Student's-t	0.3677	
95 % UCL (Adjusted for Skewness)		
Adjusted-CLT	0.4119	
Modified-t	0.3747	
95 % Non-parametric UCL		
CLT	0.3670	
Jackknife	0.3677	
Standard Bootstrap	0.3666	
Bootstrap-t	0.4658	
Chebyshev (Mean, Std)	0.5162	

SWMU 1 Ecological					
Summary Statistics for	Chromium		Summary Statistics for	ln(Chromium)	
Number of Samples	129.000		Minimum	1.660	
Minimum	5.260		Maximum	2.955	
Maximum	19.200		Mean	2.137	
Mean	8.674		Standard Deviation	0.217	
Median	8.620		Variance	0.047	
Standard Deviation	1.973				
Variance	3.894		Lilliefors Test Statisitic	0.063	
Coefficient of Variation	0.227		Lilliefors 5% Critical Value	0.078	
Skewness	1.411		Data are Lognormal at 5% Significance Level		
95 % UCL (Assuming Normal Data)			Estimates Assuming Lognormal Distribution		
Student's-t	8.962		MLE Mean	8.673	
			MLE Standard Deviation	1.905	
95 % UCL (Adjusted for Skewness)			MLE Coefficient of Variation	0.220	
Adjusted-CLT	8.983		MLE Skewness	0.669	
Modified-t	8.966		MLE Median	8.471	
			MLE 80% Quantile	10.176	
95 % Non-parametric UCL			MLE 90% Quantile	11.195	
CLT	8.960		MLE 95% Quantile	12.105	
Jackknife	8.962		MLE 99% Quantile	14.033	
Standard Bootstrap	8.962				
Bootstrap-t	8.992		MVU Estimate of Median	8.469	
Chebyshev (Mean, Std)	9.431865		MVU Estimate of Mean	8.671	
			MVU Estimate of Std. Dev.	1.903	
			MVU Estimate of SE of Mean	0.168	
			UCL Assuming Lognormal Distribution		
			95% H-UCL	8.960	
			95% Chebyshev (MVUE) UCL	9.401	
			99% Chebyshev (MVUE) UCL	10.33777	
			Recommended UCL to use:		
			Student's-t or H-UCL		

SWMU 1 Ecological		
Summary Statistics for	Lead	
Number of Samples	129	
Minimum	1.740	
Maximum	81.700	
Mean	6.494	
Median	6.090	
Standard Deviation	7.050	
Variance	49.696	
Coefficient of Variation	1.085	
Skewness	9.640	
Lilliefors Test Statisitic	0.138	
Lilliefors 5% Critical Value	0.078	
Data not Lognormal at 5% Significance Level		
Data not Normal: Try Non-parametric UCL		
99 % UCL (Assuming Normal Data)		
Student's-t	7.957	
99 % UCL (Adjusted for Skewness)		
Adjusted-CLT	8.976	
Modified-t	8.044	
99 % Non-parametric UCL		
CLT	7.938	
Jackknife	7.957	
Standard Bootstrap	7.934	
Bootstrap-t	9.820	
Chebyshev (Mean, Std)	12.670	

SWMU 1 Ecological		
Summary Statistics for	Selenium	
Number of Samples	129	
Minimum	0.068	
Maximum	2.005	
Mean	0.416	
Median	0.301	
Standard Deviation	0.454	
Variance	0.206	
Coefficient of Variation	1.091	
Skewness	1.730	
Lilliefors Test Statisitic	0.259	
Lilliefors 5% Critical Value	0.078	
Data not Lognormal at 5% Significance Level		
Data not Normal: Try Non-parametric UCL		
95 % UCL (Assuming Normal Data)		
Student's-t	0.482	
95 % UCL (Adjusted for Skewness)		
Adjusted-CLT	0.488	
Modified-t	0.483	
95 % Non-parametric UCL		
CLT	0.481	
Jackknife	0.482	
Standard Bootstrap	0.481	
Bootstrap-t	0.490	
Chebyshev (Mean, Std)	0.590	

SWMU 1 Ecological		
Summary Statistics for	Uranium	
Number of Samples	129	
Minimum	0.322	
Maximum	58.600	
Mean	1.884	
Median	1.080	
Standard Deviation	5.618	
Variance	31.557	
Coefficient of Variation	2.981	
Skewness	8.977	
Lilliefors Test Statisitic	0.179	
Lilliefors 5% Critical Value	0.078	
Data not Lognormal at 5% Significance Level		
Data not Normal: Try Non-parametric UCL		
99 % UCL (Assuming Normal Data)		
Student's-t	3.049	
99 % UCL (Adjusted for Skewness)		
Adjusted-CLT	3.805	
Modified-t	3.115	
99 % Non-parametric UCL		
CLT	3.035	
Jackknife	3.049	
Standard Bootstrap	3.032	
Bootstrap-t	10.263	
Chebyshev (Mean, Std)	6.805	

Annex B

ANNEX B
SWMU 1 Analytical Results for Verification and Soil Pile Samples

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LIST OF TABLES

Table

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Table

Table B-1
Summary of Gamma Spectroscopy Analytical Results, May 2003, for Soil Piles 33, 35, and 36 Placed in the SWMU 1 Excavation as Lift 1

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
606391	TA2-1-RWL33-1-2-S	NA	2.17	0.36	**0.216**	0.0385	0.934	0.432	0.146	0.186	**4.27**	0.719
606391	TA2-1-RWL35-1-2-S	NA	16.6	2.4	**1.54**	0.202	**1.7**	0.756	**ND (0.24)**	--	**1.46**	0.435
606391	TA2-1-RWL36-1-2-S	NA	1.03	0.209	0.0675	0.0237	0.87	0.4	0.116	0.173	ND (0.524)	--
606391	TA2-1-RWL36-2-2-S	NA	1.32	0.242	0.0782	0.017	0.82	0.385	**ND (0.194)**	--	ND (0.489)	--
606391	TA2-1-RWL36-3-3-S	NA	0.745	0.171	0.045	0.0124	0.885	0.413	**ND (0.187)**	--	ND (0.465)	--
606391	TA2-1-RWL36-4-2-S	NA	0.882	0.185	0.0579	0.0194	0.863	0.404	**ND (0.197)**	--	ND (0.493)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie September 1997, North Area Supergroup.

bgs = Below ground surface.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable (depth not applicable for soil pile).
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
NS = Not specified by Dinwiddie September 1997.
pCi/g = Picocurie(s) per gram.
RWL = Radioactive Waste Landfill.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
-- = Error not calculated for nondetectable results.

Table B-2
Summary of Isotopic Plutonium Analytical Results, May 2003, for Soil Piles 33, 35, and 36 Placed in the SWMU 1 Excavation as Lift 1

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
606390	TA2-1-RWL33-1-1-S	NA	0.174	0.0275	9.55	0.662
606390	TA2-1-RWL35-1-1-S	NA	0.682	0.0612	39.3	2.54
606390	TA2-1-RWL36-1-1-S	NA	0.0994	0.0201	6.18	0.439
606390	TA2-1-RWL36-2-1-S	NA	0.0711	0.0181	4.45	0.333
606390	TA2-1-RWL36-3-1-S	NA	0.0872	0.0194	4.03	0.299
606390	TA2-1-RWL36-4-1-S	NA	0.0787	0.019	4.54	0.334

Note: Background activity not specified by Dinwiddie September 1997.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

bgs = Below ground surface.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable (depth not applicable for soil pile).
pCi/g = Picocurie(s) per gram.
RWL = Radioactive Waste Landfill.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
-- = Error not calculated for nondetectable results.

Table B-3
Summary of Tritium Analytical Results, May 2003, for Soil Piles 33, 35, and 36 Placed in the SWMU 1 Excavation as Lift 1

Sample Attributes			Activity (pCi/L)
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium
606391	TA2-1-RWL33-1-3-S	NA	**227,000**
606391	TA2-1-RWL35-1-3-S	NA	**900,000**
606391	TA2-1-RWL36-1-3-S	NA	**20,000**
606391	TA2-1-RWL36-2-3-S	NA	**60,300**
606391	TA2-1-RWL36-3-3-S	NA	**6,990**
606391	TA2-1-RWL36-4-3-S	NA	**8,120**
Background Activity[b]			420

Note: Values in **bold** exceed background soil activities.
[a]Analysis request/chain-of-custody record.
[b]Tharp, February 1999.
bgs = Below ground surface.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
pCi/L = Picocurie(s) per liter.
RWL = Radioactive Waste Landfill.
S = Soil.
SWMU = Solid Waste Management Unit.

Table B-4
Summary of Metals Analytical Results, May 2003, for Soil Piles 33, 35, and 36 Placed in the SWMU 1 Excavation as Lift 1

Sample Attributes			Metals (EPA Method 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
606390	TA2-1-RWL33-1-1-S	NA	3.01	115	0.498	0.614	12.1	8.25	**0.298**	9.33	0.266 J (0.495)	0.145 J (0.495)	**6.28**
606390	TA2-1-RWL35-1-1-S	NA	3.69	137	0.452 J (0.495)	1.25	**14.1**	**13.5**	**1.13**	15.5	0.168 J (0.495)	0.27 J (0.495)	**5.1**
606390	TA2-1-RWL36-1-1-S	NA	3.13	107	0.508	0.217 J (0.49)	**16.2**	8.03	0.0948	9.77	ND (0.159)	ND (0.0884)	1.35
606390	TA2-1-RWL36-2-1-S	NA	2.87	106	0.474	0.359 J (0.463)	12.4	7.74	**0.176**	8.97	0.306 J (0.463)	0.156 J (0.463)	1.82
606390	TA2-1-RWL36-3-1-S	NA	3.11	110	0.538	0.18 J (0.455)	11.6	7.66	0.0439	9.13	0.217 J (0.455)	ND (0.082)	0.703
606390	TA2-1-RWL36-4-1-S	NA	3.21	106	0.505	0.175 J (0.485)	11.6	7.9	0.0423	8.75	0.323 J (0.485)	ND (0.0876)	0.802
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Note: Values in **bold** exceed background soil concentrations.
[a]Analysis request/chain-of-custody record.
[b]Dinwiddie September 1997, North Area Supergroup.

bgs = Below ground surface.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The associated value is an estimated quantity. The reported value is greater than or equal to the method detection limit but is less than the reporting limit, shown in parentheses.
NA = Not applicable (depth not applicable for soil pile).
ND ( ) = Not detected. The result is below the method detection limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
RWL = Radioactive Waste Landfill.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.

Table B-5
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603181	TA2-1-POSTGRZ-1	NA	9.36	1.75	**0.106**	0.0362	0.863	0.44	0.161	0.171	**3.69**	0.92
603181	TA2-1-POSTGRZ-2	NA	2.25	0.76	**0.149**	0.0499	1.38	0.658	**ND (.228)**	--	ND (0.911)	--
603181	TA2-1-POSTGRZ-3	NA	9.26	1.75	**0.334**	0.0688	0.945	0.579	**0.323**	0.184	**5.87**	5.53
603181	TA2-1-POSTGRZ-4	NA	4.38	0.867	**0.318**	0.0502	0.663	0.339	**0.682**	0.247	**11.5**	6.64
603182	TA2-1-POSTGRZ-10	NA	3.53	0.779	**0.601**	0.085	0.978	0.452	**0.183**	0.146	**4.67**	5.74
603182	TA2-1-POSTGRZ-11	NA	88.3	13.1	**1.2**	0.172	0.963	0.508	ND (0.176)	--	**5.12**	2.4
603182	TA2-1-POSTGRZ-12	NA	1.69	0.536	**0.609**	0.0848	0.85	0.389	**0.229**	0.126	**5.14**	1.79
603182	TA2-1-POSTGRZ-5	NA	2.19	0.624	**0.491**	0.0841	ND (0.128)	--	**0.263**	0.215	**4.23**	4.09
603182	TA2-1-POSTGRZ-6	NA	6.26	1.26	**0.627**	0.103	0.853	0.443	**0.284**	0.0799	**6.81**	5.64
603182	TA2-1-POSTGRZ-7	NA	4.72	0.993	**0.348**	0.0682	0.856	0.448	**0.215**	0.244	**6.62**	3.08
603182	TA2-1-POSTGRZ-8	NA	4.14	0.739	**0.48**	0.0716	0.817	0.392	**0.358**	0.171	**6.6**	6.7
603182	TA2-1-POSTGRZ-9	NA	4.92	1.11	**0.644**	0.314	ND (0.141)	--	**0.386**	0.244	**7.12**	4.01
603182	TA2-1-POSTGS-1	NA	12.9	2.04	**0.444**	0.0658	**1.96**	0.876	**ND (0.257)**	--	**1.68**	0.979
603182	TA2-1-POSTGS-2	NA	12.3	1.94	**0.386**	0.0575	1.29	0.586	**ND (0.229)**	--	ND (0.835)	--
603182	TA2-1-POSTGS-3	NA	30	4.6	0.0643	0.0332	0.827	0.438	0.146	0.165	ND (0.73)	--
603182	TA2-1-POSTGS-4	NA	12.1	2.01	**0.347**	0.0683	**1.62**	2.06	0.0922	0.182	ND (0.826)	--
603184	TA2-1-POSTGRIZ-13	NA	1.09	0.638	ND (0.0189)	--	0.698	0.322	ND (.149)	--	**11.1**	5.58
603184	TA2-1-POSTGRIZ-14	NA	0.914	0.557	**0.0903**	0.0328	0.735	0.398	ND (.162)	--	**10.3**	2.67
603184	TA2-1-POSTGRIZ-15	NA	2	0.699	**0.0961**	0.0369	0.705	0.361	**ND (.185)**	--	**9.26**	2
603184	TA2-1-POSTGRIZ-16	NA	1.3	0.703	**0.141**	0.0418	0.876	0.396	**0.257**	0.28	**10.6**	2.02
603184	TA2-1-POSTGRIZ-17	NA	3.41	0.877	0.068	0.0385	0.807	0.444	**0.303**	0.197	**11**	5.74
603184	TA2-1-POSTGRIZ-18	NA	8.99	1.62	**0.128**	0.0436	ND (.144)	--	**0.2**	0.243	**8.35**	3.34
603184	TA2-1-POSTGRIZ-19	NA	1.97	0.804	ND (0.0236)	--	0.882	0.457	**0.347**	0.214	**12.7**	6.1
603184	TA2-1-POSTGRIZ-20	NA	2.55	0.801	**0.0971**	0.0589	0.769	0.405	**0.23**	0.266	**7.82**	3.05
603184	TA2-1-SGSCOB-15C	NA	6.61	1.24	**0.231**	0.0535	1	0.476	**ND (.212)**	--	**1.42**	1.73
603184	TA2-1-SGSCOB-20C	NA	205	30.1	**0.152**	0.0571	0.814	0.464	**0.251**	0.167	**2.75**	2.43
603184	TA2-1-SGSCOB-25C	NA	3.3	2.22	**2.29**	0.309	0.176	1.52	**0.228**	0.172	ND (.751)	--
603184	TA2-1-SGSCOB-27C	NA	19.6	3.08	**0.231**	0.0543	ND (.116)	--	**ND (.212)**	--	ND (.737)	--
603184	TA2-1-SGSCOB-4C	NA	2.36	0.861	**0.168**	0.0474	ND (.126)	--	**0.23**	0.189	**11.1**	5.55
603188	TA2-1-POST-GRIZ-SGS-1	NA	8.12	1.53	**2.98**	0.396	ND (0.182)	--	**ND (0.291)**	--	ND (0.868)	--
603188	TA2-1-POST-GRIZ-SGS-2	NA	10.4	2.14	**4.64**	0.613	**3.39**	1.58	**ND (0.364)**	--	**3.04**	3.15
603188	TA2-1-POST-GRIZ-SGS-3	NA	9.53	1.64	**3.73**	0.483	**2.9**	1.3	**ND (0.294)**	--	**1.54**	1.55
603188	TA2-1-POST-GRIZ-SGS-4	NA	9.91	1.75	**1.67**	0.233	**1.82**	1.69	**0.248**	0.207	ND (0.938)	--
603189	TA2-1-POSTGRIZ-21	NA	5.6	0.996	**2.8**	0.363	0.96	0.442	0.164	0.185	**4.64**	3.37
603189	TA2-1-POSTGRIZ-22	NA	11.9	1.97	**0.823**	0.119	ND (0.14)	--	**ND (0.219)**	--	**3.13**	1.37
603189	TA2-1-POSTGRIZ-23	NA	17.9	2.84	**4.45**	0.647	1.54	0.751	**0.229**	0.208	ND (0.755)	--
603189	TA2-1-POSTGRIZ-24	NA	7.91	1.45	**0.566**	0.0794	ND (0.119)	--	**0.225**	0.279	**3.39**	6.25
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000,
for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603189	TA2-1-POSTGRIZ-SGS-5	NA	1.78	0.295	**0.137**	0.0274	0.804	0.374	**0.183**	0.0509	**5.75**	0.926
603189	TA2-1-POSTGRIZ-SGS-6	NA	0.862	0.174	0.0818	0.0233	ND (0.0714)	--	**0.329**	0.134	**14.3**	2.04
603189	TA2-1-POSTGRIZ-SGS-7	NA	0.75	0.125	0.0748	0.0489	0.736	0.329	**0.367**	0.125	**13.8**	3.07
603194	TA2-1-POSTGRIZ-25	NA	1.94	0.671	**0.0998**	0.0356	0.761	0.39	**0.297**	0.188	**13**	4.07
603194	TA2-1-POSTGRIZ-26	NA	1.57	0.617	0.0777	0.0453	0.783	0.355	**0.243**	0.248	**9.42**	2.91
603194	TA2-1-POSTGRIZ-27	NA	ND (0.391)	--	**0.194**	0.0511	0.925	0.46	**0.253**	0.16	**9.73**	3.12
603194	TA2-1-POSTGRIZ-28	NA	2.97	0.824	**0.183**	0.0471	0.902	0.457	**0.288**	0.196	**10.1**	1.91
603198	TA2-2-POST-GRIZ-29	NA	3.07	0.549	**0.245**	0.104	0.751	0.375	**0.237**	0.167	**8.25**	3.48
603198	TA2-2-POST-GRIZ-30	NA	3.81	0.841	**0.273**	0.0643	0.901	0.447	**0.226**	0.158	**8.11**	3.64
603198	TA2-2-POST-GRIZ-31	NA	2.97	0.898	**0.222**	0.0356	0.714	0.368	ND (0.12)	--	**6.27**	2.45
603198	TA2-2-POST-GRIZ-32	NA	3.2	0.77	**0.236**	0.0322	0.853	1.05	**0.253**	0.183	**7.59**	7.02
603349	TA2-1-POST-GRIZ-33	NA	1.91	1.57	**0.27**	0.0682	0.866	0.471	**ND (0.212)**	--	**2.95**	0.882
603349	TA2-1-POST-GRIZ-34	NA	3.59	0.679	**0.858**	0.142	0.929	0.478	**ND (0.197)**	--	**2.14**	0.738
603349	TA2-1-POST-GRIZ-35	NA	2.29	0.53	**0.282**	0.0702	ND (0.155)	--	0.0972	0.181	**3.4**	0.852
603349	TA2-1-POST-GRIZ-36	NA	2.39	1.67	**0.811**	0.129	1.08	0.528	0.128	0.138	**3.16**	0.874
603350	TA2-1-POST-GRIZ-37	NA	1.84	0.636	**0.352**	0.0676	ND (0.128)	--	ND (0.147)	--	**3.05**	2.98
603350	TA2-1-POST-GRIZ-38	NA	1.65	0.681	**0.297**	0.0606	1.01	0.512	0.17	0.163	**3.02**	1.63
603350	TA2-1-POST-GRIZ-39	NA	1.45	0.585	**0.393**	0.07	0.928	0.486	0.152	0.168	**4.27**	2.31
603350	TA2-1-POST-GRIZ-40	NA	1.8	2.18	**0.321**	0.0799	0.931	0.48	**ND (0.203)**	--	**3.03**	1.88
603350	TA2-1-POST-GRIZ-41	NA	3.81	0.97	**0.208**	0.057	0.938	0.466	**ND (0.208)**	--	ND (0.804)	--
603350	TA2-1-POST-GRIZ-42	NA	4.13	1.09	**0.203**	0.0585	0.849	0.449	0.127	0.121	**2.71**	2.98
603350	TA2-1-POST-GRIZ-43	NA	3.52	0.869	**0.217**	0.353	ND (0.185)	--	**0.702**	0.34	**25.2**	4.83
603350	TA2-1-POST-GRIZ-44	NA	3.27	0.791	**0.376**	0.0718	1.02	0.511	**0.235**	0.162	**5.2**	1.29
603361	TA2-1-POST-SGS-CS1-S	NA	ND (9.48)	--	**2,820**	360	**ND (5.02)**	--	**ND (4.4)**	--	**ND (12)**	--
603361	TA2-1-POST-SGS-CS2-S	NA	16	5.85	**1,460**	186	**ND (3.21)**	--	**ND (2.78)**	--	**ND (7.66)**	--
603361	TA2-1-POST-SGS-CS3-S	NA	ND (11.1)	--	**4,410**	564	**ND (5.63)**	--	**ND (4.86)**	--	**ND (13.8)**	--
603361	TA2-1-POST-SGS-CS4-S	NA	ND (8.86)	--	**2,660**	340	**ND (4.69)**	--	**ND (4.01)**	--	**ND (11.2)**	--
603695	TA2-1-POST-GRIZ-46	NA	3.37	0.741	**0.139**	0.0222	ND (0.166)	--	**ND (0.208)**	--	ND (0.526)	--
603695	TA2-1-POST-GRIZ-47	NA	2.46	0.572	**0.133**	0.0536	0.946	0.444	0.0966	0.165	1.19	1
603695	TA2-1-POST-GRIZ-48	NA	1.15	0.508	**0.183**	0.0562	0.904	0.469	0.0935	0.178	**2.23**	0.65
603695	TA2-1-POST-GRIZ-49	NA	2.91	0.609	**0.158**	0.0547	0.932	0.495	**ND (0.214)**	--	ND (0.597)	--
603711	TA2-1-BOUN-DARY-011-S	NA	0.545	0.259	**0.153**	0.0379	1.19	0.545	**ND (0.255)**	--	**1.34**	0.662
603711	TA2-1-BOUN-DARY-012-S	NA	ND (0.228)	--	**0.27**	0.0454	1.08	0.502	**ND (0.208)**	--	**1.6**	1.64
603711	TA2-1-BOUN-DARY-013-S	NA	ND (0.22)	--	**0.203**	0.0413	0.848	0.406	**ND (0.203)**	--	ND (0.568)	--
603711	TA2-1-BOUN-DARY-014-S	NA	1.22	0.328	**0.261**	0.0486	0.944	0.443	**ND (0.211)**	--	ND (0.607)	--
603711	TA2-1-BOUN-DARY-015-S	NA	1.37	0.353	**0.316**	0.0512	1.06	0.5	0.156	0.168	1.19	0.585
603711	TA2-1-BOUN-DARY-016-S	NA	ND (0.253)	--	0.0266	0.022	1.33	0.638	**ND (0.246)**	--	ND (0.699)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241 Result	Americium-241 Error[b]	Cesium-137 Result	Cesium-137 Error[b]	Thorium-232 Result	Thorium-232 Error[b]	Uranium-235 Result	Uranium-235 Error[b]	Uranium-238 Result	Uranium-238 Error[b]
603711	TA2-1-BOUN-DARY-017-S	NA	0.484	0.235	**0.643**	0.0942	1.18	0.563	**ND (0.22)**	--	**1.41**	0.583
603711	TA2-1-BOUN-DARY-018-S	NA	0.41	0.288	**0.578**	0.0989	1.17	0.549	**ND (0.23)**	--	ND (0.646)	--
603711	TA2-1-BOUN-DARY-019-S	NA	0.359	0.307	**0.53**	0.0809	**1.82**	0.82	**ND (0.251)**	--	ND (0.716)	--
603711	TA2-1-BOUN-DARY-020-DUP	NA	0.279	0.223	**0.452**	0.0701	1.15	0.544	**0.226**	0.182	1.16	0.577
603711	TA2-1-BOUN-DARY-020-S	NA	0.184	0.221	**0.299**	0.0501	1.01	0.47	**ND (0.207)**	--	ND (0.58)	--
603731	TA2-1-BOUN-DARY-021-S	NA	ND (0.44)	--	ND (0.0273)	--	0.877	0.401	**ND (0.196)**	--	ND (0.676)	--
603731	TA2-1-BOUN-DARY-022-S	NA	ND (0.446)	--	ND (0.0261)	--	0.801	0.376	0.111	0.159	ND (0.689)	--
603731	TA2-1-BOUN-DARY-023-S	NA	ND (0.52)	--	ND (0.0333)	--	0.793	0.401	**ND (0.228)**	--	ND (0.794)	--
603731	TA2-1-BOUN-DARY-024-S	NA	ND (0.461)	--	ND (0.029)	--	0.875	0.406	**ND (0.205)**	--	ND (0.693)	--
603731	TA2-1-BOUN-DARY-025-S	NA	ND (0.49)	--	ND (0.031)	--	1.04	0.481	**ND (0.222)**	--	ND (0.751)	--
603731	TA2-1-BOUN-DARY-026-S	NA	0.506	0.428	**0.12**	0.0431	1.07	0.5	**0.25**	0.175	ND (0.763)	--
603731	TA2-1-BOUN-DARY-027-S	NA	ND (0.454)	--	0.0833	0.0222	0.879	0.41	**ND (0.204)**	--	ND (0.701)	--
603731	TA2-1-BOUN-DARY-028-S	NA	ND (0.472)	--	**0.104**	0.0235	1	0.469	**ND (0.21)**	--	ND (0.724)	--
603731	TA2-1-BOUN-DARY-029-S	NA	ND (0.47)	--	0.0808	0.0213	0.93	0.449	**ND (0.215)**	--	ND (0.748)	--
603731	TA2-1-BOUN-DARY-030-S	NA	ND (0.451)	--	**0.122**	0.0282	0.843	0.41	0.105	0.162	ND (0.712)	--
603731	TA2-1-BOUN-DARY-031-S	NA	ND (0.459)	--	**0.122**	0.0406	0.764	0.355	**ND (0.196)**	--	ND (0.676)	--
603731	TA2-1-BOUN-DARY-032-S	NA	ND (0.478)	--	0.0136	0.0136	0.996	0.456	0.132	0.173	ND (0.741)	--
603731	TA2-1-BOUN-DARY-033-S	NA	ND (0.216)	--	**0.112**	0.0304	0.917	0.452	0.105	0.185	ND (0.558)	--
603731	TA2-1-BOUN-DARY-034-S	NA	ND (0.213)	--	ND (0.04)	--	0.973	0.478	0.115	0.183	ND (0.578)	--
603731	TA2-1-BOUN-DARY-035-S	NA	ND (0.207)	--	ND (0.0391)	--	0.965	0.464	**ND (0.203)**	--	ND (0.562)	--
603731	TA2-1-BOUN-DARY-036-S	NA	ND (0.262)	--	**0.271**	0.0491	1.17	0.551	0.168	0.208	**1.49**	0.841
603731	TA2-1-BOUN-DARY-037-S	NA	ND (0.223)	--	**0.148**	0.0553	0.929	0.445	**ND (0.222)**	--	ND (0.623)	--
603731	TA2-1-BOUN-DARY-038-S	NA	ND (0.23)	--	ND (0.0415)	--	1.09	0.567	**ND (0.225)**	--	ND (0.627)	--
603731	TA2-1-BOUN-DARY-039-S	NA	ND (0.195)	--	0.073	0.0228	0.818	0.418	**ND (0.198)**	--	ND (0.551)	--
603731	TA2-1-BOUN-DARY-040-DUP	NA	ND (0.2)	--	**0.143**	0.0341	0.816	0.388	**ND (0.201)**	--	ND (0.543)	--
603731	TA2-1-BOUN-DARY-040-S	NA	ND (0.184)	--	**0.163**	0.0331	0.746	0.348	**ND (0.185)**	--	ND (0.516)	--
603731	TA2-1-BOUN-DARY-041-S	NA	ND (0.206)	--	0.0139	0.019	1.12	0.53	**ND (0.21)**	--	ND (0.58)	--
603731	TA2-1-BOUN-DARY-042-S	NA	ND (0.217)	--	0.0119	0.0135	0.979	0.455	**ND (0.215)**	--	ND (0.623)	--
603731	TA2-1-BOUN-DARY-043-S	NA	ND (0.225)	--	ND (0.0429)	--	1.13	0.534	**ND (0.22)**	--	ND (0.588)	--
603731	TA2-1-BOUN-DARY-044-S	NA	ND (0.502)	--	ND (0.0312)	--	0.849	0.396	0.0961	0.179	ND (0.772)	--
603731	TA2-1-BOUN-DARY-045-S	NA	ND (0.544)	--	ND (0.0323)	--	0.975	0.453	0.095	0.184	ND (0.834)	--
603731	TA2-1-BOUN-DARY-046-S	NA	ND (0.493)	--	ND (0.0291)	--	1.16	0.533	**ND (0.217)**	--	ND (0.745)	--
603731	TA2-1-BOUN-DARY-047-S	NA	ND (0.213)	--	ND (0.0394)	--	0.968	0.46	**ND (0.218)**	--	ND (0.595)	--
603731	TA2-1-BOUN-DARY-048-S	NA	0.12	0.184	0.0655	0.0381	0.976	0.467	**ND (0.203)**	--	ND (0.574)	--
603731	TA2-1-BOUN-DARY-049-S	NA	ND (0.219)	--	0.031	0.0253	0.939	0.44	**ND (0.212)**	--	0.924	0.535
603731	TA2-1-BOUN-DARY-050-S	NA	ND (0.227)	--	0.0638	0.0241	0.754	0.365	**ND (0.213)**	--	**2.37**	0.818
603731	TA2-1-BOUN-DARY-051-S	NA	ND (0.223)	--	ND (0.0429)	--	0.932	0.437	**ND (0.219)**	--	1.24	0.588
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603731	TA2-1-BOUN-DARY-052-S	NA	ND (0.218)	--	**0.0948**	0.0238	0.853	0.401	0.166	0.184	ND (0.638)	--
603731	TA2-1-BOUN-DARY-053-S	NA	ND (0.229)	--	0.0631	0.0238	1.03	0.514	0.124	0.199	ND (0.618)	--
603731	TA2-1-BOUN-DARY-054-S	NA	ND (0.213)	--	**0.236**	0.0422	0.808	0.385	**ND (0.207)**	--	ND (0.571)	--
603731	TA2-1-BOUN-DARY-055-S	NA	0.883	0.271	**0.199**	0.0383	0.962	0.458	**ND (0.226)**	--	ND (0.597)	--
603731	TA2-1-BOUN-DARY-056-S	NA	ND (0.219)	--	**0.0984**	0.0272	1.11	0.516	**ND (0.214)**	--	ND (0.585)	--
603731	TA2-1-BOUN-DARY-057-S	NA	ND (0.241)	--	**0.115**	0.0345	1.04	0.484	**ND (0.233)**	--	1.13	0.745
603731	TA2-1-BOUN-DARY-058-S	NA	ND (0.214)	--	**0.0897**	0.0295	0.922	0.452	**ND (0.205)**	--	ND (0.564)	--
603731	TA2-1-BOUN-DARY-059-S	NA	ND (0.513)	--	0.0205	0.0148	0.929	0.441	**ND (0.228)**	--	ND (0.775)	--
603731	TA2-1-BOUN-DARY-060-DUP	NA	ND (0.493)	--	0.0245	0.0147	1.01	0.463	**ND (0.215)**	--	ND (0.753)	--
603731	TA2-1-BOUN-DARY-060-S	NA	ND (0.469)	--	ND (0.0297)	--	0.768	0.358	0.114	0.164	ND (0.732)	--
603731	TA2-1-BOUN-DARY-061-S	NA	ND (0.431)	--	**0.0913**	0.0218	0.831	0.401	**ND (0.19)**	--	ND (0.659)	--
603731	TA2-1-BOUN-DARY-062-S	NA	ND (0.44)	--	**0.154**	0.0434	0.768	0.356	**ND (0.189)**	--	ND (0.659)	--
603731	TA2-1-BOUN-DARY-063-S	NA	ND (0.414)	--	ND (0.0175)	--	0.823	0.391	**0.24**	0.152	ND (0.636)	--
603731	TA2-1-BOUN-DARY-064-S	NA	ND (0.444)	--	**0.143**	0.0404	0.777	0.364	**ND (0.193)**	--	ND (0.664)	--
603731	TA2-1-BOUN-DARY-065-S	NA	4.74	0.806	0.0738	0.0345	0.813	0.371	**ND (0.197)**	--	ND (0.685)	--
603731	TA2-1-BOUN-DARY-066-S	NA	1.65	0.606	0.0339	0.0143	0.793	0.363	**ND (0.192)**	--	ND (0.678)	--
603731	TA2-1-BOUN-DARY-067-S	NA	0.638	0.447	0.0796	0.0221	0.958	0.445	**0.725**	0.284	**15.8**	4.43
603731	TA2-1-BOUN-DARY-068-S	NA	ND (0.517)	--	0.0765	0.0276	0.878	0.424	0.135	0.126	**2.58**	0.9
603731	TA2-1-BOUN-DARY-069-S	NA	ND (0.475)	--	ND (0.0291)	--	1.05	0.489	**ND (0.214)**	--	ND (0.741)	--
603731	TA2-1-BOUN-DARY-070-S	NA	ND (0.156)	--	0.0281	0.0267	1.1	0.514	0.0792	0.151	**1.32**	1.05
603732	TA2-1-BOUN-DARY-071-S	NA	ND (0.219)	--	0.0355	0.027	0.934	0.435	**ND (0.213)**	--	**1.7**	0.662
603732	TA2-1-BOUN-DARY-072-S	NA	ND (0.22)	--	ND (0.042)	--	1.15	0.566	**ND (0.215)**	--	ND (0.599)	--
603732	TA2-1-BOUN-DARY-073-S	NA	ND (0.189)	--	ND (0.033)	--	1.04	0.486	**ND (0.191)**	--	0.814	0.491
603732	TA2-1-BOUN-DARY-074-S	NA	ND (0.203)	--	ND (0.0374)	--	0.891	0.428	**0.216**	0.178	ND (0.565)	--
603732	TA2-1-BOUN-DARY-075-S	NA	ND (0.19)	--	ND (0.0362)	--	0.972	0.461	**ND (0.195)**	--	ND (0.543)	--
603732	TA2-1-BOUN-DARY-076-S	NA	ND (0.215)	--	0.0225	0.0175	1	0.463	0.118	0.184	ND (0.567)	--
603732	TA2-1-BOUN-DARY-077-S	NA	1.19	0.285	**0.158**	0.0318	0.808	0.381	**ND (0.196)**	--	**2.09**	2.15
603732	TA2-1-BOUN-DARY-078-S	NA	0.739	0.194	0.0653	0.0242	1.28	0.606	**ND (0.218)**	--	ND (0.626)	--
603732	TA2-1-BOUN-DARY-079-S	NA	1.1	0.298	**0.117**	0.0463	1.12	0.536	0.107	0.112	**1.96**	0.752
603732	TA2-1-BOUN-DARY-080-DUP	NA	ND (0.195)	--	ND (0.0374)	--	0.908	0.424	**ND (0.192)**	--	ND (0.529)	--
603732	TA2-1-BOUN-DARY-080-S	NA	ND (0.192)	--	ND (0.0371)	--	0.968	0.522	0.159	0.169	ND (0.545)	--
603732	TA2-1-BOUN-DARY-081-S	NA	ND (0.205)	--	ND (0.0373)	--	1.01	0.486	**ND (0.2)**	--	ND (0.563)	--
603732	TA2-1-BOUN-DARY-082-S	NA	ND (0.482)	--	ND (0.0283)	--	0.841	0.391	**ND (0.221)**	--	ND (0.743)	--
603732	TA2-1-BOUN-DARY-083-S	NA	0.538	0.349	**0.183**	0.0326	0.826	0.396	**ND (0.204)**	--	ND (0.709)	--
603732	TA2-1-BOUN-DARY-084-S	NA	2.05	0.618	**0.206**	0.109	0.783	0.363	**ND (0.196)**	--	ND (0.688)	--
603732	TA2-1-BOUN-DARY-085-S	NA	ND (0.49)	--	ND (0.0295)	--	0.897	0.414	**ND (0.214)**	--	ND (0.745)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000,
for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603732	TA2-1-BOUN-DARY-086-S	NA	ND (0.526)	--	0.0491	0.0155	0.943	0.435	**0.208**	0.179	ND (0.802)	--
603732	TA2-1-BOUN-DARY-087-S	NA	ND (0.466)	--	ND (0.0278)	--	0.835	0.386	**ND (0.201)**	--	ND (0.7)	--
603732	TA2-1-BOUN-DARY-088-S	NA	ND (0.503)	--	0.034	0.0173	0.851	0.396	**ND (0.208)**	--	ND (0.763)	--
603732	TA2-1-BOUN-DARY-089-S	NA	ND (0.555)	--	0.0395	0.0205	0.97	0.453	**0.315**	0.181	**10.1**	3.68
603732	TA2-1-BOUN-DARY-090-S	NA	ND (0.554)	--	0.0239	0.0325	0.986	0.453	**ND (0.236)**	--	ND (0.899)	--
603732	TA2-1-BOUN-DARY-091-S	NA	ND (0.529)	--	0.0137	0.0155	1.09	0.516	**ND (0.222)**	--	ND (0.821)	--
603732	TA2-1-BOUN-DARY-092-S	NA	ND (0.519)	--	0.0586	0.0325	0.823	0.381	0.12	0.175	ND (0.791)	--
603732	TA2-1-BOUN-DARY-093-S	NA	ND (0.496)	--	**0.0906**	0.0217	0.868	0.409	0.151	0.169	**2.48**	3.4
603732	TA2-1-BOUN-DARY-094-S	NA	0.265	0.147	0.138	0.0306	0.892	0.419	**ND (0.189)**	--	**1.8**	1.35
603732	TA2-1-BOUN-DARY-095-S	NA	0.254	0.172	**0.0868**	0.0237	1.05	0.479	**ND (0.183)**	--	**1.43**	2.18
603732	TA2-1-BOUN-DARY-096-S	NA	ND (0.16)	--	**0.117**	0.036	0.859	0.402	0.142	0.148	ND (0.518)	--
603733	TA2-1-BOUN-DARY-097-S	NA	ND (0.458)	--	ND (0.0284)	--	0.993	0.471	**0.241**	0.163	ND (0.704)	--
603733	TA2-1-BOUN-DARY-098-S	NA	0.764	0.434	0.0324	0.0195	0.834	0.393	0.132	0.162	ND (0.721)	--
603733	TA2-1-BOUN-DARY-099-S	NA	ND (0.489)	--	0.0469	0.0319	1.21	0.562	ND (0.173)	--	ND (0.759)	--
603733	TA2-1-BOUN-DARY-100-DUP	NA	ND (0.448)	--	0.0519	0.0358	0.937	0.43	**ND (0.203)**	--	ND (0.72)	--
603733	TA2-1-BOUN-DARY-100-S	NA	ND (0.476)	--	0.0495	0.0184	0.943	0.433	0.101	0.167	ND (0.726)	--
603733	TA2-1-BOUN-DARY-101-S	NA	ND (0.464)	--	**0.121**	0.0249	0.894	0.43	0.111	0.161	ND (0.714)	--
603733	TA2-1-BOUN-DARY-102-S	NA	ND (0.496)	--	0.0172	0.0173	1.13	0.524	**0.241**	0.176	ND (0.774)	--
603733	TA2-1-BOUN-DARY-103-S	NA	ND (0.484)	--	0.0119	0.0129	0.946	0.429	0.137	0.171	ND (0.733)	--
603733	TA2-1-BOUN-DARY-104-S	NA	ND (0.475)	--	0.0536	0.0185	1.04	0.485	**ND (0.209)**	--	ND (0.714)	--
603733	TA2-1-BOUN-DARY-105-S	NA	ND (0.468)	--	0.0279	0.0166	1.08	0.501	0.172	0.166	ND (0.717)	--
603733	TA2-1-BOUN-DARY-106-S	NA	ND (0.458)	--	0.0276	0.0149	0.866	0.397	**ND (0.203)**	--	ND (0.695)	--
603733	TA2-1-BOUN-DARY-107-S	NA	ND (0.455)	--	0.0121	0.0117	0.915	0.42	**ND (0.206)**	--	ND (0.709)	--
603733	TA2-1-BOUN-DARY-108-S	NA	ND (0.213)	--	ND (0.0395)	--	0.885	0.415	0.0948	0.178	**1.5**	0.778
603733	TA2-1-BOUN-DARY-109-S	NA	ND (0.228)	--	ND (0.0371)	--	1.06	0.502	0.244	0.155	**9.55**	1.69
603733	TA2-1-BOUN-DARY-110-S	NA	ND (0.219)	--	0.0232	0.0193	1.06	0.492	0.141	0.189	ND (0.611)	--
603733	TA2-1-BOUN-DARY-111-S	NA	ND (0.235)	--	0.0462	0.0245	1.35	0.635	0.102	0.198	ND (0.626)	--
603733	TA2-1-BOUN-DARY-112-S	NA	ND (0.218)	--	0.0114	0.0144	1.09	0.505	**ND (0.215)**	--	ND (0.587)	--
603733	TA2-1-BOUN-DARY-113-S	NA	ND (0.208)	--	**0.0926**	0.024	0.999	0.481	**ND (0.194)**	--	**1.4**	1.52
603733	TA2-1-BOUN-DARY-114-S	NA	ND (0.202)	--	ND (0.0369)	--	0.966	0.446	**ND (0.2)**	--	ND (0.542)	--
603733	TA2-1-BOUN-DARY-115-S	NA	ND (0.204)	--	ND (0.0374)	--	1.02	0.479	**ND (0.208)**	--	ND (0.563)	--
603733	TA2-1-BOUN-DARY-116-S	NA	0.24	0.243	0.0192	0.0175	1.06	0.489	0.15	0.195	ND (0.658)	--
603734	TA2-1-BOUN-DARY-117-S	NA	ND (0.494)	--	ND (0.0309)	--	1.1	0.504	**ND (0.224)**	--	ND (0.625)	--
603734	TA2-1-BOUN-DARY-118-S	NA	0.683	0.457	**0.102**	0.0228	0.861	0.399	**ND (0.214)**	--	**2.21**	2.76
603734	TA2-1-BOUN-DARY-119-S	NA	ND (0.477)	--	ND (0.0264)	--	1.2	0.548	**ND (0.212)**	--	ND (0.749)	--
603734	TA2-1-BOUN-DARY-120-DUP	NA	0.772	0.262	0.033	0.017	0.988	0.463	0.0952	0.183	**1.6**	0.672
603734	TA2-1-BOUN-DARY-120-S	NA	0.589	0.451	0.0324	0.019	1.05	0.486	**ND (0.205)**	--	ND (0.738)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603734	TA2-1-BOUN-DARY-121-S	NA	5.41	0.85	**0.198**	0.0358	0.861	0.398	0.127	0.17	**1.88**	0.685
603734	TA2-1-BOUN-DARY-122-S	NA	8	1.32	ND (0.0231)	--	1.1	0.521	**ND (0.205)**	--	**1.91**	0.628
603734	TA2-1-BOUN-DARY-123-S	NA	1.15	0.296	**0.0881**	0.024	0.856	0.408	0.131	0.177	**2.01**	1.43
603734	TA2-1-BOUN-DARY-124-S	NA	1.52	0.351	**0.209**	0.0383	0.841	0.401	0.114	0.171	**2.17**	0.706
603734	TA2-1-BOUN-DARY-125-S	NA	0.528	0.223	0.0495	0.0224	0.984	0.46	0.114	0.18	**1.74**	1.02
603734	TA2-1-BOUN-DARY-126-S	NA	ND (0.183)	--	ND (0.0338)	--	0.86	0.4	0.124	0.165	ND (0.503)	--
603734	TA2-1-BOUN-DARY-127-S	NA	ND (0.208)	--	ND (0.0392)	--	1.15	0.536	**ND (0.206)**	--	ND (0.563)	--
603734	TA2-1-BOUN-DARY-128-S	NA	ND (0.2)	--	**0.147**	0.0309	1.08	0.498	**0.186**	0.176	ND (0.538)	--
603734	TA2-1-BOUN-DARY-129-S	NA	ND (0.21)	--	0.041	0.0218	1.03	0.485	**ND (0.209)**	--	ND (0.584)	--
603734	TA2-1-BOUN-DARY-130-S	NA	ND (0.21)	--	0.0696	0.0285	0.941	0.441	**ND (0.203)**	--	**1.43**	1.29
603734	TA2-1-BOUN-DARY-131-S	NA	ND (0.201)	--	0.0437	0.0208	0.969	0.45	**ND (0.202)**	--	ND (0.547)	--
603734	TA2-1-BOUN-DARY-132-S	NA	ND (0.451)	--	0.0349	0.0153	0.678	0.321	0.109	0.157	ND (0.672)	--
603734	TA2-1-BOUN-DARY-133-S	NA	ND (0.458)	--	0.05	0.0251	0.826	0.388	**ND (0.2)**	--	ND (0.703)	--
603734	TA2-1-BOUN-DARY-134-S	NA	ND (0.457)	--	0.0471	0.0149	1.02	0.483	**ND (0.207)**	--	ND (0.73)	--
603734	TA2-1-BOUN-DARY-135-S	NA	0.397	0.346	**0.228**	0.0369	0.687	0.325	0.145	0.154	ND (0.69)	--
603734	TA2-1-BOUN-DARY-136-S	NA	ND (0.453)	--	**0.102**	0.0241	0.929	0.432	**ND (0.204)**	--	ND (0.694)	--
603734	TA2-1-BOUN-DARY-137-S	NA	0.418	0.287	**0.165**	0.0303	0.689	0.323	**ND (0.188)**	--	ND (0.658)	--
603734	TA2-1-BOUN-DARY-138-S	NA	ND (0.449)	--	ND (0.0161)	--	0.72	0.335	0.0925	0.15	ND (0.7)	--
603734	TA2-1-BOUN-DARY-139-S	NA	ND (0.395)	--	0.0913	0.0188	0.705	0.341	ND (0.173)	--	ND (0.6)	--
603734	TA2-1-BOUN-DARY-140-DUP	NA	ND (0.401)	--	0.0244	0.0284	0.506	0.238	0.137	0.145	ND (0.609)	--
603734	TA2-1-BOUN-DARY-140-S	NA	ND (0.402)	--	0.0139	0.0107	0.656	0.321	**ND (0.181)**	--	0.893	0.58
603734	TA2-1-BOUN-DARY-141-S	NA	ND (0.484)	--	0.08	0.0148	0.841	0.385	**ND (0.207)**	--	1.25	2.4
603734	TA2-1-BOUN-DARY-142-S	NA	1.43	0.364	0.0771	0.0242	0.793	0.367	**ND (0.185)**	--	ND (0.548)	--
603734	TA2-1-BOUN-DARY-143-S	NA	ND (0.197)	--	0.0364	0.0206	0.995	0.46	0.146	0.173	ND (0.546)	--
603734	TA2-1-BOUN-DARY-144-S	NA	1.23	0.205	0.0793	0.0236	0.684	0.327	**0.191**	0.194	**2.41**	1.46
603734	TA2-1-BOUN-DARY-145-S	NA	ND (0.198)	--	**0.124**	0.0287	0.824	0.387	**ND (0.248)**	--	**1.81**	0.644
603734	TA2-1-BOUN-DARY-146-S	NA	ND (0.186)	--	0.0443	0.0218	0.819	0.41	0.0892	0.161	ND (0.507)	--
603734	TA2-1-BOUN-DARY-147-S	NA	ND (0.168)	--	**0.0874**	0.0389	0.539	0.275	ND (0.171)	--	ND (0.466)	--
603734	TA2-1-BOUN-DARY-148-S	NA	ND (0.177)	--	0.0178	0.0154	0.674	0.322	ND (0.176)	--	ND (0.493)	--
603734	TA2-1-BOUN-DARY-149-S	NA	ND (0.163)	--	0.0555	0.0288	0.666	0.318	ND (0.171)	--	ND (0.465)	--
603734	TA2-1-BOUN-DARY-150-S	NA	ND (0.188)	--	0.0702	0.0242	0.76	0.382	ND (0.166)	--	1.24	1
603734	TA2-1-BOUN-DARY-151-S	NA	ND (0.186)	--	**0.111**	0.0312	0.769	0.367	**ND (0.182)**	--	1.14	0.909
603734	TA2-1-BOUN-DARY-152-S	NA	0.275	0.126	**0.0932**	0.0238	0.945	0.451	**ND (0.19)**	--	**2.09**	1.11
603734	TA2-1-BOUN-DARY-153-S	NA	ND (0.169)	--	0.0533	0.0176	0.714	0.337	ND (0.179)	--	ND (0.476)	--
603735	TA2-1-BOUN-DARY-154-S	NA	ND (0.452)	--	0.014	0.0126	0.756	0.354	0.102	0.157	ND (0.713)	--
603735	TA2-1-BOUN-DARY-155-S	NA	ND (0.43)	--	**0.185**	0.0479	0.949	0.451	**ND (0.195)**	--	ND (0.681)	--
603735	TA2-1-BOUN-DARY-156-S	NA	ND (0.417)	--	0.0212	0.0209	0.892	0.425	0.169	0.149	ND (0.664)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000,
for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603735	TA2-1-BOUN-DARY-157-S	NA	ND (0.491)	--	0.0252	0.0207	1.04	0.474	0.0966	0.168	ND (0.751)	--
603735	TA2-1-BOUN-DARY-158-S	NA	ND (0.463)	--	0.0311	0.0146	0.867	0.399	**ND (0.2)**	--	ND (0.704)	--
603735	TA2-1-BOUN-DARY-159-S	NA	15.5	2.39	**0.159**	0.0311	1.1	0.512	0.0972	0.1	ND (0.61)	--
603735	TA2-1-BOUN-DARY-160-DUP	NA	3.52	0.66	**0.147**	0.027	0.843	0.387	**ND (0.199)**	--	**1.8**	1.75
603735	TA2-1-BOUN-DARY-160-S	NA	4	0.82	**0.172**	0.0307	0.868	0.396	**ND (0.197)**	--	**2.9**	1.85
603735	TA2-1-BOUN-DARY-161-S	NA	0.788	0.382	**0.0982**	0.0334	0.969	0.456	0.125	0.165	ND (0.721)	--
603735	TA2-1-BOUN-DARY-162-S	NA	ND (0.439)	--	**0.562**	0.166	0.666	0.326	**ND (0.195)**	--	ND (0.659)	--
603735	TA2-1-BOUN-DARY-163-S	NA	ND (0.438)	--	**0.163**	0.0438	0.787	0.374	0.103	0.15	ND (0.639)	--
603735	TA2-1-BOUN-DARY-164-S	NA	ND (0.432)	--	**0.145**	0.0405	0.865	0.403	**ND (0.194)**	--	ND (0.649)	--
603735	TA2-1-BOUN-DARY-165-S	NA	ND (0.395)	--	**0.118**	0.0346	0.68	0.313	ND (0.176)	--	ND (0.61)	--
603735	TA2-1-BOUN-DARY-166-S	NA	ND (0.423)	--	**0.132**	0.0245	0.829	0.382	**ND (0.187)**	--	ND (0.645)	--
603735	TA2-1-BOUN-DARY-167-S	NA	ND (0.458)	--	0.0324	0.0217	0.939	0.446	**0.184**	0.151	ND (0.708)	--
603735	TA2-1-BOUN-DARY-168-S	NA	1.16	0.471	**0.184**	0.0318	0.881	0.406	**ND (0.191)**	--	ND (0.566)	--
603735	TA2-1-BOUN-DARY-169-S	NA	ND (0.538)	--	ND (0.0351)	--	1.25	0.578	**ND (0.236)**	--	ND (0.847)	--
603735	TA2-1-BOUN-DARY-170-S	NA	ND (0.502)	--	ND (0.0305)	--	0.928	0.433	0.0964	0.177	ND (0.757)	--
603735	TA2-1-BOUN-DARY-171-S	NA	ND (0.499)	--	ND (0.0305)	--	1	0.469	0.105	0.173	ND (0.773)	--
603735	TA2-1-BOUN-DARY-172-S	NA	ND (0.525)	--	ND (0.0312)	--	1.09	0.493	**0.309**	0.184	ND (0.78)	--
603735	TA2-1-BOUN-DARY-173-S	NA	ND (0.457)	--	0.0388	0.0174	1.04	0.472	**ND (0.207)**	--	ND (0.702)	--
603735	TA2-1-BOUN-DARY-174-S	NA	ND (0.503)	--	0.0237	0.0145	1.06	0.479	**ND (0.214)**	--	ND (0.758)	--
603735	TA2-1-BOUN-DARY-175-S	NA	ND (0.208)	--	ND (0.0274)	--	0.818	0.377	**ND (0.189)**	--	ND (0.612)	--
603735	TA2-1-BOUN-DARY-176-S	NA	ND (0.131)	--	0.0439	0.024	0.88	0.68	0.0991	0.0781	0.548	0.433
603735	TA2-1-BOUN-DARY-177-S	NA	ND (0.191)	--	0.0191	0.0115	0.71	0.327	ND (0.163)	--	0.991	0.618
603736	TA2-1-BOUN-DARY-178-S	NA	ND (0.188)	--	ND (0.0328)	--	0.786	0.37	**ND (0.189)**	--	**1.36**	1.49
603736	TA2-1-BOUN-DARY-179-S	NA	ND (0.217)	--	0.0819	0.0264	1.01	0.469	0.101	0.109	1.18	0.914
603736	TA2-1-BOUN-DARY-180-DUP	NA	0.263	0.239	**0.146**	0.0317	0.991	0.476	**ND (0.191)**	--	1.27	0.565
603736	TA2-1-BOUN-DARY-180-S	NA	1.06	0.262	**0.132**	0.0274	0.958	0.508	**ND (0.185)**	--	**1.38**	0.615
603736	TA2-1-BOUN-DARY-181-S	NA	1.68	0.341	**0.165**	0.0335	0.73	0.38	0.116	0.113	**5.58**	1.06
603736	TA2-1-BOUN-DARY-182-S	NA	ND (0.182)	--	0.0583	0.0199	0.617	0.295	ND (0.175)	--	ND (0.489)	--
603736	TA2-1-BOUN-DARY-183-S	NA	ND (0.17)	--	0.0439	0.0192	0.672	0.326	ND (0.176)	--	ND (0.501)	--
603736	TA2-1-BOUN-DARY-184-S	NA	ND (0.188)	--	**0.161**	0.0343	0.989	0.462	**0.184**	0.169	ND (0.535)	--
603736	TA2-1-BOUN-DARY-185-S	NA	ND (0.165)	--	**0.0921**	0.0235	0.746	0.348	ND (0.163)	--	ND (0.459)	--
603736	TA2-1-BOUN-DARY-186-S	NA	ND (0.202)	--	0.08	0.0237	1.1	0.519	0.18	0.166	ND (0.536)	--
603736	TA2-1-BOUN-DARY-187-S	NA	0.324	0.214	**0.147**	0.0323	0.936	0.439	**ND (0.19)**	--	1.21	0.802
603736	TA2-1-BOUN-DARY-188-S	NA	ND (0.2)	--	0.0494	0.0221	0.921	0.425	0.119	0.174	ND (0.521)	--
603736	TA2-1-BOUN-DARY-189-S	NA	0.0816	0.0927	**0.174**	0.171	0.983	0.458	**ND (0.184)**	--	1.03	1.28
603736	TA2-1-BOUN-DARY-190-S	NA	0.243	0.12	**0.114**	0.0301	0.923	0.433	0.102	0.145	**1.54**	1.96
603736	TA2-1-BOUN-DARY-191-S	NA	0.211	0.137	0.0236	0.0175	0.997	0.464	**ND (0.213)**	--	1.24	2.14
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241 Result	Americium-241 Error[b]	Cesium-137 Result	Cesium-137 Error[b]	Thorium-232 Result	Thorium-232 Error[b]	Uranium-235 Result	Uranium-235 Error[b]	Uranium-238 Result	Uranium-238 Error[b]
603736	TA2-1-BOUN-DARY-192-S	NA	ND (0.151)	--	ND (0.0354)	--	0.873	0.423	**ND (0.183)**	--	ND (0.402)	--
603737	TA2-1-BOUN-DARY-193-S	NA	ND (0.198)	--	ND (0.0361)	--	0.824	0.388	**ND (0.191)**	--	ND (0.545)	--
603737	TA2-1-BOUN-DARY-194-S	NA	ND (0.22)	--	0.0186	0.0204	0.826	0.396	**0.186**	0.177	ND (0.569)	--
603737	TA2-1-BOUN-DARY-195-S	NA	ND (0.215)	--	ND (0.0378)	--	1.02	0.491	0.109	0.181	ND (0.573)	--
603737	TA2-1-BOUN-DARY-196-S	NA	0.408	0.203	0.0376	0.0269	0.923	0.449	**ND (0.239)**	--	1.26	1.17
603737	TA2-1-BOUN-DARY-197-S	NA	ND (0.214)	--	0.0205	0.0324	0.732	0.347	**ND (0.199)**	--	ND (0.57)	--
603737	TA2-1-BOUN-DARY-198-S	NA	ND (0.204)	--	ND (0.0357)	--	0.806	0.394	**ND (0.199)**	--	1.18	0.826
603737	TA2-1-BOUN-DARY-199-S	NA	1.98	0.4	**0.14**	0.0323	1.24	0.579	0.171	0.191	**3.6**	1.69
603737	TA2-1-BOUN-DARY-200-DUP	NA	1.52	0.345	**0.182**	0.0363	0.87	0.414	**0.194**	0.182	**4.48**	1.43
603737	TA2-1-BOUN-DARY-200-S	NA	1.3	0.395	**0.207**	0.0397	0.988	0.462	**0.225**	0.186	**6.43**	2.48
603737	TA2-1-BOUN-DARY-201-S	NA	1.1	0.423	**0.206**	0.0441	0.985	0.531	**0.591**	0.231	**21**	3.6
603737	TA2-1-BOUN-DARY-202-S	NA	1.99	0.408	**0.199**	0.0393	0.943	0.452	**0.211**	0.208	**9.81**	3.11
603737	TA2-1-BOUN-DARY-203-S	NA	0.403	0.221	0.0494	0.021	0.757	0.39	**ND (0.201)**	--	0.931	0.505
603737	TA2-1-BOUN-DARY-204-S	NA	5.89	0.878	**0.133**	0.0309	0.939	0.452	0.131	0.159	**1.77**	2.1
603737	TA2-1-BOUN-DARY-205-S	NA	ND (0.508)	--	**0.321**	0.0486	0.98	0.452	**ND (0.211)**	--	ND (0.747)	--
603737	TA2-1-BOUN-DARY-206-S	NA	ND (0.476)	--	0.0642	0.0323	0.841	0.39	**0.197**	0.167	ND (0.71)	--
603737	TA2-1-BOUN-DARY-207-S	NA	ND (0.506)	--	0.0636	0.0175	1.07	0.499	**ND (0.217)**	--	ND (0.783)	--
603737	TA2-1-BOUN-DARY-208-S	NA	0.528	0.299	**0.0892**	0.0213	0.867	0.398	**ND (0.213)**	--	1.27	0.899
603737	TA2-1-BOUN-DARY-209-S	NA	1.58	0.577	**0.113**	0.0255	1.15	0.528	**ND (0.211)**	--	ND (0.761)	--
603737	TA2-1-BOUN-DARY-210-S	NA	2.45	0.655	**0.0973**	0.0216	0.948	0.447	**ND (0.216)**	--	ND (0.783)	--
603737	TA2-1-BOUN-DARY-211-S	NA	0.623	0.484	0.0531	0.0201	0.995	0.459	**ND (0.214)**	--	ND (0.748)	--
603737	TA2-1-BOUN-DARY-212-S	NA	ND (0.485)	--	0.0326	0.039	0.919	0.423	**ND (0.211)**	--	ND (0.717)	--
603737	TA2-1-BOUN-DARY-213-S	NA	0.536	0.496	0.0684	0.0205	1	0.466	**ND (0.211)**	--	ND (0.779)	--
603737	TA2-1-BOUN-DARY-214-S	NA	ND (0.594)	--	0.0669	0.0209	1.04	0.476	**ND (0.24)**	--	ND (0.745)	--
603737	TA2-1-BOUN-DARY-215-S	NA	ND (0.488)	--	ND (0.0314)	--	0.774	0.366	**ND (0.215)**	--	ND (0.759)	--
603737	TA2-1-BOUN-DARY-216-S	NA	0.537	0.528	0.0466	0.0198	0.933	0.437	**ND (0.211)**	--	0.919	0.695
603738	TA2-1-BOUN-DARY-217-S	NA	2.18	0.609	0.0345	0.0175	1.15	0.529	0.116	0.174	ND (0.784)	--
603738	TA2-1-BOUN-DARY-218-S	NA	ND (0.531)	--	0.0355	0.0232	1.13	0.536	**ND (0.219)**	--	ND (0.789)	--
603738	TA2-1-BOUN-DARY-219-S	NA	ND (0.467)	--	0.00946	0.0111	0.804	0.37	**ND (0.207)**	--	ND (0.735)	--
603738	TA2-1-BOUN-DARY-220-DUP	NA	0.606	0.238	ND (0.0419)	--	0.763	0.376	**ND (0.218)**	--	ND (0.626)	--
603738	TA2-1-BOUN-DARY-220-S	NA	ND (0.535)	--	0.014	0.0127	0.929	0.443	**ND (0.212)**	--	ND (0.745)	--
603738	TA2-1-BOUN-DARY-221-S	NA	2.23	0.378	0.058	0.0214	0.949	0.438	0.13	0.171	ND (0.555)	--
603738	TA2-1-BOUN-DARY-222-S	NA	ND (0.207)	--	ND (0.0419)	--	0.955	0.462	**ND (0.205)**	--	ND (0.577)	--
603738	TA2-1-BOUN-DARY-223-S	NA	ND (0.188)	--	ND (0.0339)	--	0.704	0.334	**ND (0.185)**	--	1.15	0.948
603738	TA2-1-BOUN-DARY-224-S	NA	ND (0.436)	--	0.0173	0.0128	0.918	0.428	0.118	0.154	ND (0.683)	--
603738	TA2-1-BOUN-DARY-225-S	NA	0.827	0.472	0.0542	0.0191	1.06	0.491	0.0869	0.161	ND (0.712)	--
603738	TA2-1-BOUN-DARY-226-S	NA	ND (0.447)	--	0.0755	0.0341	0.931	0.43	**ND (0.199)**	--	ND (0.689)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603738	TA2-1-BOUN-DARY-227-S	NA	ND (0.469)	--	0.0186	0.0148	1.08	0.503	**ND (0.207)**	--	ND (0.708)	--
603738	TA2-1-BOUN-DARY-228-S	NA	ND (0.384)	--	0.0597	0.0173	0.546	0.259	0.081	0.136	ND (0.586)	--
603738	TA2-1-BOUN-DARY-229-S	NA	ND (0.445)	--	**0.0977**	0.0221	0.805	0.371	0.118	0.155	ND (0.665)	--
603738	TA2-1-BOUN-DARY-230-S	NA	ND (0.458)	--	0.0266	0.0156	0.934	0.434	**ND (0.198)**	--	ND (0.7)	--
603738	TA2-1-BOUN-DARY-231-S	NA	ND (0.513)	--	**0.096**	0.0263	0.919	0.432	**ND (0.223)**	--	ND (0.771)	--
603739	TA2-1-BOUN-DARY-232-S	NA	ND (0.223)	--	0.0415	0.0256	1.13	0.534	**ND (0.216)**	--	ND (0.617)	--
603739	TA2-1-BOUN-DARY-233-S	NA	ND (0.187)	--	0.0227	0.0174	1.01	0.471	**ND (0.198)**	--	ND (0.527)	--
603739	TA2-1-BOUN-DARY-234-S	NA	ND (0.197)	--	**0.147**	0.0314	0.799	0.381	**ND (0.2)**	--	ND (0.532)	--
603739	TA2-1-BOUN-DARY-235-S	NA	ND (0.223)	--	**0.131**	0.0332	1.11	0.525	**0.225**	0.186	ND (0.592)	--
603739	TA2-1-BOUN-DARY-236-S	NA	ND (0.218)	--	**0.124**	0.0439	0.929	0.434	**ND (0.205)**	--	ND (0.575)	--
603739	TA2-1-BOUN-DARY-237-S	NA	ND (0.221)	--	**0.104**	0.0284	0.974	0.459	0.121	0.19	**3.28**	1.26
603739	TA2-1-BOUN-DARY-238-S	NA	0.184	0.147	ND (0.0429)	--	1.14	0.527	**ND (0.22)**	--	1.2	1.04
603739	TA2-1-BOUN-DARY-239-S	NA	ND (0.235)	--	0.0415	0.0263	0.963	0.462	**ND (0.229)**	--	1.04	0.458
603739	TA2-1-BOUN-DARY-240-DUP	NA	ND (0.22)	--	0.0152	0.0195	1.03	0.479	**ND (0.216)**	--	ND (0.632)	--
603739	TA2-1-BOUN-DARY-240-S	NA	ND (0.216)	--	ND (0.0426)	--	0.99	0.477	0.126	0.192	ND (0.618)	--
603739	TA2-1-BOUN-DARY-241-S	NA	ND (0.203)	--	0.0255	0.02	0.986	0.473	**ND (0.196)**	--	ND (0.538)	--
603739	TA2-1-BOUN-DARY-242-S	NA	ND (0.195)	--	0.0127	0.00796	0.689	0.35	**ND (0.189)**	--	1.03	0.462
603739	TA2-1-BOUN-DARY-243-S	NA	0.256	0.249	0.0302	0.018	0.833	0.411	0.137	0.176	ND (0.558)	--
603739	TA2-1-BOUN-DARY-244-S	NA	2.75	0.5	**0.118**	0.0298	1.06	0.507	**ND (0.231)**	--	ND (0.677)	--
603739	TA2-1-BOUN-DARY-245-S	NA	0.712	0.207	**0.0921**	0.0265	1	0.488	**ND (0.213)**	--	ND (0.603)	--
603739	TA2-1-BOUN-DARY-246-S	NA	1.03	0.283	0.0824	0.0274	0.905	0.503	**ND (0.216)**	--	ND (0.63)	--
603739	TA2-1-BOUN-DARY-247-S	NA	0.206	0.238	ND (0.0373)	--	0.848	0.417	**0.203**	0.168	ND (0.538)	--
603739	TA2-1-BOUN-DARY-248-S	NA	ND (0.249)	--	ND (0.0464)	--	1.16	0.565	0.105	0.198	ND (0.655)	--
603739	TA2-1-BOUN-DARY-249-S	NA	ND (0.214)	--	0.0127	0.0183	0.986	0.459	0.128	0.181	ND (0.581)	--
603739	TA2-1-BOUN-DARY-250-S	NA	ND (0.224)	--	ND (0.0419)	--	1.24	0.592	**ND (0.222)**	--	ND (0.625)	--
603739	TA2-1-BOUN-DARY-251-S	NA	0.312	0.0884	**0.0987**	0.0281	0.938	0.442	0.162	0.19	**1.34**	0.603
603739	TA2-1-BOUN-DARY-252-S	NA	0.382	0.268	**0.176**	0.0393	1.1	0.527	**ND (0.222)**	--	ND (0.627)	--
603739	TA2-1-BOUN-DARY-253-S	NA	ND (0.212)	--	ND (0.0392)	--	0.887	0.413	**ND (0.209)**	--	ND (0.585)	--
603739	TA2-1-BOUN-DARY-254-S	NA	ND (0.163)	--	0.0234	0.0192	0.512	0.251	ND (0.167)	--	0.659	0.424
603739	TA2-1-BOUN-DARY-255-S	NA	ND (0.173)	--	**0.319**	0.0531	0.982	0.487	**ND (0.203)**	--	**1.35**	1.89
603740	TA2-1-BOUN-DARY-256-S	NA	0.518	0.25	**0.138**	0.0349	0.916	0.436	**ND (0.234)**	--	ND (0.752)	--
603740	TA2-1-BOUN-DARY-257-S	NA	0.304	0.35	0.0576	0.0228	1.06	0.498	**ND (0.245)**	--	ND (0.781)	--
603740	TA2-1-BOUN-DARY-258-S	NA	0.625	0.408	0.0788	0.0289	1.02	0.485	**ND (0.243)**	--	**1.75**	2.67
603740	TA2-1-BOUN-DARY-259-S	NA	ND (0.344)	--	0.0342	0.0238	0.782	0.376	**ND (0.218)**	--	ND (0.697)	--
603740	TA2-1-BOUN-DARY-260-DUP	NA	ND (0.314)	--	ND (0.0385)	--	0.722	0.346	0.131	0.151	ND (0.669)	--
603740	TA2-1-BOUN-DARY-260-S	NA	ND (0.316)	--	ND (0.0363)	--	0.757	0.366	**0.195**	0.197	ND (0.672)	--
603740	TA2-1-BOUN-DARY-261-S	NA	ND (0.305)	--	ND (0.0345)	--	0.723	0.352	**0.268**	0.193	ND (0.655)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
			Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603740	TA2-1-BOUN-DARY-262-S	NA	0.465	0.227	ND (0.0418)	--	0.673	0.329	0.105	0.205	ND (0.733)	--
603740	TA2-1-BOUN-DARY-263-S	NA	ND (0.379)	--	0.0378	0.0353	1.04	0.492	**0.183**	0.228	ND (0.81)	--
603740	TA2-1-BOUN-DARY-264-S	NA	0.553	0.256	**0.112**	0.0366	1.07	0.504	**ND (0.251)**	--	ND (0.808)	--
603740	TA2-1-BOUN-DARY-265-S	NA	ND (0.357)	--	ND (0.0423)	--	0.982	0.465	**ND (0.245)**	--	ND (0.773)	--
603740	TA2-1-BOUN-DARY-266-S	NA	2.24	0.427	**0.171**	0.0392	1.07	0.497	**ND (0.245)**	--	**4.73**	3.67
603740	TA2-1-BOUN-DARY-267-S	NA	0.471	0.262	**0.143**	0.0369	1.03	0.492	**ND (0.262)**	--	ND (0.87)	--
603740	TA2-1-BOUN-DARY-268-S	NA	ND (0.408)	--	0.0285	0.0194	1.11	0.527	**ND (0.271)**	--	ND (0.897)	--
603740	TA2-1-BOUN-DARY-269-S	NA	ND (0.405)	--	**0.17**	0.0416	1.3	0.603	**ND (0.265)**	--	**1.62**	1.63
603740	TA2-1-BOUN-DARY-270-S	NA	ND (0.398)	--	**0.213**	0.0458	1.18	0.551	0.161	0.242	**1.93**	2.14
603740	TA2-1-BOUN-DARY-271-S	NA	ND (0.356)	--	0.0224	0.0215	0.993	0.47	**ND (0.245)**	--	ND (0.76)	--
603740	TA2-1-BOUN-DARY-272-S	NA	ND (0.406)	--	0.0733	0.033	1.13	0.529	0.172	0.246	ND (0.858)	--
603740	TA2-1-BOUN-DARY-273-S	NA	ND (0.429)	--	**0.149**	0.0391	1.34	0.622	**ND (0.28)**	--	ND (0.933)	--
603740	TA2-1-BOUN-DARY-274-S	NA	ND (0.366)	--	0.0393	0.0279	1.16	0.538	**ND (0.244)**	--	ND (0.787)	--
603740	TA2-1-BOUN-DARY-275-S	NA	28.6	4.08	0.0656	0.0266	1.15	0.537	0.134	0.229	ND (0.781)	--
603740	TA2-1-BOUN-DARY-276-S	NA	0.201	0.212	0.0715	0.0253	0.941	0.443	**ND (0.222)**	--	ND (0.731)	--
603740	TA2-1-BOUN-DARY-277-S	NA	ND (0.358)	--	0.0367	0.0217	1.11	0.518	**ND (0.243)**	--	ND (0.765)	--
603740	TA2-1-BOUN-DARY-278-S	NA	ND (0.428)	--	ND (0.0284)	--	1.12	0.535	**0.212**	0.268	ND (0.922)	--
603740	TA2-1-BOUN-DARY-279-S	NA	0.353	0.283	0.0334	0.0216	0.95	0.451	0.11	0.218	0.855	1.38
603747	TA2-1-RET1-S	NA	3.37	0.565	**0.125**	0.0436	0.879	0.431	**ND (0.191)**	--	**1.47**	0.573
603747	TA2-1-RET2-S	NA	2.04	0.372	**0.148**	0.0338	0.949	0.437	0.171	0.165	1.3	0.594
603747	TA2-1-SGS1-S	NA	10.2	1.53	**1.69**	0.229	**1.99**	0.905	**0.249**	0.213	**2.97**	0.949
603747	TA2-1-SGS2-S	NA	12.7	1.88	**1.57**	0.21	**2.45**	1.1	**ND (0.257)**	--	**2.64**	1.23
603749	TA2-1-BOUN-DARY-280-DUP	NA	NR	--	0.0214	0.0201	0.974	0.467	0.107	0.213	ND (0.669)	--
603749	TA2-1-BOUN-DARY-280-S	NA	ND (0.237)	--	0.017	0.0207	1.14	0.534	**ND (0.235)**	--	ND (0.661)	--
603749	TA2-1-BOUN-DARY-281-S	NA	ND (0.235)	--	0.0315	0.0208	1.37	0.651	0.12	0.198	ND (0.645)	--
603749	TA2-1-BOUN-DARY-282-S	NA	ND (0.268)	--	0.0362	0.0289	1.1	0.536	**ND (0.247)**	--	ND (0.712)	--
603749	TA2-1-BOUN-DARY-283-S	NA	ND (0.248)	--	0.0158	0.02	1.07	0.501	**ND (0.233)**	--	ND (0.63)	--
603749	TA2-1-BOUN-DARY-284-S	NA	ND (0.223)	--	**0.105**	0.0299	0.985	0.491	0.111	0.198	ND (0.634)	--
603749	TA2-1-BOUN-DARY-285-S	NA	ND (0.252)	--	0.0318	0.022	1.09	0.514	**ND (0.244)**	--	ND (0.68)	--
603749	TA2-1-BOUN-DARY-286-S	NA	ND (0.251)	--	**0.0975**	0.0537	0.984	0.467	**ND (0.237)**	--	ND (0.671)	--
603749	TA2-1-BOUN-DARY-287-S	NA	1.01	0.32	0.0362	0.0469	1.03	0.482	**ND (0.23)**	--	ND (0.647)	--
603749	TA2-1-BOUN-DARY-288-S	NA	ND (0.245)	--	ND (0.0459)	--	1	0.473	**ND (0.233)**	--	ND (0.632)	--
603749	TA2-1-BOUN-DARY-289-S	NA	0.474	0.26	ND (0.0465)	--	1.11	0.53	**ND (0.243)**	--	ND (0.703)	--
603749	TA2-1-BOUN-DARY-290-S	NA	ND (0.239)	--	ND (0.0433)	--	1.29	0.608	**ND (0.239)**	--	0.66	0.498
603749	TA2-1-BOUN-DARY-291-S	NA	ND (0.28)	--	ND (0.051)	--	1.23	0.616	**0.217**	0.237	ND (0.789)	--
603749	TA2-1-BOUN-DARY-292-S	NA	ND (0.271)	--	0.0348	0.0268	1.11	0.528	0.116	0.217	**2.01**	1.66
603749	TA2-1-BOUN-DARY-293-S	NA	2.76	0.491	**0.428**	0.0661	1.04	0.49	0.154	0.192	ND (0.629)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603749	TA2-1-BOUN-DARY-294-S	NA	4.01	0.902	**0.686**	0.103	1.19	0.568	**0.23**	0.234	**6.32**	1.39
603749	TA2-1-BOUN-DARY-295-S	NA	ND (0.255)	--	ND (0.0485)	--	1.08	0.514	**ND (0.24)**	--	ND (0.678)	--
603749	TA2-1-BOUN-DARY-296-S	NA	2.13	0.406	**0.145**	0.0345	0.811	0.386	**ND (0.211)**	--	ND (0.532)	--
603749	TA2-1-BOUN-DARY-297-S	NA	1.4	0.363	**0.194**	0.0394	0.879	0.419	0.142	0.191	ND (0.637)	--
603749	TA2-1-BOUN-DARY-298-S	NA	15.8	2.33	**0.102**	0.028	1.03	0.481	**ND (0.223)**	--	ND (0.609)	--
603749	TA2-1-BOUN-DARY-299-S	NA	0.482	0.196	**0.105**	0.0254	0.785	0.371	0.0849	0.167	**1.32**	1.43
603749	TA2-1-BOUN-DARY-300-DUP	NA	0.364	0.256	**0.148**	0.0341	0.923	0.435	**ND (0.206)**	--	ND (0.569)	--
603749	TA2-1-BOUN-DARY-300-S	NA	0.448	0.257	**0.163**	0.0366	1.04	0.491	**ND (0.206)**	--	ND (0.571)	--
603749	TA2-1-BOUN-DARY-301-S	NA	0.821	0.248	**0.188**	0.0379	0.868	0.409	0.107	0.174	ND (0.565)	--
603749	TA2-1-BOUN-DARY-302-S	NA	1.63	0.336	**0.217**	0.0417	1.11	0.542	**ND (0.223)**	--	ND (0.636)	--
603749	TA2-1-BOUN-DARY-303-S	NA	0.996	0.346	**0.103**	0.0274	0.849	0.432	**ND (0.234)**	--	ND (0.647)	--
603749	TA2-1-BOUN-DARY-304-S	NA	ND (0.272)	--	ND (0.0505)	--	1.48	0.71	**0.23**	0.218	1.2	0.635
603749	TA2-1-BOUN-DARY-305-S	NA	ND (0.232)	--	0.0319	0.0326	1.03	0.487	**ND (0.229)**	--	ND (0.626)	--
603825	TA2-1-BOUN-DARY-369-S	NA	0.651	0.24	**0.109**	0.0312	0.701	0.355	**ND (0.204)**	--	ND (0.569)	--
603825	TA2-1-BOUN-DARY-373-S	NA	0.983	0.296	**0.108**	0.0345	0.977	0.475	0.114	0.188	ND (0.604)	--
603825	TA2-1-BOUN-DARY-376-S	NA	6.05	1.05	**0.169**	0.0365	0.774	0.374	**ND (0.212)**	--	1.29	0.531
603825	TA2-1-BOUN-DARY-379-S	NA	0.619	0.229	0.0346	0.0211	0.787	0.38	**ND (0.195)**	--	ND (0.538)	--
603825	TA2-1-BOUN-DARY-380-DUP	NA	0.104	0.12	ND (0.0381)	--	0.878	0.417	**ND (0.205)**	--	0.503	0.469
603825	TA2-1-BOUN-DARY-381-S	NA	ND (0.202)	--	**0.235**	0.0415	0.782	0.388	**ND (0.204)**	--	ND (0.536)	--
603825	TA2-1-BOUN-DARY-383-S	NA	ND (0.198)	--	0.0184	0.0145	0.856	0.417	ND (0.148)	--	ND (0.528)	--
603825	TA2-1-BOUN-DARY-389-S	NA	0.751	0.215	**0.28**	0.046	0.628	0.344	**ND (0.191)**	--	ND (0.479)	--
603825	TA2-1-BOUN-DARY-390-S	NA	0.46	0.194	**0.341**	0.0551	0.855	0.413	**ND (0.187)**	--	ND (0.515)	--
603825	TA2-1-BOUN-DARY-392-S	NA	ND (0.217)	--	ND (0.0389)	--	0.941	0.443	**ND (0.212)**	--	0.822	0.852
603825	TA2-1-BOUN-DARY-395-S	NA	8.11	1.33	0.0457	0.0262	1.11	0.531	0.124	0.183	1.05	1.16
603825	TA2-1-BOUN-DARY-403-S	NA	0.304	0.25	**0.201**	0.0405	0.831	0.407	**0.253**	0.174	ND (0.555)	--
603826	TA2-1-BOUN-DARY-360-DUP	NA	1.55	0.594	ND (0.0329)	--	1.07	0.51	0.146	0.202	ND (0.804)	--
603826	TA2-1-BOUN-DARY-360-S	NA	1.03	0.594	0.0232	0.0156	0.847	0.403	**ND (0.22)**	--	ND (0.79)	--
603826	TA2-1-BOUN-DARY-361-S	NA	0.603	0.436	0.0477	0.0237	1.19	0.558	**ND (0.274)**	--	ND (0.993)	--
603826	TA2-1-BOUN-DARY-362-S	NA	ND (0.504)	--	ND (0.031)	--	0.885	0.41	**ND (0.223)**	--	ND (0.747)	--
603826	TA2-1-BOUN-DARY-363-S	NA	ND (0.506)	--	0.0289	0.0248	0.971	0.446	0.122	0.176	ND (0.768)	--
603826	TA2-1-BOUN-DARY-364-S	NA	ND (0.479)	--	0.0476	0.0163	0.936	0.429	**ND (0.205)**	--	ND (0.725)	--
603826	TA2-1-BOUN-DARY-365-S	NA	0.757	0.458	**0.115**	0.0243	0.777	0.365	0.143	0.17	ND (0.735)	--
603826	TA2-1-BOUN-DARY-366-S	NA	ND (0.51)	--	ND (0.0311)	--	0.817	0.382	**ND (0.213)**	--	ND (0.761)	--
603826	TA2-1-BOUN-DARY-367-S	NA	1.82	0.542	**0.151**	0.03	0.682	0.328	**ND (0.215)**	--	ND (0.72)	--
603826	TA2-1-BOUN-DARY-368-S	NA	ND (0.481)	--	**0.169**	0.033	0.751	0.357	0.134	0.165	ND (0.716)	--
603826	TA2-1-BOUN-DARY-370-S	NA	ND (0.491)	--	0.0179	0.0145	0.893	0.425	**ND (0.204)**	--	ND (0.703)	--
603826	TA2-1-BOUN-DARY-378-S	NA	ND (0.484)	--	**0.126**	0.0243	0.841	0.389	**ND (0.198)**	--	ND (0.694)	--
603826	TA2-1-BOUN-DARY-380-S	NA	ND (0.488)	--	ND (0.0296)	--	0.835	0.387	0.117	0.165	ND (0.73)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
			Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603826	TA2-1-BOUN-DARY-388-S	NA	ND (0.523)	--	ND (0.0317)	--	1.04	0.481	**ND (0.228)**	--	ND (0.82)	--
603826	TA2-1-BOUN-DARY-391-S	NA	ND (0.531)	--	ND (0.0314)	--	0.867	0.4	**ND (0.231)**	--	ND (0.8)	--
603826	TA2-1-BOUN-DARY-393-S	NA	2.68	0.857	**0.127**	0.0425	0.903	0.43	**0.24**	0.277	**1.35**	1.15
603826	TA2-1-BOUN-DARY-394-S	NA	ND (0.52)	--	ND (0.0329)	--	0.928	0.439	**ND (0.225)**	--	ND (0.764)	--
603827	TA2-1-BOUN-DARY-306-S	NA	1.15	0.297	**0.31**	0.0783	1.12	0.552	**0.181**	0.181	0.704	0.496
603827	TA2-1-BOUN-DARY-307-S	NA	ND (0.238)	--	ND (0.0405)	--	0.785	0.378	**ND (0.225)**	--	ND (0.622)	--
603827	TA2-1-BOUN-DARY-308-S	NA	ND (0.212)	--	ND (0.0418)	--	0.969	0.47	0.0958	0.177	ND (0.571)	--
603827	TA2-1-BOUN-DARY-309-S	NA	ND (0.213)	--	ND (0.037)	--	1.03	0.478	**ND (0.208)**	--	ND (0.599)	--
603827	TA2-1-BOUN-DARY-310-S	NA	ND (0.216)	--	ND (0.0389)	--	0.936	0.44	**ND (0.205)**	--	ND (0.582)	--
603827	TA2-1-BOUN-DARY-311-S	NA	ND (0.211)	--	ND (0.0403)	--	0.819	0.392	**ND (0.216)**	--	ND (0.592)	--
603827	TA2-1-BOUN-DARY-312-S	NA	ND (0.206)	--	ND (0.0383)	--	0.869	0.42	**ND (0.197)**	--	ND (0.558)	--
603827	TA2-1-BOUN-DARY-313-S	NA	9.82	1.62	0.0746	0.0258	0.988	0.475	**0.201**	0.188	ND (0.594)	--
603827	TA2-1-BOUN-DARY-314-S	NA	ND (0.225)	--	ND (0.04)	--	0.963	0.46	**0.206**	0.181	ND (0.573)	--
603827	TA2-1-BOUN-DARY-315-S	NA	ND (0.181)	--	ND (0.0322)	--	0.638	0.305	ND (0.178)	--	ND (0.445)	--
603827	TA2-1-BOUN-DARY-316-S	NA	0.446	0.206	0.0515	0.0215	0.786	0.379	0.0891	0.177	ND (0.584)	--
603827	TA2-1-BOUN-DARY-317-S	NA	0.198	0.198	0.0209	0.0187	1.02	0.478	**0.193**	0.185	ND (0.598)	--
603827	TA2-1-BOUN-DARY-318-S	NA	ND (0.507)	--	0.0264	0.0139	0.9	0.413	**ND (0.212)**	--	ND (0.755)	--
603827	TA2-1-BOUN-DARY-319-S	NA	ND (0.479)	--	0.012	0.0131	0.934	0.43	**ND (0.216)**	--	ND (0.757)	--
603827	TA2-1-BOUN-DARY-320-DUP	NA	ND (0.51)	--	ND (0.0323)	--	0.932	0.444	**ND (0.226)**	--	ND (0.771)	--
603827	TA2-1-BOUN-DARY-320-S	NA	ND (0.531)	--	ND (0.0348)	--	1.19	0.564	**ND (0.242)**	--	ND (0.832)	--
603827	TA2-1-BOUN-DARY-321-S	NA	ND (0.464)	--	ND (0.0288)	--	0.937	0.446	0.172	0.16	ND (0.712)	--
603827	TA2-1-BOUN-DARY-322-S	NA	ND (0.5)	--	0.0342	0.0349	0.971	0.441	**ND (0.222)**	--	ND (0.764)	--
603827	TA2-1-BOUN-DARY-323-S	NA	ND (0.519)	--	ND (0.0297)	--	0.989	0.464	**0.182**	0.174	ND (0.777)	--
603827	TA2-1-BOUN-DARY-324-S	NA	ND (0.491)	--	0.0193	0.0177	0.804	0.371	**ND (0.212)**	--	ND (0.725)	--
603827	TA2-1-BOUN-DARY-325-S	NA	ND (0.474)	--	**0.259**	0.056	1.08	0.507	0.125	0.164	ND (0.727)	--
603827	TA2-1-BOUN-DARY-330-S	NA	ND (0.464)	--	ND (0.0294)	--	0.957	0.461	**ND (0.203)**	--	ND (0.722)	--
603827	TA2-1-BOUN-DARY-332-S	NA	ND (0.513)	--	0.0121	0.0127	0.84	0.441	**ND (0.203)**	--	ND (0.72)	--
603827	TA2-1-BOUN-DARY-334-S	NA	ND (0.51)	--	**0.115**	0.0267	0.822	0.385	**ND (0.217)**	--	ND (0.737)	--
603827	TA2-1-BOUN-DARY-335-S	NA	1.78	0.614	**0.145**	0.0282	0.92	0.424	**ND (0.211)**	--	**2.16**	3.04
603827	TA2-1-BOUN-DARY-339-S	NA	ND (0.538)	--	ND (0.033)	--	0.946	0.446	0.142	0.173	ND (0.771)	--
603827	TA2-1-BOUN-DARY-340-DUP	NA	ND (0.493)	--	0.0238	0.0144	0.925	0.437	0.123	0.166	ND (0.59)	--
603827	TA2-1-BOUN-DARY-340-S	NA	ND (0.524)	--	0.0361	0.0165	0.944	0.449	**ND (0.229)**	--	ND (0.779)	--
603828	TA2-1-BOUN-DARY-326-S	NA	ND (0.512)	--	0.0971	0.0405	0.999	0.47	0.131	0.0871	**2.74**	3.61
603828	TA2-1-BOUN-DARY-327-S	NA	ND (0.524)	--	0.0279	0.0313	1.06	0.499	**ND (0.218)**	--	ND (0.791)	--
603828	TA2-1-BOUN-DARY-328-S	NA	ND (0.527)	--	0.0208	0.0182	0.926	0.445	**0.228**	0.179	ND (0.751)	--
603828	TA2-1-BOUN-DARY-329-S	NA	0.981	0.56	0.0633	0.0115	0.821	0.382	0.15	0.173	ND (0.777)	--
603828	TA2-1-BOUN-DARY-331-S	NA	ND (0.578)	--	0.0179	0.0142	1.09	0.507	**0.196**	0.177	ND (0.775)	--
603828	TA2-1-BOUN-DARY-333-S	NA	ND (0.521)	--	0.0334	0.0153	0.843	0.392	**ND (0.217)**	--	ND (0.773)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000,
for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241 Result	Americium-241 Error[b]	Cesium-137 Result	Cesium-137 Error[b]	Thorium-232 Result	Thorium-232 Error[b]	Uranium-235 Result	Uranium-235 Error[b]	Uranium-238 Result	Uranium-238 Error[b]
603828	TA2-1-BOUN-DARY-336-S	NA	0.717	0.324	**0.104**	0.0299	0.826	0.387	**ND (0.206)**	--	ND (0.764)	--
603828	TA2-1-BOUN-DARY-337-S	NA	0.53	0.3	0.0547	0.0236	0.872	0.422	0.107	0.196	0.696	0.565
603828	TA2-1-BOUN-DARY-338-S	NA	2.31	0.462	**0.119**	0.0317	0.723	0.354	0.179	0.164	ND (0.615)	--
603828	TA2-1-BOUN-DARY-341-S	NA	ND (0.201)	--	0.024	0.0206	0.978	0.454	**ND (0.208)**	--	ND (0.566)	--
603828	TA2-1-BOUN-DARY-342-S	NA	ND (0.211)	--	0.0449	0.0321	0.958	0.474	0.134	0.183	ND (0.582)	--
603828	TA2-1-BOUN-DARY-343-S	NA	0.528	0.179	0.034	0.0204	1.37	0.641	**ND (0.228)**	--	ND (0.626)	--
603828	TA2-1-BOUN-DARY-344-S	NA	0.64	0.331	**0.196**	0.0431	1.25	0.578	**ND (0.249)**	--	ND (0.696)	--
603828	TA2-1-BOUN-DARY-345-S	NA	ND (0.182)	--	**0.158**	0.0511	0.782	0.402	0.112	0.178	0.664	0.501
603828	TA2-1-BOUN-DARY-346-S	NA	0.611	0.394	**0.104**	0.0272	0.958	0.453	**0.194**	0.176	ND (0.566)	--
603828	TA2-1-BOUN-DARY-347-S	NA	ND (0.21)	--	ND (0.037)	--	0.967	0.465	**ND (0.226)**	--	ND (0.546)	--
603828	TA2-1-BOUN-DARY-348-S	NA	ND (0.213)	--	0.047	0.0207	0.976	0.472	0.114	0.17	ND (0.54)	--
603828	TA2-1-BOUN-DARY-349-S	NA	ND (0.199)	--	ND (0.0353)	--	1.03	0.482	**0.202**	0.165	ND (0.521)	--
603828	TA2-1-BOUN-DARY-350-S	NA	0.122	0.174	**0.108**	0.0271	ND (0.138)	--	0.0861	0.16	ND (0.454)	--
603828	TA2-1-BOUN-DARY-351-S	NA	ND (0.464)	--	0.012	0.00976	0.934	0.436	**ND (0.207)**	--	ND (0.687)	--
603828	TA2-1-BOUN-DARY-352-S	NA	0.317	0.324	**0.126**	0.0249	0.95	0.447	**ND (0.212)**	--	ND (0.742)	--
603828	TA2-1-BOUN-DARY-353-S	NA	2.27	0.464	**0.607**	0.0936	1.47	0.685	**ND (0.226)**	--	ND (0.647)	--
603828	TA2-1-BOUN-DARY-354-S	NA	3.56	0.61	**0.755**	0.107	0.954	0.447	**ND (0.204)**	--	ND (0.587)	--
603828	TA2-1-BOUN-DARY-355-S	NA	ND (0.208)	--	0.0956	0.0248	0.868	0.409	**ND (0.196)**	--	ND (0.533)	--
603828	TA2-1-BOUN-DARY-356-S	NA	1.73	0.441	**0.18**	0.0361	0.787	0.374	ND (0.179)	--	ND (0.506)	--
603828	TA2-1-BOUN-DARY-357-S	NA	1.11	0.328	**0.116**	0.0287	0.739	0.371	**0.193**	0.156	1.18	0.477
603828	TA2-1-BOUN-DARY-358-S	NA	0.719	0.294	0.0703	0.0247	0.954	0.447	0.113	0.162	ND (0.51)	--
603828	TA2-1-BOUN-DARY-359-S	NA	0.293	0.206	ND (0.0351)	--	0.941	0.434	**ND (0.193)**	--	ND (0.506)	--
603829	TA2-1-BOUN-DARY-371-S	NA	0.641	0.187	0.0331	0.0255	1.11	0.535	**ND (0.224)**	--	ND (0.605)	--
603829	TA2-1-BOUN-DARY-372-S	NA	0.614	0.278	**0.118**	0.0378	0.769	0.399	**ND (0.213)**	--	ND (0.597)	--
603829	TA2-1-BOUN-DARY-374-S	NA	8.01	1.23	**0.287**	0.0526	1.01	0.479	0.148	0.195	ND (0.643)	--
603829	TA2-1-BOUN-DARY-375-S	NA	0.376	0.182	**0.211**	0.0496	0.788	0.385	0.126	0.177	0.618	0.377
603829	TA2-1-BOUN-DARY-377-S	NA	0.834	0.28	**0.152**	0.0339	0.802	0.385	**ND (0.197)**	--	ND (0.566)	--
603829	TA2-1-BOUN-DARY-382-S	NA	ND (0.205)	--	**0.0935**	0.0384	0.853	0.404	**ND (0.194)**	--	ND (0.534)	--
603829	TA2-1-BOUN-DARY-384-S	NA	ND (0.203)	--	ND (0.0403)	--	1.03	0.478	**ND (0.206)**	--	ND (0.557)	--
603829	TA2-1-BOUN-DARY-385-S	NA	ND (0.206)	--	0.0387	0.0248	0.881	0.419	**ND (0.199)**	--	ND (0.586)	--
603829	TA2-1-BOUN-DARY-386-S	NA	ND (0.237)	--	0.0555	0.026	0.878	0.423	**ND (0.216)**	--	ND (0.606)	--
603829	TA2-1-BOUN-DARY-387-S	NA	ND (0.214)	--	0.0348	0.0225	1.11	0.525	**ND (0.199)**	--	ND (0.559)	--
603829	TA2-1-BOUN-DARY-396-S	NA	4.47	0.731	**0.147**	0.0367	0.865	0.405	0.158	0.185	ND (0.601)	--
603829	TA2-1-BOUN-DARY-397-S	NA	0.695	0.365	**0.159**	0.0373	0.887	0.423	**ND (0.223)**	--	1.09	0.577
603829	TA2-1-BOUN-DARY-398-S	NA	0.434	0.234	ND (0.0412)	--	1.04	0.485	**ND (0.218)**	--	ND (0.621)	--
603829	TA2-1-BOUN-DARY-399-S	NA	0.391	0.273	ND (0.0414)	--	0.815	0.406	**ND (0.222)**	--	ND (0.608)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000,
for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603829	TA2-1-BOUN-DARY-400-DUP	NA	ND (1.01)	--	ND (0.0335)	--	1.04	0.485	**ND (0.233)**	--	ND (0.817)	--
603829	TA2-1-BOUN-DARY-400-S	NA	1.05	0.342	0.021	0.0166	1.04	0.496	0.153	0.19	ND (0.619)	--
603829	TA2-1-BOUN-DARY-401-S	NA	0.483	0.38	ND (0.0307)	--	0.724	0.335	**ND (0.209)**	--	ND (0.719)	--
603829	TA2-1-BOUN-DARY-402-S	NA	ND (0.44)	--	0.0258	0.0176	0.794	0.379	**ND (0.2)**	--	ND (0.689)	--
603830	TA2-1-BOUN-DARY-404-S	NA	ND (0.491)	--	0.019	0.0169	0.821	0.383	**ND (0.215)**	--	ND (0.752)	--
603830	TA2-1-BOUN-DARY-405-S	NA	ND (0.512)	--	0.0333	0.0134	0.837	0.389	**ND (0.229)**	--	ND (0.791)	--
603830	TA2-1-BOUN-DARY-406-S	NA	ND (0.524)	--	**0.157**	0.03	0.994	0.465	**0.226**	0.178	ND (0.778)	--
603830	TA2-1-BOUN-DARY-407-S	NA	ND (0.468)	--	**0.14**	0.0265	0.79	0.375	0.144	0.164	ND (0.705)	--
603830	TA2-1-BOUN-DARY-408-S	NA	10.1	1.61	**0.0942**	0.0235	0.783	0.379	**ND (0.213)**	--	ND (0.739)	--
603830	TA2-1-BOUN-DARY-409-S	NA	14.5	2.27	0.0975	0.0444	0.79	0.374	**ND (0.228)**	--	ND (0.775)	--
603830	TA2-1-BOUN-DARY-410-S	NA	8.88	1.55	0.0363	0.0161	0.675	0.313	**ND (0.192)**	--	ND (0.651)	--
603830	TA2-1-BOUN-DARY-411-S	NA	5.16	0.963	0.0646	0.0205	0.854	0.407	**ND (0.215)**	--	ND (0.759)	--
603830	TA2-1-BOUN-DARY-412-S	NA	10.8	1.75	0.0857	0.152	0.979	0.451	**ND (0.215)**	--	ND (0.762)	--
603830	TA2-1-BOUN-DARY-413-S	NA	ND (0.515)	--	**0.234**	0.0622	0.915	0.422	0.118	0.175	ND (0.771)	--
603830	TA2-1-BOUN-DARY-414-S	NA	1.2	0.473	**0.136**	0.034	0.966	0.449	**ND (0.238)**	--	ND (0.828)	--
603830	TA2-1-BOUN-DARY-415-S	NA	5.99	1.05	**0.158**	0.0304	0.825	0.39	**ND (0.215)**	--	ND (0.731)	--
603830	TA2-1-BOUN-DARY-416-S	NA	0.728	0.366	**0.173**	0.0315	1.02	0.489	**ND (0.215)**	--	ND (0.79)	--
603830	TA2-1-BOUN-DARY-417-S	NA	1.65	0.593	**0.241**	0.0426	1.01	0.475	**ND (0.231)**	--	ND (0.834)	--
603830	TA2-1-BOUN-DARY-418-S	NA	2.63	0.725	**0.306**	0.0484	0.975	0.451	0.131	0.186	ND (0.832)	--
603830	TA2-1-BOUN-DARY-419-S	NA	0.379	0.377	**0.165**	0.031	0.887	0.427	**ND (0.221)**	--	ND (0.752)	--
603830	TA2-1-BOUN-DARY-420-DUP	NA	1.07	0.514	0.0394	0.0331	0.993	0.484	**ND (0.213)**	--	ND (0.575)	--
603830	TA2-1-BOUN-DARY-420-S	NA	0.969	0.388	0.0226	0.00939	0.805	0.381	0.131	0.163	ND (0.717)	--
603830	TA2-1-BOUN-DARY-421-S	NA	1.09	0.497	**0.263**	0.0643	0.802	0.387	0.186	0.178	ND (0.761)	--
603830	TA2-1-BOUN-DARY-425-S	NA	15.1	2.35	0.0714	0.0222	0.54	0.301	0.153	0.178	ND (0.778)	--
603830	TA2-1-BOUN-DARY-426-S	NA	4.56	0.903	**0.302**	0.0482	0.943	0.44	**ND (0.226)**	--	ND (0.777)	--
603830	TA2-1-BOUN-DARY-427-S	NA	1.77	0.496	**0.126**	0.0429	1.01	0.483	**ND (0.214)**	--	ND (0.751)	--
603830	TA2-1-BOUN-DARY-428-S	NA	3.95	0.84	**0.186**	0.0327	0.945	0.438	**ND (0.208)**	--	ND (0.742)	--
603830	TA2-1-BOUN-DARY-429-S	NA	0.536	0.42	**0.186**	0.0378	0.909	0.42	**ND (0.214)**	--	ND (0.748)	--
603830	TA2-1-BOUN-DARY-437-S	NA	ND (0.496)	--	0.0367	0.0411	1.01	0.465	**ND (0.213)**	--	0.842	0.645
603830	TA2-1-BOUN-DARY-438-S	NA	ND (0.583)	--	0.042	0.0191	1.06	0.489	**ND (0.257)**	--	ND (0.912)	--
603830	TA2-1-BOUN-DARY-439-S	NA	ND (0.543)	--	0.0784	0.022	0.968	0.467	**ND (0.229)**	--	ND (0.818)	--
603831	TA2-1-BOUN-DARY-422-S	NA	0.794	0.269	0.0556	0.0229	0.834	0.391	**ND (0.199)**	--	ND (0.523)	--
603831	TA2-1-BOUN-DARY-423-S	NA	0.747	0.294	0.0344	0.0199	0.78	0.381	**ND (0.221)**	--	ND (0.615)	--
603831	TA2-1-BOUN-DARY-424-S	NA	0.506	0.285	0.0347	0.0239	0.898	0.419	**ND (0.213)**	--	ND (0.594)	--
603831	TA2-1-BOUN-DARY-430-S	NA	0.766	0.245	**0.188**	0.0414	0.887	0.423	**ND (0.206)**	--	ND (0.572)	--
603831	TA2-1-BOUN-DARY-431-S	NA	25.3	3.68	0.0524	0.0206	0.794	0.375	0.0974	0.18	ND (0.554)	--
603831	TA2-1-BOUN-DARY-432-S	NA	3.92	0.655	0.0895	0.0265	0.726	0.354	0.139	0.177	ND (0.541)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603831	TA2-1-BOUN-DARY-433-S	NA	5.81	0.893	**0.156**	0.0369	1.1	0.529	0.13	0.174	1.11	1.5
603831	TA2-1-BOUN-DARY-434-S	NA	0.579	0.257	**0.136**	0.0367	0.966	0.479	0.122	0.201	1.13	0.621
603831	TA2-1-BOUN-DARY-435-S	NA	ND (0.208)	--	**0.152**	0.0323	0.885	0.417	**ND (0.206)**	--	ND (0.547)	--
603831	TA2-1-BOUN-DARY-436-S	NA	0.532	0.258	**0.102**	0.029	1.12	0.552	**ND (0.226)**	--	ND (0.653)	--
603831	TA2-1-BOUN-DARY-440-DUP	NA	3.53	0.605	**0.0905**	0.028	0.9	0.422	**ND (0.202)**	--	ND (0.558)	--
603831	TA2-1-BOUN-DARY-440-S	NA	3.51	0.594	**0.0956**	0.0293	0.78	0.365	0.103	0.175	ND (0.568)	--
603831	TA2-1-BOUN-DARY-441-S	NA	0.994	0.273	**0.11**	0.0303	0.915	0.46	**ND (0.213)**	--	ND (0.587)	--
603831	TA2-1-BOUN-DARY-442-S	NA	0.5	0.241	**0.108**	0.0341	0.86	0.414	**ND (0.231)**	--	ND (0.651)	--
603831	TA2-1-BOUN-DARY-443-S	NA	0.502	0.226	**0.246**	0.0431	0.866	0.407	**ND (0.213)**	--	ND (0.585)	--
603831	TA2-1-BOUN-DARY-444-S	NA	6.48	0.993	**0.108**	0.0325	0.811	0.392	**ND (0.225)**	--	ND (0.617)	--
603831	TA2-1-BOUN-DARY-445-S	NA	5.88	0.986	**0.309**	0.0523	0.676	0.334	**ND (0.2)**	--	ND (0.555)	--
603831	TA2-1-BOUN-DARY-446-S	NA	20.4	2.99	**0.139**	0.0312	0.854	0.413	0.125	0.189	ND (0.606)	--
603831	TA2-1-BOUN-DARY-447-S	NA	20.5	3.09	**0.154**	0.0384	1.11	0.527	**ND (0.22)**	--	ND (0.632)	--
603831	TA2-1-BOUN-DARY-448-S	NA	0.225	0.242	0.0488	0.0328	0.779	0.405	**ND (0.222)**	--	ND (0.607)	--
603831	TA2-1-BOUN-DARY-449-S	NA	ND (0.233)	--	**0.284**	0.0498	0.843	0.395	**ND (0.205)**	--	ND (0.576)	--
603831	TA2-1-BOUN-DARY-450-S	NA	1.28	0.3	**0.141**	0.0352	0.768	0.362	**ND (0.196)**	--	ND (0.534)	--
603831	TA2-1-BOUN-DARY-451-S	NA	27.1	3.95	**0.0948**	0.0279	0.825	0.418	**ND (0.21)**	--	ND (0.61)	--
603831	TA2-1-BOUN-DARY-452-S	NA	14.5	2.13	ND (0.0247)	--	0.955	0.475	**ND (0.213)**	--	ND (0.588)	--
603831	TA2-1-BOUN-DARY-453-S	NA	2.73	0.641	**0.293**	0.0509	0.968	0.464	**ND (0.232)**	--	ND (0.615)	--
603831	TA2-1-BOUN-DARY-454-S	NA	2.41	0.444	ND (0.0297)	--	0.827	0.404	**ND (0.215)**	--	ND (0.599)	--
603831	TA2-1-BOUN-DARY-455-S	NA	0.276	0.201	**0.148**	0.0363	1.07	0.507	**ND (0.209)**	--	ND (0.585)	--
603833	TA2-1-BOUN-DARY-456-S	NA	0.461	0.222	**0.165**	0.0339	0.945	0.468	**0.218**	0.173	1.13	1.89
603833	TA2-1-BOUN-DARY-459-S	NA	ND (0.228)	--	**0.098**	0.0361	0.821	0.386	**ND (0.202)**	--	ND (0.553)	--
603833	TA2-1-BOUN-DARY-460-S	NA	ND (0.216)	--	0.0725	0.0254	0.887	0.428	**ND (0.216)**	--	ND (0.608)	--
603833	TA2-1-BOUN-DARY-461-S	NA	ND (0.212)	--	**0.174**	0.0372	0.935	0.458	**0.189**	0.173	ND (0.564)	--
603833	TA2-1-BOUN-DARY-462-S	NA	0.66	0.228	**0.151**	0.0323	0.958	0.46	**ND (0.208)**	--	ND (0.564)	--
603833	TA2-1-BOUN-DARY-469-S	NA	0.974	0.29	**0.16**	0.0346	0.855	0.397	**ND (0.195)**	--	ND (0.525)	--
603833	TA2-1-BOUN-DARY-473-S	NA	0.454	0.205	0.0687	0.0236	0.835	0.426	**ND (0.204)**	--	0.935	0.488
603833	TA2-1-BOUN-DARY-475-S	NA	0.917	0.281	**0.151**	0.0334	1.09	0.511	**ND (0.206)**	--	ND (0.589)	--
603833	TA2-1-BOUN-DARY-476-S	NA	0.338	0.252	0.0776	0.026	0.64	0.313	**ND (0.191)**	--	ND (0.576)	--
603833	TA2-1-BOUN-DARY-478-S	NA	ND (0.217)	--	**0.104**	0.025	0.888	0.449	**ND (0.204)**	--	ND (0.574)	--
603833	TA2-1-BOUN-DARY-480-DUP	NA	ND (0.215)	--	**0.111**	0.0305	0.849	0.407	**ND (0.214)**	--	ND (0.576)	--
603833	TA2-1-BOUN-DARY-480-S	NA	ND (0.208)	--	**0.121**	0.0317	0.892	0.42	**ND (0.206)**	--	ND (0.572)	--
603844	TA2-1-BOUN-DARY-457-S	NA	0.942	0.486	**0.132**	0.0284	0.739	0.354	**ND (0.2)**	--	ND (0.701)	--
603844	TA2-1-BOUN-DARY-458-S	NA	1.27	0.567	**0.147**	0.0323	0.949	0.449	**ND (0.215)**	--	ND (0.746)	--
603844	TA2-1-BOUN-DARY-460-DUP	NA	ND (0.527)	--	0.071	0.021	1.13	0.546	**0.231**	0.181	ND (0.808)	--
603844	TA2-1-BOUN-DARY-463-S	NA	ND (0.466)	--	0.0381	0.018	0.769	0.377	0.157	0.161	ND (0.707)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Continued)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603844	TA2-1-BOUN-DARY-464-S	NA	0.582	0.568	**0.25**	0.0409	0.922	0.451	0.144	0.165	ND (0.719)	--
603844	TA2-1-BOUN-DARY-465-S	NA	0.305	0.368	**0.246**	0.0408	0.943	0.446	**ND (0.206)**	--	ND (0.734)	--
603844	TA2-1-BOUN-DARY-466-S	NA	0.982	0.501	**0.117**	0.0234	0.835	0.409	**ND (0.208)**	--	ND (0.698)	--
603844	TA2-1-BOUN-DARY-467-S	NA	11.5	1.83	0.063	0.0394	0.866	0.409	**ND (0.217)**	--	ND (0.769)	--
603844	TA2-1-BOUN-DARY-468-S	NA	2.93	0.81	**0.196**	0.0362	0.922	0.428	**ND (0.234)**	--	ND (0.831)	--
603844	TA2-1-BOUN-DARY-470-S	NA	ND (0.478)	--	**0.199**	0.0376	0.936	0.447	**ND (0.205)**	--	ND (0.711)	--
603844	TA2-1-BOUN-DARY-471-S	NA	0.888	0.563	**0.101**	0.0256	1.01	0.472	0.105	0.171	ND (0.737)	--
603844	TA2-1-BOUN-DARY-472-S	NA	1.89	0.508	0.0752	0.0217	0.784	0.365	0.106	0.172	ND (0.75)	--
603844	TA2-1-BOUN-DARY-474-S	NA	ND (0.476)	--	**0.102**	0.0218	0.792	0.375	0.166	0.165	ND (0.702)	--
603844	TA2-1-BOUN-DARY-477-S	NA	ND (0.485)	--	**0.168**	0.0317	0.713	0.349	0.0964	0.0871	ND (0.701)	--
603844	TA2-1-BOUN-DARY-479-S	NA	ND (0.511)	--	**0.194**	0.0359	0.864	0.406	**ND (0.221)**	--	ND (0.755)	--
604476	TA2-1-POST-GRIZ-001-S	NA	1.96	0.358	**0.183**	0.0414	0.931	0.45	**ND (0.234)**	--	ND (0.675)	--
604476	TA2-1-POST-GRIZ-002-S	NA	2.88	0.481	**0.146**	0.0383	1.2	0.554	**ND (0.235)**	--	**1.7**	0.435
604476	TA2-1-POST-GRIZ-003-S	NA	1.38	0.284	**0.211**	0.0469	1.22	0.572	**ND (0.258)**	--	ND (0.754)	--
604476	TA2-1-POST-GRIZ-004-S	NA	1.73	0.334	**0.174**	0.0448	1.04	0.506	**0.201**	0.222	ND (0.805)	--
604476	TA2-1-POST-GRIZ-005-S	NA	2.14	0.375	**0.168**	0.0385	0.994	0.47	0.136	0.153	**1.34**	0.375
604476	TA2-1-POST-GRIZ-006-S	NA	2.29	0.394	**0.172**	0.041	1.31	0.606	0.156	0.207	**2.03**	0.485
604476	TA2-1-POST-GRIZ-007-S	NA	1.71	0.323	**0.126**	0.0355	1.06	0.499	0.134	0.191	ND (0.665)	--
604476	TA2-1-POST-GRIZ-008-S	NA	2.26	0.394	**0.0867**	0.0319	1.13	0.533	**0.261**	0.215	**1.41**	0.398
604476	TA2-1-POST-GRIZ-009-S	NA	2.44	0.416	**0.284**	0.0537	1.05	0.498	**ND (0.232)**	--	**1.77**	0.426
604476	TA2-1-POST-GRIZ-010-S	NA	2.59	0.447	**0.449**	0.0724	0.837	0.416	**ND (0.264)**	--	**5.25**	0.905
604476	TA2-1-POST-GRIZ-011-S	NA	1.75	0.331	**0.169**	0.038	1.16	0.541	**ND (0.266)**	--	**1.54**	0.409
604476	TA2-1-POST-GRIZ-012-S	NA	2.07	0.373	**0.191**	0.043	1.07	0.508	**ND (0.243)**	--	1.29	0.393
604476	TA2-1-POST-GRIZ-013-S	NA	1.8	0.34	**0.72**	0.105	0.982	0.475	**ND (0.234)**	--	1.21	0.37
604476	TA2-1-POST-GRIZ-014-S	NA	1.7	0.317	**0.161**	0.0367	1.16	0.538	**ND (0.213)**	--	1.19	0.351
604476	TA2-1-POST-GRIZ-015-DUP	NA	4.15	0.8	**0.211**	0.0385	0.998	0.459	**ND (0.232)**	--	**1.47**	0.408
604476	TA2-1-POST-GRIZ-015-S	NA	1.63	0.314	**0.147**	0.0363	0.93	0.445	**ND (0.215)**	--	1.21	0.351
604476	TA2-1-POST-GRIZ-016-S	NA	1.95	0.584	**0.188**	0.035	1.22	0.564	0.143	0.169	**2.85**	0.576
604476	TA2-1-POST-GRIZ-017-S	NA	2.31	0.685	**0.147**	0.0335	1.31	0.597	**ND (0.245)**	--	ND (0.882)	--
604476	TA2-1-POST-GRIZ-018-S	NA	2.36	0.683	**0.195**	0.0332	1.17	0.547	**0.218**	0.21	**2.06**	0.501
604476	TA2-1-POST-GRIZ-019-S	NA	2.51	0.635	**0.206**	0.0422	1.23	0.577	0.168	0.18	ND (0.992)	--
604476	TA2-1-POST-GRIZ-020-S	NA	1.3	0.495	**0.313**	0.0518	1.24	0.562	**ND (0.259)**	--	**1.6**	0.44
604476	TA2-1-POST-GRIZ-021-S	NA	2.79	0.736	**0.2**	0.0407	1.37	0.637	**ND (0.268)**	--	ND (0.984)	--
604476	TA2-1-POST-GRIZ-022-S	NA	3.35	0.841	**0.168**	0.034	1.3	0.615	0.152	0.208	ND (0.956)	--
604476	TA2-1-POST-GRIZ-023-S	NA	2.77	0.715	**0.314**	0.0652	1.02	0.47	**ND (0.236)**	--	**3.93**	0.719
604476	TA2-1-POST-GRIZ-024-S	NA	3.71	0.837	**0.357**	0.0554	1.16	0.529	**0.211**	0.199	**3.37**	0.661
604476	TA2-1-POST-GRIZ-025-S	NA	3.02	0.92	**0.291**	0.0544	1.43	0.683	**ND (0.332)**	--	**2.97**	0.668
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-5 (Concluded)
Summary of Gamma Spectroscopy Analytical Results, January 1997–October 2000, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241 Result	Americium-241 Error[b]	Cesium-137 Result	Cesium-137 Error[b]	Thorium-232 Result	Thorium-232 Error[b]	Uranium-235 Result	Uranium-235 Error[b]	Uranium-238 Result	Uranium-238 Error[b]
604476	TA2-1-POST-GRIZ-026-S	NA	1.34	0.379	**0.142**	0.028	0.791	0.384	**ND (0.193)**	--	ND (0.713)	--
604476	TA2-1-POST-GRIZ-027-S	NA	3.03	0.5	**0.208**	0.0426	0.991	0.474	**ND (0.226)**	--	**1.47**	0.406
604476	TA2-1-POST-GRIZ-028-S	NA	1.49	0.28	**0.202**	0.0413	1.13	0.524	0.125	0.152	**1.72**	0.412
604476	TA2-1-POST-GRIZ-029-S	NA	1.34	0.277	**0.143**	0.0363	1.08	0.505	**0.202**	0.19	**1.44**	0.381
604476	TA2-1-POST-GRIZ-030-DUP	NA	1.84	0.351	**0.133**	0.0381	1.05	0.503	**ND (0.248)**	--	**1.44**	0.414
604476	TA2-1-POST-GRIZ-030-S	NA	2.47	0.446	**0.186**	0.0486	1.26	0.599	**0.195**	0.235	1.24	0.417
6202	TA2-RWL-CONT. SP#010-S	NA	NR	--	NR	--	0.954	0.099	0.066	0.032	**1.65**	0.18
6203	TA2-RWL-CONT. SP. #011-S	NA	NR	--	NR	--	0.96	0.11	0.071	0.039	1.17	0.16
6204	TA2-RWL-CONT. SP# 012-S	NA	NR	--	NR	--	1.1	0.12	0.045	0.018	**4.13**	0.272
6205	TA2-RWL-CONT. SP# 013-S	NA	NR	--	NR	--	**3.47**	0.28	0.46	0.13	**13.6**	0.95
6206	TA2-RWL-CONT. SP# 014-S	NA	NR	--	NR	--	1.08	0.12	0.176	0.053	**4.19**	0.33
6207	TA2-RWL-CONT. SP. #017-S	NA	NR	--	NR	--	0.83	0.11	0.169	0.058	**1.8**	0.2
6208	TA2-RWL-CONT. SP#018-S	NA	NR	--	NR	--	1.44	0.14	0.159	0.057	1.12	0.15
6209	TA2-RWL-CONT. SP. #019-S	NA	NR	--	NR	--	**1.76**	0.14	0.073	0.041	0.85	0.14
6210	TA2-RWL-CONT. SP. #020-S	NA	NR	--	NR	--	0.92	0.11	0.108	0.074	**2.8**	0.39
6211	TA2-RWL-CONT. SP# 021-S	NA	NR	--	NR	--	0.87	0.1	0.082	0.039	**1.9**	0.21
6212	TA2-RWL-CONT. SP# 022-S	NA	NR	--	NR	--	0.791	0.083	**3.05**	0.34	**70.4**	3.8
6213	TA2-RWL-CONT. SP# 026-S	NA	NR	--	NR	--	1.34	0.12	0.1	0.04	1.28	0.15
6214	TA2-RWL-CONT. SP# 001-S	NA	6.06	0.65	0.045	0.026	0.83	0.081	0.073	0.034	0.85	0.12
6228	TA2-RWL-CONT.SP#021-S	NA	0.995	0.188	0.0398	0.0268	0.546	0.275	ND (0.175)	--	ND (0.879)	--
6229	TA2-RWL-CONT.SP#022-S	NA	1.85	0.402	ND (0.0354)	--	0.65	0.336	**2.83**	0.485	**51.6**	12.8
6230	TA2-RWL-CONT.SP#026-S	NA	0.205	0.101	**0.512**	0.214	ND (0.156)	--	**ND (0.196)**	--	**ND (1.37)**	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie September 1997, North Area Supergroup.

- bgs = Below ground surface.
- CONT = Contaminated.
- DUP = Duplicate.
- ER = Environmental Restoration.
- ft = Foot (feet).
- ID = Identification.
- NA = Not applicable (depth not applicable for soil pile).
- ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
- ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
- NR = Not required.
- NS = Not specified by Dinwiddie September 1997.
- pCi/g = Picocurie(s) per gram.
- POSTGRIZ = Post grizzly (post sieve/screen)
- POSTGRZ = Post grizzly.
- POSTGS = Post grizzly.
- RET = Return.
- S = Soil.
- SGSCOB = Segmented Gate System Cobbles.
- SP = Soil Pile.
- SWMU = Solid Waste Management Unit.
- TA2 = Technical Area II.
- -- = Error not calculated for nondetectable results.

Table B-6
Summary of Isotopic Plutonium Analytical Results, January–February 1997, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Plutonium-238 Result	Plutonium-238 Error[b]	Plutonium-239/240 Result	Plutonium-239/240 Error[b]
6202	TA2-RWL-CONT. SP#010-S	NA	ND (0.0049)	--	0.064	0.025
6203	TA2-RWL-CONT. SP. #011-S	NA	0.022	0.013	0.575	0.068
6204	TA2-RWL-CONT. SP# 012-S	NA	0.01	0.01	0.154	0.038
6205	TA2-RWL-CONT. SP# 013-S	NA	2.23	0.18	113.5	5.8
6206	TA2-RWL-CONT. SP# 014-S	NA	0.346	0.058	14.56	0.81
6207	TA2-RWL-CONT. SP. #017-S	NA	0.213	0.047	9.11	0.54
6208	TA2-RWL-CONT. SP#018-S	NA	ND (0.0042)	--	0.038	0.019
6209	TA2-RWL-CONT. SP. #019-S	NA	0.011	0.011	0.069	0.026
6210	TA2-RWL-CONT. SP. #020-S	NA	5.8	0.84	273	15
6211	TA2-RWL-CONT. SP# 021-S	NA	0.06	0.026	3.32	0.25
6212	TA2-RWL-CONT. SP# 022-S	NA	0.5	0.072	25.5	1.4
6213	TA2-RWL-CONT. SP# 026-S	NA	NR	--	2.45	0.2
6214	TA2-RWL-CONT. SP# 001-S	NA	0.626	0.072	31.1	1.6

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.

bgs = Below ground surface.
CONT = Contaminated.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
NR = Not required.
pCi/g = Picocurie(s) per gram.
RWL = Radioactive Waste Landfill.
S = Soil.
SP = Soil Pile.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
-- = Error not calculated for nondetectable results.

Table B-7
Summary of Tritium Analytical Results, January–February 1997, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Activity
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium pCi/L
603748	TA2-1-RET1-S	NA	**19,000**
603748	TA2-1-RET2-S	NA	**9,160**
603748	TA2-1-SGS1-S	NA	**127,000**
603748	TA2-1-SGS2-S	NA	**92,500**
6202	TA2-RWL-CONT. SP#010-S	NA	**138,400**
6203	TA2-RWL-CONT. SP. #011-S	NA	**2,980,000**
6204	TA2-RWL-CONT. SP# 012-S	NA	**56,600**
6205	TA2-RWL-CONT. SP# 013-S	NA	**453,000**
6206	TA2-RWL-CONT. SP# 014-S	NA	**1,167,000**
6207	TA2-RWL-CONT. SP. #017-S	NA	**1,046,000**
6208	TA2-RWL-CONT. SP#018-S	NA	**72,200**
6209	TA2-RWL-CONT. SP. #019-S	NA	**61,100**
6210	TA2-RWL-CONT. SP. #020-S	NA	**3,180,000**
6211	TA2-RWL-CONT. SP# 021-S	NA	**1,701,000**
6212	TA2-RWL-CONT. SP# 022-S	NA	**18,580,000**
6213	TA2-RWL-CONT. SP# 026-S	NA	**845,000**
6214	TA2-RWL-CONT. SP# 001-S	NA	**1,460**
Background Activity[b]			420

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Tharp, February 1999.

bgs = Below ground surface.
CONT = Contaminated.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable (depth not applicable for soil pile).
pCi/L = Picocurie(s) per liter.
RET = Return.
RWL = Radioactive Waste Landfill.
S = Soil.
SGS = Segmented Gate System.
SP = Soil Pile.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.

Table B-8
Summary of Metals Analytical Results, January–March 1997, October 2000 and May 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Metals (EPA Method 6010/6020/ 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
603748	TA2-1-RET1-S	NA	4.2	132	0.53	0.457 J (0.49)	9.04	**11.7**	**0.261**	9.59	0.501	ND (0.101)	NR
603748	TA2-1-RET2-S	NA	3.55	136	0.521	0.178 J (0.459)	8.55	**11.4**	**0.237**	8.65	0.532	ND (0.101)	NR
603748	TA2-1-SGS1-S	NA	3.11	140	0.419 J (0.472)	1	7.12	**17.7**	**1.46**	9.48	0.441 J (0.472)	0.332 J (0.472)	NR
603748	TA2-1-SGS2-S	NA	2.89	119	0.373 J (0.481)	0.851	5.42	**13.2**	**1.62**	9.97	0.4 J (0.481)	0.218 J (0.481)	NR
604477	TA2-1-POST-GRIZ-001-S	NA	**4.55**	126	0.603	0.596	**13.9**	10	**0.248**	11.1	**1.03**	ND (0.0578)	1.84
604477	TA2-1-POST-GRIZ-002-S	NA	4.05	134	0.623	ND (0.013)	**13.7**	10.6	**0.231**	11.3	**1.01**	ND (0.0578)	2.16
604477	TA2-1-POST-GRIZ-003-S	NA	**4.54**	137	0.649	ND (0.013)	**13.7**	10.2	**0.284**	11.7	**1.13**	0.127 J (0.472)	2.16
604477	TA2-1-POST-GRIZ-004-S	NA	4.4	163	0.671	ND (0.013)	**13.4**	9.75	**0.26**	11.1	1	ND (0.0578)	1.91
604477	TA2-1-POST-GRIZ-005-S	NA	**4.49**	140	0.625	0.116 J (0.481)	**14**	9.75	**0.285**	11.4	1	ND (0.0578)	**2.37**
604477	TA2-1-POST-GRIZ-006-S	NA	4.09	129	0.601	0.257 J (0.495)	**14.5**	10.1	**0.357**	11.3	0.751	ND (0.0578)	**2.72**
604477	TA2-1-POST-GRIZ-007-S	NA	3.92	126	0.598	0.443 J (0.463)	**13.3**	9.75	**0.219**	12.8	0.71	0.245 J (0.463)	2.16
604477	TA2-1-POST-GRIZ-008-S	NA	4.33	122	0.598	**2.18**	12	10.1	**0.271**	10.1	0.997	ND (0.0578)	1.91
604477	TA2-1-POST-GRIZ-009-S	NA	4.34	142	0.618	0.458 J (0.49)	**13.5**	10.4	**0.44**	12.4	0.997	0.369 J (0.49)	**2.71**
604477	TA2-1-POST-GRIZ-010-S	NA	4.33	129	0.597	0.302 J (0.495)	**12.8**	9.64	**0.323**	10.7	0.674	ND (0.0578)	**2.66**
604477	TA2-1-POST-GRIZ-011-S	NA	4.13	138	0.631	**1.12**	**14.8**	10.3	**0.434**	12.2	**1.03**	0.272 J (0.49)	**5.4**
604477	TA2-1-POST-GRIZ-012-S	NA	4.27	139	0.629	0.55	**13.9**	10.2	**0.417**	12.2	0.866	0.328 J (0.481)	**3.26**
604477	TA2-1-POST-GRIZ-013-S	NA	4.33	140	0.634	ND (0.013)	**13.4**	10	**0.268**	11.2	0.85	ND (0.0578)	2.02
604477	TA2-1-POST-GRIZ-014-S	NA	3.99	128	0.627	ND (0.013)	12.7	9.36	**0.255**	10.5	0.581	ND (0.0578)	2.05
604477	TA2-1-POST-GRIZ-015-DUP	NA	4.18	120	0.589	0.0986 J (0.467)	11.5	9.09	**0.235**	10.1	0.806	ND (0.0578)	**2.85**
604477	TA2-1-POST-GRIZ-015-S	NA	4.25	120	0.582	0.0778 J (0.476)	**13.8**	9.55	**0.26**	10.8	**1.33**	ND (0.0578)	**2.87**
604477	TA2-1-POST-GRIZ-016-S	NA	3.96	132	0.58	0.141 J (0.495)	12.5	11.1	**0.263**	10.8	0.693	ND (0.0578)	**2.7**
604477	TA2-1-POST-GRIZ-017-S	NA	4.24	143	0.603	0.113 J (0.459)	12.7	9.48	**0.238**	11.4	0.546	ND (0.0578)	**2.67**
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-8 (Continued)
Summary of Metals Analytical Results, January–March 1997, October 2000 and May 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Metals (EPA Method 6010/6020/ 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
604477	TA2-1-POST-GRIZ-018-S	NA	**4.41**	139	0.627	0.0456 J (0.495)	**13.7**	9.65	**0.205**	11.8	0.6	ND (0.0578)	3.05
604477	TA2-1-POST-GRIZ-019-S	NA	4.18	131	0.61	0.0303 J (0.49)	**13.4**	9.86	**0.321**	11.1	**1.09**	ND (0.0578)	2.12
604477	TA2-1-POST-GRIZ-020-S	NA	3.48	126	0.532	0.744	9.72	9.9	**0.318**	9.55	ND (0.135)	ND (0.0578)	**2.45**
604477	TA2-1-POST-GRIZ-021-S	NA	3.32	118	0.52	0.689	9.73	9.71	**0.271**	9.2	ND (0.135)	ND (0.0578)	**2.66**
604477	TA2-1-POST-GRIZ-022-S	NA	3.22	113	0.51	0.685	9.05	9.17	**0.241**	8.91	ND (0.135)	ND (0.0578)	**2.4**
604477	TA2-1-POST-GRIZ-023-S	NA	2.89	108	0.417 J (0.485)	**1.19**	8.61	10.9	**0.361**	8.24	ND (0.135)	ND (0.0578)	**11.8**
604477	TA2-1-POST-GRIZ-024-S	NA	2.87	109	0.419 J (0.485)	**1.11**	8.33	9.68	**0.485**	7.78	ND (0.135)	ND (0.0578)	**7.73**
604477	TA2-1-POST-GRIZ-025-S	NA	3.45	124	0.495	**0.95**	9.11	9.29	**0.307**	9.87	ND (0.135)	ND (0.0578)	**2.78**
604477	TA2-1-POST-GRIZ-026-S	NA	3.34	129	0.514	**1.19**	10.2	**11.9**	**0.421**	10.1	ND (0.135)	0.206 J (0.476)	**4.04**
604477	TA2-1-POST-GRIZ-027-S	NA	3.58	126	0.503	**1.15**	9.69	10.4	**0.4**	9.92	ND (0.135)	0.174 J (0.49)	**3.44**
604477	TA2-1-POST-GRIZ-028-S	NA	3.73	116	0.469 J (0.49)	**1.3**	8.77	**41.2**	**0.294**	8.8	ND (0.135)	0.174 J (0.49)	**5.15**
604477	TA2-1-POST-GRIZ-029-S	NA	3.33	123	0.577	**1.27**	10.1	9.51	**0.275**	10.3	ND (0.135)	ND (0.0578)	2.04
604477	TA2-1-POST-GRIZ-030-DUP	NA	3.45	120	0.537	0.769	9.93	10.5	**0.248**	9.67	ND (0.135)	0.115 J (0.49)	2.06
604477	TA2-1-POST-GRIZ-030-S	NA	3.55	120	0.533	0.688	10.1	9.27	**0.227**	9.44	ND (0.135)	ND (0.0578)	2.1
6231	TA2-RWL-CONT.SP#001-S	NA	3.6	130	NR	0.18	7.1	6.8	ND (0.044)	NR	0.9 J (1.3)	0.067 J (0.18)	NR
6232	TA2-RWL-CONT.SP#002-S	NA	2.5 J (0.64)	190	NR	0.45	11	7.7	ND (0.043)	NR	**1 J (1.3)**	ND (0.043)	NR
6233	TA2-RWL-CONT.SP#003-S	NA	3	120	NR	0.5	8.9	9.5	ND (0.043)	NR	0.97 J (1.3)	ND (0.043)	NR
6234	TA2-RWL-CONT.SP#004-S	NA	2.6	130	NR	0.35	7.7	6.3	ND (0.041)	NR	0.82 J (1.2)	0.068 J (0.16)	NR
6235	TA2-RWL-CONT.SP#005-S	NA	2.4 J (0.63)	120	NR	0.32	7.1	6.2	ND (0.042)	NR	0.69 J (1.3)	ND (0.042)	NR
6236	TA2-RWL-CONT. SP#006-S	NA	2.4 J (0.64)	170	NR	**4.1**	8.5	5.4	ND (0.042)	NR	0.97 J (1.3)	ND (0.042)	NR
6237	TA2-RWL-CONT. SP#007-S	NA	3.3	180	NR	0.53	6.4	4.6	ND (0.041)	NR	0.58 J (1.2)	ND (0.041)	NR
6238	TA2-RWL-CONT. SP#008-S	NA	1.3 J (2.4)	200	NR	0.6	11	5.8	**0.14 J (0.16)**	NR	0.79 J (1.2)	ND (0.04)	NR
6239	TA2-RWL-CONT. SP#009-S	NA	2 J (2.5)	110	NR	0.65	7.3	6.6	**1.8**	NR	0.48 J (1.3)	ND (0.042)	NR
6240	TA2-RWL-CONT. SP#010-S	NA	2.4 J (2.7)	120	NR	0.2	6.8	4.9	**0.54**	NR	0.58 J (1.4)	ND (0.046)	NR
6241	TA2-RWL-CONT. SP#011-S	NA	2.2 J (2.5)	140	NR	0.25	16	8.4	0.074 J (0.17)	NR	0.66 J (1.2)	ND (0.042)	NR
6242	TA2-RWL-CONT.SP#13-S	NA	2.2 J (2.4)	**240**	NR	0.44	11	6.7	0.095 J (0.16)	NR	**1.1 J (1.2)**	ND (0.041)	NR
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-8 (Concluded)
Summary of Metals Analytical Results, January–March 1997, October 2000 and May 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 2 through 7

Sample Attributes			Metals (EPA Method 6010/6020/ 7471) (mg/kg)											
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
6243	TA2-RWL-CONTAMINATED SP-#12-S	NA	1.8 J (2.4)	150	NR	0.32	8.4	6.5	**0.18**	NR	0.85 J (1.2)	ND (0.04)	NR
6244	TA2-RWL-CONT.SP#14-S	NA	2 J (2.6)	120	NR	0.41	12	7.3	**0.19**	NR	**1.3**	ND (0.043)	NR
6245	TA2-RWL-CONT. SP#015-S	NA	2.6	140	0.33 E	**3.6**	9.8	9.4	**1.5**	NR	**1.1 J (1.3)**	0.067 J (0.17)	NR
6246	TA2-RWL-CONT.SP#016-S	NA	2.1 J (2.4)	130	NR	0.4	8.4	**41**	**0.12 J (0.16)**	NR	0.71 J (1.2)	ND (0.04)	NR
6247	TA2-RWL-CONT.SP#017-S	NA	2.6	**300**	NR	0.35	6.6	5.5	**0.18**	NR	0.62 J (1.2)	ND (0.04)	NR
6248	TA2-RWL-CONT.SP#018-S	NA	2.1 J (2.5)	100	NR	0.55	8	4.7	**0.13 J (0.17)**	NR	0.43 J (1.2)	ND (0.042)	NR
6249	TA2-RWL-CONT.SP#019-S	NA	2 J (2.6)	110	NR	0.41	8.2	4.8	**0.15 J (0.17)**	NR	0.59 J (1.3)	ND (0.042)	NR
6250	TA2-RWL-CONT. SP#020-S	NA	1.4 J (2.5)	100	NR	0.29	8.2	9.4	**1.3**	NR	0.42 J (1.3)	0.28	NR
6251	TA2-RWL-CONT.SP#021-S	NA	4.2	200	NR	0.2	7.3	7.2	**0.69**	NR	0.7 J (1.4)	ND (0.046)	NR
6252	TA2-RWL-CONT.SP#022-S	NA	3.5	200	NR	**2.6**	9.3	**20**	**1.2**	NR	0.73 J (1.3)	0.048 J (0.17)	NR
6253	TA2-RWL-CONT.SP#023-S	NA	1.9 J (2.6)	89	NR	**3.6**	12	**14**	**3**	NR	0.63 J (1.3)	**1.8**	NR
6254	TA2-RWL-CONT.SP#024-S	NA	2.3 J (2.4)	98	NR	**0.98**	7.1	7	**0.77**	NR	0.52 J (1.2)	ND (0.04)	NR
6255	TA2-RWL-CONT.SP#025-S	NA	2.4	110	NR	6.5	12	**24**	**7.8**	NR	0.59 J (0.3)	0.49	NR
6256	TA2-RWL-CONT.SP#026-S	NA	2 J (2.5)	100 J (2.1)	NR	0.6	5.2	6.7	**0.5**	NR	0.79 J (1.2)	ND (0.041)	NR
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Note: Values in **bold** exceed background soil concentrations.

[a]Analysis request/chain-of-custody record.

[b]Dinwiddie September 1997, North Area Supergroup.

bgs = Below ground surface.
CONT = Contaminated.
DUP = Duplicate.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet)
ID = Identification.
J ( ) = The associated value is an estimated quantity. The reported value is greater than or equal to the method detection limit but less than the reporting limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable (depth not applicable for soil pile).
ND ( ) = Not detected. The result is below the method detection limit, shown in parentheses.
POST-GRIZ = Post grizzly.
RET = Return.
RWL = Radioactive Waste Landfill.
S = Soil.
SGS = Segmented Gate System.
SP = Soil Pile.
SWMU = Solid Waste Management Unit.

Table B-9
Summary of Gamma Spectroscopy Analytical Results, May 2003, for the Over-Excavation Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
606387	TA2-1-GRAB1-10FT-2-S	5–10	NR	--	ND (0.0239)	--	0.874	0.402	**ND (0.196)**	--	ND (0.617)	--
606387	TA2-1-GRAB1-15FT-2-S	10–15	ND (0.349)	--	ND (0.024)	--	0.752	0.351	**ND (0.191)**	--	ND (0.598)	--
606387	TA2-1-GRAB1-20FT-2-S	15–20	ND (0.363)	--	ND (0.0245)	--	0.677	0.324	**ND (0.195)**	--	ND (0.628)	--
606387	TA2-1-GRAB1-5FT-2-S	0–5	ND (0.444)	--	0.0167	0.0153	0.755	0.355	**0.191**	0.141	**9.25**	1.36
606387	TA2-1-GRAB2-10FT-2-S	5–10	ND (0.363)	--	ND (0.0247)	--	0.881	0.406	**0.186**	0.138	ND (0.65)	--
606387	TA2-1-GRAB2-15FT-2-S	10–15	ND (0.341)	--	ND (0.0237)	--	0.591	0.286	0.0887	0.145	ND (0.586)	--
606387	TA2-1-GRAB2-20FT-2-S	15–20	ND (0.377)	--	ND (0.0249)	--	0.674	0.321	**ND (0.2)**	--	ND (0.642)	--
606387	TA2-1-GRAB2-5FT-2-S	0–5	ND (0.373)	--	ND (0.0261)	--	0.852	0.394	0.114	0.163	ND (0.656)	--
606387	TA2-1-GRAB3-10FT-2-S	5–10	ND (0.319)	--	ND (0.0211)	--	0.601	0.285	ND (0.17)	--	ND (0.547)	--
606387	TA2-1-GRAB3-15FT-2-S	10–15	0.336	0.217	ND (0.0218)	--	0.747	0.346	ND (0.177)	--	ND (0.555)	--
606387	TA2-1-GRAB3-20FT-2-S	15–20	ND (0.351)	--	ND (0.0224)	--	0.649	0.308	**ND (0.184)**	--	ND (0.603)	--
606387	TA2-1-GRAB3-5FT-2-S	0–5	ND (0.349)	--	ND (0.0228)	--	0.775	0.358	0.0903	0.0907	0.308	0.226
606387	TA2-1-GRAB4-10FT-2-S	5–10	ND (0.37)	--	ND (0.0254)	--	0.784	0.365	**ND (0.196)**	--	ND (0.627)	--
606387	TA2-1-GRAB4-15FT-2-S	10–15	ND (0.466)	--	ND (0.0233)	--	0.691	0.326	**0.197**	0.139	**12.2**	1.77
606387	TA2-1-GRAB4-20FT-2-S	15–20	ND (0.337)	--	ND (0.024)	--	0.509	0.253	**ND (0.185)**	--	ND (0.584)	--
606387	TA2-1-GRAB4-5FT-2-S	0–5	0.352	0.282	0.0301	0.00959	0.732	0.34	**ND (0.197)**	--	**2.23**	0.466
606387	TA2-1-GRAB5-10FT-2-S	5–10	ND (0.347)	--	ND (0.0233)	--	0.853	0.393	**ND (0.191)**	--	ND (0.588)	--
606387	TA2-1-GRAB5-5FT-2-S	0–5	ND (0.353)	--	ND (0.0238)	--	0.846	0.391	0.118	0.154	ND (0.622)	--
606389	TA2-1-GRAB5-15FT-2-S	10–15	ND (0.151)	--	ND (0.0294)	--	0.848	0.392	**ND (0.185)**	--	ND (0.461)	--
606389	TA2-1-GRAB5-20FT-2-S	15–20	ND (0.152)	--	ND (0.0296)	--	0.737	0.343	ND (0.177)	--	ND (0.452)	--
606389	TA2-1-GRAB6-10FT-2-S	5–10	ND (0.145)	--	ND (0.0278)	--	0.63	0.3	**ND (0.169)**	--	ND (0.431)	--
606389	TA2-1-GRAB6-15FT-2-S	10–15	ND (0.145)	--	ND (0.0278)	--	0.604	0.294	ND (0.171)	--	ND (0.421)	--
606389	TA2-1-GRAB6-20FT-2-S	15–20	ND (0.152)	--	ND (0.0283)	--	0.648	0.307	ND (0.171)	--	ND (0.423)	--
606389	TA2-1-GRAB6-5FT-2-S	0–5	ND (0.151)	--	ND (0.0272)	--	0.927	0.426	ND (0.177)	--	ND (0.43)	--
606389	TA2-1-GRAB7-10FT-2-S	5–10	ND (0.154)	--	ND (0.0308)	--	0.809	0.375	**ND (0.188)**	--	ND (0.478)	--
606389	TA2-1-GRAB7-15FT-2-S	10–15	ND (0.152)	--	ND (0.0305)	--	0.598	0.288	0.0843	0.101	ND (0.441)	--
606389	TA2-1-GRAB7-20FT-2-S	15–20	ND (0.147)	--	ND (0.0288)	--	0.7	0.329	ND (0.177)	--	ND (0.436)	--
606389	TA2-1-GRAB7-5FT-2-S	0–5	ND (0.152)	--	ND (0.0294)	--	0.83	0.386	**ND (0.182)**	--	ND (0.449)	--
606389	TA2-1-GRAB8-10FT-2-S	5–10	ND (0.151)	--	ND (0.0281)	--	0.796	0.372	0.132	0.148	1.26	0.316
606389	TA2-1-GRAB8-15FT-2-S	10–15	ND (0.14)	--	ND (0.0286)	--	0.472	0.237	ND (0.171)	--	ND (0.408)	--
606389	TA2-1-GRAB8-20FT-2-S	15–20	ND (0.151)	--	ND (0.0295)	--	0.654	0.307	0.0929	0.104	ND (0.448)	--
606389	TA2-1-GRAB8-5FT-2-S	0–5	ND (0.157)	--	ND (0.0305)	--	1.03	0.47	0.126	0.165	ND (0.472)	--
606389	TA2-1-GRAB9-10FT-2-S	5–10	ND (0.149)	--	ND (0.0284)	--	0.673	0.321	ND (0.177)	--	ND (0.438)	--
606389	TA2-1-GRAB9-15FT-2-S	10–15	ND (0.158)	--	ND (0.0296)	--	0.648	0.313	0.0789	0.154	ND (0.456)	--
606389	TA2-1-GRAB9-20FT-2-S	15–20	ND (0.159)	--	ND (0.03)	--	0.749	0.351	ND (0.179)	--	ND (0.467)	--
606389	TA2-1-GRAB9-5FT-2-S	0–5	ND (0.155)	--	ND (0.0283)	--	0.75	0.347	ND (0.179)	--	ND (0.449)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-9 (Concluded)
Summary of Gamma Spectroscopy Analytical Results, May 2003, for the Over-Excavation Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie September 1997, North Area Supergroup.

bgs	= Below ground surface.
ER	= Environmental Restoration.
ft	= Foot (feet).
GRAB	= Grab (discrete) sample.
ID	= Identification.
ND ( )	= Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
ND ( )	= Not detected. The result is below the minimum detectable activity, shown in parentheses.
NR	= Not required.
NS	= Not specified by Dinwiddie September 1997.
pCi/g	= Picocurie(s) per gram.
S	= Soil.
SWMU	= Solid Waste Management Unit.
TA2	= Technical Area II.
--	= Error not calculated for nondetectable results.

Table B-10
Summary of Isotopic Plutonium Analytical Results, May 2003,
for the Over-Excavation Trench Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
Record		Sample	Plutonium-238		Plutonium-239/240	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]
606386	TA2-1-GRAB1-10FT-1-S	5–10	ND (0.01)	--	ND (0.011)	--
606386	TA2-1-GRAB1-15FT-1-S	10–15	ND (0.008)	--	0.04	0.0132
606386	TA2-1-GRAB1-20FT-1-S	15–20	ND (0.01)	--	0.0126	0.00994
606386	TA2-1-GRAB1-5FT-1-S	0–5	ND (0.008)	--	0.211	0.0344
606386	TA2-1-GRAB2-10FT-1-S	5–10	ND (0.012)	--	0.0317	0.0166
606386	TA2-1-GRAB2-15FT-1-S	10–15	ND (0.009)	--	0.0465	0.0157
606386	TA2-1-GRAB2-20FT-1-S	15–20	ND (0.009)	--	0.0591	0.018
606386	TA2-1-GRAB2-5FT-1-S	0–5	ND (0.01)	--	0.16	0.0312
606386	TA2-1-GRAB3-10FT-1-S	5–10	ND (0.012)	--	0.0632	0.0256
606386	TA2-1-GRAB3-15FT-1-S	10–15	0.0159	0.01	1.2	0.109
606386	TA2-1-GRAB3-20FT-1-S	15–20	0.0122	0.0148	0.0365	0.0156
606386	TA2-1-GRAB3-5FT-1-S	0–5	0.00976	0.00898	0.853	0.0877
606386	TA2-1-GRAB4-10FT-1-S	5–10	0.0161	0.00956	0.734	0.084
606386	TA2-1-GRAB4-15FT-1-S	10–15	0.0207	0.0095	0.279	0.0373
606386	TA2-1-GRAB4-20FT-1-S	15–20	ND (0.007)	--	0.0931	0.0203
606386	TA2-1-GRAB4-5FT-1-S	0–5	0.0277	0.0112	0.869	0.0845
606386	TA2-1-GRAB5-10FT-1-S	5–10	ND (0.009)	--	ND (0.01)	--
606386	TA2-1-GRAB5-5FT-1-S	10–15	ND (0.01)	--	0.0134	0.00991
606388	TA2-1-GRAB5-15FT-1-S	15–20	ND (0.008)	--	0.0147	0.0101
606388	TA2-1-GRAB5-20FT-1-S	0–5	ND (0.011)	--	0.0851	0.0241
606388	TA2-1-GRAB6-10FT-1-S	5–10	ND (0.01)	--	0.179	0.0331
606388	TA2-1-GRAB6-15FT-1-S	10–15	ND (0.01)	--	0.0381	0.0162
606388	TA2-1-GRAB6-20FT-1-S	15–20	0.0202	0.0108	0.313	0.0443
606388	TA2-1-GRAB6-5FT-1-S	0–5	0.12	0.0257	0.5	0.0601
606388	TA2-1-GRAB7-10FT-1-S	5–10	0.12	0.028	1.37	0.124
606388	TA2-1-GRAB7-15FT-1-S	10–15	ND (0.009)	--	0.489	0.0588
606388	TA2-1-GRAB7-20FT-1-S	15–20	ND (0.019)	--	0.0684	0.0297
606388	TA2-1-GRAB7-5FT-1-S	0–5	ND (0.011)	--	0.221	0.0391
606388	TA2-1-GRAB8-10FT-1-S	5–10	ND (0.009)	--	0.216	0.0364
606388	TA2-1-GRAB8-15FT-1-S	10–15	ND (0.01)	--	ND (0.012)	--
606388	TA2-1-GRAB8-20FT-1-S	15–20	ND (0.01)	--	ND (0.012)	--
606388	TA2-1-GRAB8-5FT-1-S	0–5	0.0378	0.0197	0.374	0.05
606388	TA2-1-GRAB9-10FT-1-S	5–10	ND (0.009)	--	0.0113	0.0113
606388	TA2-1-GRAB9-15FT-1-S	10–15	0.0195	0.0142	0.329	0.0432
606388	TA2-1-GRAB9-20FT-1-S	15–20	ND (0.008)	--	0.0134	0.00883
606388	TA2-1-GRAB9-5FT-1-S	0–5	ND (0.009)	--	0.0586	0.0195

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
bgs = Below ground surface.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
-- = Error not calculated for nondetectable results.

Table B-11
Summary of Tritium Analytical Results, May 2003, for the Over-Excavation Trench Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Sample Attributes			Activity	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium pCi/L	Tritium pCi/g
606387	TA2-1-GRAB1-10FT-3-S	5–10	**1,660**	**ND (11.5)**
606387	TA2-1-GRAB1-15FT-3-S	10–15	**801**	**ND (11.5)**
606387	TA2-1-GRAB1-20FT-3-S	15–20	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB1-5FT-3-S	0–5	**13,300**	**ND (11.5)**
606387	TA2-1-GRAB2-10FT-3-S	5–10	**3,820**	**ND (11.5)**
606387	TA2-1-GRAB2-15FT-3-S	10–15	350	**ND (11.5)**
606387	TA2-1-GRAB2-20FT-3-S	15–20	304	**ND (11.5)**
606387	TA2-1-GRAB2-5FT-3-S	0–5	**19,700**	**ND (11.5)**
606387	TA2-1-GRAB3-10FT-2-S	5–10	**27,800**	**ND (11.5)**
606387	TA2-1-GRAB3-15FT-3-S	10–15	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB3-20FT-3-S	15–20	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB3-5FT-3-S	0–5	**769**	**ND (11.5)**
606387	TA2-1-GRAB4-10FT-3-S	5–10	**3,860**	**4.49**
606387	TA2-1-GRAB4-15FT-3-S	10–15	**18,300**	**ND (11.5)**
606387	TA2-1-GRAB4-20FT-3-S	15–20	**1,430**	**ND (11.5)**
606387	TA2-1-GRAB4-5FT-3-S	0–5	**79,400**	**ND (11.5)**
606387	TA2-1-GRAB5-10FT-3-S	5–10	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB5-5FT-3-S	10–15	ND (267)	**0.79**
606389	TA2-1-GRAB5-15FT-3-S	15–20	ND (248)	NR
606389	TA2-1-GRAB5-20FT-3-S	0–5	ND (248)	NR
606389	TA2-1-GRAB6-10FT-3-S	5–10	ND (248)	NR
606389	TA2-1-GRAB6-15FT-3-S	10–15	ND (248)	NR
606389	TA2-1-GRAB6-20FT-3-S	15–20	**561**	NR
606389	TA2-1-GRAB6-5FT-3-S	0–5	**650**	NR
606389	TA2-1-GRAB7-10FT-3-S	5–10	**8,480**	NR
606389	TA2-1-GRAB7-15FT-3-S	10–15	**63,600**	NR
606389	TA2-1-GRAB7-20FT-3-S	15–20	**11,400**	NR
606389	TA2-1-GRAB7-5FT-3-S	0–5	**11,600**	NR
606389	TA2-1-GRAB8-10FT-3-S	5–10	**1,630**	NR
606389	TA2-1-GRAB8-15FT-3-S	10–15	289	NR
606389	TA2-1-GRAB8-20FT-3-S	15–20	380	NR
606389	TA2-1-GRAB8-5FT-3-S	0–5	**1,590**	NR
606389	TA2-1-GRAB9-10FT-3-S	5–10	ND (248)	NR
606389	TA2-1-GRAB9-15FT-3-S	10–15	368	NR
606389	TA2-1-GRAB9-20FT-3-S	15–20	**487**	NR
606389	TA2-1-GRAB9-5FT-3-S	0–5	**698**	NR
Background Activity[b]			420	0.021

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Tharp, February 1999.

bgs = Below ground surface.
ER = Environmental Restoration.
ID = Identification.
ft = Foot (feet).
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
NR = Not required.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.

Table B-12
Summary of Metals Analytical Results, May 2003,
for the Over-Excavation Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Sample Attributes			Metals (EPA SW-846 Method 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
606386	TA2-1-GRAB1-10FT-1-S	5–10	**5.53**	51.8	0.368 J (0.455)	ND (0.0435)	7.43	3.78	ND (0.000917)	6.63	ND (0.147)	ND (0.082)	1.45
606386	TA2-1-GRAB1-15FT-1-S	10–15	4.25	**258**	0.397 J (0.5)	ND (0.0478)	8.2	4.45	0.00755 J (0.00998)	6.59	0.354 J (0.5)	ND (0.0902)	1.11
606386	TA2-1-GRAB1-20FT-1-S	15–20	**5.04**	**479**	0.487	ND (0.0464)	10.2	5.25	0.00282 J (0.00974)	8.26	0.183 J (0.485)	ND (0.0876)	1.05
606386	TA2-1-GRAB1-5FT-1-S	0–5	**4.45**	**221**	0.457 J (0.5)	0.075 J (0.5)	10.1	4.59	0.0151	8.43	ND (0.162)	ND (0.0902)	1.48
606386	TA2-1-GRAB2-10FT-1-S	5–10	3.33	164	0.349 J (0.49)	0.0677 J (0.49)	8.83	4.53	0.00564 J (0.00946)	6	ND (0.159)	ND (0.0884)	1.2
606386	TA2-1-GRAB2-15FT-1-S	10–15	4.31	**403**	0.385 J (0.481)	0.0927 J (0.481)	7.22	4	0.00398 J (0.00995)	6.12	ND (0.156)	ND (0.0867)	0.975
606386	TA2-1-GRAB2-20FT-1-S	15–20	**4.86**	**322**	0.532	ND (0.0447)	11.3	6.34	0.00477 J (0.00892)	9.4	ND (0.151)	ND (0.0843)	0.895
606386	TA2-1-GRAB2-5FT-1-S	0–5	2.76	159	0.337 J (0.455)	ND (0.0435)	7.27	3.08	0.0087 J (0.00952)	5.85	ND (0.147)	ND (0.082)	1.77
606386	TA2-1-GRAB3-10FT-1-S	5–10	3.49	**280**	0.345 J (0.495)	ND (0.0473)	6.11	2.86	0.00419 J (0.0093)	4.62	0.249 J (0.495)	ND (0.0893)	0.944
606386	TA2-1-GRAB3-15FT-1-S	10–15	3.71	**300**	0.36 J (0.455)	ND (0.0435)	8.54	3.76	0.00412 J (0.0091)	6.23	ND (0.147)	ND (0.082)	0.923
606386	TA2-1-GRAB3-20FT-1-S	15–20	3.44	140	0.409 J (0.485)	ND (0.0464)	8.25	4.52	0.00352 J (0.00898)	6.44	0.298 J (0.485)	ND (0.0876)	1.19
606386	TA2-1-GRAB3-5FT-1-S	0–5	3.22	103	0.311 J (0.495)	0.0506 J (0.495)	6.73	5.42	0.00439 J (0.00952)	5.63	0.181 J (0.495)	ND (0.0893)	1.34
606386	TA2-1-GRAB4-10FT-1-S	5–10	3.48	119	0.403 J (0.481)	0.285 J (0.481)	8.98	4.56	**0.161**	7.46	ND (0.156)	ND (0.0867)	2.19
606386	TA2-1-GRAB4-15FT-1-S	10–15	4.38	**322**	0.369 J (0.481)	0.102 J (0.481)	7.5	3.43	0.0303	7.13	0.196 J (0.481)	ND (0.0867)	1.17
606386	TA2-1-GRAB4-20FT-1-S	15–20	3.78	**447**	0.345 J (0.476)	0.0691 J (0.476)	7.15	3.27	0.0281	5.57	ND (0.154)	ND (0.0859)	1.09
606386	TA2-1-GRAB4-5FT-1-S	0–5	3.45	117	0.372 J (0.495)	0.937	9.55	5.53	0.0983	7.15	ND (0.16)	ND (0.0893)	7.3
606386	TA2-1-GRAB5-10FT-1-S	5–10	3.05	162	0.379 J (0.463)	ND (0.0443)	9.35	4.29	0.00319 J (0.00935)	6.82	ND (0.15)	ND (0.0835)	0.968
606386	TA2-1-GRAB5-5FT-1-S	0–5	**6.99**	**232**	0.381 J (0.476)	0.102 J (0.476)	9.39	5.19	0.00792 J (0.00938)	8.71	ND (0.154)	ND (0.0859)	1.52
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-12 (Continued)
Summary of Metals Analytical Results, May 2003, for the Over-Excavation Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Sample Attributes			Metals (EPA SW-846 Method 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
606388	TA2-1-GRAB5-15FT-1-S	10–15	2.11	**228**	0.459	ND (0.0435)	7.39	2.35	0.00496 J (0.0096)	5.7	ND (0.737)	**1.43**	0.983
606388	TA2-1-GRAB5-20FT-1-S	15–20	2.63	**233**	0.493	ND (0.0464)	8.62	3.14	0.00745 J (0.00873)	5.94	ND (0.787)	0.401 J (0.485)	1.02
606388	TA2-1-GRAB6-10FT-1-S	5–10	1.04	134	0.473 J (0.495)	ND (0.0473)	6.27	2.58	0.00404 J (0.00969)	4.91	**ND (4.01)**	0.651	0.948
606388	TA2-1-GRAB6-15FT-1-S	10–15	2.33	105	0.487 J (0.49)	ND (0.0469)	6.57	2.85	0.00742 J (0.00988)	5.19	ND (0.795)	0.422 J (0.49)	1.36
606388	TA2-1-GRAB6-20FT-1-S	15–20	1.72	160	0.472 J (0.495)	ND (0.0473)	5.87	2.44	0.00766 J (0.00912)	4.43	ND (0.802)	0.372 J (0.495)	1.08
606388	TA2-1-GRAB6-5FT-1-S	0–5	2.12	104	0.472	ND (0.0451)	6.59	2.03	0.00423 J (0.00863)	4.33	**ND (1.53)**	ND (0.851)	1.77
606388	TA2-1-GRAB7-10FT-1-S	5–10	1.3	92.7	0.47 J (0.472)	ND (0.0451)	6.09	1.74	0.0112	4.51	**ND (3.82)**	0.795	2.07
606388	TA2-1-GRAB7-15FT-1-S	10–15	1.68	170	0.446 J (0.485)	ND (0.0464)	6.71	2.47	**0.121**	5.19	**ND (1.57)**	**1.72**	1.85
606388	TA2-1-GRAB7-20FT-1-S	15–20	1.81	**203**	0.489	ND (0.0443)	7.52	2.12	0.0103	5.49	**ND (1.5)**	0.693	1.15
606388	TA2-1-GRAB7-5FT-1-S	0–5	2.03	99.6	0.523	ND (0.046)	7.03	1.8	0.0183	4.66	**ND (3.9)**	ND (0.867)	1.17
606388	TA2-1-GRAB8-10FT-1-S	5–10	0.936	141	0.419 J (0.476)	ND (0.0455)	5.78	1.8	0.00507 J (0.00882)	4.42	**ND (1.54)**	0.667	1.33
606388	TA2-1-GRAB8-15FT-1-S	10–15	1.75	194	0.41 J (0.495)	ND (0.0473)	5.26	2.1	0.00373 J (0.00985)	4.33	ND (0.802)	**1.95**	0.818
606388	TA2-1-GRAB8-20FT-1-S	15–20	2.25	104	0.52	ND (0.0473)	7.21	3.23	0.00296 J (0.00935)	5.4	ND (0.802)	ND (0.0893)	1.35
606388	TA2-1-GRAB8-5FT-1-S	0–5	1.05	42.2	0.428 J (0.472)	ND (0.0451)	5.54	1.96	0.00216 J (0.00954)	3.9	**ND (3.82)**	ND (0.0851)	0.926
606388	TA2-1-GRAB9-10FT-1-S	5–10	1.76	197	0.487	ND (0.0439)	6.72	2.52	0.00389 J (0.00929)	4.99	**ND (1.49)**	**1.41**	1.32
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-12 (Concluded)
Summary of Metals Analytical Results, May 2003,
for the Over-Excavation Soil Placed in the SWMU 1 Excavation as Lifts 8 through 14

Sample Attributes			Metals (EPA SW-846 Method 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
606388	TA2-1-GRAB9-15FT-1-S	10–15	1.91	**291**	0.474 J (0.49)	ND (0.0469)	6.92	2.22	0.00536 J (0.00942)	4.96	**ND (1.59)**	**1.24**	0.875
606388	TA2-1-GRAB9-20FT-1-S	15–20	2.39	124	0.548	ND (0.046)	8.38	3.27	0.00478 J (0.00897)	6.02	**ND (1.56)**	ND (0.0867)	0.864
606388	TA2-1-GRAB9-5FT-1-S	0–5	2.09	79.8	0.512	ND (0.0473)	7.03	2.84	0.00456 J (0.00935)	5.06	**ND (1.6)**	ND (0.893)	1.31
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Note: Values in **bold** exceed background soil concentrations.

[a]Analysis request/chain-of-custody record.

[b]Dinwiddie September 1997, North Area Supergroup.

bgs = Below ground surface.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The associated value is an estimated quantity. The reported value is greater than or equal to the method detection limit but less than the reporting limit, shown in parentheses.
ND ( ) = Not detected. The result is below the method detection limit, shown in parentheses.
ND ( ) = Not detected, but the method detection limit (shown in parentheses) exceeds background soil concentration.
mg/kg = Milligram(s) per kilogram.
S = Soil.
SWMU = Solid Waste Management Unit.

Table B-13
Summary of Gamma Spectroscopy Analytical Results, April 2001,
for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
604426	TA2-1-OVER-SLPE-001-S	NA	ND (0.613)	--	0.0595	0.0235	1.12	0.516	**ND (0.27)**	--	ND (0.947)	--
604426	TA2-1-OVER-SLPE-002-S	NA	ND (0.565)	--	0.0433	0.0174	0.848	0.425	**ND (0.25)**	--	ND (0.888)	--
604426	TA2-1-OVER-SLPE-003-S	NA	ND (0.542)	--	**0.123**	0.029	0.871	0.411	0.162	0.188	ND (0.819)	--
604426	TA2-1-OVER-SLPE-004-S	NA	ND (0.557)	--	**0.092**	0.0401	1.02	0.498	0.178	0.199	ND (0.871)	--
604426	TA2-1-OVER-SLPE-005-S	NA	ND (0.541)	--	ND (0.0364)	--	0.946	0.436	**ND (0.247)**	--	ND (0.835)	--
604426	TA2-1-OVER-SLPE-006-S	NA	ND (0.516)	--	0.0205	0.0131	0.861	0.401	0.13	0.174	ND (0.749)	--
604426	TA2-1-OVER-SLPE-007-S	NA	ND (0.576)	--	0.0278	0.0282	1.13	0.532	**ND (0.252)**	--	ND (0.903)	--
604426	TA2-1-OVER-SLPE-008-S	NA	ND (0.545)	--	0.0456	0.0186	1.17	0.548	**ND (0.235)**	--	ND (0.872)	--
604426	TA2-1-OVER-SLPE-009-S	NA	ND (0.542)	--	**0.13**	0.0385	0.988	0.464	0.175	0.196	ND (0.883)	--
604426	TA2-1-OVER-SLPE-010-S	NA	ND (0.497)	--	ND (0.0322)	--	1.07	0.501	**ND (0.218)**	--	ND (0.798)	--
604426	TA2-1-OVER-SLPE-011-S	NA	ND (0.509)	--	0.0445	0.0161	0.835	0.388	**ND (0.227)**	--	ND (0.809)	--
604426	TA2-1-OVER-SLPE-012-S	NA	ND (0.532)	--	**0.115**	0.0277	1.17	0.548	**ND (0.239)**	--	ND (0.833)	--
604426	TA2-1-OVER-SLPE-013-S	NA	ND (0.586)	--	**0.106**	0.0289	1.2	0.549	**ND (0.257)**	--	ND (0.892)	--
604426	TA2-1-OVER-SLPE-014-S	NA	ND (0.558)	--	**0.113**	0.0302	1.24	0.565	**ND (0.245)**	--	ND (0.708)	--
604426	TA2-1-OVER-SLPE-015-S	NA	ND (0.519)	--	0.0125	0.0167	0.89	0.416	**ND (0.227)**	--	ND (0.809)	--
604428	TA2-1-OVER-SLPE-016-S	NA	ND (0.489)	--	ND (0.0169)	--	1	0.464	**ND (0.218)**	--	ND (0.767)	--
604428	TA2-1-OVER-SLPE-017-S	NA	ND (0.529)	--	ND (0.0339)	--	1.06	0.498	**ND (0.243)**	--	ND (0.844)	--
604428	TA2-1-OVER-SLPE-018-S	NA	ND (0.595)	--	ND (0.0378)	--	1.21	0.567	**0.182**	0.209	ND (0.946)	--
604428	TA2-1-OVER-SLPE-019-S	NA	ND (0.581)	--	0.0392	0.0199	0.968	0.456	0.114	0.2	ND (0.924)	--
604428	TA2-1-OVER-SLPE-020-S	NA	ND (0.517)	--	0.0139	0.014	0.87	0.416	0.106	0.182	ND (0.815)	--
604428	TA2-1-OVER-SLPE-021-S	NA	ND (0.542)	--	0.0193	0.0211	0.756	0.365	**ND (0.24)**	--	ND (0.88)	--
604428	TA2-1-OVER-SLPE-022-S	NA	ND (0.518)	--	ND (0.0352)	--	0.922	0.431	**ND (0.235)**	--	ND (0.854)	--
604428	TA2-1-OVER-SLPE-023-S	NA	ND (0.627)	--	0.0324	0.0209	1.24	0.583	0.143	0.215	ND (0.913)	--
604428	TA2-1-OVER-SLPE-024-S	NA	ND (0.545)	--	0.0334	0.0212	1.06	0.547	**ND (0.242)**	--	ND (0.848)	--
604428	TA2-1-OVER-SLPE-025-S	NA	ND (0.592)	--	0.0719	0.0182	0.98	0.467	**ND (0.27)**	--	ND (0.925)	--
604428	TA2-1-OVER-SLPE-026-S	NA	ND (0.525)	--	0.0747	0.0212	0.847	0.415	**ND (0.228)**	--	ND (0.803)	--
604428	TA2-1-OVER-SLPE-027-S	NA	ND (0.534)	--	0.083	0.0324	1.05	0.487	**ND (0.239)**	--	0.643	0.309
604428	TA2-1-OVER-SLPE-028-S	NA	ND (0.511)	--	0.0577	0.0199	1.09	0.5	**ND (0.234)**	--	ND (0.826)	--
604428	TA2-1-OVER-SLPE-029-DU	NA	ND (0.219)	--	**0.104**	0.0315	0.915	0.437	**0.225**	0.188	ND (0.615)	--
604428	TA2-1-OVER-SLPE-029-S	NA	ND (0.238)	--	**0.0918**	0.0337	0.968	0.465	**0.215**	0.206	ND (0.657)	--
604428	TA2-1-OVER-SLPE-030-S	NA	ND (0.217)	--	**0.203**	0.0418	0.768	0.382	**ND (0.219)**	--	ND (0.606)	--
604432	TA2-1-OVER-SLPE-031-S	NA	ND (0.235)	--	0.0737	0.0314	0.914	0.441	**ND (0.228)**	--	ND (0.633)	--
604432	TA2-1-OVER-SLPE-032-S	NA	ND (0.231)	--	0.0435	0.0277	1.06	0.5	**ND (0.226)**	--	ND (0.65)	--
604432	TA2-1-OVER-SLPE-033-S	NA	ND (0.241)	--	0.0279	0.0239	0.891	0.441	**ND (0.254)**	--	1	0.344
604432	TA2-1-OVER-SLPE-034-S	NA	ND (0.213)	--	0.0624	0.0334	0.725	0.357	0.134	0.179	ND (0.573)	--
604432	TA2-1-OVER-SLPE-035-S	NA	ND (0.19)	--	0.0204	0.016	0.879	0.416	0.163	0.169	0.742	0.268
604432	TA2-1-OVER-SLPE-036-S	NA	ND (0.228)	--	ND (0.0427)	--	1.05	0.493	**ND (0.229)**	--	ND (0.638)	--
604432	TA2-1-OVER-SLPE-037-S	NA	ND (0.214)	--	ND (0.0407)	--	0.849	0.401	**ND (0.217)**	--	0.793	0.285
604432	TA2-1-OVER-SLPE-038-S	NA	ND (0.226)	--	**0.102**	0.0292	1	0.473	0.0964	0.19	ND (0.615)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-13 (Continued)
Summary of Gamma Spectroscopy Analytical Results, April 2001,
for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Activity (pCi/g)									
Record		Sample	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Number[a]	ER Sample ID	Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
604432	TA2-1-OVER-SLPE-039-S	NA	ND (0.209)	--	ND (0.0393)	--	0.835	0.401	**ND (0.204)**	--	0.699	0.271
604432	TA2-1-OVER-SLPE-040-S	NA	ND (0.215)	--	0.0186	0.0227	0.848	0.409	**ND (0.218)**	--	ND (0.599)	--
604432	TA2-1-OVER-SLPE-041-S	NA	ND (0.198)	--	ND (0.0342)	--	0.754	0.364	**0.228**	0.17	0.4	0.234
604432	TA2-1-OVER-SLPE-042-S	NA	ND (0.208)	--	ND (0.0379)	--	0.838	0.397	**ND (0.203)**	--	ND (0.568)	--
604432	TA2-1-OVER-SLPE-043-S	NA	0.164	0.147	ND (0.0383)	--	0.89	0.423	**0.191**	0.176	0.999	0.308
604432	TA2-1-OVER-SLPE-044-S	NA	ND (0.214)	--	ND (0.0392)	--	0.837	0.4	**ND (0.201)**	--	ND (0.579)	--
604432	TA2-1-OVER-SLPE-045-S	NA	ND (0.425)	--	ND (0.0568)	--	0.831	0.442	**0.351**	0.269	**25**	4.88
604474	TA2-1-OVER-SLPE-046-S	NA	ND (0.233)	--	ND (0.0409)	--	1.09	0.508	**ND (0.228)**	--	ND (0.61)	--
604474	TA2-1-OVER-SLPE-047-S	NA	ND (0.2)	--	ND (0.0384)	--	0.976	0.454	0.145	0.171	ND (0.547)	--
604474	TA2-1-OVER-SLPE-048-S	NA	ND (0.232)	--	ND (0.043)	--	0.965	0.456	0.124	0.191	ND (0.618)	--
604474	TA2-1-OVER-SLPE-049-S	NA	ND (0.226)	--	0.0283	0.0251	0.994	0.47	**0.272**	0.191	ND (0.628)	--
604474	TA2-1-OVER-SLPE-050-S	NA	ND (0.226)	--	ND (0.0436)	--	0.73	0.368	**0.244**	0.195	ND (0.623)	--
604474	TA2-1-OVER-SLPE-051-S	NA	ND (0.265)	--	0.0349	0.028	0.826	0.413	**ND (0.25)**	--	ND (0.689)	--
604474	TA2-1-OVER-SLPE-052-S	NA	ND (0.228)	--	0.0801	0.0313	0.928	0.445	0.108	0.194	ND (0.628)	--
604474	TA2-1-OVER-SLPE-053-S	NA	ND (0.252)	--	0.0594	0.0266	1.19	0.557	0.146	0.208	ND (0.692)	--
604474	TA2-1-OVER-SLPE-054-S	NA	ND (0.193)	--	0.026	0.0193	0.929	0.434	**ND (0.198)**	--	ND (0.534)	--
604474	TA2-1-OVER-SLPE-055-S	NA	ND (0.231)	--	0.0472	0.0287	0.887	0.429	0.131	0.194	ND (0.622)	--
604474	TA2-1-OVER-SLPE-056-S	NA	ND (0.23)	--	0.0698	0.0375	0.988	0.466	**ND (0.215)**	--	ND (0.594)	--
604474	TA2-1-OVER-SLPE-057-S	NA	ND (0.477)	--	0.0367	0.0191	1.04	0.484	0.162	0.167	ND (0.727)	--
604474	TA2-1-OVER-SLPE-058-S	NA	ND (0.472)	--	0.0253	0.0158	0.806	0.373	**ND (0.203)**	--	ND (0.704)	--
604474	TA2-1-OVER-SLPE-059-S	NA	ND (0.484)	--	ND (0.0303)	--	0.828	0.384	0.13	0.158	ND (0.724)	--
604474	TA2-1-OVER-SLPE-060-DU	NA	ND (0.512)	--	0.0171	0.0124	1.02	0.481	0.096	0.178	ND (0.778)	--
604474	TA2-1-OVER-SLPE-060-S	NA	ND (0.496)	--	0.0215	0.0157	0.953	0.445	**ND (0.218)**	--	ND (0.739)	--
604735	TA2-2-BLDG-901-001-S	NA	ND (0.182)	--	ND (0.0381)	--	0.883	0.437	**ND (0.213)**	--	ND (0.551)	--
604735	TA2-2-BLDG-901-002-S	NA	ND (0.18)	--	ND (0.0356)	--	1.09	0.519	**ND (0.211)**	--	ND (0.543)	--
604735	TA2-2-BLDG-901-003-S	NA	ND (0.18)	--	ND (0.0352)	--	0.836	0.392	**ND (0.203)**	--	ND (0.528)	--
604735	TA2-2-BLDG-901-004-S	NA	ND (0.201)	--	ND (0.0375)	--	1.03	0.473	**ND (0.226)**	--	ND (0.568)	--
604735	TA2-2-BLDG-901-005-S	NA	ND (0.173)	--	0.0152	0.0145	1.08	0.516	0.0932	0.183	ND (0.533)	--
604735	TA2-2-BLDG-901-006-S	NA	ND (0.195)	--	ND (0.0403)	--	0.977	0.458	**ND (0.233)**	--	ND (0.567)	--
604735	TA2-2-BLDG-901-007-DU	NA	ND (0.177)	--	ND (0.0374)	--	0.806	0.394	**ND (0.209)**	--	ND (0.537)	--
604735	TA2-2-BLDG-901-007-S	NA	ND (0.174)	--	ND (0.0355)	--	0.981	0.466	0.141	0.179	ND (0.514)	--
604739	TA2-XPLO-SIVE-001-S	NA	ND (0.181)	--	0.0282	0.0193	0.995	0.472	**ND (0.208)**	--	ND (0.525)	--
604739	TA2-XPLO-SIVE-002-S	NA	ND (0.193)	--	ND (0.0397)	--	0.958	0.445	0.134	0.19	ND (0.568)	--
604739	TA2-XPLO-SIVE-003-S	NA	ND (0.186)	--	ND (0.0382)	--	0.847	0.403	**ND (0.211)**	--	ND (0.538)	--
604739	TA2-XPLO-SIVE-004-S	NA	ND (0.183)	--	0.0313	0.0123	0.971	0.471	**ND (0.214)**	--	ND (0.532)	--
604739	TA2-XPLO-SIVE-005-S	NA	ND (0.171)	--	0.0296	0.0206	0.92	0.443	**ND (0.204)**	--	0.57	0.263
604739	TA2-XPLO-SIVE-006-S	NA	ND (0.176)	--	0.0247	0.0298	0.816	0.383	0.0892	0.175	ND (0.502)	--
604739	TA2-XPLO-SIVE-007-S	NA	ND (0.19)	--	ND (0.0414)	--	0.978	0.479	**ND (0.223)**	--	ND (0.574)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table B-13 (Concluded)
Summary of Gamma Spectroscopy Analytical Results, April 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Activity									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
Quality Assurance (pCi/L)												
604430	TA2-1-OVER-SLPE-EB1	NA	ND (59)	--	ND (21.5)	--	ND (138)	--	ND (98)	--	ND (219)	--
604474	TA2-1-OVER-SLPE-EB2	NA	ND (286)	--	ND (25.4)	--	ND (149)	--	ND (161)	--	ND (431)	--

Note: Values in **bold** exceed background soil activities.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Dinwiddie September 1997, North Area Supergroup.

bgs = Below ground surface.
BLDG = Building.
DU = Duplicate.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable (depth not applicable for soil pile).
ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
NS = Not specified by Dinwiddie September 1997.
OVER-SLPE = Over-excavation slope.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
S = Soil.
SWMU = Solid Waste Management Unit.
XPLO-SIVE = Explosive storage bunker.
-- = Error not calculated for nondetectable results.

Table B-14
Summary of Isotopic Plutonium Analytical Results, April-September 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
604427	TA2-1-OVER-SLPE-001-S	NA	0.0131	0.0139	0.429	0.0731
604427	TA2-1-OVER-SLPE-002-S	NA	ND (0.00413)	--	0.324	0.0575
604427	TA2-1-OVER-SLPE-003-S	NA	ND (0.00458)	--	0.138	0.0367
604427	TA2-1-OVER-SLPE-004-S	NA	0.00754	0.00875	0.0344	0.0162
604427	TA2-1-OVER-SLPE-005-S	NA	0.01	0.0101	0.164	0.0389
604427	TA2-1-OVER-SLPE-006-S	NA	0.0418	0.0202	2.55	0.3
604427	TA2-1-OVER-SLPE-007-S	NA	0.0178	0.0118	0.61	0.0818
604427	TA2-1-OVER-SLPE-008-S	NA	0.019	0.0128	0.559	0.0825
604427	TA2-1-OVER-SLPE-009-S	NA	0.011	0.00903	0.427	0.0647
604427	TA2-1-OVER-SLPE-010-S	NA	ND (0.00545)	--	0.233	0.0458
604427	TA2-1-OVER-SLPE-011-S	NA	0.00812	0.00817	0.294	0.0516
604427	TA2-1-OVER-SLPE-012-S	NA	0.0069	0.00979	0.239	0.0555
604427	TA2-1-OVER-SLPE-013-S	NA	0.0127	0.0105	0.324	0.056
604427	TA2-1-OVER-SLPE-014-S	NA	ND (0.00397)	--	0.0345	0.0151
604427	TA2-1-OVER-SLPE-015-S	NA	ND (0.00429)	--	0.41	0.0709
604429	TA2-1-OVER-SLPE-016-S	NA	ND (0.0261)	--	0.322	0.101
604429	TA2-1-OVER-SLPE-017-S	NA	ND (0.00961)	--	0.225	0.0546
604429	TA2-1-OVER-SLPE-018-S	NA	ND (0.0096)	--	0.387	0.077
604429	TA2-1-OVER-SLPE-019-S	NA	0.0122 U	0.0158	0.268	0.0621
604429	TA2-1-OVER-SLPE-020-S	NA	ND (0.0248)	--	0.378	0.105
604429	TA2-1-OVER-SLPE-021-S	NA	0.0403	0.0406	1.48	0.276
604429	TA2-1-OVER-SLPE-022-S	NA	ND (0.0267)	--	0.294	0.0939
604429	TA2-1-OVER-SLPE-023-S	NA	0.0115	0.0133	0.438	0.0855
604429	TA2-1-OVER-SLPE-024-S	NA	ND (0.0249)	--	0.251	0.0891
604429	TA2-1-OVER-SLPE-025-S	NA	ND (0.0366)	--	ND (0.0165)	--
604429	TA2-1-OVER-SLPE-026-S	NA	ND (0.0274)	--	ND (0.0128)	--
604429	TA2-1-OVER-SLPE-027-S	NA	0.0281	0.0283	ND (0.0111)	--
604429	TA2-1-OVER-SLPE-028-S	NA	ND (0.022)	--	0.0526	0.035
604429	TA2-1-OVER-SLPE-029-DU	NA	ND (0.00694)	--	0.0637	0.0253
604429	TA2-1-OVER-SLPE-029-S	NA	ND (0.00637)	--	0.0619	0.0311
604429	TA2-1-OVER-SLPE-030-S	NA	ND (0.0223)	--	0.0611	0.036
604433	TA2-1-OVER-SLPE-031-S	NA	0.184	0.0446	0.475	0.0818
604433	TA2-1-OVER-SLPE-032-S	NA	ND (0.00814)	--	0.132	0.0367
604433	TA2-1-OVER-SLPE-033-S	NA	0.0138	0.0113	0.0396	0.0202
604433	TA2-1-OVER-SLPE-034-S	NA	0.01	0.0111	0.205	0.05
604433	TA2-1-OVER-SLPE-035-S	NA	0.00799	0.00881	0.29	0.0562
604433	TA2-1-OVER-SLPE-036-S	NA	0.0239	0.016	1.03	0.151
604433	TA2-1-OVER-SLPE-037-S	NA	0.00818	0.00823	0.458	0.0787
604433	TA2-1-OVER-SLPE-038-S	NA	ND (0.00661)	--	0.362	0.0703
604433	TA2-1-OVER-SLPE-039-S	NA	0.0199	0.0164	0.721	0.116
604433	TA2-1-OVER-SLPE-040-S	NA	ND (0.0055)	--	0.123	0.0352
604433	TA2-1-OVER-SLPE-041-S	NA	0.00332 U	0.00665	0.497	0.0883
604433	TA2-1-OVER-SLPE-042-S	NA	0.023	0.0189	0.414	0.0825
604433	TA2-1-OVER-SLPE-043-S	NA	0.0106	0.00959	0.309	0.0613
604433	TA2-1-OVER-SLPE-044-S	NA	ND (0.00271)	--	0.123	0.0343
604433	TA2-1-OVER-SLPE-045-S	NA	0.013	0.0144	0.645	0.103
604475	TA2-1-OVER-SLPE-046-S	NA	0.00636	0.00766	0.479	0.0712
604475	TA2-1-OVER-SLPE-047-S	NA	0.00632	0.006	0.35	0.053
604475	TA2-1-OVER-SLPE-048-S	NA	0.00499	0.00614	0.423	0.0645
604475	TA2-1-OVER-SLPE-049-S	NA	0.00522	0.00524	0.233	0.0425
604475	TA2-1-OVER-SLPE-050-S	NA	0.0806	0.0243	0.355	0.0599
604475	TA2-1-OVER-SLPE-051-S	NA	0.0189	0.0091	0.524	0.072
604475	TA2-1-OVER-SLPE-052-S	NA	ND (0.00246)	--	0.198	0.0355
604475	TA2-1-OVER-SLPE-053-S	NA	0.0564	0.0183	0.41	0.0631
604475	TA2-1-OVER-SLPE-054-S	NA	ND (0.00345)	--	0.0652	0.0195

Refer to footnotes at end of table.

Table B-14 (Concluded)
Summary of Isotopic Plutonium Analytical Results, April-September 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
604475	TA2-1-OVER-SLPE-055-S	NA	0.00726	0.00554	0.261	0.0426
604475	TA2-1-OVER-SLPE-056-S	NA	0.00932	0.00814	0.415	0.0622
604475	TA2-1-OVER-SLPE-057-S	NA	0.00513	0.00462	0.218	0.0375
604475	TA2-1-OVER-SLPE-058-S	NA	0.0096	0.00833	0.287	0.0479
604475	TA2-1-OVER-SLPE-059-S	NA	0.0116	0.0078	0.596	0.0785
604475	TA2-1-OVER-SLPE-060-DU	NA	0.00425	0.00523	0.105	0.024
604475	TA2-1-OVER-SLPE-060-S	NA	0.0111	0.00794	0.169	0.0356
604736	TA2-2-BLDG-901-001-S	NA	0.00255	0.00374	0.0561	0.0152
604736	TA2-2-BLDG-901-002-S	NA	ND (0.00193)	--	0.0232	0.00948
604736	TA2-2-BLDG-901-003-S	NA	0.0042	0.0037	0.021	0.00879
604736	TA2-2-BLDG-901-004-S	NA	0.0134	0.0074	0.515	0.0692
604736	TA2-2-BLDG-901-005-S	NA	ND (0.00263)	--	0.0213	0.00992
604736	TA2-2-BLDG-901-006-S	NA	ND (0.00263)	--	0.0136	0.00773
604736	TA2-2-BLDG-901-007-DU	NA	ND (0.00267)	--	ND (0.00324)	--
604736	TA2-2-BLDG-901-007-S	NA	ND (0.00198)	--	ND (0.00343)	--
604740	TA2-XPLO-SIVE-001-S	NA	ND (0.00227)	--	ND (0.00275)	--
604740	TA2-XPLO-SIVE-002-S	NA	ND (0.00159)	--	ND (0.00526)	--
604740	TA2-XPLO-SIVE-003-S	NA	ND (0.00228)	--	ND (0.00478)	--
604740	TA2-XPLO-SIVE-004-S	NA	ND (0.00242)	--	0.0117	0.00714
604740	TA2-XPLO-SIVE-005-S	NA	0.00294	0.00289	0.0066	0.00777
604740	TA2-XPLO-SIVE-006-S	NA	ND (0.00229)	--	ND (0.00229)	--
604740	TA2-XPLO-SIVE-007-DU	NA	ND (0.00199)	--	0.00428	0.00446
604740	TA2-XPLO-SIVE-007-S	NA	0.00317	0.0036	ND (0.00286)	--
Quality Assurance/Quality Control Samples (pCi/L)						
604431	TA2-1-OVER-SLPE-EB1	NA	ND (0.0336)	2	ND (0.0251)	0.0116
604475	TA2-1-OVER-SLPE-EB2	NA	ND (0.0174)	--	ND (0.0125)	--

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.

bgs	= Below ground surface.
BLDG	= Building.
DU	= Duplicate.
EB	= Equipment blank.
EPA	= U.S. Environmental Protection Agency.
ER	= Environmental Restoration.
ft	= Foot (feet).
ID	= Identification.
NA	= Not applicable.
ND ( )	= Not detected. The result is below the minimum detectable activity, shown in parentheses.
OVER-SLPE	= Over-excavation slope.
pCi/g	= Picocurie(s) per gram.
pCi/L	= Picocurie(s) per liter.
S	= Soil.
SWMU	= Solid Waste Management Unit.
XPLO-SIVE	= Explosives storage bunker.
--	= Error not calculated for nondetectable results.

Table B-15
Summary of Tritium Analytical Results, April 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 16

Sample Attributes			Activity	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium pCi/L	Tritium pCi/g
604427	TA2-1-OVER-SLPE-001-S	NA	ND (185)	ND (0.00925)
604427	TA2-1-OVER-SLPE-002-S	NA	ND (190)	ND (0.0095)
604427	TA2-1-OVER-SLPE-003-S	NA	ND (186)	ND (0.0093)
604427	TA2-1-OVER-SLPE-004-S	NA	ND (192)	ND (0.0096)
604427	TA2-1-OVER-SLPE-005-S	NA	211	0.01055
604427	TA2-1-OVER-SLPE-006-S	NA	351	0.01755
604427	TA2-1-OVER-SLPE-007-S	NA	**659**	**0.03295**
604427	TA2-1-OVER-SLPE-008-S	NA	**460**	**0.023**
604427	TA2-1-OVER-SLPE-009-S	NA	**558**	**0.0279**
604427	TA2-1-OVER-SLPE-010-S	NA	338	0.0169
604427	TA2-1-OVER-SLPE-011-S	NA	**620**	**0.031**
604427	TA2-1-OVER-SLPE-012-S	NA	**621**	**0.03105**
604427	TA2-1-OVER-SLPE-013-S	NA	357	0.01785
604427	TA2-1-OVER-SLPE-014-S	NA	**979**	**0.04895**
604427	TA2-1-OVER-SLPE-015-S	NA	**676**	**0.0338**
604429	TA2-1-OVER-SLPE-016-S	NA	**614**	**0.0307**
604429	TA2-1-OVER-SLPE-017-S	NA	**1,980**	**0.099**
604429	TA2-1-OVER-SLPE-018-S	NA	**1,070**	**0.0535**
604429	TA2-1-OVER-SLPE-019-S	NA	**2,030**	**0.1015**
604429	TA2-1-OVER-SLPE-020-S	NA	**763**	**0.03815**
604429	TA2-1-OVER-SLPE-021-S	NA	**618**	**0.0309**
604429	TA2-1-OVER-SLPE-022-S	NA	312	0.0156
604429	TA2-1-OVER-SLPE-023-S	NA	**1,040**	**0.052**
604429	TA2-1-OVER-SLPE-024-S	NA	**444**	**0.0222**
604429	TA2-1-OVER-SLPE-025-S	NA	106	0.0053
604429	TA2-1-OVER-SLPE-026-S	NA	149	0.00745
604429	TA2-1-OVER-SLPE-027-S	NA	ND (104)	ND (0.0052)
604429	TA2-1-OVER-SLPE-028-S	NA	173	0.00865
604429	TA2-1-OVER-SLPE-029-DU	NA	139	0.00695
604429	TA2-1-OVER-SLPE-029-S	NA	**1,150**	**0.0575**
604429	TA2-1-OVER-SLPE-030-S	NA	147	0.00735
604433	TA2-1-OVER-SLPE-031-S	NA	81.4	0.00407
604433	TA2-1-OVER-SLPE-032-S	NA	**1,260**	**0.063**
604433	TA2-1-OVER-SLPE-033-S	NA	118	0.0059
604433	TA2-1-OVER-SLPE-034-S	NA	113	0.00565
604433	TA2-1-OVER-SLPE-035-S	NA	208	0.0104
604433	TA2-1-OVER-SLPE-036-S	NA	401	0.02005
604433	TA2-1-OVER-SLPE-037-S	NA	**585**	**0.02925**
604433	TA2-1-OVER-SLPE-038-S	NA	252	0.0126
604433	TA2-1-OVER-SLPE-039-S	NA	**1,370**	**0.0685**
604433	TA2-1-OVER-SLPE-040-S	NA	**1,910**	**0.0955**
604433	TA2-1-OVER-SLPE-041-S	NA	**1,440**	**0.072**
604433	TA2-1-OVER-SLPE-042-S	NA	**809**	**0.04045**
604433	TA2-1-OVER-SLPE-043-S	NA	360	0.018
604433	TA2-1-OVER-SLPE-044-S	NA	**421**	**0.02105**
604433	TA2-1-OVER-SLPE-045-S	NA	167	0.00835
604475	TA2-1-OVER-SLPE-046-S	NA	322	0.0161
604475	TA2-1-OVER-SLPE-047-S	NA	**1,430**	**0.0715**
604475	TA2-1-OVER-SLPE-048-S	NA	321	0.01605
604475	TA2-1-OVER-SLPE-049-S	NA	318	0.0159
604475	TA2-1-OVER-SLPE-050-S	NA	274	0.0137
604475	TA2-1-OVER-SLPE-051-S	NA	223	0.01115
604475	TA2-1-OVER-SLPE-052-S	NA	369	0.01845
Background Activity[b]			420	0.021

Refer to footnotes at end of table.

Table B-15 (Concluded)
Summary of Tritium Analytical Results, April 2001,
for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 16

Sample Attributes			Activity	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium pCi/L	Tritium pCi/g
604475	TA2-1-OVER-SLPE-053-S	NA	311	0.01555
604475	TA2-1-OVER-SLPE-054-S	NA	**470**	**0.0235**
604475	TA2-1-OVER-SLPE-055-S	NA	**918**	**0.0459**
604475	TA2-1-OVER-SLPE-056-S	NA	**570**	**0.0285**
Background Activity[b]			420	0.021

Sample Attributes			Activity
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium pCi/L
604475	TA2-1-OVER-SLPE-057-S	NA	159
604475	TA2-1-OVER-SLPE-058-S	NA	ND (189)
604475	TA2-1-OVER-SLPE-059-S	NA	ND (189)
604475	TA2-1-OVER-SLPE-060-DU	NA	237
604475	TA2-1-OVER-SLPE-060-S	NA	ND (188)
604736	TA2-2-BLDG-901-001-S	NA	ND (118)
604736	TA2-2-BLDG-901-002-S	NA	ND (118)
604736	TA2-2-BLDG-901-003-S	NA	ND (118)
604736	TA2-2-BLDG-901-004-S	NA	**4,410**
604736	TA2-2-BLDG-901-005-S	NA	ND (117)
604736	TA2-2-BLDG-901-006-S	NA	**832**
604736	TA2-2-BLDG-901-007-DU	NA	ND (117)
604736	TA2-2-BLDG-901-007-S	NA	ND (116)
604740	TA2-XPLO-SIVE-001-S	NA	ND (119)
604740	TA2-XPLO-SIVE-002-S	NA	ND (118)
604740	TA2-XPLO-SIVE-003-S	NA	ND (117)
604740	TA2-XPLO-SIVE-004-S	NA	ND (119)
604740	TA2-XPLO-SIVE-005-S	NA	ND (120)
604740	TA2-XPLO-SIVE-006-S	NA	ND (119)
604740	TA2-XPLO-SIVE-007-DU	NA	ND (119)
604740	TA2-XPLO-SIVE-007-S	NA	ND (119)
Background Activity[b]			420
Quality Assurance/Quality Control Samples			
604431	TA2-1-OVER-SLPE-EB1	NA	112
604475	TA2-1-OVER-SLPE-EB2	NA	117

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Tharp February 1999.

bgs = Below ground surface.
DU = Duplicate.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
OVER-SLPE = Over-excavation slope.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
RWL = Radioactive Waste Landfill.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
XPLO-SIVE = Explosives storage bunker.

Table B-16
Summary of Metals Analytical Results, April 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Metals (EPA Method 6020/ 7470/6 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
604427	TA2-1-OVER-SLPE-001-S	NA	4.31	125	0.511	0.0753 J (0.485)	10.3	7.76	0.014	8.85	0.295 J (0.485)	0.527	0.719
604427	TA2-1-OVER-SLPE-002-S	NA	3.25	169	0.44 J (0.495)	0.139 J (0.495)	8.74	7.82	0.0231	7.5	0.308 J (0.495)	0.196 J (0.495)	0.84
604427	TA2-1-OVER-SLPE-003-S	NA	2.63	102	0.365 J (0.49)	0.136 J (0.49)	**19.2**	81.7	0.0143	6.32	ND (0.135)	0.116 J (0.49)	0.715
604427	TA2-1-OVER-SLPE-004-S	NA	3.14	128	0.473 J (0.5)	0.093 J (0.5)	**15.7**	7.26	0.0184	9.97	ND (0.135)	ND (0.0578)	0.691
604427	TA2-1-OVER-SLPE-005-S	NA	3.5	114	0.398 J (0.5)	0.0722 J (0.5)	8.47	5.85	0.0247	6.86	ND (0.135)	ND (0.0578)	1.08
604427	TA2-1-OVER-SLPE-006-S	NA	3.95	174	0.454 J (0.495)	0.126 J (0.495)	9.19	7.06	0.0256	7.52	ND (0.135)	ND (0.0578)	0.706
604427	TA2-1-OVER-SLPE-007-S	NA	3.53	146	0.452 J (0.5)	0.174 J (0.5)	10.1	6.49	0.0221	7.62	ND (0.135)	ND (0.0578)	0.906
604427	TA2-1-OVER-SLPE-008-S	NA	3.3	128	0.43 J (0.481)	0.102 J (0.481)	7.59	7.06	0.0259	6.8	ND (0.135)	0.137 J (0.481)	**28.1**
604427	TA2-1-OVER-SLPE-009-S	NA	3.51	186	0.417 J (0.455)	0.121 J (0.455)	8.62	8.84	0.0266	7.06	ND (0.135)	0.137 J (0.455)	2.17
604427	TA2-1-OVER-SLPE-010-S	NA	3.46	154	0.408 J (0.481)	0.093 J (0.481)	8.63	5.48	0.0259	7.12	0.382 J (0.481)	ND (0.0578)	1.52
604427	TA2-1-OVER-SLPE-011-S	NA	3.16	143	0.394 J (0.481)	0.108 J (0.481)	7.67	7.24	0.0789	7.01	0.301 J (0.481)	ND (0.0578)	1.69
604427	TA2-1-OVER-SLPE-012-S	NA	3.23	169	0.374 J (0.476)	0.154 J (0.476)	7.74	8.14	0.0314	6.51	ND (0.135)	ND (0.0578)	1.29
604427	TA2-1-OVER-SLPE-013-S	NA	3.11	113	0.356 J (0.485)	0.0685 J (0.485)	6.77	5.51	0.0181	5.83	ND (0.135)	ND (0.0578)	1.48
604427	TA2-1-OVER-SLPE-014-S	NA	3.66	100	0.529	0.0363 J (0.463)	10.2	8.65	0.0261	8.22	ND (0.135)	ND (0.0578)	0.65
604427	TA2-1-OVER-SLPE-015-S	NA	4.14	194	0.417 J (0.455)	0.0484 J (0.455)	7.65	4.96	0.0382	6.64	0.553	ND (0.0578)	1.48
604429	TA2-1-OVER-SLPE-016-S	NA	2.82	**206**	0.357 J (0.476)	0.51	7.48	5.2	0.0611	6.37	ND (0.135)	ND (0.0578)	1.68
604429	TA2-1-OVER-SLPE-017-S	NA	2.57	146	0.343 J (0.481)	0.513	9.29	4.87	0.0427	7.23	ND (0.135)	ND (0.0578)	1.62
604429	TA2-1-OVER-SLPE-018-S	NA	2.83	111	0.361 J (0.49)	0.601	8.26	5.32	0.0323	7.14	ND (0.135)	ND (0.0578)	1.37
604429	TA2-1-OVER-SLPE-019-S	NA	2.91	130	0.36 J (0.485)	0.485 J (0.485)	8.36	5.82	0.0299	6.67	ND (0.135)	ND (0.0578)	**2.31**
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-16 (Continued)
Summary of Metals Analytical Results, April 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Metals (EPA Method 6020/ 7470/6 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
604429	TA2-1-OVER-SLPE-020-S	NA	2.65	164	0.338 J (0.476)	0.485	7.88	5.4	0.0313	6.16	ND (0.135)	ND (0.0578)	1.35
604429	TA2-1-OVER-SLPE-021-S	NA	3.15	121	0.376 J (0.467)	0.602	9.38	6.19	0.036	7.33	ND (0.135)	ND (0.0578)	**2.47**
604429	TA2-1-OVER-SLPE-022-S	NA	3.04	122	0.386 J (0.495)	0.543	10.3	6.1	0.0454	7.8	ND (0.135)	ND (0.0578)	**2.92**
604429	TA2-1-OVER-SLPE-023-S	NA	3.03	160	0.37 J (0.49)	0.583	8.74	6.18	0.0339	6.94	ND (0.135)	ND (0.0578)	1.41
604429	TA2-1-OVER-SLPE-024-S	NA	2.97	166	0.36 J (0.495)	0.577	8.6	5.64	0.0328	7.41	ND (0.135)	ND (0.0578)	1.35
604429	TA2-1-OVER-SLPE-025-S	NA	3.42	126	0.447 J (0.495)	0.613	10.6	8.02	0.0246	9.1	ND (0.135)	ND (0.0578)	0.67
604429	TA2-1-OVER-SLPE-026-S	NA	2.8	104	0.405 J (0.495)	0.525	9.45	7.47	0.0148	7.56	ND (0.135)	ND (0.0578)	0.853
604429	TA2-1-OVER-SLPE-027-S	NA	2.88	105	0.397 J (0.5)	0.55	9.19	18	0.0141	7.64	ND (0.135)	ND (0.0578)	0.764
604429	TA2-1-OVER-SLPE-028-S	NA	3.53	100	0.376 J (0.481)	0.613	9.38	6.9	0.0159	7.6	1.04 J (1.2)	ND (0.0578)	0.756
604429	TA2-1-OVER-SLPE-029-DU	NA	2.52	88.7	0.39 J (0.485)	0.624	9.25	9.15	0.019	7.28	ND (0.135)	ND (0.0578)	0.851
604429	TA2-1-OVER-SLPE-029-S	NA	2.95	96.4	0.415 J (0.49)	0.654	9.38	8.06	0.0145	7.42	ND (0.135)	ND (0.0578)	0.786
604429	TA2-1-OVER-SLPE-030-S	NA	2.54	103	0.429 J (0.481)	0.679	10.6	10.5	0.0154	8.09	ND (0.135)	ND (0.0578)	0.679
604433	TA2-1-OVER-SLPE-031-S	NA	3.47	111	0.523	0.501	8.5	7.31	0.0147	7.59	ND (0.135)	ND (0.0578)	0.8
604433	TA2-1-OVER-SLPE-032-S	NA	4.04	119	0.584	0.646	11.1	8.17	0.0208	7.94	ND (0.135)	ND (0.0578)	1.23
604433	TA2-1-OVER-SLPE-033-S	NA	3.64	126	0.553	0.686	12.1	7.46	0.0173	8.63	0.869 J (1.15)	ND (0.0578)	1.12
604433	TA2-1-OVER-SLPE-034-S	NA	4.08	145	0.555	0.852	12.1	10.3	0.0169	8.13	ND (0.135)	ND (0.0578)	0.79
604433	TA2-1-OVER-SLPE-035-S	NA	3.98	129	0.532	0.595	10.3	6.89	0.0132	7.86	ND (0.135)	ND (0.0578)	0.773
604433	TA2-1-OVER-SLPE-036-S	NA	**4.5**	140	0.526	0.642	10.3	6.36	0.0266	7.59	ND (0.135)	ND (0.0578)	1.06
604433	TA2-1-OVER-SLPE-037-S	NA	3.81	156	0.487	0.546	9.09	5.61	0.029	6.62	ND (0.135)	ND (0.0578)	1.5
604433	TA2-1-OVER-SLPE-038-S	NA	4.14	145	0.523	0.653	9.96	7.83	0.021	7.55	ND (0.135)	ND (0.0578)	0.901
604433	TA2-1-OVER-SLPE-039-S	NA	3.74	153	0.439 J (0.481)	0.744	9.49	5.68	**0.178**	7.28	ND (0.135)	ND (0.0578)	2.27
604433	TA2-1-OVER-SLPE-040-S	NA	3.93	153	0.527	**6.7**	9.8	5.7	0.0579	6.96	ND (0.135)	ND (0.0578)	1.14
604433	TA2-1-OVER-SLPE-041-S	NA	4.05	**240**	0.469 J (0.485)	0.551	8.96	5.3	0.0837	6.57	ND (0.135)	ND (0.0578)	1.37
604433	TA2-1-OVER-SLPE-042-S	NA	3.83	109	0.613	0.726	9.16	7.41	0.0441	6.87	ND (0.135)	ND (0.0578)	1.29
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-16 (Continued)
Summary of Metals Analytical Results, April 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Metals (EPA Method 6020/ 7470/6 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
604433	TA2-1-OVER-SLPE-043-S	NA	3.52	103	0.495	0.69	7.75	5.37	0.0855	6.15	ND (0.135)	ND (0.0578)	**58.6**
604433	TA2-1-OVER-SLPE-044-S	NA	3.42	108	0.496	0.831	8.41	5.09	**0.133**	6.08	ND (0.135)	ND (0.0578)	1.57
604433	TA2-1-OVER-SLPE-045-S	NA	3.79	**300**	0.485	0.854	9.63	6.4	0.0439	7.03	ND (0.135)	ND (0.0578)	**5.05**
604475	TA2-1-OVER-SLPE-046-S	NA	3.04	159	0.384 J (0.495)	0.0715 J (0.495)	8.66	5.53	0.0239	7.35	ND (0.135)	ND (0.0578)	1.43
604475	TA2-1-OVER-SLPE-047-S	NA	3.36	157	0.401 J (0.473)	0.0554 J (0.473)	8.17	4.89	0.0204	6.98	0.498	ND (0.0578)	1.71
604475	TA2-1-OVER-SLPE-048-S	NA	3.39	147	0.351 J (0.469)	0.143 J (0.469)	7.64	8.6	0.0254	6.7	ND (0.135)	ND (0.0578)	1.23
604475	TA2-1-OVER-SLPE-049-S	NA	3.01	**235**	0.344 J (0.491)	0.0424 J (0.491)	7.15	6.55	0.0227	6.16	0.302 J (0.491)	ND (0.0578)	1.4
604475	TA2-1-OVER-SLPE-050-S	NA	4.36	**202**	0.385 J (0.472)	0.0514 J (0.472)	8.62	6.14	0.0281	7.15	0.423 J (0.472)	ND (0.0578)	1.39
604475	TA2-1-OVER-SLPE-051-S	NA	2.9	198	0.399 J (0.479)	0.0367 J (0.479)	8.49	6.18	0.0227	7.33	ND (0.135)	ND (0.0578)	0.896
604475	TA2-1-OVER-SLPE-052-S	NA	2.88	138	0.466 J (0.477)	0.361 J (0.477)	10.5	8.18	**0.108**	8.84	0.361 J (0.477)	ND (0.0578)	1.3
604475	TA2-1-OVER-SLPE-053-S	NA	3.76	156	0.565	0.026 J (0.467)	11.8	7.61	0.0376	9.59	0.307 J (0.467)	ND (0.0578)	0.726
604475	TA2-1-OVER-SLPE-054-S	NA	3.1	165	0.386 J (0.474)	ND (0.013)	8.42	5.73	0.0221	7.03	0.455 J (0.474)	ND (0.0578)	**3.36**
604475	TA2-1-OVER-SLPE-055-S	NA	3.31	123	0.472 J (0.481)	ND (0.013)	9.89	6.59	0.0221	8.63	0.407 J (0.481)	ND (0.0578)	0.736
604475	TA2-1-OVER-SLPE-056-S	NA	3.36	163	0.485 J (0.487)	ND (0.013)	10.9	7.48	0.0255	8.69	0.422 J (0.487)	ND (0.0578)	0.805
604475	TA2-1-OVER-SLPE-057-S	NA	3.2	137	0.447 J (0.479)	ND (0.013)	8.46	6.03	0.0275	7.61	0.432 J (0.479)	ND (0.0578)	0.709
604475	TA2-1-OVER-SLPE-058-S	NA	3.59	178	0.439 J (0.498)	0.0284 J (0.498)	9.57	6.09	0.0202	8.18	0.306 J (0.498)	ND (0.0578)	0.688
604475	TA2-1-OVER-SLPE-059-S	NA	2.69	155	0.339 J (0.469)	ND (0.013)	7.36	4.72	0.00455 J (0.00952)	6.29	ND (0.135)	ND (0.0578)	1.21
604475	TA2-1-OVER-SLPE-060-DU	NA	2.37	135	0.304 J (0.472)	ND (0.013)	7.48	3.78	ND (0.00455)	5.66	0.444 J (0.472)	ND (0.0578)	1.39
604475	TA2-1-OVER-SLPE-060-S	NA	2.22	105	0.281 J (0.494)	ND (0.013)	8.69	3.63	ND (0.00455)	7.61	0.507	ND (0.0578)	1.06
604736	TA2-2-BLDG-901-001-S	NA	4.12	167	0.487	0.161 J (0.485)	10.6	7.4	0.0057 J (0.00997)	8.77	0.943	ND (0.112)	1.32
604736	TA2-2-BLDG-901-002-S	NA	**4.43**	154	0.473 J (0.485)	0.152 J (0.485)	10.7	7.13	0.00936	9.35	0.895	ND (0.112)	1.03
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Refer to footnotes at end of table.

Table B-16 (Concluded)
Summary of Metals Analytical Results, April 2001, for Soil Placed in the SWMU 1 Excavation as Lifts 14 through 17

Sample Attributes			Metals (EPA Method 6020/ 7470/6 7471) (mg/kg)										
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
604736	TA2-2-BLDG-901-003-S	NA	4.1	159	0.451 J (0.472)	0.153 J (0.472)	10.2	9.86	0.0108	8.45	0.563	ND (0.109)	1.14
604736	TA2-2-BLDG-901-004-S	NA	4.1	186	0.543	0.134 J (0.467)	11.4	7.83	0.0183	10.3	0.779	ND (0.108)	1.34
604736	TA2-2-BLDG-901-005-S	NA	3.77	153	0.445 J (0.49)	0.133 J (0.49)	8.76	6.21	0.0101	7.98	0.905	ND (0.113)	0.913
604736	TA2-2-BLDG-901-006-S	NA	4.27	170	0.553	0.171 J (0.455)	11.9	8.17	0.0114	10.4	0.804	ND (0.105)	1.16
604736	TA2-2-BLDG-901-007-DU	NA	**4.61**	182	0.449 J (0.49)	0.15 J (0.49)	10.2	7.26	0.00895 J (0.00932)	9.27	0.646	ND (0.113)	0.869
604736	TA2-2-BLDG-901-007-S	NA	4.04	138	0.442 J (0.467)	0.147 J (0.467)	9.47	7.06	0.0105	8.48	0.849	ND (0.108)	1.02
604740	TA2-XPLO-SIVE-001-S	NA	3.65	175	0.467 J (0.5)	0.178 J (0.5)	9.72	7.8	0.0116	8.44	0.733	ND (0.116)	1.25
604740	TA2-XPLO-SIVE-002-S	NA	4.41	152	0.487	0.151 J (0.481)	10.7	7.29	0.0174	9.18	0.732	ND (0.111)	0.922
604740	TA2-XPLO-SIVE-003-S	NA	4.09	149	0.465 J (0.481)	0.186 J (0.481)	9.64	7.29	0.011	8.29	0.804	ND (0.111)	0.908
604740	TA2-XPLO-SIVE-004-S	NA	4.39	163	0.484	0.168 J (0.467)	9.69	7.22	0.0128	8.57	0.898	ND (0.108)	0.895
604740	TA2-XPLO-SIVE-005-S	NA	4.34	169	0.496	0.179 J (0.455)	10.4	7.75	0.0145	9.13	0.578	ND (0.105)	0.804
604740	TA2-XPLO-SIVE-006-S	NA	3.7	134	0.454 J (0.463)	0.158 J (0.463)	10.5	6.76	0.0115	9.38	0.82	ND (0.107)	0.876
604740	TA2-XPLO-SIVE-007-DU	NA	4.36	169	0.503	0.175 J (0.472)	10.4	7.79	0.0115	8.88	0.593	ND (0.109)	0.949
604740	TA2-XPLO-SIVE-007-S	NA	**4.59**	160	0.511	0.182 J (0.5)	10.4	7.73	0.0082 J (0.00821)	9.5	0.868	ND (0.116)	1.04
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3
Quality Assurance/Quality Control Samples (all in mg/L)													
604431	TA2-1-OVER-SLPE-EB1	NA	ND (0.00457)	0.0007	ND (0.0002)	0.00026	0.0011	ND (0.00344)	ND (0.00007)	ND (0.00074)	ND (0.00309)	0.00051	ND (0.00002)
604475	TA2-1-OVER-SLPE-EB2	NA	ND (0.00457)	0.00074 J (0.005)	ND (0.0002)	ND (0.00025)	ND (0.00078)	ND (0.00344)	ND (0.00007)	ND (0.00074)	ND (0.00309)	ND (0.0002)	ND (0.00002)

Note: Values in **bold** exceed background soil concentrations.

[a]Analysis request/chain-of-custody record.

[b]Dinwiddie September 1997, North Area Supergroup.

bgs = Below ground surface.
BLDG = Building.
DU = Duplicate.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The associated value is an estimated quantity.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable (depth not applicable for soil pile).
ND ( ) = Not detected. The result is below the method detection limit, shown in parentheses.
OVER-SLPE = Over-excavation slope.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
XPLO-SIVE = Explosive storage bunker.

Table B-17
Summary of Gamma Spectroscopy Analytical Results, November 1999, for Verification Samples Collected from the Floor of the SWMU 1 Excavation

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
602934	TA2-1-VERF-CDP-15.0-S	15.0	ND (0.467)	--	ND (0.0284)	--	0.573	1.03	0.0942	0.155	ND (0.694)	--
602934	TA2-1-VERF-PIT1-17.2-S	17.2	ND (0.387)	--	ND (0.0243)	--	0.673	0.348	ND (0.179)	--	ND (0.599)	--
602934	TA2-1-VERF-PIT2-18.6-S	18.6	ND (0.428)	--	0.0152	0.0217	ND (0.123)	--	0.114	0.15	ND (0.643)	--
602934	TA2-1-VERF-PIT7-16.5-D	16.5	ND (0.449)	--	0.0154	0.0166	0.383	0.202	**ND (0.196)**	--	ND (0.678)	--
602934	TA2-1-VERF-PIT7-16.5-S	16.5	ND (0.46)	--	0.0569	0.0315	0.502	0.302	**ND (0.191)**	--	ND (0.673)	--
602934	TA2-1-VERF-TR5-18.6-S	18.6	0.562	0.302	0.0397	0.0146	0.732	0.34	**ND (0.191)**	--	ND (0.682)	--
602934	TA2-1-VERF-TR6-22.9-S	22.9	ND (0.376)	--	0.0377	0.0199	0.61	0.343	0.11	0.154	ND (0.708)	--
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Two standard deviations about the mean detected activity.

[c]Dinwiddie September 1997, North Area Supergroup.

CDP = Chemical Disposal Pits.
D = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
NS = Not specified by Dinwiddie September 1997.
pCi/g = Picocurie(s) per gram.
PIT = Pit.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
TR = Trench.
VERF = Verification.
-- = Error not calculated for nondetectable results.

Table B-18
Summary of Isotopic Plutonium Analytical Results, November 1999, for Verification Samples Collected from the Floor of the SWMU 1 Excavation

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
602935	TA2-1-VERF-PIT1-17.2-S	17.2	ND (0.0131)	--	0.00006	0.0087
602935	TA2-1-VERF-PIT2-18.6-S	18.6	ND (0.0113)	--	0.189	0.0594
602935	TA2-1-VERF-PIT7-16.5-D	16.5	ND (0.0117)	--	0.0576	0.0333
602935	TA2-1-VERF-PIT7-16.5-S	16.5	ND (0.0228)	--	0.549	0.121
602935	TA2-1-VERF-TR5-18.6-S	18.6	0.074	0.033	3.98	0.574
602935	TA2-1-VERF-TR6-22.9-S	22.9	0.0622	0.0316	2.56	0.39

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
D = Duplicate.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
PIT = Pit.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area.
TR = Trench.
VERF = Verification.
-- = Error not calculated for nondetectable results.

Table B-19
Summary of Tritium Analytical Results, November 1999 and May 2003, for Verification Samples Collected from the Floor of the SWMU 1 Excavation

Sample Attributes			Activity (EPA Method 906.0)	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium pCi/L	Tritium pCi/g
602935	TA2-1-VERF-PIT1-17.2-S	17.2	ND (158)	NR
602935	TA2-1-VERF-PIT2-18.6-S	18.6	**606**	NR
602935	TA2-1-VERF-TR5-18.6-S	18.6	**714**	NR
602935	TA2-1-VERF-TR6-22.9-S	22.9	ND (158)	NR
606385	TA2-1-VERF-CDP-15.0-R	15.0	NR	**ND (0.715)**
606385	TA2-1-VERF-PIT7-16.5-R	16.5	**60,700**	NR
Background Activity[b]			420	0.021

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Tharp, February 1999.

CDP = Chemical Disposal Pits.
D = Duplicate.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
NR = Not required.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
PIT = Pit.
R = Resample (soil).
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
TR = Trench.
VERF = Verification.

Table B-20
Summary of Metals Analytical Results, November 1999, for Verification Samples Collected from the Floor of the SWMU 1 Excavation

Sample Attributes			Metals (EPA Method 6010/ 7471) (mg/kg)[b]		
Record Number[a]	ER Sample ID	Sample Depth (ft)	Cadmium	Mercury	Silver
602935	TA2-1-VERF-CDP-15.0-S	15.0	0.0936 J (0.463)	0.0165 J (0.0312)	ND (0.101)
602935	TA2-1-VERF-PIT1-17.2-S	17.2	ND (0.0382)	ND (0.0152)	ND (0.101)
602935	TA2-1-VERF-PIT2-18.6-S	18.6	ND (0.0382)	0.0232 J (0.025)	ND (0.101)
602935	TA2-1-VERF-PIT7-16.5-D	16.5	0.0796 J (0.5)	ND (0.0152)	ND (0.101)
602935	TA2-1-VERF-PIT7-16.5-S	16.5	0.175 J (0.5)	0.0364	ND (0.101)
602935	TA2-1-VERF-TR5-18.6-S	18.6	0.223 J (0.455)	**0.137**	ND (0.101)
602935	TA2-1-VERF-TR6-22.9-S	22.9	0.243 J (0.5)	0.051	ND (0.101)
Background Concentration[c]			0.9	<0.1	<1

Note: Values in **bold** exceed background soil concentrations.

[a]Analysis request/chain-of-custody record.

[b]NMED requested only 3 metals for analysis.

[c]Dinwiddie September 1997, North Area Supergroup.

CDP = Chemical Disposal Pits.
D = Duplicate.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The associated value is an estimated quantity. The reported value is greater than or equal to the method detection limit but is less than the reporting limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
ND ( ) = Not detected. The result is below the method detection limit, shown in parentheses.
PIT = Pit.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
TR = Trench.
VERF = Verification.

Table B-21
Summary of Gamma Spectroscopy Analytical Results, November 2003, SWMU 1 Final Verification Surface-Soil Samples for Restored Ground Surface

Sample Attributes			Activity (pCi/g)									
Record Number[a]	ER Sample ID	Sample Depth (ft)	Americium-241		Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
606993	TA2-1-FINL-VER-001-S	0–0.5	ND (0.0562)	--	0.0187	0.0109	0.947	0.0781	0.1	0.104	0.531	0.791
606993	TA2-1-FINL-VER-002-S	0–0.5	0.0672	0.0488	0.0349	0.0148	0.917	0.073	0.0959	0.0876	0.654	0.502
606993	TA2-1-FINL-VER-003-S	0–0.5	0.0458	0.0609	0.0264	0.0217	1.02	0.11	0.0904	0.0832	0.574	0.554
606993	TA2-1-FINL-VER-004-S	0–0.5	ND (0.0337)	--	ND (0.00811)	--	0.668	0.0763	ND (0.0484)	--	0.331	0.511
606993	TA2-1-FINL-VER-005-S	0–0.5	ND (0.0351)	--	0.0189	0.0142	0.711	0.0304	ND (0.0453)	--	0.913	0.556
606993	TA2-1-FINL-VER-006-S	0–0.5	ND (0.0351)	--	ND (0.00877)	--	0.696	0.0672	ND (0.0472)	--	0.75	0.537
606993	TA2-1-FINL-VER-007-S	0–0.5	ND (0.0361)	--	ND (0.00633)	--	0.628	0.0524	0.0527	0.0754	ND (0.29)	--
606993	TA2-1-FINL-VER-008-S	0–0.5	ND (0.0224)	--	ND (0.00594)	--	0.635	0.0521	ND (0.0383)	--	0.401	0.41
606994	TA2-1-FINL-VER-009-S	0–0.5	ND (0.0235)	--	ND (0.00629)	--	0.551	0.0465	0.0696	0.0727	0.375	0.4
606994	TA2-1-FINL-VER-010-S	0–0.5	ND (0.0432)	--	ND (0.0074)	--	0.685	0.0576	0.0643	0.0515	0.654	0.452
606994	TA2-1-FINL-VER-011-S	0–0.5	ND (0.011)	--	ND (0.00938)	--	0.716	0.0839	0.0509	0.0778	0.571	0.282
606994	TA2-1-FINL-VER-012-S	0–0.5	ND (0.0592)	--	0.0101	0.0153	0.66	0.0638	ND (0.0518)	--	ND (0.425)	--
606994	TA2-1-FINL-VER-013-S	0–0.5	0.0887	0.0301	0.0112	0.0189	0.734	0.0688	0.0783	0.0943	0.671	0.363
606994	TA2-1-FINL-VER-014-S	0–0.5	0.034	0.04	**0.15**	0.0278	0.947	0.0893	ND (0.0794)	--	0.536	0.579
606994	TA2-1-FINL-VER-015-S	0–0.5	ND (0.0283)	--	0.0301	0.0122	0.841	0.0657	ND (0.0461)	--	0.46	0.448
Background Activity[c]			NS		0.084		1.54		0.18		1.3	

Note: Values in **bold** exceed background soil activities.
[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]Dinwiddie September 1997, North Area Supergroup.

ER = Environmental Restoration.
FINL-VERF = Final verification.
ft = Foot (feet).
ID = Identification.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
NS = Not specified by Dinwiddie September 1997.
pCi/g = Picocurie(s) per gram.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
-- = Error not calculated for nondetectable results.

Table B-22
Summary of Isotopic Plutonium Analytical Results, November 2003, SWMU 1 Final Verification Surface-Soil Samples for Restored Ground Surface

Sample Attributes			Activity (EPA Method HASL 300) (pCi/g)			
			Plutonium-238		Plutonium-239/240	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
606993	TA2-1-FINL-VER-001-S	0-0.5	0.00836	0.0102	0.187	0.0387
606993	TA2-1-FINL-VER-002-S	0-0.5	ND (0.00858)	--	0.465	0.0701
606993	TA2-1-FINL-VER-003-S	0-0.5	0.00573	0.00776	0.273	0.0491
606993	TA2-1-FINL-VER-004-S	0-0.5	ND (0.00629)	--	0.0109	0.0102
606993	TA2-1-FINL-VER-005-S	0-0.5	0.00419	0.00613	0.134	0.0287
606993	TA2-1-FINL-VER-006-S	0-0.5	ND (0.021)	--	0.129	0.0288
606993	TA2-1-FINL-VER-007-S	0-0.5	ND (0.00613)	--	0.00922	0.00858
606993	TA2-1-FINL-VER-008-S	0-0.5	ND (0.00284)	--	ND (0.017)	--
606994	TA2-1-FINL-VER-009-S	0-0.5	ND (0.00782)	--	ND (0.016)	--
606994	TA2-1-FINL-VER-010-S	0-0.5	0.00689	0.00902	0.12	0.0255
606994	TA2-1-FINL-VER-011-S	0-0.5	ND (0.00396)	--	ND (0.017)	--
606994	TA2-1-FINL-VER-012-S	0-0.5	ND (0.00619)	--	0.00542	0.00565
606994	TA2-1-FINL-VER-013-S	0-0.5	ND (0.00943)	--	0.727	0.0887
606994	TA2-1-FINL-VER-014-S	0-0.5	0.0108	0.00975	0.126	0.0268
606994	TA2-1-FINL-VER-015-S	0-0.5	ND (0.00767)	--	0.269	0.0374

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.

EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
FINL-VER = Final verification.
ft = Foot (feet).
ID = Identification.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.
-- = Error not calculated for nondetectable results.

Table B-23
Summary of Tritium Analytical Results, November 2003, SWMU 1 Final Verification Surface-Soil Samples for Restored Ground Surface

Sample Attributes			Activity
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium (pCi/L)
606993	TA2-1-FINL-VER-001-S	0-0.5	ND (120)
606993	TA2-1-FINL-VER-002-S	0-0.5	345
606993	TA2-1-FINL-VER-003-S	0-0.5	337
606993	TA2-1-FINL-VER-004-S	0-0.5	ND (116)
606993	TA2-1-FINL-VER-005-S	0-0.5	ND (118)
606993	TA2-1-FINL-VER-006-S	0-0.5	**2,120**
606993	TA2-1-FINL-VER-007-S	0-0.5	ND (111)
606993	TA2-1-FINL-VER-008-S	0-0.5	ND (118)
606994	TA2-1-FINL-VER-009-S	0-0.5	ND (99.7)
606994	TA2-1-FINL-VER-010-S	0-0.5	**673**
606994	TA2-1-FINL-VER-011-S	0-0.5	ND (94)
606994	TA2-1-FINL-VER-012-S	0-0.5	254
606994	TA2-1-FINL-VER-013-S	0-0.5	**609**
606994	TA2-1-FINL-VER-014-S	0-0.5	**777**
606994	TA2-1-FINL-VER-015-S	0-0.5	230
Background Activity[b]			420

Note: Values in **bold** exceed background soil activities.
[a]Analysis request/chain-of-custody record.
[b]Tharp, February 1999.
ER = Environmental Restoration.
FINL-VERF = Final verification.
ft = Foot (feet).
ID = Identification.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
pCi/L = Picocurie(s) per liter.
S = Soil.
SWMU = Solid Waste Management Unit.

Table B-24
Summary of Metals Analytical Results, November 2003, SWMU 1 Final Verification Surface-Soil Samples for Restored Ground Surface

Sample Attributes			Metals (EPA SW-846 Method 7471) (mg/kg)											
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Uranium
606993	TA2-1-FINL-VER-001-S	0-0.5	3.19	137	0.406 J (0.495)	0.0844 J (0.495)	7.3	6.34	0.0249	6.97	0.675	ND (0.0893)	1.15
606993	TA2-1-FINL-VER-002-S	0-0.5	3.05	169	0.363 J (0.467)	0.256 J (0.467)	7.83	7.33	0.0482	6.77	0.47	ND (0.0843)	1.38
606993	TA2-1-FINL-VER-003-S	0-0.5	3.33	124	0.43 J (0.495)	0.134 J (0.495)	8.18	7.46	0.024	7.56	0.427 J (0.495)	ND (0.0893)	1.07
606993	TA2-1-FINL-VER-004-S	0-0.5	4.27	116	0.335 J (0.49)	0.0574 J (0.49)	6.02	5.94	0.0117	5.94	0.405 J (0.49)	ND (0.0884)	0.358 J (0.396)
606993	TA2-1-FINL-VER-005-S	0-0.5	3.2	131	0.353 J (0.5)	0.221 J (0.5)	6.61	7.55	0.0346	6.49	0.444 J (0.5)	ND (0.0902)	0.716
606993	TA2-1-FINL-VER-006-S	0-0.5	3.87	139	0.352 J (0.472)	0.0568 J (0.472)	6.16	4.99	0.0277	5.99	0.239 J (0.472)	ND (0.0851)	0.591
606993	TA2-1-FINL-VER-007-S	0-0.5	3.33	110	0.334 J (0.5)	ND (0.0478)	5.95	5.45	0.00997	6.16	0.451 J (0.5)	ND (0.0902)	0.323 J (0.397)
606993	TA2-1-FINL-VER-008-S	0-0.5	4.35	99.3	0.315 J (0.5)	0.0504 J (0.5)	5.41	5.3	0.0289	5.28	0.473 J (0.5)	ND (0.0902)	0.483
606994	TA2-1-FINL-VER-009-S	0-0.5	2.56	112	0.317 J (0.5)	0.0866 J (0.5)	5.36	5.29	0.022	5.43	ND (1.62)	ND (0.0902)	0.322 J (0.394)
606994	TA2-1-FINL-VER-010-S	0-0.5	2.99	157	0.433 J (0.5)	0.208 J (0.5)	6.94	6.57	0.0371	7.02	ND (0.162)	ND (0.0902)	0.919
606994	TA2-1-FINL-VER-011-S	0-0.5	2.66	110	0.345 J (0.481)	0.191 J (0.481)	5.84	6.16	0.0954	6.52	ND (3.12)	ND (0.0867)	0.377 J (0.398)
606994	TA2-1-FINL-VER-012-S	0-0.5	2.49	105	0.335 J (0.5)	0.111 J (0.5)	5.34	5.06	0.019	5.5	ND (3.24)	ND (0.0902)	0.396
606994	TA2-1-FINL-VER-013-S	0-0.5	3.01	128	0.392 J (0.495)	0.829	7	7.11	**0.147**	7.39	ND (3.21)	0.122 J (0.495)	0.756
606994	TA2-1-FINL-VER-014-S	0-0.5	3.39	144	0.496	0.202 J (0.495)	7.97	6.91	0.0196	7.87	ND (0.16)	ND (0.0893)	0.893
606994	TA2-1-FINL-VER-015-S	0-0.5	3.34	**214**	0.443 J (0.5)	0.412 J (0.5)	7.66	10.2	**0.101**	7.55	ND (3.24)	ND (0.0902)	0.761
Background Concentration[b]			4.4	200	0.8	0.9	12.8	11.2	<0.1	25.4	<1	<1	2.3

Note: Values in **bold** exceed background soil concentrations.
[a]Analysis request/chain-of-custody record.
[b]Dinwiddie September 1997, North Area Supergroup.

EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
FINL-VER = Final verification.
ft = Foot (feet).
ID = Identification.
J ( ) = The associated value is an estimated quantity. The reported value is greater than or equal to the method detection limit but is less than the reporting limit, shown in parentheses.
ND ( ) = Not detected. The result is below the method detection limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.

Annex C

ANNEX C
Index of SWMU 1 Sampling Events, Sample Locations, and Analytical Request/Chain-of-Custody Records

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Table C-1
Index for Radionuclide Analyses versus SWMU 1 Sampling Events

Soil Sampling Activities - SWMU 1 Voluntary Corrective Measure Activities, 1997 Potentially Contaminated Soil Samples - Discrete Samples			
AR/COC	Sample Location	Date Sampled	
6202	Contaminated Pile 10	17-Feb-1997	Lift 2 - Lift 7
6203	Contaminated Pile 11	7-Feb-1997	
6204	Contaminated Pile 12	31-Jan-1997	
6205	Contaminated Pile 13	31-Jan-1997	
6206	Contaminated Pile 14	31-Jan-1997	
6207	Contaminated Pile 17	11-Feb-1997	
6208	Contaminated Pile 18	11-Feb-1997	
6209	Contaminated Pile 19	11-Feb-1997	
6210	Contaminated Pile 20	7-Feb-1997	
6211	Contaminated Pile 21	11-Feb-1997	
6212	Contaminated Pile 22	10-Feb-1997	
6213	Contaminated Pile 26	10-Feb-1997	
6214	Contaminated Pile 1	3-Mar-1997	
6215	Contaminated Pile 2	3-Feb-1997	
6216	Contaminated Pile 3	3-Feb-1997	
6217	Contaminated Pile 4	3-Feb-1997	
6218	Contaminated Pile 5	4-Feb-1997	
6219	Contaminated Pile 6	6-Feb-1997	
6220	Contaminated Pile 7	17-Feb-1997	
6221	Contaminated Pile 8	17-Feb-1997	
6222	Contaminated Pile 9	17-Feb-1997	
6223	Contaminated Pile 15	6-Feb-1997	
6224	Contaminated Pile 16	31-Jan-1997	
6225	Contaminated Pile 23	11-Feb-1997	
6226	Contaminated Pile 24	7-Feb-1997	
6227	Contaminated Pile 25	3-Mar-1997	
6228	Contaminated Pile 21	11-Feb-1997	
6229	Contaminated Pile 22	10-Feb-1997	
6230	Contaminated Pile 26	10-Feb-1997	
RWL BUNKER SOIL PILES (656 cy, 248 cy, 466 cy = 1,370 cy)			
AR/COC	Sample Location	Date Sampled	
604735	TA2-2-BLDG-901-001-S thru 901-007-S + 1 DUP	5-Sep-01	Lift 16-Lift 17
604736	TA2-2-BLDG- 901-001-S thru 901-007-S + 1 DUP set	5-Sep-01	
604739	TA2-XPLO-SIVE-001-s thru 007-S + 1 DUP	6-Sep-01	
604740	TA2-XPLO-SIVE-001-S thru -007-S + 1 DUP	6-Sep-01	
RWL SLOPE/OVERBURDEN PILE - CONSOLIDATED CLEAN SOIL (- 4,710 cy)			
AR/COC	Sample Location	Date Sampled	
604426	TA2-1-OVER-SLPE-001-S thru -015-S	23-Apr-01	Lift 14-Lift 16
604427	TA2-1-OVER-SLPE- 001-S thru 015-S	23-Apr-01	
604428	TA2-1-OVER-SLPE-016-S thru 030-S	24-Apr-01	
604429	TA2-1-OVER-SLPE-016-S thru 030-S + 1 DUP	24-Apr-01	
604432	TA2-1-OVER-SLPE-031-S thru 045-S	25-Apr-01	
604433	TA2-1-OVER-SLPE-031-S thru 045-S	25-Apr-01	
604474	TA2-1-OVER-SLPE-046-S thru 060-S + 1 DUP	26-Apr-01	
604475	TA2-1-OVER-SLPE-046-S thru 060-S + 1 DUP	26-Apr-01	

Table C-1
Index for Radionuclide Analyses versus SWMU 1 Sampling Events

RWL PILE 32 - CONSOLIDATED SLIGHTLY CONTAMINATED SOIL (2,976 cy)

AR/COC	Sample Location	Date Sampled	
603181	TA2-1-POSTGRIZ-1 thru 4	23-May-00	Lift 2 - Lift 7
603182	TA2-1-POSTGRIZ-5 thru -12	24-May-00	
603184	TA2-1-POSTGRIZ-13 thru -20	31-May-00	
603189	TA2-2-POSTGRIZ-21 thru -24	20-Jun-00	
603194	TA2-1-POSTGRIZ-25 thru -28	22-Jun-00	
603198	TA2-1-POST-GRIZ-29 thru -32	7-Jul-00	
603349	TA2-1-POST-GRIZ-33 thru -36	25-Jul-00	
603350	TA2-1-POST-GRIZ-37 thru -41	31-Jul-02	
603695	TA2-1-POST-GRIZ-46 thru -49	22-Aug-00	
603747	TA2-1-RET1-S, RET2-S	5-Oct-00	
603748	TA2-1-RET1-S thru RET4-S	5-Oct-00	
604476	TA2-1-POST-GRIZ-001-S thru 030-S + 2 DUP	7-May-01	

RWL PILE 33 - BERM SOIL - (Soil used to berm around the soil piles - 75 cy) - SWMU 1 Backfill Operations, 2003

AR/COC	Sample Location	Date Sampled	
606390	TA2-1-RWL33-1-1-S	19-May-2003	Lift 1 & Lift 2
606391	TA2-1-RWL33-1-2-S and -TA2-1-RWL33-1-2-S	19-May-2003	

Contaminated Soil from the Segmented Gate System

AR/COC	Sample Location	Date Sampled	
510250	Pile 4, Pile 15, Pile 20, Pile 25, Pile 27	30-Mar-1998	Lift 1
510638	Pile 4, Pile 15, Pile 20, Pile 25, Pile 27	30-Mar-1998	

RWL PILE 34 - (Consolidated pile remaining after processing contaminated piles 4, 15, 20, 25 and 27 through the SGS - 269 cy)

AR/COC	Sample Location	Date Sampled	
603188	TA2-1-POST-GRIZ-SGS-1 thru SGS-4	19-Jun-00	Lift 1
603189	TA2-1-POSTGRIZ-SGS-5 thru -8	20-Jun-00	
603361	TA2-1-SGS-CS1-S thru CS4-S	14-Aug-00	
603747	TA2-1-SGS1-S1, SGS2-S	5-Oct-00	
603748	TA2-1-SGS1-S thru SGS4-S	5-Oct-00	

RWL PILE 35 - Soil removed from pile after FIDLER survey. (89 cy) - SWMU 1 Backfill Operations, 2003

AR/COC	Sample Location	Date Sampled	
606390	TA2-1-RWL35-1-1-S	19-May-2003	Lift 1
606391	TA2-1-RWL35-1-2-S and -TA2-1-RWL35-1-2-S	19-May-2003	

Table C-1
Index for Radionuclide Analyses versus SWMU 1 Sampling Events

RWL PILE 36 - SLIGHTLY CONTAMINATED Soil from SCRAPING of RWL SITE (335 cy) - DISCRETE SAMPLES 2000			
AR/COC	Sample Location	Date Sampled	
603711	TA2-1-BOUN-DARY-001-S thru 020-S + 1 DUP	21-Sep-00	Lift 2
603731	TA2-1-BOUN-DARY-021-S thru 070-S + 2 DUP	25-Sep-00	
603732	TA2-1-BOUN-DARY-071-S thru 096-S + 1 DUP	26-Sep-00	
603733	TA2-1-BOUN-DARY-097-S thru 116-S + 1 DUP	26-Sep-00	
603734	TA2-1-BOUN-DARY-117-S thru 153-S + 2 DUP	26-Sep-00	
603735	TA2-1-BOUN-DARY-154-S thru 177-S + 1 DUP	26-Sep-00	
603736	TA2-1-BOUN-DARY-178-S thru 191-S + 1 DUP	26-Sep-00	
603737	TA2-1-BOUN-DARY-193-S thru 206-S + 1 DUP	27-Sep-00	
603738	TA2-1-BOUN-DARY-217-S thru 231-S + 1 DUP	27-Sep-00	
603739	TA2-1-BOUN-DARY-232-S thru 255-S + 1 DUP	4-Oct-00	
603740	TA2-1-BOUN-DARY-257-S thru 279-S + 1 DUP	5-Oct-00	
603749	TA2-1-BOUN-DARY-280-S thru 305-S + 1 DUP	5-Oct-00	
603825	TA2-1-BOUN-DARY-369-S, 373-S, 376-S, 379-S, 381-S, 383-S, 389-S, 390-S, 392-S, 395-S, 403-S + 1 DUP)	18-Oct-00	
603826	TA2-1-BOUN-DARY-360-S thru 368-S, 370-S, 378-S, 380-S, 388-S, 391-S, 393-S, 294-S + 1 DUP	18-Oct-00	
603827	TA2-1-BOUN-DARY-306-S thru 325-S; 330-S, 332-S, 334-S, 335-S, 339-S, 340-S + 2 DUP	17-Oct-00	
603828	TA2-1-BOUN-DARY-326-S thru 329-S; 331-S, 333-S, 336-S thru 338-S, 341-S thru 359-S	17-Oct-00	
603829	TA2-1-BOUN-DARY-371-S, 372-S, 374-S, 375-S, 377-S, 382-S, 384-S thru 387-S, 396-S thru 402-S + 1 DUP	18-Oct-00	
603830	TA2-1-BOUN-DARY-404-S thru 421-S, 425-S thru 429-S, 437-S thru 439-S + 1 DUP	18-Oct-00	
603831	TA2-1-BOUN-DARY-422-S thru 424-S, 430-S, 431-S thru 436-S, 440-S thru 455-S + 1 DUP	18-Oct-00	
603832	TA2-1-BOUN-DARY- (457-S, 458-S, 463-S thru 468-S, 470-S thru 472-S, 474-S thru 477-S; 479-S + 1 DUP	19-Oct-00	
603833	TA2-1-BOUN-DARY-456-S, 459-S thru 462-S, 469-S, 473-S, 473-S, 475-S; 476-S, 478-S, 480-S + 1 DUP	19-Oct-00	
RWL PILE 36 - SLIGHTLY CONTAMINATED Soil from SCRAPING of RWL SITE - DISCRETE SAMPLES 2000			
AR/COC	Sample Location	Date Sampled	
606390	TA2-1-RWL36-1-1-S thru -4-1-S	19-May-2003	Lift 2
606391	TA2-1-RWL36-1-2-S thru -4-2-S; TA2-1-RWL36-1-3-S thru -4-3-S	19-May-2003	
Soil Sampling Activities - SWMU 1 Backfill Operations, 2003 Discrete Over-Excavation Samples (3,600 cy)			
AR/COC	Sample Location	Date Sampled	
606386	Over-excavation, locations 1-4, 5 ft, 10 ft, 15 ft, 20 ft; location 5; 5 ft, 10 ft	16-May-2003	Lift 8 - Lift 14
606387	Over-excavation, locations 1-4, 5 ft, 10 ft, 15 ft, 20 ft; location 5; 5 ft, 10 ft	16-May-2003	
606388	Over-excavation, location 5, 15 ft, 20 ft; location 6-9, 5 ft, 10 ft, 15 ft, 20 ft	16-May-2003	
606389	Over-excavation, location 5, 15 ft, 20 ft; location 6-9, 5 ft, 10 ft, 15 ft, 20 ft	16-May-2003	

Table C-1
Index for Radionuclide Analyses versus SWMU 1 Sampling Events

Verification Samples			
Discrete Verification Samples - SWMU 1 Remediation Voluntary Corrective Measure, 1999			
AR/COC	Sample Location	Date Sampled	Verification
602934	excavation floor: TA2-1-VERF-CDP through TA2-1-VERF-TR6	29-Nov-1999	
602935	excavation floor: TA2-1-VERF-PIT1 through TA2-1-VERF-TR6	29-Nov-1999	
Discrete Verification Samples - SWMU 1 Backfill Operations, 2003			
AR/COC	Sample Location	Date Sampled	
606385	TA2-1-VERF-CDP-15.0-R; TA2-1-VERF-PIT7-16.5-R	8-May-2003	
Final Discrete Verification Samples - SWMU 1 Backfill Operations, 2003			
AR/COC	Sample Location	Date Sampled	
606993	TA2-1-FINL-VER-001-S thru -008-S	10-Nov-2003 & 11-Nov-2003	Verification
606994	TA2-1-FINL-VER-009-S thru -015-S	10-Nov-2003 & 12-Nov-2003	

Table C-2
Index for Metal Analyses versus SWMU 1 Sampling Events

Soil Sampling Activities - SWMU 1 Remediation Voluntary Corrective Measure, 1997 Potentially Contaminated Soil Samples - Discrete Samples			
AR/COC	Sample Location	Date Sampled	Lift
06246	Contaminated Pile 16	30-Jan-1997	Lift 2 - Lift 7
06242	Contaminated Pile 13	31-Jan-1997	
06243	Contaminated Pile 12	31-Jan-1997	
06244	Contaminated Pile 14	31-Jan-1997	
06232	Contaminated Pile 2	3-Feb-1997	
06233	Contaminated Pile 3	3-Feb-1997	
06234	Contaminated Pile 4	3-Feb-1997	
06235	Contaminated Pile 5	4-Feb-1997	
06236	Contaminated Pile 6	6-Feb-1997	
06245	Contaminated Pile 15	6-Feb-1997	
06241	Contaminated Pile 11	7-Feb-1997	
06250	Contaminated Pile 20	7-Feb-1997	
06254	Contaminated Pile 24	7-Feb-1997	
06252	Contaminated Pile 22	10-Feb-1997	
06256	Contaminated Pile 26	10-Feb-1997	
06247	Contaminated Pile 17	11-Feb-1997	
06248	Contaminated Pile 18	11-Feb-1997	
06249	Contaminated Pile 19	11-Feb-1997	
06251	Contaminated Pile 21	11-Feb-1997	
06253	Contaminated Pile 23	11-Feb-1997	
06237	Contaminated Pile 7	17-Feb-1997	
06238	Contaminated Pile 8	17-Feb-1997	
06239	Contaminated Pile 9	17-Feb-1997	
06240	Contaminated Pile 10	17-Feb-1997	
06231	Contaminated Pile 1	3-Mar-1997	
06255	Contaminated Pile 25	3-Mar-1997	
RWL BUNKER SOIL PILES (656 cy, 248 cy, 466 cy = 1,370 cy)			
AR/COC	Sample Location	Date Sampled	
604736	TA2-2-BLDG- 901-001-S thru 901-007-S + 1 DUP set	5-Sep-01	Lift 16-Lift 17
604740	TA2-XPLO-SIVE-001-S thru -007-S + 1 DUP	6-Sep-01	
RWL SLOPE/OVERBURDEN PILE - CONSOLIDATED CLEAN SOIL (- 4,710 cy)			
AR/COC	Sample Location	Date Sampled	
604427	TA2-1-OVER-SLPE- 001-S thru 015-S	23-Apr-01	Lift 14-Lift 16
604429	TA2-1-OVER-SLPE-016-S thru 030-S + 1 DUP	24-Apr-01	
604433	TA2-1-OVER-SLPE-031-S thru 045-S	25-Apr-01	
604475	TA2-1-OVER-SLPE-046-S thru 060-S + 1 DUP	26-Apr-01	
RWL PILE 32 - CONSOLIDATED SLIGHTLY CONTAMINATED SOIL (2,976 cy)			
AR/COC	Sample Location	Date Sampled	
603748	TA2-1-RET1-S thru RET4-S	5-Oct-00	Lift 2 - Lift 7
604477	TA2-1-POST-GRIZ-001-S thru 030-S + 2 DUP	7-May-01	
RWL PILE 33 - BERM SOIL - (Soil used to berm around the soil piles - 75 cy) - SWMU 1 & 3 Backfill Operations, 2003			
AR/COC	Sample Location	Date Sampled	
606390	TA2-1-RWL33-1-1-S	19-May-2003	Lift 1 & Lift 2

Table C-2
Index for Metal Analyses versus SWMU 1 Sampling Events

AR/COC	Sample Location	Date Sampled	Lift
Contaminated Soil from the Segmented Gate System			
AR/COC	Sample Location	Date Sampled	
510250	Pile 4, Pile 15, Pile 20, Pile 25, Pile 27 (TCLP Data)	30-Mar-1998	Lift 1 - Over Rock
RWL PILE 34 - (Consolidated pile remaining after processing contaminated piles 4, 15, 20, 25 and 27 through the SGS, yields 269 cy)			
AR/COC	Sample Location	Date Sampled	
603748	TA2-1-SGS1-S thru SGS4-S	5-Oct-00	Lift 1
RWL PILE 35 - HOT SPOT SOIL - (Soil Identified as 'rad hot" by FIDLER and surgically removed - 89 cy) - SWMU 1 & 3 Backfill Operations, 2003			
AR/COC	Sample Location	Date Sampled	
606390	TA2-1-RWL35-1-1-S	19-May-2003	Lift 1 & Lift 2
RWL PILE 36 - SLIGHTLY CONTAMINATED soil scraped from SWMU 1 (335 cy) - DISCRETE SAMPLES 2000			
AR/COC	Sample Location	Date Sampled	
606390	TA2-1-RWL36-1-1-S thru -4-1-S	19-May-2003	Lift 1 & Lift 2
Soil Sampling Activities - SWMU 1 Backfill Operations, 2003 **Discrete Over-Excavation Samples**			
AR/COC	Sample Location	Date Sampled	
606386	Over-excavation, locations 1-4, 5 ft, 10 ft, 15 ft, 20 ft; location 5; 5 ft, 10 ft	16-May-2003	Lift 8 - Lift 14
606388	Over-excavation, location 5, 15 ft, 20 ft; location 6-9, 5 ft, 10 ft, 15 ft, 20 ft	16-May-2003	
Verification Samples			
Discrete Verification Samples - SWMU 1, November 1999			
AR/COC	Sample Location	Date Sampled	
602935	excavation floor: TA2-1-VERF-PIT1 through TA2-1-VERF-TR6	29-Nov-1999	Verification
Final Discrete Verification Samples - SWMU 1 Backfill Operations, 2003			
AR/COC	Sample Location	Date Sampled	
606993	TA2-1-FINL-VER-001-S thru -008-S	10-Nov-2003 & 11-Nov-2003	Verification
606994	TA2-1-FINL-VER-009-S thru -015-S	10-Nov-2003 & 12-Nov-2003	

RSI

National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

MAY 2 2005

cc: ES&H SEC Carolyn O.

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Mr. James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Road East, Building 1
Santa Fe, NM 87505

Dear Mr. Bearzi:

On behalf of the Department of Energy (DOE) and Sandia Corporation, DOE is submitting the enclosed responses to NMED's Request for Supplemental Information, Environmental Restoration Project Supplemental and No Further Action for Various Solid Waste Management Units (SWMUs 1, 78, 196 and 46) dated October 2004 Sandia National Laboratories, New Mexico, EPA ID No. NM589011518, HWB-SNL-99-006, 99-021, and 99-013, dated March 2, 2005.

If you have any questions, please contact John Gould at (505) 845-6089.

Sincerely,

Patty Wagner

Patty Wagner
Manager

Enclosure

cc w/enclosure:
W. Moats, NMED-HWB (via Certified Mail)
L. King, EPA, Region 6 (Via Certified Mail)
M. Gardipe, NNSA/SC/ERD
J. Volkerding, NMED-OB
D. Pepe, NMED-OB

cc w/o enclosure:
J. Estrada, NNSA/SSO, MS 0184
F. Nimick, SNL, MS 1089
R. E. Fate, SNL, MS 1089
M. J. Davis, SNL, MS 1089
D. Stockham, SNL, MS 1087
B. Langkopf, SNL, MS 1087
J. Copland, SNL, MS 1087
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S. Griffith, SNL, MS 1087
A. Blumberg, SNL, MS 0141

Sandia National Laboratories
Albuquerque, New Mexico
May 2005

Environmental Restoration Project
Responses to NMED Request for Supplemental Information
Environmental Restoration Project Supplemental and No Further Action Information for Various Solid Waste Management Units (SWMUs 1, 78, 196 and 46)
Dated October 2004

INTRODUCTION

This document responds to a March 2, 2005 Request for Supplemental Information (RSI) letter from William P. Moats of the State of New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) to the U.S. Department of Energy and Sandia National Laboratories/New Mexico (SNL/NM). A response to this RSI was due within sixty (60) days of receipt of the letter by SNL/NM, or by May 4, 2005.

In this document, the NMED comments (in bold font) are restated in the same order in which they were provided in the RSI. Following each comment, the word "Response" introduces the U.S. Department of Energy/SNL/NM reply (in normal font style).

1. **SWMU 78: Gas Cylinder Disposal Pit:**
   Please provide a copy of Appendix F, the data validation reports for the 2003 confirmation sampling. The appendix was not included in NMED's copy of the subject report.

Response: Enclosed in Annex A are the data validation reports for the 2003 confirmation sampling that was labeled Attachment F in the original document.

2. **SWMU 196: Building 6597 Cistern:**
   Please state whether the cistern has been backfilled. If it has not been backfilled, explain why this is the case.

Response: The Building 6597 Cistern has not been backfilled. The site has been adequately characterized to demonstrate that it poses no significant risk to human health or the environment in its present state. The cistern is located within an industrial area in Technical Area 5 and is fenced to prevent inadvertent or unauthorized access.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

3. **SWMU 46: Old Acid Waste Line Outfall:**
   Table 11 in Attachment G (Risk Assessment) provides the risk assessment values (hazard index and cancer risk) that were calculated using the maximum concentrations of contaminants at the site. However, the report states that the site meets residential risk standards based on risk assessment values that were calculated using the 95% Upper Confidence Limit (UCL) of the mean concentrations of contaminants. Please provide a table which shows the risk assessment values calculated using the UCLs. It does not appear that the site currently meets residential risk goals based on the UCLs.

Response: Enclosed in Annex B is a revised Table 11 that includes the risk assessment values calculated using UCLs. The total incremental excess cancer risk is 4E-6 which is below NMED guidance of 1E-5. The total hazard index is 1.61 which exceeds NMED guidance of 1. However, because the hazard indices do not provide additive affects for any specific health condition, the hazard index for each constituent of concern (COC) is compared to the NMED guidance of 1. All COCs with the exception of cadmium are below the NMED guidance of 1; cadmium has a hazard index of 1.03 that slightly exceeds the NMED guidance of 1.

4. **SWMU 1: Radioactive Waste Landfill:**

   a. **NMED understands that a factor was entered into the RESRAD equations to account for the placement of cover material at the site. NMED notes that the "clean fill" placed at this site contains both radiological and nonradiological contaminants. Please provide the values of the various parameters assumed for this cover soil, including the thickness of the fill and the chemical and radiological constituents in the fill. Any deviations from the typical assumptions used in risk assessments (e.g., exposure routes, parameter values) should be described in the text of the document. Please state how the placement of fill affects the results of the risk assessments and describe any other variances that were made during the calculations of the human health and ecological risk assessments.**

Response: Five feet of "clean fill" was assumed for the SWMU 1 radiological risk assessment based on the current onsite conditions at SWMU 1. Originally the "clean fill" was assumed to have no radiological contamination; therefore no radiological risk was completed for direct contact exposure with the clean backfill. There was no "clean fill" considered in the nonradiological calculations; the risk assessment for human health nonradiological contaminants used the "standard" assumptions and exposure parameters (i.e., the maximum chemical concentration were used in the risk evaluation). The ecological risk assessment process also was not affected by the assumption of the clean fill (i.e., the radiological and nonradiological contaminants within the 0 to 5 feet bgs horizon were evaluated at maximum concentrations and activities). The only deviation from the typical risk assessment process was the assumption of 5 feet of clean fill with no radiological contamination for the human health radiological risk assessment. Within the human health radiological risk assessment calculations, the clean fill provides shielding from the soil that is below 5 feet. No other deviations from the typical risk assessment process occurred. All the receptors, exposure routes and parameter values remain consistent with the SNL risk assessment process.

To determine the human health radiological risk associated with direct contact with the clean fill, the maximum activities for the radiological COCs within the 0 to 5 feet bgs horizon were used; the results are included here. With the exception of the tritium activity which is discussed below, the maximum activities for the 0 to 5 feet bgs horizon are those that were reported in Annex A, Table A-5. The maximum activities are as follows:

Table 1
Summary of Maximum Radionuclide Activities Used in Direct Contact Exposure Calculations for 0-5 ft bgs Fill for SWMU 1

Radionuclide	Activity (pCi/g)	Sample ID	Table (SNL/NM October 2004)
Am-241	ND (<0.352)	TA2-1-GRAB4-5FT-2-S	Annex B, Table B-9
Cs-137	0.203	TA2-1-OVER-SLPE-030-S	Annex B, Table B-13
H-3	4.49	TA2-1-GRAB4-10FT-3-S	Annex B, Table B-11
Pu-238	0.184	TA2-1-OVER-SLPE-031-S	Annex B, Table B-14
Pu-239/240	2.55	TA2-1-OVER-SLPE-006-S	Annex B, Table B-14
Th-232	1.24*	TA2-1-OVER-SLPE-014-S	Annex B, Table B-13
U-235	0.351	TA2-1-OVER-SLPE-045-S	Annex B, Table B-13
U-238	25	TA2-1-OVER-SLPE-045-S	Annex B, Table B-13

*This value was below background and was screened out of risk calculations.

The incremental TEDE and corresponding estimated cancer risk associated with the activities of these radiological COCs are much less than EPA guidance values; the estimated TEDE is 8.3E-1 mrem/yr for the industrial land use scenario. This value is much less than the EPA numerical guidance of 15 mrem/yr. The corresponding incremental estimated cancer risk value is 6.8E-6 for the industrial land use scenario. Furthermore, the incremental TEDE for the residential land use scenario that results from a complete loss of institutional control is only 2.2 mrem/yr, with an associated risk of 2.0E-5. The guideline for this scenario is 75 mrem/yr. Therefore, SWMU 1 is eligible for unrestricted radiological release within the 0 to 5 feet bgs horizon.

b. **Please clarify what was the maximum value of tritium detected in the soil that was placed from 0 to 5 feet below ground surface. Table 4-2 gives a maximum value of 4.49 pCi/g, while Table A-6 in the Risk Assessment lists the maximum value as 0.2205 pCi/g. Please also provide the sample identification number for this maximum tritium value and state where it is listed in the analytical data included in the subject report. State which value was used for calculating the ecological risk for SWMU 1.**

Response: The value of 4.49 pCi/g is shown in Table B-11 of Appendix B. It corresponds to sample TA2-1-GRAB4-10FT-3-S; this sample was from the over-excavation soil that was used as backfill in Lifts 8 through 14 (approximately 11 to 3 ft bgs). The tritium value of 0.2205 pCi/g (or 4,410 pCi/L) corresponds to sample TA2-2-BLDG-901-004-S in Table B-15 of Appendix B; this sample was from soil placed in the excavation as Lifts 14 through 16 (approximately 4 ft to 1 ft bgs). The value of 0.2205 was erroneously used in the risk assessment for the 0 - 5 ft bgs backfill layer (SNL/NM October 2005); the intent was to use the value of 4.49 pCi/g. The human health and ecological risk assessment has been re-calculated using the tritium value of 4.49 pCi/g, which was listed in Table 4-2 (SNL/NM October 2005). Because these tritium activites contribute such meager amounts to the overall total doses and risks, the final results are numerically equivalent; therefore, no revision to the SWMU 1 risk assessment conclusion was necessary.

A revised version of Table B-11 is included in this RSI in Annex C. The tritium results from LCS (Liquid Scintillation Counting) for samples TA2-1-GRAB5-15FT-3-S through TA2-1-GRAB9-5FT-3-S that were originally listed as "NR" ("not reported") are now included.

Annex B
Revised Table 11 for SWMU 1

Revised Table 11
Risk Assessment Values for SWMU 46 Nonradiological COCs

COC	Maximum Concentration/UCL (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	5.23 / **2.8**	0.02	3E-6	0.24 / **Below Background**	1E-5 / **Below Background**
Barium	572	0.01	–	0.11	–
Beryllium	0.891	0.00	4E-10	0.01	8E-10
Cadmium	213 / **40.6**	0.42	7E-8	5.46 / **1.03**	1E-7 / **3E-8**
Chromium VI	2.08	0.00	4E-9	0.01	1E-8
Chromium-total	120	0.00	–	0.00	–
Copper	133 J	0.00	–	0.05	–
Mercury	0.0766	0.00	–	0.00	–
Nickel	379 / **87.5**	0.02	–	0.25 / **0.03**	–
Selenium	1.28	0.00	–	0.00	–
Silver	16.2	0.00	–	0.04	–
Thallium	2.19 / **1.1**	0.03	–	0.44 / **0.22**	–
Vanadium	46.5	0.01	–	0.09	–
Zinc	149 J	0.00	–	0.01	–
Cyanide-total	12.7	0.00	–	0.01	–
VOCs					
Acetone	0.0132	0.00	–	0.00	–
2-Butanone	0.107	0.00	–	0.00	–
Methylene chloride	0.00385 J	0.00	3E-8	0.00	5E-8
Toluene	0.017	0.00	–	0.00	–
SVOCs					
Acenaphthene	0.00626 J	0.00	–	0.00	–
Acenaphthylene	0.00406 J	0.00	–	0.00	–
Anthracene	0.0212 J	0.00	–	0.00	–
Benzo(a)anthracene	0.258	0.00	1E-7	0.00	4E-7
Benzo(a)pyrene	0.435 / **0.06**	0.00	2E-6	0.00	7E-6 / **1E-6**
Benzo(b)fluoranthene	0.506	0.00	2E-7	0.00	8E-7
Benzo(ghi)perylene	0.309 / **0.05**	0.00	1E-6	0.00	5E-6 / **8E-7**
Benzo(k)fluoranthene	0.471	0.00	2E-8	0.00	8E-8
Butylbenzylphthalate	0.0565 J	0.00	–	0.00	–
Carbazole	0.0182 J	0.00	1E-10	0.00	6E-10
2-Chlorophenol	0.00835 J	0.00	–	0.00	–
Chrysene	0.435	0.00	2E-9	0.00	7E-9
Di-n-butylphthalate	0.0495 J	0.00	–	0.00	–
Di-n-octylphthalate	0.0102 J	0.00	–	0.00	–
Diethylpthalate	0.0877 J	0.00	–	0.00	–
Dibenzofuran	0.0094 J	0.00	–	0.00	–
1,2-Dichlorobenzene	0.00451 J	0.00	–	0.00	–
1,3-Dichlorobenzene	0.00486 J	0.00	–	0.00	–
Diphenylamine	0.0073 J	0.00	–	0.00	–

Refer to footnotes at end of table.

Revised Table 11 (Concluded)
Risk Assessment Values for SWMU 46 Nonradiological COCs

COC	Maximum Concentration/UCL (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
bis(2-Ethylhexyl) phthalate[b]	2.04	0.00	1E-8	0.00	5E-8
Fluoranthene	0.450	0.00	–	0.00	–
Fluorene	0.014 J	0.00	–	0.00	–
Hexachlorobenzene	0.0057 J	0.00	5E-9	0.00	2E-8
Indeno(1,2,3-c,d)pyrene	0.345 J	0.00	2E-7	0.00	6E-7
Naphthalene	0.00345 J	0.00	–	0.00	–
Phenanthrene	0.139	0.00	–	0.00	–
Phenol	1.59	0.00	–	0.00	–
Pyrene	0.603	0.00	–	0.00	–
HE Compound					
2-Nitrotoluene	0.0152	0.00	–	0.00	–
Total		0.52	7E-6	6.72 / **1.61**	3E-5 / **4E-6**

[a]EPA 1989.

[b]The maximum concentration in this table previously was 0.00704. This value was from a trip blank. The hazard index and cancer risk included in this table and the previous table was for the 0.00385 J concentration for this COC.

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HE = High explosive(s).
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
UCL = Upper Confidence Limit.
VOC = Volatile organic compound.
– = Information not available.

Annex C

Revised Table B-11 for SWMU 1

Table B-11
Summary of Tritium Analytical Results, May 2003,
for the Over-Excavation Trench Soil Placed in the SWMU 1 Excavation
as Lifts 8 through 14 (On-site laboratory)

Sample Attributes			Activity	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Tritium, pCi/L (EPA Method 906.0)	Tritium, pCi/g (LSC method)
606387	TA2-1-GRAB1-10FT-3-S	5–10	**1,660**	**ND (11.5)**
606387	TA2-1-GRAB1-15FT-3-S	10–15	**801**	**ND (11.5)**
606387	TA2-1-GRAB1-20FT-3-S	15–20	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB1-5FT-3-S	0–5	**13,300**	**ND (11.5)**
606387	TA2-1-GRAB2-10FT-3-S	5–10	**3,820**	**ND (11.5)**
606387	TA2-1-GRAB2-15FT-3-S	10–15	350	**ND (11.5)**
606387	TA2-1-GRAB2-20FT-3-S	15–20	304	**ND (11.5)**
606387	TA2-1-GRAB2-5FT-3-S	0–5	**19,700**	**ND (11.5)**
606387	TA2-1-GRAB3-10FT-2-S	5–10	**27,800**	**ND (11.5)**
606387	TA2-1-GRAB3-15FT-3-S	10–15	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB3-20FT-3-S	15–20	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB3-5FT-3-S	0–5	**769**	**ND (11.5)**
606387	TA2-1-GRAB4-10FT-3-S	5–10	**3,860**	**4.49**
606387	TA2-1-GRAB4-15FT-3-S	10–15	**18,300**	**ND (11.5)**
606387	TA2-1-GRAB4-20FT-3-S	15–20	**1,430**	**ND (11.5)**
606387	TA2-1-GRAB4-5FT-3-S	0–5	**79,400**	**ND (11.5)**
606387	TA2-1-GRAB5-10FT-3-S	5–10	ND (267)	**ND (11.5)**
606387	TA2-1-GRAB5-5FT-3-S	10–15	ND (267)	**0.79**
606389	TA2-1-GRAB5-15FT-3-S	15–20	ND (248)	**0.61**
606389	TA2-1-GRAB5-20FT-3-S	0–5	ND (248)	**ND (11.5)**
606389	TA2-1-GRAB6-10FT-3-S	5–10	ND (248)	**1.44**
606389	TA2-1-GRAB6-15FT-3-S	10–15	ND (248)	**ND (11.5)**
606389	TA2-1-GRAB6-20FT-3-S	15–20	**561**	**1.01**
606389	TA2-1-GRAB6-5FT-3-S	0–5	**650**	**ND (11.5)**
606389	TA2-1-GRAB7-10FT-3-S	5–10	**8,480**	**ND (11.5)**
606389	TA2-1-GRAB7-15FT-3-S	10–15	**63,600**	**ND (11.5)**
606389	TA2-1-GRAB7-20FT-3-S	15–20	**11,400**	**ND (11.5)**
606389	TA2-1-GRAB7-5FT-3-S	0–5	**11,600**	**ND (11.5)**
606389	TA2-1-GRAB8-10FT-3-S	5–10	**1,630**	**ND (11.5)**
606389	TA2-1-GRAB8-15FT-3-S	10–15	289	**ND (11.5)**
606389	TA2-1-GRAB8-20FT-3-S	15–20	380	**ND (11.5)**
606389	TA2-1-GRAB8-5FT-3-S	0–5	**1,590**	**ND (11.5)**
606389	TA2-1-GRAB9-10FT-3-S	5–10	ND (248)	**ND (11.5)**
606389	TA2-1-GRAB9-15FT-3-S	10–15	368	**ND (11.5)**
606389	TA2-1-GRAB9-20FT-3-S	15–20	**487**	**ND (11.5)**
606389	TA2-1-GRAB9-5FT-3-S	0–5	**698**	**ND (11.5)**
Background Activity[b]			420	0.021

Note: Values in **bold** exceed background soil activities.

[a]Analysis request/chain-of-custody record.

[b]Tharp, February 1999.

bgs = Below ground surface.
ER = Environmental Restoration.
GRAB = grab sample.
ID = Identification.
ft = Foot (feet).
LSC = Liquid Scintillation Counting.
ND ( ) = Not detected. The result is below the minimum detectable activity, shown in parentheses.
ND ( ) = Not detected, but the minimum detectable activity (shown in parentheses) exceeds background activity.
NR = Not required.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
S = Soil.
SWMU = Solid Waste Management Unit.
TA2 = Technical Area II.