3-1-2006

Justification for Class III Permit Modification March 2006 SWMU 138 Operable Unit 1295 Building 6630 Septic System (Technical Area III)

Sandia National Laboratories/NM

This work supported by the United States Department of Energy under contract DE-AC04-94I85000.

Drain and Septic Systems (DSS) Solid Waste Management Units 49, 101, 116, 138, 140, 147, 149, 150, 154, and 161 (Poster 1 of 3)

Environmental Restoration Project

Site Histories

Drain and septic system site histories for the ten sites are as follows:

Site Number	Site Name	Location	Year Bldg and System Built	Year Drain or Septic System Abandoned	Year(s) Septic Tank Effluent Sampled	Year(s) Septic Tank and Seepage Pits Backfilled
49	Bldg 9820 Drains	Lurance Canyon	1958	1995 (distal end of drainpipe sealed)	No septic tank at this site	NA
101	Bldg 9926 Explosive Contaminated Sumps and Drains	Coyote Test Field	1960	1991	1992, 1994	1995/1996
116	Bldg 9990 Septic System	Coyote Test Field	1971	Early 1990s	1992, 1994, 1995	1996
138	Bldg 6630 Septic System	TA-III	1959	1991	1994, 1995	1995
140	Bldg 9965 Septic System	Thunder Range	1965	1991	1992, 1994	1995/1996
147	Bldg 9925 Septic Systems	Coyote Test Field	1959 (south system); 1965/1966 (west system); 1980 (north system)	Before 1994 (south system); 1991 (west and north system)	1992, 1994, 1995 (west system); 1992, 1995 (north system)	Before 1994 (south system tanks); 1996 (north and west system tanks)
149	Bldg 9930 Septic System	Coyote Test Field	1961	1993	1992, 1994	1996
150	Bldg 9939/9939A Septic System	Coyote Test Field	1974 (Bldg. 9939); 1982 (Bldg. 9939A)	1993	1992, 1994	1996
154	Bldg 9960 Septic Systems	Coyote Test Field	1965	1991 (seepage pits); 1993 (septic tank)	1992, 1994	1996 (septic system) 2005 (HE seepage pits)
161	Bldg 6636 Septic System	TA-III	1971	1993	1992, 1994	1996

Depth to Groundwater

Depth to the regional aquifer at the ten sites is as follows:

Site Number	Site Name	Location	Groundwater Depth (ft bgs)
49	Bldg 9820 Drains	Lurance Canyon	107
101	Bldg 9926 Explosive Contaminated Sumps and Drains	Coyote Test Field	420
116	Bldg 9990 Septic System	Coyote Test Field	230
138	Bldg 6630 Septic System	TA-III	475
140	Bldg 9965 Septic System	Thunder Range	230
147	Bldg 9925 Septic Systems	Coyote Test Field	41
149	Bldg 9930 Septic System	Coyote Test Field	302
150	Bldg 9939/9939A Septic System	Coyote Test Field	315
154	Bldg 9960 Septic Systems	Coyote Test Field	44
161	Bldg 6636 Septic System	TA-III	466

Constituents of Concern

Site Number	Site Name	COCs
49	Bldg 9820 Drains	VOCs, SVOCs, metals, cyanide, chromium VI, and radionuclides
101	Bldg 9926 Explosive Contaminated Sumps and Drains	VOCs, SVOCs, metals, cyanide, chromium VI, and radionuclides
116	Bldg 9990 Septic System	VOCs, SVOCs, metals, cyanide, chromium VI, PCBs, and radionuclides
138	Bldg 6630 Septic System	VOCs, SVOCs, metals, cyanide, PCBs, and radionuclides
140	Bldg 9965 Septic System	VOCs, SVOCs, metals, nitrate, cyanide, chromium VI and radionuclides
147	Bldg 9925 Septic Systems	VOCs, SVOCs, metals, and radionuclides
149	Bldg 9930 Septic System	VOCs, SVOCs, metals, cyanide, chromium VI, and radionuclides
150	Bldg 9939/9939A Septic System	VOCs, SVOCs, metals, PCBs, and radionuclides
154	Bldg 9960 Septic Systems	VOCs, SVOCs, metals, nitrate, chromium VI, HE compounds, and radionuclides
161	Bldg 6636 Septic System	VOCs, SVOCs, metals, cyanide, chromium VI, and radionuclides

Investigations

- All of these sites were selected by NMED for passive soil-vapor sampling to screen for VOCs and SVOCs, and no significant contamination was identified at any of the ten sites.
- A backhoe was used to positively locate buried components (drainfield drain lines, drywells, and seepage pits) so that locations for soil vapor samplers and soil borings could be selected.
- Soil samples were collected from directly beneath drainfield drain lines, next to or beneath seepage pits, and on either side of septic tanks to determine if COCs were released to the environment from drain systems.
- A 160-ft-deep groundwater monitoring well (CYN-MW5), a 265-ft-deep groundwater monitoring well (CTF-MW1), a 365-ft-deep groundwater monitoring well (CTF-MW3), and a 135-ft-deep groundwater monitoring well (CTF-MW2) were installed at SWMUs 49, 116, 149, and 154, respectively. Groundwater samples were collected on a quarterly basis for eight quarters beginning in July 2002. Samples were analyzed for VOCs, SVOCs, HE compounds, RCRA metals, chromium VI, cyanide, nitrate plus nitrite, gross alpha/beta activity, and major anions and cations.

The years that site-specific characterization activities were conducted, and soil sampling depths at each of these ten sites are as follows:

Site Number	Site Name	Buried Components (Drain Lines, Drywells) Located With Backhoe	Soil Sampling Beneath Drainlines, Seepage Pits, Drywells	Type(s) of Drain System, and Soil Sampling Depths (ft bgs)	Passive Soil-Vapor Sampling	Groundwater Monitor Well Installation and Sampling Period
49	Bldg 9820 Drains	None	1994, 1995	Drain Outfall: 1, 11 Surface Discharge: 1, 11	1994	2001; 8 quarters of sampling (2002-2004)
101	Bldg 9926 Explosive Contaminated Sumps and Drains	1995	1994, 1995	West Seepage Pit: 12, 22 Middle and East Seepage Pit: 16, 26 Septic Tank: 9 Drywell: 4, 14	1994	None
116	Bldg 9990 Septic System	1995	1995, 2002	Seepage Pits: 13 Septic Tank: 8.5	1994	2001; 8 quarters of sampling (2002-2004)
138	Bldg 6630 Septic System	1994	1994	Drainfield: 6.5, 16.5 Septic Tank: 10	1994	None
140	Bldg 9965 Septic System	1995	1994, 1995, 2003	Seepage Pit: 11, 16, 21, 26 Septic Tank: 7 Drywell: 8, 18	1994	None
147	Bldg 9925 Septic Systems	1994	1995, 2002	**North System:** Drainfield: 9, 19 Septic Tank: 9 **West System:** Drainfield: 5, 15 Septic Tank: 9 **South System:** Drainfield: 5, 15 Septic Tank: 10	1994	None
149	Bldg 9930 Septic System	1994	1995, 2002	Seepage Pit: 8 Septic Tank: 7	1994	2001, 8 quarters of sampling (2002-2004)
150	Bldg 9939/9939A Septic System	1995	1995	Drainfield: 4 Septic Tank: 8 East and West Seepage Pits: 8	1994	None
154	Bldg 9960 Septic Systems	None	1994, 1995, 1996, 1997, 1998, 2003	**Septic System:** Seepage Pit: 10, 20 Septic Tank: 9.5 **West System:** North HE Seepage Pit: 21.5, 24 South HE Seepage Pit: 22, 23	1994	2001; 8 quarters of sampling (2002-2004)
161	Bldg 6636 Septic System	1994	1994	Drainfield: 10, 20 Septic Tank: 7.5	1994	None

Drain and Septic Systems (DSS) Solid Waste Management Units 49, 101, 116, 138, 140, 147, 149, 150, 154, and 161 (Poster 2 of 3)

This work supported by the United States Department of Energy under contract DE-AC04-94I85000.

Sandia National Laboratories

EGIS — Environmental Geographic Information System

Environmental Restoration Project

Summary of Data Used for NFA Justification

- Soil samples were analyzed at on- and off-site laboratories for constituents of concern as listed in the table above.
- There were detections of VOCs at all ten sites; SVOCs were detected at SWMUs 49, 138, 147, and 154; PCBs were detected at SWMU 116; HE compounds were detected at SWMU 154.
- Arsenic was detected above the background value at SWMUs 140 and 154. Total chromium was detected above the background value at SWMUs 101, 154, and 161. Barium was detected above the background value at SWMUs 138, 140, 147, and 154. Silver was detected above the background value at SWMUs 49, 101, 116, 138, 154, and 161. Selenium was detected above the background value at SWMUs 101, 140, and 154. Lead was detected above the background value at SWMUs 147 and 154. Nickel was detected above the background value at SWMU 138 and mercury was detected above the background value at SWMU 49. No other metals were detected above background values.
- Cyanide was detected above the MDL at SWMUs 101, 116, 140, and 161.
- Tritium was detected slightly above the background activity at SWMUs 101, 147, and 149. Tritium was not detected, but the MDA exceeded the background activity at SWMU 138. U-235 and U-238 were not detected, but MDAs exceeded background activities at SWMUs 49, 101, 140, 147, 150, and 154. U-235 was not detected, but the MDA exceeded the background activity for SWMUs 116, 149, and 161.
- All confirmatory soil sample analytical results for each site were used for characterizing that site, for performing the risk screening assessment, and as justification for the NFA proposal.

Recommended Future Land Use

- Industrial land use was established for these ten sites.

Results of Risk Analysis

- Risk assessment results for industrial and residential land-use scenarios 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 levels, it was necessary to perform risk assessments for these ten sites. The risk assessment analysis evaluated the potential for adverse health effects for the residential land-use scenarios for nine of the sites. For the remaining site, SWMU 154, the risk assessment analysis evaluated the potential for adverse health effects for the industrial land-use scenario.
- The maximum value for lead was 30 mg/kg at SWMU 154 and 39.7 mg/kg at SWMU 147; both exceed 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. Because, the maximum concentration for lead at these sites is less than the screening values, lead was eliminated from further consideration in the human health risk assessment.
- The non-radiological total human health HIs and estimated excess cancer risks for eight of the ten sites are below NMED guidelines for the residential land-use scenarios.
- For SWMU 140, the HI is below the residential land-use guideline, but the total estimated excess cancer risk is slightly above the residential land-use guideline. However, the incremental excess cancer risk value for this site is below the NMED residential land-use guideline.
- For SWMU 154, the total HI and the estimated excess cancer risk are above the NMED guidelines for the residential land-use scenario due to the levels of 2,4,6-trinitrotoluene, the main contributor to the risk). Thus, the results for an industrial land use are presented here. The HI and the total estimated excess cancer risk for SWMU 154 exceed the NMED industrial land-use guidelines. However, the incremental HI and excess cancer risk values for SWMU 154 are below the NMED industrial land-use guidelines.
- The incremental human health TEDEs for the industrial land-use scenario for the ten sites ranged from 1.5E-1 to 5.3E-8 mrem/yr, all of which are substantially below the EPA numerical guideline of 15 mrem/yr. The incremental human health TEDEs for residential land-use scenario ranged from 4.0E-1 to 4E-8 mrem/yr, all of which are substantially below the EPA numerical guideline of 75 mrem/yr. Therefore, these sites are eligible for unrestricted radiological release.
- Using the SNL predictive ecological risk and scoping assessment methodologies, it was concluded that there is not a complete ecological pathway for seven of the sites. For the remaining three sites (SWMUs 49, 101, and 150) the ecological risk is predicted to be very low.
- In conclusion, human health risk under a residential land-use scenario and ecological risk are acceptable per NMED guidance for nine of the ten sites. Thus, these nine sites are proposed for CAC without institutional controls. For the remaining site, SWMU 154, the human health risk under an industrial land-use scenario and the ecological risk are acceptable per NMED guidance. Thus, SWMU 154 is proposed for CAC with institutional controls.

The total HIs and excess cancer risk values for the nonradiological COCs at the ten sites are as follows:

Site Number	Site Name	Residential Land-Use Scenario: Hazard Index	Residential Land-Use Scenario: Excess Cancer Risk
49	Bldg 9820 Drains	0.00	5E-8 Total
101	Bldg 9926 Explosive Contaminated Sumps and Drains	0.00	1E-7 Total
116	Bldg 9990 Septic System	0.01	4E-8 Total
138	Bldg 6630 Septic System	0.20	6E-8 Total
140	Bldg 9965 Septic System	0.33	1E-5[a] Total / 3.40E-6 Incremental
147	Bldg 9925 Septic System	0.07	5E-8 Total
149	Bldg 9930 Septic System	0.00	3E-8 Total
150	Bldg 9939/9939A Septic System	0.00	4E-8 Total
161	Bldg 6636 Septic System	0.11	5E-8 Total
	NMED Guidance	< 1	<1E-5

Site Number	Site Name	Industrial Land-Use Scenario: Hazard Index	Industrial Land-Use Scenario: Excess Cancer Risk
154	Bldg 9960 Septic System	4.72[a] Total / 0.36 Incremental	3E-5[a] Total / 2.43E-6 Incremental
	NMED Guidance	< 1	<1E-5

[a]Value exceeds NMED guidance for the specified land-use scenario; therefore, the incremental values are shown.

Drain and Septic Systems (DSS) Solid Waste Management Units 49, 101, 116, 138, 140, 147, 149, 150, 154, and 161 (Poster 3 of 3)

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

Sandia National Laboratories

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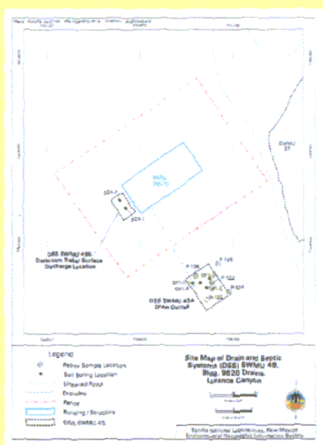

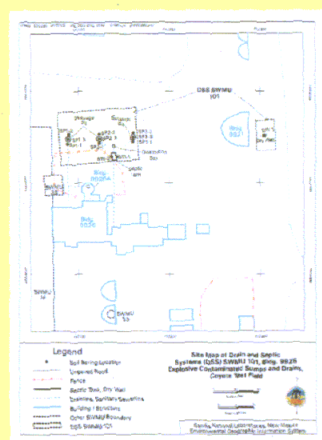

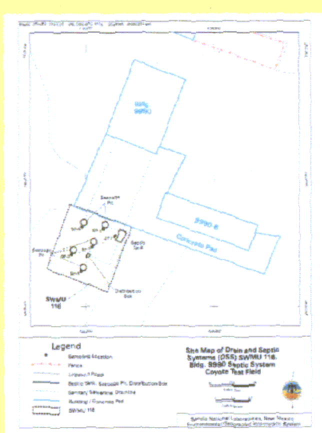

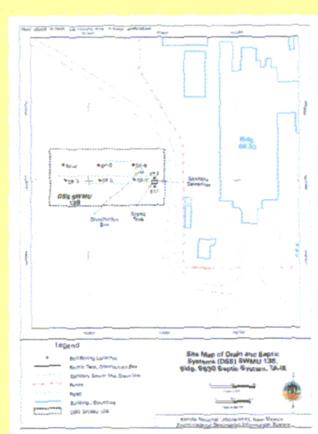

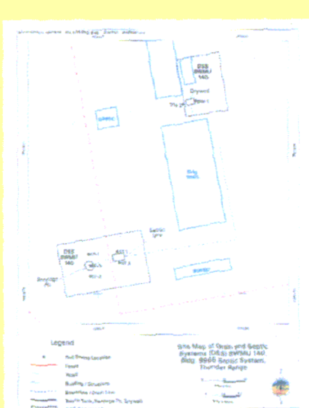

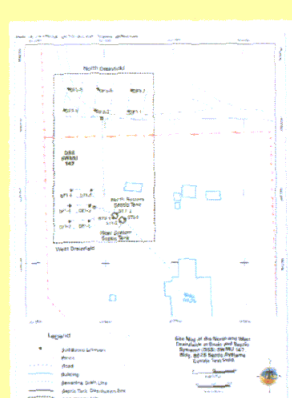

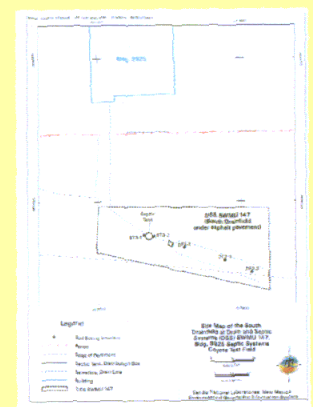

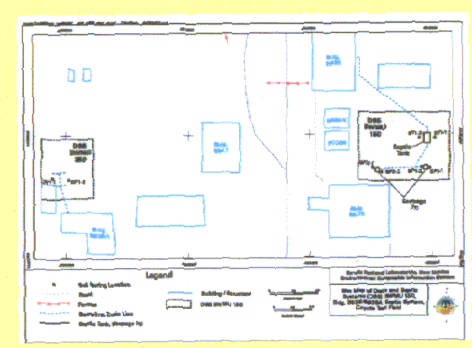

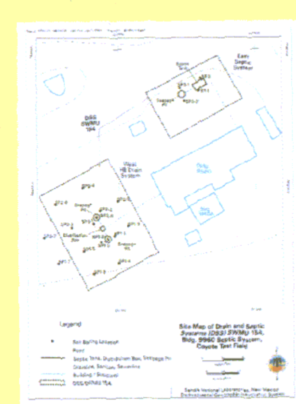

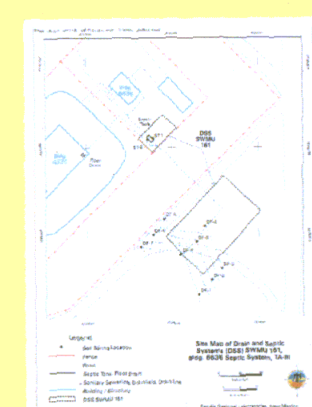

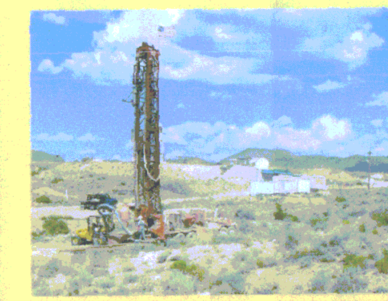

Drilling groundwater monitoring well CTF-MW3 west of SWMU 149

Drilling groundwater monitoring CYN-MW5 northwest of SWMU 49

Drilling groundwater monitoring well CTF-MW1 south-west of SWMU 116.
Drilling groundwater monitoring well CTF-MW2 north-west of SWMU 154 with the two HE seepage pits and an HE storage bunker in the foreground.

Drilling groundwater monitoring well CTF-MW2 north-west of SWMU 154 with the two HE seepage pits and an HE storage bunker in the foreground.

For More Information Contact

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Sandia National Laboratories

Justification for Class III Permit Modification

March 2006

SWMU 138
Operable Unit 1295
Building 6630 Septic System (Technical Area III)

NFA Submitted July 1996
RSI Response Submitted November 1998
RSI Response Submitted June 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/REO' SOR

Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P.O. Box 5400
Albuquerque New Mexico 87115

JUL 19 1995

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

<u>OU 1295</u>
- Site 49
- Site 101
- Site 116
- Site 138
- Site 141
- Site 149
- Site 151
- Site 160
- Site 161

<u>OU 1303</u>
- Site 113
- Site 114

<u>OU 1335</u>
- Site 38

One of the twelve (Site#113) is a resubmission from the October 1994 package of NFA proposals.

If you have any questions, please contact John Gould at (505) 845-6089, or Mark Jackson at (505) 845-6288.

Sincerely,

George K. Laskar

for Michael J. Zamorski
Acting Area Manager

Enclosure

cc w/enclosure:
T. Trujillo, AL, ERD
W. Cox, SNL, MS 1147
N. Weber, NMED-AIP
R. Kern, NMED-AIP
D. Neleigh, EPA, Region 6 (2 copies)

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B. Oms, DOE/KAO
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B. Sweeney, NMED
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C. Lojek, SNL, MS 1148
F. Nimick, SNL, MS 1147
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PROPOSAL FOR
NO FURTHER ACTION
ENVIRONMENTAL RESTORATION PROJECT

SITE 138, BUILDING 6630 SEPTIC SYSTEM
OPERABLE UNIT 1295
June 1996

Prepared by Sandia National Laboratories/New Mexico
Environmental Restoration Project
Albuquerque, New Mexico

Prepared for the
United States Department of Energy

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1. INTRODUCTION

1.1 ER Site 138, Building 6630 Septic System

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a no further action (NFA) decision based on confirmatory sampling for Environmental Restoration (ER) Site 138, Building 6630 Septic System, Operable Unit (OU) 1295. ER Site 138 is listed in the Hazardous and Solid Waste Amendments (HSWA) Module IV (EPA August 1993) of the SNL/NM Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518-1) (EPA August 1992).

1.2 SNL/NM Administrative NFA Process

This proposal for a determination of a NFA decision based on confirmatory sampling was prepared using the criteria presented in Section 4.5.3 of the SNL/NM Program Implementation Plan (PIP) (SNL/NM February 1995). Specifically, this proposal "must contain information demonstrating that there are no releases of hazardous waste (including hazardous constituents) from solid waste management units (SWMUs) at the facility that may pose a threat to human health or the environment" (as proposed in 40 CFR 264.514[a] [2]) (EPA July 1990). The HSWA Module IV contains the same requirements for an NFA demonstration:

> "Based on the results of the RFI [RCRA Facility Investigation] and other relevant information, the Permittee may submit an application to the Administrative Authority for a Class III permit modification under 40 CFR 270.42(c) to terminate the RFI/CMS [corrective measures study] process for a specific unit. This permit modification application must contain information demonstrating that there are no releases of hazardous waste including hazardous constituents from a particular SWMU at the facility that pose threats to human health and/or the environment, as well as additional information required in 40 CFR 270.42(c) (EPA August 1993)."

If the available archival evidence is not considered convincing, SNL/NM performs confirmatory sampling to increase the weight of the evidence and allow an informed decision on whether to proceed with the administrative-type NFA or to return to the site characterization program for additional data collection (SNL/NM February 1995).

The Environmental Protection Agency (EPA) acknowledged that the extent of sampling required may vary greatly, stating that:

> the agency does not intend this rule [the second codification of HSWA] to require extensive sampling and monitoring at every SWMU. . . . Sampling is generally required only in situations where there is insufficient evidence on which to make an initial release determination. . . . The actual extent of sampling will vary . . . depending on the amount and quality of existing information available (EPA December 1987).

This request for an NFA decision for ER Site 138 is based primarily on results of a passive soil-gas survey (NERI June 1995) and analytical results of confirmatory soil samples collected at the site. Concentrations of site-specific constituents of concern (COCs) detected in the soil samples were first compared to background 95th percentile or upper tolerance limit (UTL) concentrations of COCs found in SNL/NM soils (IT March 1996) or other relevant background limits. If no SNL/NM background limit was available for a particular COC, or if the COC concentration exceeded the SNL/NM or other relevant background limit, then the constituent concentration was compared to the proposed 40 CFR Part 264 Subpart S (Subpart S) or other relevant soil action level for the compound (EPA July 1990). If the COC concentration exceeded both the background limit and relevant action level for that compound, or if no background limit or action level has been determined or proposed for the constituent, then a risk assessment was performed. The highest concentration of the particular COC identified at the site was then compared to the derived risk assessment action level to determine if the COC concentration at the site poses a significant health risk.

A site is eligible for an NFA proposal if it meets one or more of the following criteria presented in the Environmental Restoration Document of Understanding (NMED, November 1995):

- NFA Criterion 1: The site cannot be located or has been found not to exist, is a duplicate potential release site (PRS) or is located within and therefore, investigated as part of another PRS.

- NFA Criterion 2: The site has never been used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other CERCLA hazardous substances.

- NFA Criterion 3: No release to the environment has occurred, nor is likely to occur in the future.

- NFA Criterion 4: There was a release, but the site was characterized and/or remediated under another authority which adequately addresses corrective action, and documentation, such as a closure letter, is available.

- NFA Criterion 5: The PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

Review and analysis of the ER Site 138 soil sample analytical data indicate that concentrations of COCs detected in soils at this site are less than (1) SNL/NM or other applicable background concentrations, or (2) proposed Subpart S or other action levels, or (3) derived risk assessment action levels. Thus ER Site 138 is being proposed for an NFA decision based on confirmatory sampling data demonstrating that hazardous waste or COCs that may have been released from this SWMU into the environment pose an acceptable level of risk under current and projected future land use (Criterion 5).

1.3 Local Setting

SNL/NM occupies 2,829 acres of land owned by the Department of Energy (DOE), with an additional 14,920 acres of land provided by land-use permits with Kirtland Air Force Base (KAFB), the United States Forest Service (USFS), the State of New Mexico, and the Isleta Indian Reservation. SNL/NM has been involved in nuclear weapons research, component development, assembly, testing, and other research and development activities since 1945 (DOE September 1987).

ER Site 138 is located on KAFB, and is in the southeast quadrant of SNL/NM Technical Area III (TA III). Access to the site is provided by paved and graded dirt roads that extend approximately 1.7 miles south from the controlled-access TA III main gate (Figure 1-1). ER Site 138 consists of the immediate area around a 600-gallon septic tank west of Building 6630, and the area west of the septic tank around a drainfield which consists of four 4-inch clay-tile distribution lines (SNL/NM September 1994) (Figure 1-2). The site encompasses approximately 0.27 acres of flat-lying land at an average mean elevation of 5,409 feet above mean sea level (AMSL).

The surficial geology at ER Site 138 is characterized by alluvial fan deposits. These heterogeneous deposits contain poorly sorted, laterally and vertically discontinuous sand, silt, and gravel beds (SNL/NM March 1996). Based on drilling records of similar deposits at KAFB, the alluvial materials are highly heterogeneous, composed primarily of medium to fine silty sands with frequent coarse sand, gravel, and cobble lenses. The alluvial deposits probably extend to the water-table. Vegetation consists predominantly of grasses including grama, muhly, dropseed, and galleta. Shrubs commonly associated with the grasslands include sand sage, winter fat, saltbrush, and rabbitbush. Cacti are common, and include cholla, pincushion, strawberry, and prickly pear (SNL/NM March 1993).

The water-table elevation is approximately 4,930 feet AMSL at this location, so depth to ground-water is approximately 479 feet. Local groundwater flow is believed to be in a generally west to northwest direction in the vicinity of this site (SNL/NM March 1996). The nearest production wells are northwest of the site and include KAFB-1, 2, 4, 7, and 14, which are approximately 4 to 6 miles away. The nearest ground-water monitoring wells to the site are the group of wells installed around the Chemical Waste Landfill in the southeast corner of TA III and MWL-BW1 in the Mixed Waste Landfill in the center of TA III. These wells are located, respectively, approximately 0.7 miles southeast and northwest of ER Site 138 (SNL/NM October 1995).

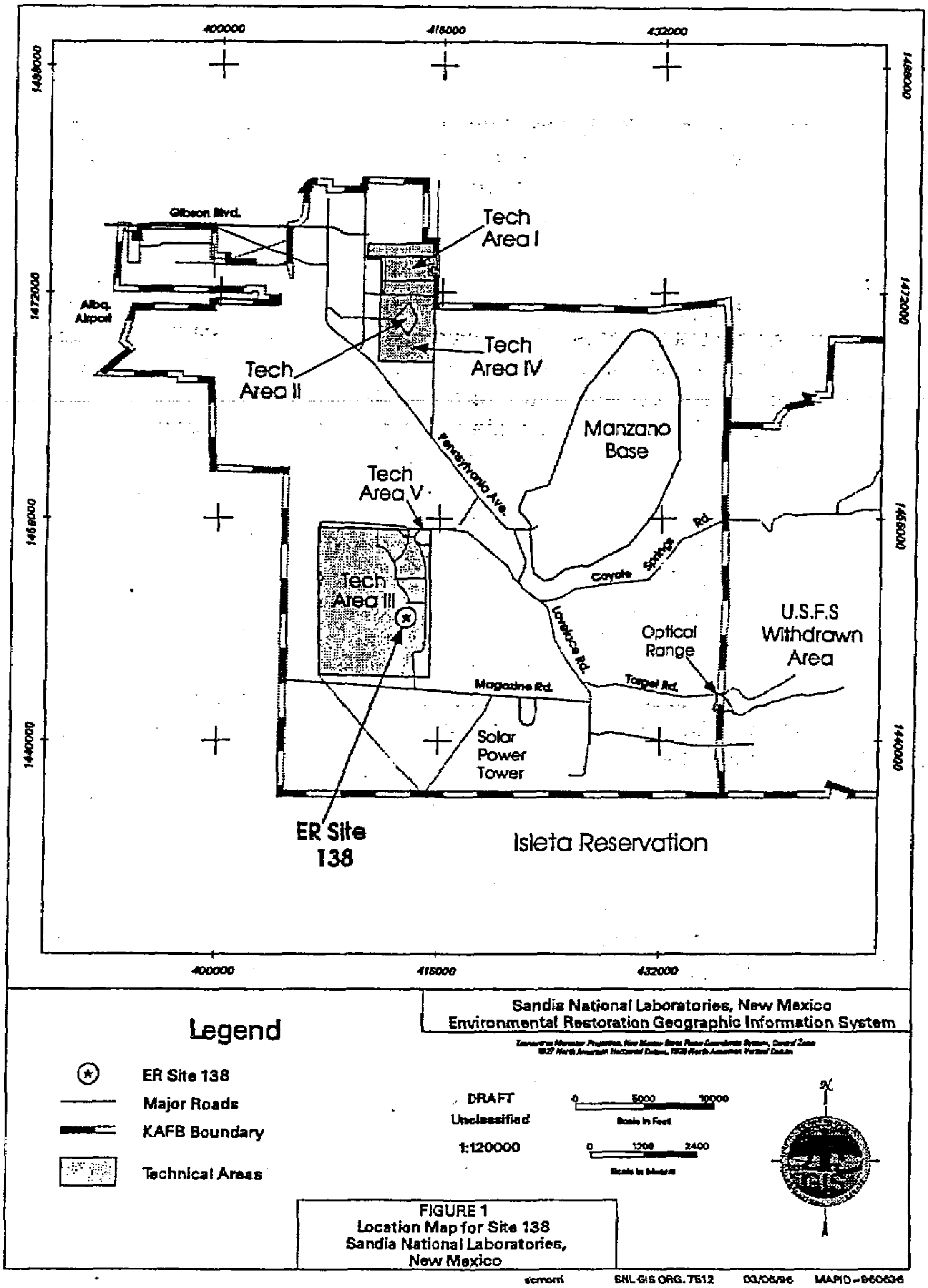

Figure 1-1: ER Site 138 Location Map

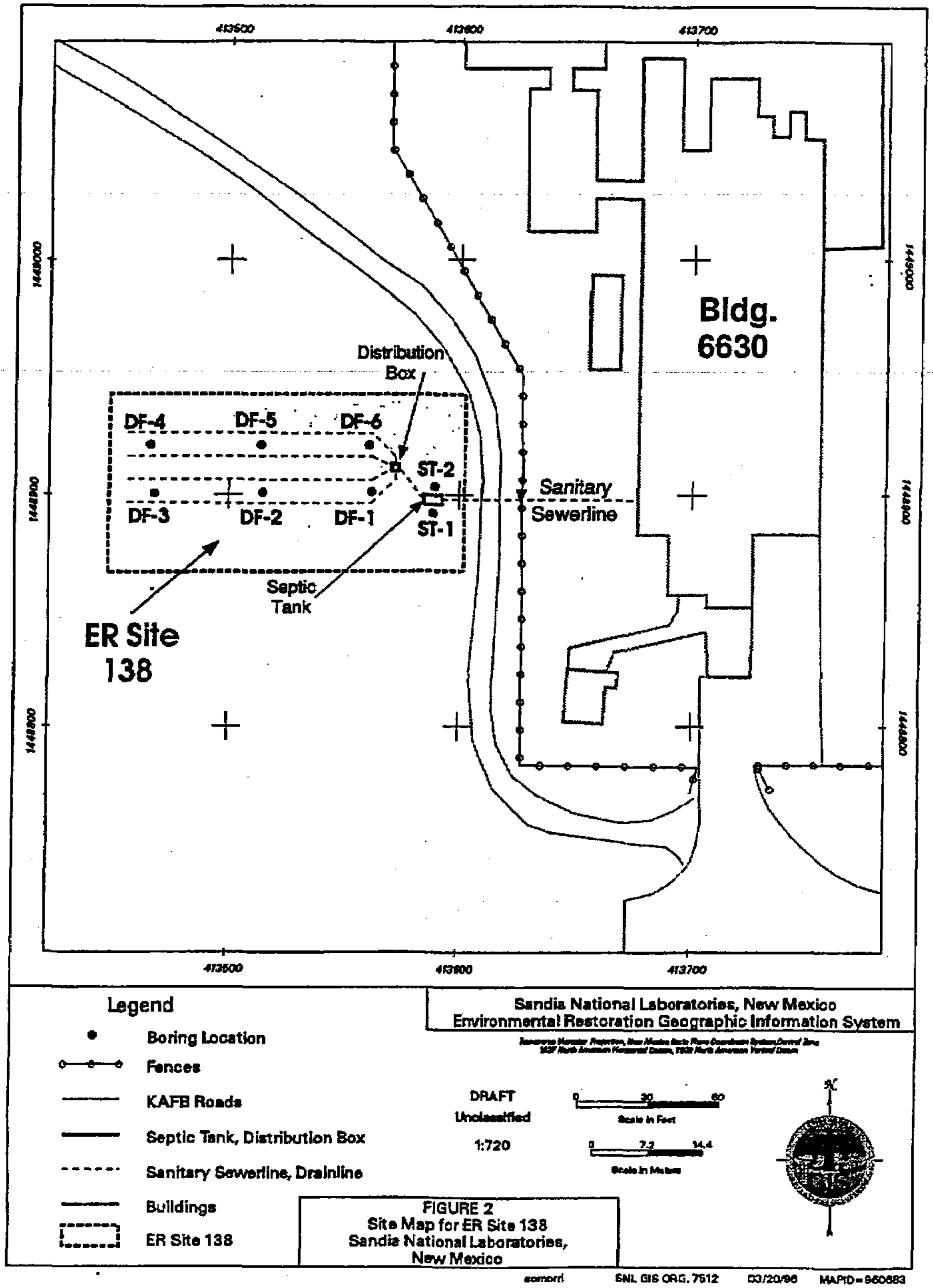

Figure 1-2: ER Site 138 Site Map

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2. HISTORY OF THE SWMU

2.1 Sources of Supporting Information

In preparing the confirmatory sampling NFA proposal for ER Site 138, available background information was reviewed to quantify potential releases and to select analytes for the soil sampling. Background information was collected from SNL/NM Facilities Engineering drawings and interviews with employees familiar with the site operational history. The following sources of information, hierarchically listed with respect to assigned validity, were used to evaluate ER Site 138:

- Confirmatory subsurface soil sampling conducted in December 1994 (SNL/NM December 1994a and b);
- Two survey reports, including a geophysical survey (Lamb 1994), and a passive soil gas survey (NERI June 1995);
- Results of samples collected from the septic tank and distribution box in 1994, 1995 and 1996 (SNL/NM May 1994 and January 1995);
- RCRA Facility Investigation Work Plan for OU 1295, Septic Tanks and Drainfields (SNL/NM March 1993);
- Photographs and field notes collected at the site by SNL/NM ER staff;
- SNL/NM Facilities Engineering building drawings (SNL/NM June 1959);
- SNL/NM Geographic Information System (GIS) data; and
- The RCRA Facility Assessment (RFA) report (EPA April 1987).

2.2 Previous Audits, Inspections, and Findings

ER Site 138 was first listed as a potential release site in the RFA report to the EPA in 1987 (EPA April 1987). This report contained a generic statement about this and many other SNL/NM septic systems where sanitary and industrial wastes may have been discharged during past operations. This SWMU was included in the RFA report as Site number 79, along with other septic and drain systems at SNL/NM. All the sites included in Site 79 are now designated by individual SWMU numbers.

2.3 Historical Operations

The following historical information has been excerpted from several sources, including SNL/NM March 1993, IT March 1994, and SNL/NM November 1994a.

Building 6630, the Melting/Solidification Facility, was constructed in 1959 for environmental testing of steel alloys. Metal mixtures containing iron, nickel, chromium, manganese, silicon, copper, depleted uranium, molybdenum, and titanium were melted in either a vacuum induction furnace, a vacuum arc furnace, or a high-vacuum electron beam furnace. Ingots from the furnaces were milled by various saws, which were cooled by an ethylene glycol/water recirculating system. A limited number of corrosion studies were performed on the alloys in a salt spray/fog climatic chamber. The septic system received wastewater from the bathrooms, sinks, floor drains, and sumps in Bldg. 6630. Estimated effluent discharge rates ranged between 120 and 1,200 gallons per day. Past spills of ethylene glycol coolant occurred and may have been flushed down the floor drains or into the sumps. Discharges from the sumps no longer occur. At one time a vacuum pump in the facility spilled approximately 76 gallons of chlorinated lubricating oil, which may have contained polychlorinated biphenyls, into one of the sumps. The spill was managed by using absorbent materials and wiping affected areas. The contaminated material was drummed and transported off-site for disposal. Interviews with building users indicate that approximately 20 gallons of solvents were used for cleaning parts and vacuum chambers. The solvents included acetone, alcohol, carbon tetrachloride, trichloroethene, and xylene. Small quantities of hydrochloric and nitric acid were used in etching operations.

3. EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics

There are no safeguards inherent in the drain systems from Buildings 6630 or in facility operations that could have prevented past releases to the environment.

3.2 Operating Practices

As discussed in Section 2.3, effluent was released to the Building 6630 septic tank and drainfield when the septic system was active. Hazardous wastes were not managed or contained at ER Site 138.

3.3 Presence or Absence of Visual Evidence

No visible evidence of soil discoloration, staining, or odors indicating residual contamination was observed when soil samples were collected in the drainfield and around the septic tank in December 1994 (SNL/NM December 1994a).

3.4 Results of Previous Sampling/Surveys

Septic tank sludge samples were collected in May 1994 and January 1995 (SNL/NM May 1994 and January 1995) for waste characterization purposes and were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total and Toxicity Characteristic Leaching Procedure (TCLP) RCRA metals, isotopic uranium, polychlorinated biphenyls (PCBs), tritium, and gamma spectroscopy radionuclides. The septic system was not used after 1990 and the sludge in the tank was very dry. Concentrations of a number of RCRA metals were detected. However, only barium and cadmium were detected in the TCLP analysis and concentrations of both were below regulatory levels. The SVOC analysis identified a phthalate above the detection limit and trace quantities of 11 other SVOCs. The PCB analysis detected Aroclor 1254 in the sludge. The VOC analysis detected methylene chloride, acetone, and 2-butanone in the sludge. However, these are common laboratory contaminants. Analysis of the septic tank sludge detected a uranium-238 anomaly.

The distribution box had a small amount of sludge that was sampled in January 1996 for RCRA metals, tritium, isotopic uranium, and gamma spectroscopy radionuclides. The concentrations of metals were all lower than those in the septic tank sludge because of the precipitation mechanism in the tank. No radiological anomalies were evident and there was no detectable tritium. The analytical results of the septic tank and distribution box samples are presented in Appendix A.1.

A geophysical survey using a Geonics™ model EM-38 ground conductivity meter was performed at the site in June 1994 to attempt to locate the drainfield. The technique was not successful in delineating the drainfield or finding areas of higher moisture concentrations (Lamb 1994).

The passive soil-gas survey conducted in the area of the drainfield in June and November 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the drainfield that may have occurred (SNL/NM, November, 1994b). A PETREX™ soil-gas survey is a semi-quantitative screening procedure that can be used to identify many volatile and semivolatile organic compounds. This technique may be used to guide VOC and SVOC site investigations. The advantages of this sampling methodology are that large areas can be surveyed at relatively low cost, the technique is highly sensitive to organic vapors, and the result produces a measure of soil vapor chemistry over a two- to three-week period rather than at one point in time. Each PETREX™ soil-gas sampler consists of two activated charcoal coated wires housed in a reusable glass test tube container. At each sampling location, sample tubes are buried in an inverted position so that the mouth of the sampler is about 1 foot below grade. Samplers are left in place for a two- to three-week period, and are then removed from the ground and sent to the manufacturer, Northeast Research Institute (NERI), for analysis using thermal desorption-gas chromatography/mass spectrometry. The analytical laboratory reports all sample results in terms of "ion counts" instead of concentrations, and identifies those samples that contain compounds above the PETREX™ technique detection limits. In NERI's experience, levels below 100,000 ion counts for a single compound (such as perchloroethene [PCE] or trichloroethene[TCE]), and 200,000 ion counts for mixtures (such as BTEX or aliphatic compounds [C4-C11 cycloalkanes]), under normal site conditions, would not represent detectable levels by standard quantitative methods for soils and/or groundwater (NERI June 1995).

Fifty-five PETREX™ tube samplers were placed, in two phases, in a grid pattern that covered the drainfield and septic tank area at this site (SNL/NM November 1994b). A map showing the tube sampling locations and the analytical results of the ER Site 138 passive soil gas survey is presented in Appendix A.2. The soil gas survey detected tetrachloroethene, trichloroethene, BTEX, and aliphatic compounds at several locations in and around the drainfield. However, at one of the sample locations where trichloroethene was detected, an additional overlapping PETREX sample did not detect trichloroethene. Also, subsequent confirmatory soil samples that were collected near some of the PETREX sample locations in the drainfield and analyzed for VOCs and SVOCs did not detect any of these constituents.

3.5 Assessment of Gaps in Information

The most recent material in the septic tank was not necessarily representative of all discharges to the unit that occurred since it was put into service in 1959. The analytical results of the various rounds of septic tank sampling were used, along with process knowledge and other available information, to help identify the most likely COCs that might be found in soils surrounding the septic tank and beneath the drainfield, and to help select the types of analyses to be performed on soil samples collected from the site. While the history of past releases at the site is incomplete, analytical data from confirmatory soil samples collected in December 1994 (discussed below) are sufficient to determine whether releases of COCs occurred at the site.

3.6 Confirmatory Sampling

Although the likelihood of significant releases of hazardous constituents at ER Site 138 was considered low, confirmatory soil sampling was conducted to determine whether COCs above background or action levels were released via the septic system at this site. A backhoe was used in September 1994 to determine the location, dimensions, and depth of the ER Site 138 drainfield, which had no surface expression (SNL/NM September 1994). The drainfield excavation operation is shown in Figure 3. Once the drainfield was located, soil samples were collected from boreholes within the drainfield, and from either side of the septic tank (SNL/NM

December 1994a). The confirmatory soil sampling program was performed in accordance with the rationale and procedures described in the Septic Tank and Drainfields (ADS-1295) RCRA Facility Investigation Work Plan (SNL/NM March 1993), and addenda to the Work Plan developed during the OU 1295 project approval process (IT March 1994 and SNL/NM November 1994a). A summary of the types of samples, number of sample locations, sample depths and analytical requirements for confirmatory soil samples collected at this site is presented in Table 3-1.

Confirmatory soil samples were collected from one boring on either side of the septic tank, and from six borings located in the middle and near the ends of the two pairs of drainfield lateral lines (Figure 1-2). For septic tank borings, samples were collected from one interval in each borehole starting at the outside bottom of the tank, which was 10 feet below ground surface (BGS) at this site. For the drainfield borings, samples were collected from two intervals in each borehole. The top of the shallow interval started at the bottom of the drain line trenches which were 6.5 feet BGS on average at this site, and the lower (deep) interval started at 10 feet below the top of the upper interval, or 16.5 feet BGS.

The Geoprobe™ sampling system was used to collect subsurface soil samples at this site. The Geoprobe™ sampling tool was fitted with a butyl acetate (BA) sampling sleeve and was then hydraulically driven to the top of the designated sampling depth. The sampling tool was opened, and driven an additional two feet in order to fill the two-foot long by approximately 1.25-inch diameter BA sleeve. The sampling tool and soil-filled sleeve were then retrieved from the borehole. In order to minimize the potential for loss of volatile compounds (if present), the soil to be analyzed for VOCs was not emptied from the BA sleeve into another sample container. The filled BA sleeve was removed from the sampling tool, and the top seven inches were cut off. Both ends of the seven-inch section of filled sleeve were immediately capped with a teflon membrane and rubber end cap, sealed with tape, and placed in an ice-filled cooler at the site. The soil in this section of sleeve was submitted for a VOC analysis.

Soil from the remainder of the sleeve was then emptied into a decontaminated mixing bowl. Following this, additional two-foot sampling runs were completed in order to recover enough soil to satisfy sample volume requirements for the interval. Soil recovered from these additional runs was also emptied into the mixing bowl, and blended with soil from the first sampling run. The soil was then transferred from the bowl into sample containers using a decontaminated plastic spatula.

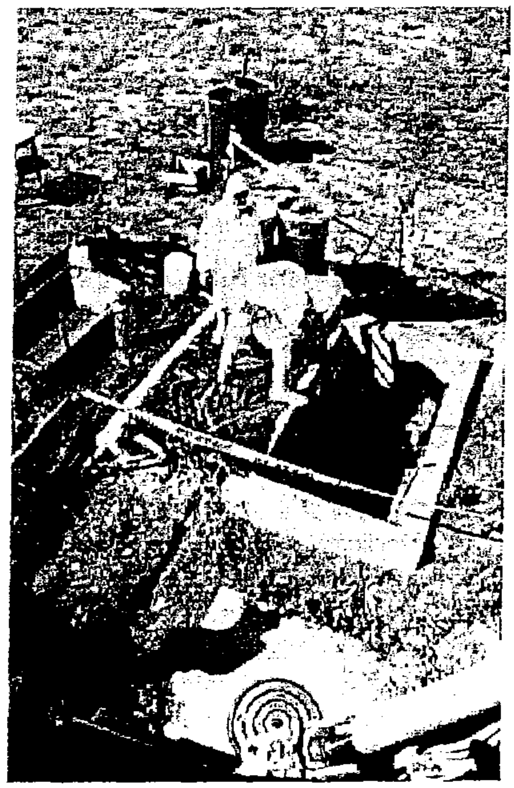
Table 3-1
ER Site 138: Confirmatory Sampling Summary Table

Sampling Location	Analytical Parameters	Number of Borehole Locations	Top of Sampling Intervals at Each Boring Location	Total Number of Investigative Samples	Total Number of Duplicate Samples	Date(s) Samples Collected
Drainfield	VOCs	6	6.5', 16.5'	12	1	12/19, 20/94
	SVOCs	6	6.5', 16.5'	12	1	
	Soil pH	6	6.5', 16.5'	12	1	
	PCBs	6	6.5', 16.5'	12	1	
	RCRA metals + Ni	6	6.5', 16.5'	12	1	
	Cyanide	6	6.5', 16.5'	12	1	
	Gamma spec. composite	6	6.5', 16.5'	2		
	Tritium composite	6	6.5', 16.5'	2		
	Isotopic uranium composite	6	6.5', 16.5'	2		
Septic tank	VOCs	2	10'	2		12/19/94
	SVOCs	2	10'	2		
	Soil pH	2	10'	2		
	PCBs	2	10'	2		
	RCRA metals + Ni	2	10'	2		
	Cyanide	2	10'	2		
	Isotopic uranium composite	2	10'	1		
	Gamma spec. composite	2	10'	1		
	Tritium composite	2	10'	1		

Notes
Ni = Nickel
PCB = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
Spec. = Spectroscopy
SVOCs = Semivolatile organic compounds
VOCs = Volatile organic compounds

Drainfield and septic tank soil samples were analyzed for VOCs, SVOCs, cyanide, PCBs, RCRA metals, and nickel by a commercial laboratory. Samples were shipped to the offsite commercial laboratories by an overnight delivery service. Samples were analyzed for pH at the SNL/NM field laboratory. Also, to determine if radionuclides were released from past activities at this site, composite samples were collected from the drainfield shallow and deep sampling intervals and were analyzed by a commercial laboratory for tritium and isotopic uranium, and were screened for other radionuclides using SNL/NM in-house gamma spectroscopy. Routine SNL/NM chain-of-custody and sample documentation procedures were employed for all samples collected at this site.

Excavating down to drainlines to determine configuration, 9/6/94. View looking west.



Septic tank sludge removal and cleaning, 10/10/95.

Figure 3-1: ER Site 138 Photographs

Quality assurance/quality control (QA/QC) samples collected during this effort consisted of one set of duplicate soil samples from the shallow sampling interval in DF-5 (Figure 2) analyzed for RCRA constituents. Concentrations of constituents detected in the duplicate soil samples were generally in good agreement with those detected in the equivalent field samples from the same intervals. One set of aqueous equipment rinsate samples were also collected following completion of soil sampling at the site and were analyzed for the same non-radiologic constituents and isotopic uranium as the soil samples collected at this site. Trace levels of the common laboratory contaminant methylene chloride were detected in the equipment blank, but no SVOCs, cyanide, or metals were identified. Low activity levels of the three isotopic uranium radionuclides were also identified in the rinsate samples. Also, a soil trip blank sample was included with the shipment of ER Site 138 VOC soil samples to the commercial laboratory and was analyzed for VOCs only. The following compounds were detected in the trip blank: acetone, methyl ethyl ketone (MEK), and methylene chloride. These common laboratory contaminants were either not detected, or were found in lower concentrations in the characterization samples. Soil used for the trip blank was prepared by heating the material, and then transferring it immediately to the sample container. This heating process drives off any residual organic compounds (if present), and soil moisture, that may be contained in the material. It is thought that when the soil trip blank container was opened at the laboratory, it immediately adsorbed both moisture and VOCs present in the laboratory atmosphere, and therefore became contaminated.

Summaries of all constituents detected by commercial laboratory analyses and pH measurements completed by the SNL/NM field laboratory in these confirmatory samples are presented in Tables 3-2, 3-3, and 3-4. Results of the SNL/NM in-house gamma spectroscopy composite soil sample screening for other radionuclides are presented in Appendices A.3 through A.5. Complete soil sample analytical data packages are archived in the SNL/NM Environmental Operations Records Center and are readily available for review and verification (SNL/NM December 1994b).

3.7 Rationale for Pursuing a Confirmatory Sampling NFA Decision

As discussed in Section 3.4, the passive soil-gas survey identified some areas with VOC anomalies in the drainfield area and septic tank area but subsequent soil sampling did not confirm the existence of detectable concentrations of these compounds in soils beneath and around these units.

Confirmatory soil sampling around the septic tank and in the drainfield did not identify any residual COCs indicating past discharges that could pose a threat to human health or the environment. As shown in Table 3-2, only below-reporting-limit concentrations of three VOC compounds (acetone, methylene chloride, and toluene), which are common laboratory contaminants, were detected in soil samples collected from this site. Cyanide and PCBs were not detected. Trace concentrations of the SVOCs bis (2-ethylhexyl) phlalate (BEHP), 2-chloro-napthalene, and phenol were detected in three soil samples in the shallow sampling interval. These constituents were not detected in the deeper intervals at the same locations. The pH of the soil indicates that it is slightly alkaline.

Table 3-3, concluded:

ER Site 138
Summary of RCRA Metals and Nickel in Confirmatory Soil Samples Collected Around the Septic Tank and in the Drainfield

Notes:

As = Arsenic. Arsenic background concentrations presented above are based on analyses of subsurface soil samples collected in the Coyote Test Field (CTF) area.
Ba = Barium. Barium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest and CTF areas.
Cd = Cadmium. Cadmium background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF, and Offsite areas.
Cr = Chromium. Chromium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest area.
Ni = Nickel. Nickel background concentrations presented above are based on analyses of surface and subsurface samples collected in the Southwest and CTF areas.
Pb = Lead. Lead background concentrations presented above are based on analyses of subsurface samples collected in the Southwest and Offsite areas.
Hg = Mercury. Mercury background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF and Offsite areas.
Se = Selenium. Selenium background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the North, Tijeras, Southwest, CTF and Offsite areas.
Ag = Silver. Silver background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF, and Offsite areas.

Dupl. = Duplicate soil sample
EB = Equipment blank
fbgs = Feet below ground surface
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
NA = Not applicable
ND = Not detected
QA = Quality assurance
RCRA = Resource Conservation and Recovery Act
UTL = Upper Tolerance Limit
* IT March 1996
** 80,000 mg/kg is for Cr^{3+} only. For Cr^{6+}, proposed Subpart S action level is 400 mg/kg.
*** No proposed Subpart S action level for lead in soil; 400 ppm is EPA proposed action level (EPA July 1994)

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Table 3-4

ER Site 138
Summary of Isotopic Uranium and Tritium in Confirmatory Soil Samples Collected Around the Septic Tank and in the Drainfield

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	Isotopic Uranium Method HASL-300 (pCi/g for soil, pCi/L for water) U-233/ U-234 Result	U-233/ U-234 Error *	U-233/ U-234 M.D.A.	U-235 Result	U-235 Error *	U-235 M.D.A.	U-238 Result	U-238 Error *	U-238 M.D.A.	Tritium Method EPA-600 906.0 (pCi/L) Result	Error *	M.D.A.
Septic Tank Soil Samples:																	
018845-5	Soil	Compos.	12/19/94	ST-1/2	10	0.73	0.17	0.074	0.054 J	0.046	0.061	0.79	0.17	0.061			
018860-7	Water	EB	12/20/94	Site 138	NA	0.057 J	0.082	0.13	0.021 J	0.082	0.17	0.021 J	0.082	0.17			
018845-4	Soil	Compos.	12/19/94	ST-1/2	10										ND	1,500	2,500
Drainfield Composite Soil Samples:																	
018847-5	Soil	Compos.	12/19/94	DF-1/6	6.5	0.82	0.16	0.057	0.036	0.03	0.036	0.69	0.14	0.036			
018848-5	Soil	Compos.	12/19/94	DF-1/6	16.5	0.59	0.13	0.059	0.041	0.032	0.036	0.7	0.14	0.049			
018847-4	Soil	Compos.	12/19/94	DF-1/6	6.5										ND	140	250
018848-4	Soil	Compos.	12/19/94	DF-1/6	16.5										ND	1,500	2,500
Number of SNL/NM Background Soil Sample Analyses **						14			283			90			U		
SNL/NM Soil Background Range **						0.44-<5.02			0.004-3			0.153-2.3			U		
SNL/NM Soil Background 95th Percentile **						<5.02			0.16			1.4			U		
Nationwide Tritium Range in Precipation and Drinking Water ***						NA			NA			NA			100-400		

Notes:
U-233 = Uranium 233
U-234 = Uranium 234. Uranium 233/234 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
U-235 = Uranium 235. Uranium 235 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
U-238 = Uranium 238. Uranium 235 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.

Compos. = Composite
EB = Equipment blank
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.

M.D.A. = Minimum detectable activity
NA = Not applicable
ND = Not detected
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter

U = Undefined for SNL/NM soils
* Error = +- 2 sigma uncertainty
** IT March 1996
*** EPA October 1993

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Table 3-2

ER Site 138
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Septic Tank and in the Drainfield

Sample Number	Sampl Matrix	Sampl Type	Sample Date	Sample Location (Figure 2	Top of Sample Interval (fbgs)	VOCs Method 8240 Acetone	MEK	Methylene Chloride	Toluene	SVOCs Method 8270 BEHP	2-Chloro-napthalene	Phenol	Cyanide Method 9010/9012	PCBs Method 8080	Units	Soil pH ASTM Method 4972 (pH units)
Septic Tank Soil Samples:																
018845-1,2	Soil	Field	12/19/94	ST-1	10	ND	ND	2.5 B,J	ND	ND	ND	ND	ND	ND	ug/kg	7.2
018846-1,2	Soil	Field	12/19/94	ST-2	10	ND	ND	1.3 J	ND	ND	ND	ND	ND	ND	ug/kg	7.5
Drainfield Soil and QA Samples:																
018858-1,2	Soil	Field	12/20/94	DF-1	6.5	ND	ND	1.3 J	ND	ND	ND	ND	ND	ND	ug/kg	7.4
018859-1,2	Soil	Field	12/20/94	DF-1	16.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	7.5
018856-1,2	Soil	Field	12/20/94	DF-2	6.5	7.9 J	ND	1.2 J	ND	51 J	ND	36 J	ND	ND	ug/kg	7.5
018857-1,2	Soil	Field	12/20/94	DF-2	16.5	ND	ND	1.2 J	ND	ND	ND	ND	ND	ND	ug/kg	7.6
018854-1,2	Soil	Field	12/20/94	DF-3	6.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	7.6
018855-1,2	Soil	Field	12/20/94	DF-3	16.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	7.7
018852-1,2	Soil	Field	12/19/94	DF-4	6.5	4.2 B,J	ND	3.3 B,J	ND	ND	ND	ND	ND	ND	ug/kg	7.6
018853-1,2	Soil	Field	12/19/94	DF-4	16.5	3.6 B,J	ND	3.1 B,J	2.1 J	ND	ND	ND	ND	ND	ug/kg	7.5
018849-1,2	Soil	Field	12/19/94	DF-5	6.5	ND	ND	3.9 B,J	ND	ND	ND	ND	ND	ND	ug/kg	7.7
018850-1,2	Soil	Dupl.	12/19/94	DFD-5	6.5	3.9 B,J	ND	3.5 B,J	ND	ND	ND	ND	ND	ND	ug/kg	NS
018851-1,2	Soil	Field	12/19/94	DF-5	16.5	ND	ND	3.2 B,J	ND	ND	ND	ND	ND	ND	ug/kg	7.5
018847-1,2	Soil	Field	12/19/94	DF-6	6.5	ND	ND	3 B,J	ND	ND	200 J	ND	ND	ND	ug/kg	7.6
018848-1,2	Soil	Field	12/19/94	DF-6	16.5	ND	ND	3 B,J	ND	ND	ND	ND	ND	ND	ug/kg	7.6
018860-1,2,5,6	Water	EB	12/20/94	Site 138	NA	ND	ND	1.4 B,J	ND	ND	ND	ND	ND	ND	ug/L	NS
021314-1	Soil	TB	12/20/94	Site 138	NA	22	10 J	4 J	ND	NS	NS	NS	NS	NS	ug/kg	NS
Laboratory Reporting Limit for Soil						10	10	5	5	330	330	330	500	33	ug/kg	
Laboratory Reporting Limit for Water						10	10	5	5	10	10	10	10	1	ug/L	
Proposed Subpart S Action Level For Soil						8E+06	8E+06	9E+04	2E+07	5E+04	6E+06	5E+07	2E+06	9E+01	ug/kg	

Notes:

B = Compound detected in associated method blank sample
BEHP = Bis(2-Ethylhexyl)phthalate
Dupl. = Duplicate soil sample
EB = Equipment blank
fbgs = feet below ground surface

J = Result is detected below the reporting limit or is an estimated concentration.
MEK = Methyl ethyl ketone
NA = Not applicable
ND = Not detected
NS = No sample

PCBs = Polychlorinated biphenyls
QA = Quality assurance
SVOCs = Semivolatile organic compounds
TB = Trip blank
ug/kg = Micrograms per kilogram
ug/L = Micrograms per liter
VOCs = Volatile organic compounds

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Table 3-3

ER Site 138
Summary of RCRA Metals and Nickel in Confirmatory Soil Samples
Collected Around the Septic Tank and in the Drainfield

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471: As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag	Other Metals: Nickel Method 6010	Units
Septic Tank Soil Samples:															
018845-2	Soil	Field	12/19/94	ST-1	10	2.7	106	ND	7.9	7.5	ND	ND	ND	37	mg/kg
018846-2	Soil	Field	12/19/94	ST-2	10	2.9	139	ND	9	ND	ND	ND	ND	20.5	mg/kg
Drainfield Soil and QA Samples:															
018858-2	Soil	Field	12/20/94	DF-1	6.5	3	169	ND	7.5	ND	ND	ND	ND	108	mg/kg
018859-2	Soil	Field	12/20/94	DF-1	16.5	2.9	132	ND	9	ND	ND	ND	ND	83.5	mg/kg
018856-2	Soil	Field	12/20/94	DF-2	6.5	2.8	86	ND	9.5	5.8	ND	ND	ND	63.5	mg/kg
018857-2	Soil	Field	12/20/94	DF-2	16.5	2.4	71.7	ND	8	ND	ND	ND	ND	91.6	mg/kg
018854-2	Soil	Field	12/20/94	DF-3	6.5	2.8	143	ND	13	ND	ND	ND	11.9	9.2	mg/kg
018855-2	Soil	Field	12/20/94	DF-3	16.5	1.9	91.1	ND	7.9	ND	ND	ND	ND	73.6	mg/kg
018852-2	Soil	Field	12/19/94	DF-4	6.5	3.3	497	ND	8.7	5.1	ND	ND	ND	7.5	mg/kg
018853-2	Soil	Field	12/19/94	DF-4	16.5	2.6	85.9	ND	7.3	ND	ND	ND	ND	16.5	mg/kg
018849-2	Soil	Field	12/19/94	DF-5	6.5	3.3	191	ND	7.6	5	ND	ND	ND	9.7	mg/kg
018850-2	Soil	Dupl.	12/19/94	DFD-5	6.5	3	200	ND	8.5	5	ND	ND	ND	10.7	mg/kg
018851-2	Soil	Field	12/19/94	DF-5	16.5	2	70.8	ND	8.2	ND	ND	ND	ND	29.1	mg/kg
018847-2	Soil	Field	12/19/94	DF-6	6.5	2.9	109	ND	9.6	5.6	ND	ND	ND	24.9	mg/kg
018848-2	Soil	Field	12/19/94	DF-6	16.5	2.6	138	ND	6.9	ND	ND	ND	ND	24.6	mg/kg
018860-3,4	Water	EB	12/20/94	Site 138	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	mg/L
Laboratory Reporting Limit For Soil						1	1	0.5	1	5	0.1	0.5	1	4	mg/kg
Laboratory Reporting Limit for Water						0.01	0.01	0.005	0.01	0.003	0.0002	0.005	0.01	0.04	mg/L
Number of SNL/NM Background Soil Sample Analyses *						15	727	1,740	647	536	1,724	2,134	2,302	1,016	mg/kg
SNL/NM Soil Background Range *						2.1-7.9	0.5-495	0.0027-6.2	0.5-31.4	0.75-103	0.0001-0.68	0.037-17.2	0.0016-8.7	0.5-70.2	mg/kg
SNL/NM Soil Background UTL or 95th Percentile *						7	214	0.9	15.9	11.8	<0.1	<1.0	<1.0	11.5	mg/kg
Proposed Subpart S Action Level For Soil						0.50	6,000	80	80,000 **	400 ***	20	400	400	2,000	mg/kg

As shown on Table 3-3, septic tank and drainfield soil sample analytical results indicate that the nine metals that were targeted in the Site 138 investigation were either (1) not detected, or (2) were detected in concentrations below the background UTL or 95th percentile concentrations presented in the SNL/NM study of naturally-occurring constituents (IT March 1996), or (3) were less than the proposed Subpart S or other action levels for these metals.

As shown on Table 3-4, the results of the isotopic uranium analysis were all below the 95th percentile background concentrations. Tritium was not detected in soil moisture from the shallow and deep interval composite samples collected from the drainfield sampling intervals, or from the composite sample collected from either side of the septic tank (Table 3-4). Also, the gamma spectroscopy semi-qualitative screening of composite samples from the drainfield shallow and deep sampling intervals and from the septic tank borehole locations did not indicate significant concentrations of other radionuclides in soils at this site (Appendices A.3, A.4, and A.5).

Finally, the ER Site 138 septic tank contents were removed and the tank was cleaned in October 1995 (SNL/NM October 1995). The tank was then inspected by a representative of the New Mexico Environment Department (NMED) to verify that the tank contents had been removed and the tank closed in accordance with applicable State of New Mexico regulations (SNL/NM December 1995).

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4. CONCLUSION

Sample analytical results generated from this confirmatory sampling investigation have shown that detectable or significant concentrations of COCs are not present in soils at ER Site 138, and that additional investigations are unwarranted and unnecessary. Based on archival information and chemical and radiological analytical results of soil samples collected next to the septic tank, and in the drainfield, SNL/NM has demonstrated that any contaminants present at this site pose an acceptable level of risk under current and projected future land use (Criterion 5 of Section 1.2). Therefore, ER Site 138 is recommended for an NFA determination.

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Appendix A

OU 1295, Site 138
Results of Previous Sampling and Surveys

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Appendix A.1

ER Site 138
Summary of Constituents Detected in Septic Tank and Distribution Box Samples

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Appendix A.1

ER Site 138
Summary of Constituents in Septic Tank and Distribution Box Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Detection Limit	+- 2 Sigma Uncertainty	Units
May 1994 Septic Tank Samples:									
15463-1	Sludge	Field	5/9/94	6010	Arsenic	11.1 J	20	NA	mg/kg
				6010	Barium	96.6	2	NA	mg/kg
				6010	Cadmium	9.4	1	NA	mg/kg
				6010	Chromium	162	2	NA	mg/kg
				6010	Lead	156	10	NA	mg/kg
				6010	Silver	6	2	NA	mg/kg
				6010	Nickel	151	8	NA	mg/kg
				7471	Mercury	1.8	0.27	NA	mg/kg
15463-2	Sludge	Field	5/9/94	8270	Benzoic acid	0.39 J	8	NA	mg/kg
				8270	Phenanthrene	0.23 J	1.6	NA	mg/kg
				8270	Di-n-butyl phthalate	0.25 J	1.6	NA	mg/kg
				8270	Fluoranthene	0.6 J	1.6	NA	mg/kg
				8270	Pyrene	0.46 J	1.6	NA	mg/kg
				8270	Butyl benzyl phthalate	0.36 J	1.6	NA	mg/kg
				8270	Benzo(a) anthracene	0.3 J	1.6	NA	mg/kg
				8270	bis(2-Ethylhexyl) phthalate	5.9	1.6	NA	mg/kg
				8270	Chrysene	0.38 J	1.6	NA	mg/kg
				8270	Di-n-octyl phthalate	0.45 J	1.6	NA	mg/kg
				8270	Benzo(b) fluoranthene	0.45 J	1.6	NA	mg/kg
				8270	Benzo(a) pyrene	0.26 J	1.6	NA	mg/kg
15463-3	Sludge	Field	5/9/94	8080	Aroclor 1254	700	330	NA	ug/kg
15463-4	Sludge	Field	5/9/94	6010/TCLP	Barium	0.14 B	0.02	NA	mg/L
				6010/TCLP	Cadmium	0.37	0.01	NA	mg/L
15463-5	Sludge	Field	5/9/94	8240	Methylene chloride	0.38 BJ	0.5	NA	mg/kg
					Acetone	1.1 B	1	NA	mg/kg
					2-Butanone	0.92 BJ	1	NA	mg/kg
January 1995 Septic Tank Samples:									
021472-2	Sludge	Field	1/23/95		Uranium Series:				
				Gamma Spec.	Uranium-238	16.4	2.65	4	pCi/g
				Gamma Spec.	Thorium-234	15.6	1.01	4.39	pCi/g
				Gamma Spec.	Radium-226	3.31	0.807	1.05	pCi/g
					Thorium Series:				
				Gamma Spec.	Thorium-232	0.415	0.227	0.199	pCi/g
				Gamma Spec.	Radium-228	0.455	0.372	0.253	pCi/g
				Gamma Spec.	Radium-224	1.16	0.705	0.541	pCi/g
				Gamma Spec.	Lead-212	0.361	0.065	0.123	pCi/g
				Gamma Spec.	Telurium-208	0.449	0.137	0.136	pCi/g
					Other Radionuclides:				
				Gamma Spec.	Cesium-137	0.051	0.052	0.0302	pCi/g
				Gamma Spec.	Potassium-40	11.5	0.752	2.06	pCi/g
021472-1	Sludge	Field	1/23/95	EPA-600 906.0	Tritium	530	730	1200	pCi/l

Page 1 of 2

Appendix A.1, concluded

ER Site 138
Summary of Constituents in Septic Tank and Distribution Box Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Detection Limit	+- 2 Sigma Uncertainty	Units
January 1995 Septic Tank Sample, continued:									
021472-1	Sludge	Field	1/23/95	HASL-300	Uranium 238	19	2.2	0.038	pCi/g
				HASL-300	Uranium 235	0.33	0.092	0.015	pCi/g
				HASL-300	Uranium 233/234	4.1	0.53	0.038	pCi/g
January 1996 Distribution Box Samples									
027553-4	Sludge	Field	1/16/96	7196	Hexavalent Chromium	0.1	0.1	NA	ug/kg
				6010	Arsenic	3.3	1	NA	mg/kg
				6010	Barium	89.9	20	NA	mg/kg
				6010	Beryllium	0.54	0.5	NA	mg/kg
				6010	Cadmium	3.6	0.5	NA	mg/kg
				6010	Chromium	35.8	1	NA	mg/kg
				6010	Lead	99.1	0.3	NA	mg/kg
				6010	Selenium	1.1	0.5	NA	mg/kg
				6010	Silver	1.5	1	NA	mg/kg
027553-1	Sludge	Field	1/16/96	U-NAS-NS-3050	Uranium 238	1.19	0.01	0.33	pCi/g
				U-NAS-NS-3050	Uranium 235/236	0.071	0.019	0.04	pCi/g
				U-NAS-NS-3050	Uranium 234	1.06	0.02	0.24	pCi/g
027553-03	Sludge	Field	1/16/95		Uranium Series:				
				Gamma Spec.	Radium-226	1.72	0.72	0.55	pCi/g
				Gamma Spec.	Lead-214	0.473	0.063	0.085	pCi/g
				Gamma Spec.	Bismuth-214	0.4	0.052	0.07	pCi/g
					Thorium Series:				
				Gamma Spec.	Thorium-232	0.541	0.206	0.168	pCi/g
				Gamma Spec.	Radium-228	0.435	0.279	0.347	pCi/g
				Gamma Spec.	Actinium-228	0.561	0.089	0.114	pCi/g
				Gamma Spec.	Thorium-228	0.59	0.439	0.219	pCi/g
				Gamma Spec.	Radium-224	0.602	0.527	0.39	pCi/g
				Gamma Spec.	Lead-212	0.601	0.036	0.109	pCi/g
				Gamma Spec.	Bismuth-212	0.625	0.331	0.246	pCi/g
				Gamma Spec.	Telurium-208	0.522	0.081	0.099	pCi/g
					Other Radionuclides:				
				Gamma Spec.	Cesium-137	0.088	0.039	0.029	pCi/g
				Gamma Spec.	Potassium-40	14.4	0.303	1.99	pCi/g
027553-2	Sludge	Field	1/16/96	Cryogenic H3	Tritium	ND	300	172	pCi/L

Notes

B = Compound detected in asociated blank sample
J = Result is detected below the reporting limit
or is an estimated concentration
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
ug/kg = micrograms per kilogram

NA = Not Applicable
ND = Not Detectable
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
TCLP = Toxicity Characteristic Leaching Procedure

Page 2 of 2

Appendix A.2

ER Site 138
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

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ER Site 138
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 138

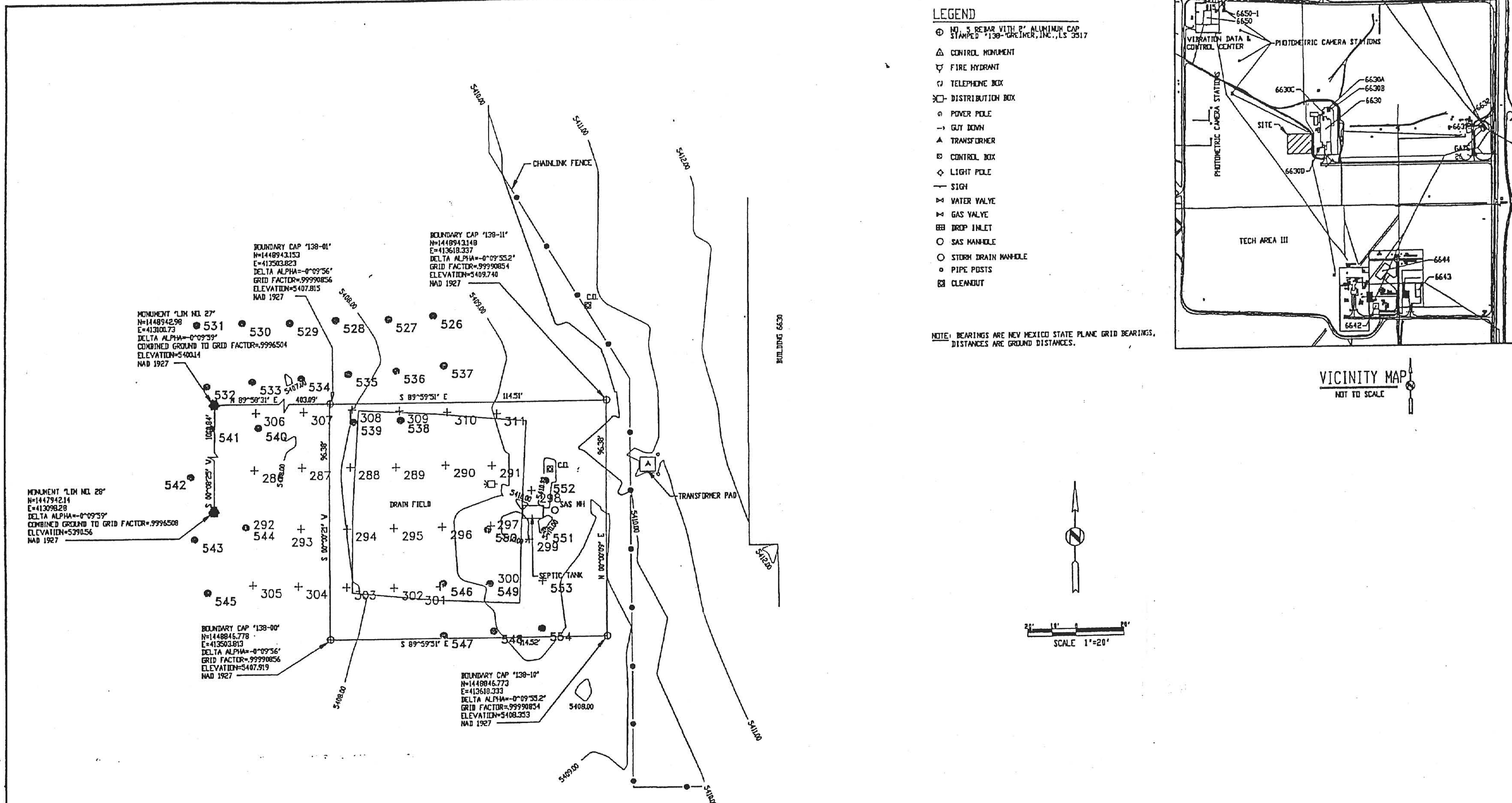
	Sample	PCE	TCE	BTEX	Aliphatics
Phase I Sampling	286	1153	31646	10456	11340
	287	17750	59694	21506	25037
	288	49145	80343	185087	72783
	289	21912	134112	64407	45327
	290	48964	73140	148354	139886
	291	11707	13037	ND	ND
	292	11441	120664	8644	29393
	293	ND	41950	12762	6443
	294	9028	42750	26107	6749
	295	2554	25613	7990	8663
	296	3580	10246	16452	177592
	297	58038	10954	8496	10083
	298	31033	17019	9762	6636
	299	237909	22076	21860	133473
	300	127218	4344	4775	30384
	301	5701	28017	18368	5071
	302	22260	24934	10371	8660
	303	11382	68950	7657	5654
	304	20309	12582	24097	16540
	305	28774	52654	542884	546585
	306	40875	128974	12348	31114
	307	22330	86739	26060	26039
	308	9093	121367	21052	23059
	309	12640	64028	871	6492
	310	36326	108333	8412	13638
	311	22391	40377	ND	14225
	D-1291	21096	25074	2740	6194
	D-1296	12070	24181	27560	847622
	D-1301	ND	15998	16842	7076
	* 900	ND	ND	4553	6219
	* 901	ND	ND	4732	ND

ER Site 138
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 138

	Sample	PCE	TCE	BTEX	Aliphatics
Phase II Sampling	526	4,909	81,426	24,740	107,671
	527	1,930	31,070	ND	4,400
	528	ND	506	480	1,090
	529	13,569	8,140	210,114	242,494
	530	2,636	49,516	3,804	8,172
	531	586	11,616	1,022	ND
	532	ND	3,742	ND	ND
	533	1,775	38,852	4,641	4,074
	534	4,898	50,395	10,145	14,942
	535	5,076	44,921	25,650	33,412
	536	4,338	11,203	9,702	4,836
	537	ND	21,206	6,520	23,545
	538	584	80,989	53,803	90,569
	539	13,674	138,962	4,143	21,009
	540	1,095	11,418	2,299	1,230
	541	ND	2,462	9,116	5,662
	542	ND	ND	1,890	3,718
	543	12,275	107,171	19,019	30,538
	544	ND	2,867	3,076	6,131
	545	ND	4,562	ND	ND
	546	19,424	29,162	21,314	43,551
	547	14,836	4,659	9,334	7,108
	548	18,307	11,963	2,721	13,009
	549	19,364	7,190	13,020	11,199
	550	12,676	2,812	3,480	2,590
	551	32,948	18,111	3,714	13,365
	552	33,973	ND	6,030	11,825
	553	22,301	3,229	2,958	2,453
	554	35,746	29,697	86,075	61,832
	* 900	ND	ND	ND	ND
	* 901	ND	ND	ND	ND
	D-2531	3,840	23,557	6,664	6,629
	D-2532	ND	3,035	ND	ND
	D-2547	14,834	5,177	8,028	3,661

PCE - Tetrachloroethene
Indicator Mass Peak(s) 164



NER — Northeast Research Institute LLC, 605 Parfet Street, Suite 100, Lakewood, Colorado 80215, (303) 238-0090	Drawn By: JCS Checked By: Project Manager: JOG	Project #: 2096-138 Date: 5/23/1995 File Name: 138_1.dwg	Sandia National Laboratories STD Site 138 Albuquerque, New Mexico PETREX FINGERPRINT TECHNOLOGY	LEGEND Features: + PETREX Sample Location (PHASE I) ● PETREX Sample Location (PHASE II)	Sample Locations Plate 16

ER Site 138
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 138

TCE - Trichloroethene
Indicator Mass Peak(s) 130

BTEX - Benzene, Toluene, Ethylbenzene/Xylene(s)
Indicator Mass Peak(s) 78, 92, 106

Aliphatics - C4-C11 Cycloalkanes/Alkenes
Indicator Mass Peak(s) 56, 70, 84, 98, 112, 126, 140, 154

D - Duplicate Sample
Sample numbers in thousands duplicate of sample numbers in hundreds

* QA/QC Blank Sample - No Compounds Detected above the PETREX Normal reporting Limits

Appendix A.3

ER Site 138
Gamma Spectroscopy Screening Results for the Drainfield Shallow Interval Composite Soil Sample

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ER Site 138
Gamma Spectroscopy Screening Results for the Drainfield Shallow Interval Composite Soil Sample

```
****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  20-DEC-94 14:20:24 *
****************************************************************************
B.GALLOWAY/E.ROSS (7582/IT)  018847-3

Operator: [signature] 12/20/94    Reviewed by [signature] 12/20/94
****************************************************************************
                                        *
Data File    : 94075202.DAT             * Sample Quantity: 906.000  GRAM
Acquire Date: 20-DEC-94 13:07:35        * Efficiency File: SMAR2.EFF
Sample  Date: 19-DEC-94 14:30:00        * Library    File: RSDP.LIB
Sample  Type: SOLID                     *
****************************************************************************
                                        *
Preset  Live Time: 3600.0  sec          * FWHM at 1332 KeV         : 2.3  KeV
Elapsed Live Time: 3600.0  sec          * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3601.0  sec          * Gaussian Assymetry       : 10.0 %
****************************************************************************
                                        *
Detector    : DET2                      * Fit Iterations   : 20.
Calib Date : 01-NOV-94 09:53:16         * Energy Tolerance: 1.5  KeV
KeV/Channel: .36661                     * Half Life Ratio : 8.0
Offset      : -.47933                   * Abundance Limit : 50.00 %
****************************************************************************

[Summary Report        -- SNL (7715) --      version 1.2]
```

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM
U-238	Not Detected	--------	3.11E-01
TH-234	Not Detected	--------	3.11E-01
U-234	Not Detected	--------	5.02E+00
RA-226	9.97E-01	4.58E-01	--------
PB-214	4.81E-01	5.67E-02	--------
BI-214	5.18E-01	6.00E-02	--------
PB-210	1.78E+00	1.37E+00	--------
TH-232	6.37E-01	1.16E-01	--------
RA-228	6.37E-01	1.16E-01	--------
AC-228	5.75E-01	1.05E-01	--------
TH-228	5.61E-01	3.90E-02	--------
RA-224	3.91E-01	4.48E-01	--------
PB-212	5.63E-01	3.92E-02	--------
BI-212	3.12E-01	1.39E-01	--------
TL-208	4.86E-01	8.94E-02	--------
U-235	Not Detected	--------	2.65E-02
TH-231	~~2.99E-01~~	~~2.05E-01~~	not detected [initials] 12/20
PA-231	Not Detected	--------	6.93E-01
AC-227	Not Detected	--------	7.75E-01
TH-227	Not Detected	--------	1.18E-01
AM-241	Not Detected	--------	7.10E-02
NP-237	Not Detected	--------	1.30E-01
PA-233	Not Detected	--------	3.17E-02
TH-229	Not Detected	--------	5.86E-02

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Appendix A.3, concluded:

ER Site 138
Gamma Spectroscopy Screening Results for the Drainfield
Shallow Interval Composite Soil Sample

ID: B.GALLOWAY/E.ROSS (7582/IT) 018847-3

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	1.93E+02
AG-110	Not Detected	--------	1.40E-02
BE-7	Not Detected	--------	1.10E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	1.94E-02
BA-140	Not Detected	--------	4.86E-02
BI-207	Not Detected	--------	1.30E-02
CD-109	Not Detected	--------	4.99E-01
CE-139	Not Detected	--------	1.34E-02
CE-144	Not Detected	--------	9.14E-02
CO-56	Not Detected	--------	1.63E-02
CO-57	Not Detected	--------	1.22E-02
CO-58	Not Detected	--------	1.12E-02
CO-60	Not Detected	--------	1.81E-02
CR-51	Not Detected	--------	1.33E-01
CS-134	Not Detected	--------	1.45E-02
CS-137	Not Detected	--------	1.41E-02
CU-64	Not Detected	--------	1.94E+01
EU-152	Not Detected	--------	3.82E-02
EU-154	Not Detected	--------	6.48E-02
EU-155	Not Detected	--------	5.92E-02
FE-59	Not Detected	--------	3.24E-02
GD-153	Not Detected	--------	3.79E-02
HG-203	Not Detected	--------	1.76E-02
HO-166	Not Detected	--------	1.63E-02
I-125	Not Detected	--------	1.52E+00
I-129	Not Detected	--------	7.37E-01
I-131	Not Detected	--------	1.55E-02
IN-115M	Not Detected	--------	1.20E+00
IR-192	Not Detected	--------	1.49E-02
K-40	1.16E+01	5.54E-01	--------
LA-140	Not Detected	--------	1.93E-02
MN-54	Not Detected	--------	1.46E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	1.67E-02
NA-24	Not Detected	--------	3.47E-02
NB-95	Not Detected	--------	6.42E-02
RU-103	Not Detected	--------	1.32E-02
RU-106	Not Detected	--------	1.13E-01
SB-124	Not Detected	--------	1.44E-02
SB-125	Not Detected	--------	3.64E-02
SB-126	Not Detected	--------	1.61E-02
SC-46	Not Detected	--------	1.16E-02
SN-113	Not Detected	--------	2.01E-02
SR-85	Not Detected	--------	1.18E-02
TA-182	Not Detected	--------	1.21E-01
TE-123M	Not Detected	--------	1.29E-02
TL-201	Not Detected	--------	1.35E-01
XE-133	Not Detected	--------	4.86E-02
Y-88	Not Detected	--------	1.34E-02
ZN-65	Not Detected	--------	3.40E-02
ZR-95	Not Detected	--------	2.44E-02

Appendix A.4

ER Site 138
Gamma Spectroscopy Screening Results for the Drainfield
Deep Interval Composite Soil Sample

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ER Site 138
Gamma Spectroscopy Screening Results for the Drainfield
Deep Interval Composite Soil Sample

```
****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  20-DEC-94 15:23:45 *
****************************************************************************
B.GALLOWAY/E.ROSS (7582/IT) 018848-3

Operator: [signature] 12/20/94   Reviewed by [signature] 12/20/94
****************************************************************************
                                          *
Data File     : 94075203.DAT              * Sample Quantity: 840.000  GRAM
Acquire Date: 20-DEC-94 14:20:33          * Efficiency File: SMAR2.EFF
Sample  Date: 19-DEC-94 14:50:00          * Library    File: RSDP.LIB
Sample  Type: SOLID                       *
****************************************************************************
                                          *
Preset  Live Time: 3600.0  sec            * FWHM at 1332 KeV          : 2.3  KeV
Elapsed Live Time: 3600.0  sec            * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3601.0  sec            * Gaussian Assymetry        : 10.0 %
****************************************************************************
                                          *
Detector     : DET2                       * Fit Iterations     : 20.
Calib Date : 01-NOV-94 09:53:16           * Energy Tolerance: 1.5  KeV
KeV/Channel: .36661                       * Half Life Ratio  : 8.0
Offset       : -.47933                    * Abundance Limit  : 50.00 %
****************************************************************************
```

[Summary Report -- SNL (7715) -- version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM
U-238	5.95E-01	3.17E-01	--------
TH-234	5.96E-01	3.18E-01	--------
U-234	Not Detected	--------	4.80E+00
RA-226	1.27E+00	5.00E-01	--------
PB-214	5.60E-01	5.65E-02	--------
BI-214	5.21E-01	5.88E-02	--------
PB-210	Not Detected	--------	1.15E+00
TH-232	6.58E-01	1.15E-01	--------
RA-228	6.58E-01	1.15E-01	--------
AC-228	5.94E-01	1.04E-01	--------
TH-228	5.20E-01	4.19E-02	--------
RA-224	3.39E-01	4.50E-01	--------
PB-212	5.23E-01	4.20E-02	--------
BI-212	3.71E-01	1.89E-01	--------
TL-208	4.83E-01	8.20E-02	--------
U-235	Not Detected	--------	2.86E-02
TH-231	Not Detected	--------	1.98E-01
PA-231	Not Detected	--------	6.86E-01
AC-227	Not Detected	--------	7.98E-01
TH-227	Not Detected	--------	1.19E-01
AM-241	Not Detected	--------	7.07E-02
NP-237	Not Detected	--------	1.24E-01
PA-233	Not Detected	--------	3.19E-02
TH-229	Not Detected	--------	6.19E-02

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ER Site 138
Gamma Spectroscopy Screening Results for the Drainfield
Deep Interval Composite Soil Sample

ID: B.GALLOWAY/E.ROSS (7582/IT) 018848-3

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	1.81E+02
AG-110	Not Detected	--------	1.40E-02
BE-7	Not Detected	--------	1.31E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.07E-02
BA-140	Not Detected	--------	5.45E-02
BI-207	Not Detected	--------	1.30E-02
CD-109	Not Detected	--------	5.02E-01
CE-139	Not Detected	--------	1.39E-02
CE-144	Not Detected	--------	9.55E-02
CO-56	Not Detected	--------	1.55E-02
CO-57	Not Detected	--------	1.22E-02
CO-58	Not Detected	--------	1.20E-02
CO-60	Not Detected	--------	2.03E-02
CR-51	Not Detected	--------	1.32E-01
CS-134	Not Detected	--------	1.33E-02
CS-137	Not Detected	--------	1.50E-02
CU-64	Not Detected	--------	2.17E+01
EU-152	Not Detected	--------	3.70E-02
EU-154	Not Detected	--------	6.28E-02
EU-155	Not Detected	--------	6.12E-02
FE-59	Not Detected	--------	3.16E-02
GD-153	Not Detected	--------	3.97E-02
HG-203	Not Detected	--------	1.78E-02
HO-166	Not Detected	--------	1.73E-02
I-125	Not Detected	--------	1.52E+00
I-129	Not Detected	--------	7.98E-01
I-131	Not Detected	--------	1.63E-02
IN-115M	Not Detected	--------	1.32E+00
IR-192	Not Detected	--------	1.60E-02
K-40	1.22E+01	5.99E-01	--------
LA-140	Not Detected	--------	2.38E-02
MN-54	Not Detected	--------	1.48E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	1.45E-02
NA-24	Not Detected	--------	4.22E-02
NB-95	Not Detected	--------	6.55E-02
RU-103	Not Detected	--------	1.43E-02
RU-106	Not Detected	--------	1.13E-01
SB-124	Not Detected	--------	1.41E-02
SB-125	Not Detected	--------	4.40E-02
SB-126	Not Detected	--------	1.57E-02
SC-46	Not Detected	--------	1.29E-02
SN-113	Not Detected	--------	1.94E-02
SR-85	Not Detected	--------	1.43E-02
TA-182	Not Detected	--------	1.30E-01
TE-123M	Not Detected	--------	1.31E-02
TL-201	Not Detected	--------	1.30E-01
XE-133	Not Detected	--------	5.38E-02
Y-88	Not Detected	--------	1.49E-02
ZN-65	Not Detected	--------	3.52E-02
ZR-95	Not Detected	--------	2.45E-02

Appendix A.5

ER Site 138
Gamma Spectroscopy Screening Results for the Septic Tank Composite Soil Sample

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ER Site 138
Gamma Spectroscopy Screening Results for the Septic Tank
Composite Soil Sample

```
*****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881   20-DEC-94 13:07:24 *
*****************************************************************************
B.GALLOWAY/E.ROSS (7582/IT)  018845-3

Operator: [signature] 12/20/94          Reviewed by [signature] 12/20/94
*****************************************************************************
                                        *
Data File    : 94075201.DAT             * Sample Quantity: 909.000  GRAM
Acquire Date: 20-DEC-94 11:02:09        * Efficiency File: SMAR2.EFF
Sample  Date: 19-DEC-94 13:00:00        * Library    File: RSDP.LIB
Sample  Type: SOLID                     *
*****************************************************************************
                                        *
Preset  Live Time: 3600.0  sec          * FWHM at 1332 KeV          : 2.3  KeV
Elapsed Live Time: 3600.0  sec          * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec          * Gaussian Assymetry        : 10.0 %
*****************************************************************************
                                        *
Detector    : DET2                      * Fit Iterations   : 20.
Calib Date  : 01-NOV-94 09:53:16        * Energy Tolerance: 1.5  KeV
KeV/Channel: .36661                     * Half Life Ratio  : 8.0
Offset      : -.47933                   * Abundance Limit  : 50.00 %
*****************************************************************************
```

[Summary Report   -- SNL (7715) --   version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	Not Detected	--------	2.98E-01
TH-234	Not Detected	--------	2.99E-01
U-234	Not Detected	--------	4.55E+00
RA-226	1.47E+00	4.95E-01	--------
PB-214	6.96E-01	6.05E-02	--------
BI-214	6.94E-01	6.07E-02	--------
PB-210	Not Detected	--------	1.08E+00
TH-232	6.11E-01	1.08E-01	--------
RA-228	6.11E-01	1.08E-01	--------
AC-228	5.51E-01	9.72E-02	--------
TH-228	5.63E-01	4.04E-02	--------
RA-224	Not Significant	--------	--------
PB-212	5.65E-01	4.06E-02	--------
BI-212	3.25E-01	1.42E-01	--------
TL-208	5.48E-01	8.11E-02	--------
U-235	Not Detected	--------	2.75E-02
~~TH-231~~	~~3.19E-01~~	~~1.80E-01~~	Not detected [initials] 12/20/
PA-231	Not Detected	--------	6.83E-01
AC-227	Not Detected	--------	8.03E-01
TH-227	Not Detected	--------	1.15E-01
AM-241	Not Detected	--------	7.58E-02
NP-237	Not Detected	--------	1.31E-01
PA-233	Not Detected	--------	3.40E-02
TH-229	Not Detected	--------	6.19E-02

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SNL/SMC

ER Site 138
Gamma Spectroscopy Screening Results for the Septic Tank Composite Soil Sample

ID: B.GALLOWAY/E.ROSS (7582/IT) 018845-3

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	1.84E+02
AG-110	Not Detected	--------	1.31E-02
BE-7	Not Detected	--------	1.21E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.25E-02
BA-140	Not Detected	--------	4.77E-02
BI-207	Not Detected	--------	1.13E-02
CD-109	Not Detected	--------	5.16E-01
CE-139	Not Detected	--------	1.38E-02
CE-144	Not Detected	--------	9.87E-02
CO-56	Not Detected	--------	1.82E-02
CO-57	Not Detected	--------	1.19E-02
CO-58	Not Detected	--------	1.30E-02
CO-60	Not Detected	--------	1.90E-02
CR-51	Not Detected	--------	1.26E-01
CS-134	Not Detected	--------	1.44E-02
CS-137	Not Detected	--------	1.47E-02
CU-64	Not Detected	--------	1.73E+01
EU-152	Not Detected	--------	3.65E-02
EU-154	Not Detected	--------	6.64E-02
EU-155	Not Detected	--------	6.21E-02
FE-59	Not Detected	--------	3.09E-02
GD-153	Not Detected	--------	3.80E-02
HG-203	Not Detected	--------	1.74E-02
HO-166	Not Detected	--------	1.64E-02
I-125	Not Detected	--------	1.53E+00
I-129	Not Detected	--------	7.53E-01
I-131	Not Detected	--------	1.59E-02
IN-115M	Not Detected	--------	1.08E+00
IR-192	Not Detected	--------	1.58E-02
K-40	1.18E+01	5.65E-01	--------
LA-140	Not Detected	--------	2.20E-02
MN-54	Not Detected	--------	1.60E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	1.98E-02
NA-24	Not Detected	--------	4.68E-02
NB-95	Not Detected	--------	6.21E-02
RU-103	Not Detected	--------	1.16E-02
RU-106	Not Detected	--------	1.10E-01
SB-124	Not Detected	--------	1.42E-02
SB-125	Not Detected	--------	4.07E-02
SB-126	Not Detected	--------	1.49E-02
SC-46	Not Detected	--------	1.36E-02
SN-113	Not Detected	--------	2.18E-02
SR-85	Not Detected	--------	1.27E-02
TA-182	Not Detected	--------	1.21E-01
TE-123M	Not Detected	--------	1.34E-02
TL-201	Not Detected	--------	1.41E-01
XE-133	Not Detected	--------	5.33E-02
Y-88	Not Detected	--------	1.41E-02
ZN-65	Not Detected	--------	3.42E-02
ZR-95	Not Detected	--------	2.39E-02

RSI

Sandia National Laboratories
Albuquerque, New Mexico
November 1998

Environmental Restoration Project
Responses to NMED Request for Supplemental Information
No Further Action Proposals (4th Round)
Dated June 1996

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) (Dinwiddie, June 5, 1998) documenting the review of 12 No Further Action (NFA) Proposals submitted June 1996.

This response document is organized in numerical order by operable unit (OU) and subdivided in numerical order by site number. Each OU section provides NMED comments repeated in **bold** by comment number and by site number in the same order as provided in the call for response to comments. The DOE/Sandia National Laboratories (SNL) response is written in normal font style on a separate line under "Response." Responses to general technical comments begin on page 3 and responses to site-specific technical comments begin on page 10. Additional supporting information for the site-specific comments is included as attachments to each section.

1464

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Page

RESPONSES TO COMMENTS
ON NO FURTHER ACTION PROPOSALS
JUNE 1996 (4TH ROUND)

GENERAL COMMENTS

1. **For the purpose of determining suitability for No Further Action (NFA), final versions of site maps must be submitted. As applicable, sample locations, wells, drainages, watercourses, PETREX soil-vapor survey (SVS) locations, and any other important features must be accurately shown on such maps.**

   Response: All submitted maps will be reviewed for completeness with respect to sample locations, wells, drainages, watercourses, PETREX soil-vapor survey (SVS), and any other important features, as applicable. All submitted maps are final, but the word "Draft" had been mistakenly left on the maps for Sites 49, 101, 116, 138, 141, 149, 151, 160, and 161 when they were printed. Replacement maps for these sites are included as attachments under specific comments for Operable Unit (OU) 1295. For all future No Further Action (NFA) proposal submittals, final rather than draft products will be submitted.

2. **For Environmental Restoration (ER) sites with leachfields, drywells or seepage pits; the core of a contaminant plume, which usually contains the highest concentrations of Constituents of Concern (COC's), is most likely located along a vertical axis beneath the center of the disposal structure. It is within this plume core where higher levels of contaminants will most likely reach the greatest depths in the soil/sediment column, possibly extending even to ground water. Therefore, at minimum, a vertical borehole must be installed in the center of the discharge, and sediment must be sampled below the bottom of the disposal structure to an appropriate depth for the appropriate organic and inorganic parameters.**

   The latter sampling strategy contradicts Sandia's sampling protocol (two boreholes outside the discharge structure).

   In order to compare sampling strategies, the US Department of Energy/Sandia National Laboratories (DOE/Sandia) have agreed to reinvestigate five seepage pits (see letter to Mr. Michael J. Zamorski dated January 29, 1998). Depending on the results of this test, additional drilling and sampling may be required at some, none, or all of the septic systems previously sampled.

   Response: Completion of the reinvestigation of five seepage pits as addressed in the New Mexico Environment Department (NMED) letter to Mr. Michael J. Zamorski dated January 29, 1998 (Attachment A) was completed by the U.S. Department of Energy/Sandia National Laboratories/New Mexico (DOE/SNL) in late January 1998. Analytical results of the center boring samples are not significantly different from the analytical results of the side borings collected previously. Results from the center boring samples are included in the specific comments for OU 1295. NMED Oversight Bureau (OB) staff have indicated their concurrence with this conclusion based upon DOE/SNL results and the results of split samples collected by the agency and have verbally told the DOE/SNL that additional seepage pit sampling is not necessary. The DOE/SNL is now following Hazardous and Radioactive Materials Bureau (HRMB) policy on investigation of septic tanks and drainfields. Any necessary deviation from that policy will be discussed with the HRMB.

3. **Shallow water-table conditions may necessitate a monitoring-well network, if the results obtained in satisfying General Comments 1 and 2 indicate that the potential for impacting ground water is high.**

Response: As mentioned in the response to General Comment 2 above, the DOE/SNL plan to meet with the NMED/HRMB now that the reinvestigation at the five seepage pits is completed. Any outstanding groundwater issues at sites with shallow water-table conditions can be discussed with the regulator at this meeting.

4. **It is unclear whether all the septic systems have been closed or sealed in some manner so as to prevent any future releases to the septic systems. Additionally, no sampling was conducted beneath the drainlines. Some of these drainlines span more than 50 or 100 ft in length, and, given the age of the systems, it is prudent to collect samples from beneath them, especially at joints/connections.**

Response: All septic systems have been closed in an approved manner so as to prevent any future releases. Each NFA involving a septic system referenced an NMED inspection report generated by an NMED inspector who determined that the septic systems were closed to his satisfaction. Also, see the responses for specific comments on this topic.

The characterization approach presented in the approved RCRA facility investigation (RFI) Work Plan did not include sampling beneath the drainlines. If significant contaminants of concern (COC) concentrations were not found in the drainfields, around the seepage pits, or near the surface outfalls, it is unlikely that significant COCs would be found beneath the drainlines leading to the release points. Thus, sampling beneath the drainlines does not appear to be necessary.

5. **The following statement made by Sandia regarding PETREX SVS results (e.g., page 3-4) is of concern:**

"In NERI's experience, levels below 100,000 ion counts for a single compound, (such as perchloroethene [PCE] or trichloroethane [TCE]), and 200,000 ion counts for mixtures (such as BTEX or aliphatic compounds [C4-C11 cycloalkanes]), under normal site conditions, would not represent detectable levels by standard quantitative methods for soils and/or groundwater (NERI June 1995)."

Effectively, Sandia is attempting to establish "PETREX Action Levels" ("AL's", as minimum ion counts) for these organic compounds in soil/sediment and in water in apparent disregard of the Northeast Research Institute, Inc. (NERI) warning that "...indicated response values are not directly related to absolute concentrations, but may be used to determine the extent of the plume, its boundaries, and plume direction." Sandia has used these "AL's" at various ER sites, e.g., the Technical Area (TA)-II septic tanks and drainfields and TA-V seepage pits. From the results of the PETREX SVS in these cases, Sandia concluded that:

"...the levels for all compounds were...low and may not necessarily indicate environmentally significant levels in subsurface soil...."

However, at both TA-II and TA-V, TCE contamination in ground water exceeds the Maximum Contaminant Level (MCL). This indicates that Sandia's assumption regarding PETREX SVS ion counts is wrong. NMED review of NERI case histories and Sandia's investigation results using the PETREX SVS method indicates that quantifiable levels of TCE and hydrocarbons may be present in ground water even if there are ion count levels less than Sandia's "AL's" in soil. Sandia must supply the rationale for establishing "AL's" for the PETREX method in light of NERI's warning and in recognition of the detectable levels of TCE contamination that have been documented in ground water at TA-II and TA-V. This rationale must include the models used for quantifying compounds based upon PETREX SVS results, including examples indicating the success, failure, and accuracy of the models.

Response: The DOE/SNL used the PETREX ion counts as a semiquantitative method to identify the nature and lateral extent of volatile organic compounds (VOC) and semivolatile organic compounds (SVOC) in the shallow subsurface (i.e., "hot spots"). If the groundwater is shallow, the technique also can detect VOCs volatilizing from the groundwater. However, the technique is not likely to detect VOCs in groundwater 300 to 500 feet (ft) deep, as at Technical Area (TA) II and TA-V.

The quotes cited above were taken from the Northwest Research Institute (NERI) report of the TA-II investigation and were not quotes by DOE/SNL. As stated in NERI's report (in the quotes contained in the NMED comments), those ion counts below 100,000 (100K) or 200K "would not represent detectable levels by standard quantitative methods for soils and/or groundwater (NERI 1995)" (Attachment B). In other words, the levels of VOCs are so low that they would most likely not be detected in a laboratory using standard U.S. Environmental Protection Agency (EPA) methods. Also, the statement from the NERI report that "the levels for all compounds were . . . low and may not necessarily indicate environmentally significant levels in subsurface soil. . . ." is not a conclusion from DOE/SNL but is based upon NERI's experience.

Low concentrations of VOCs are present in groundwater at TA-II and TA-V. However, because of the depth to groundwater, NERI's experience suggests that it is highly improbable that the VOCs could be detected by the SVS method. The DOE/SNL is using the SVS method to evaluate whether near-surface sources for VOCs exist. We believe that the PETREX results did not clearly identify a release site or VOC source to correlate with the groundwater concentrations.

Because the use and limitations of SVS are of importance to both the NMED and the DOE/SNL, we propose that technical staff convene a joint meeting to develop a common understanding, based upon the NERI studies, of such use and limitations.

6. **Analytical results exceeding calculated upper tolerance limits (UTL's) (or 95th percentiles) are statistically significant evidence of potential contamination and cannot be automatically construed as representative of extreme background values. Data exceeding UTL's (or 95th**

being submitted to the NMED. The DOE/SNL has reviewed all data tables in the 4th NFA Submittal for completeness with respect to the above elements and are submitting revised tables with this Request for Supplemental Information response to the NMED, as applicable.

9. **Quality Assurance/Quality Control (QA/QC) - At the December 3, 1996, Sandia North/Low-Flow Sampling meeting held at the NMED offices in Santa Fe (attended by DOE, Sandia, and NMED), representatives of the Hazardous and Radioactive Materials Bureau (HRMB) expressed concern about Sandia's QC problems in regard to "common laboratory contaminants" found in blanks (such as acetone, 2-hexanone (MBK), 2-butanone (MEK), methyl isobutyl ketone (MIBK), methylene chloride, toluene, and total xylenes). These compounds have been historically used at Sandia's ER sites and, in some cases, disposed of onto the ground and into pits, trenches, lagoons and leachfields. Thus, the presence of common laboratory chemicals in QC blanks cannot be automatically discounted as laboratory contamination. Additionally, at this meeting, HRMB staff members suggested that DOE/Sandia review its contract laboratories' QA/QC programs, and, if found deficient, remedy the problem or find another laboratory.**

Analytical results for field, trip, and equipment blanks, and duplicates must be included on data tables. Data tables must also include a comparison of offsite and onsite laboratory results (e.g., at minimum, relative percent differences (RPD's)) as part of the QA/QC information.

Response: The DOE/SNL follow the blank qualification guidelines (i.e., the "Blank Rule") set forth in "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, February 1994)" when validating data for common laboratory contaminants such as acetone, methylene chloride, and 2-butanone. Common laboratory contaminants are generally VOCs that are required by EPA methods for the extraction and concentration of organic compounds. Because they are volatile and are generally used in concentrated solutions, they can be found in small concentrations throughout any analytical laboratory. To minimize potential contamination of samples, analytical laboratories isolate all VOC samples and the associated instrument laboratories, restrict access to these areas, and pressurize the analysis areas with filtered air. The EPA has historically recognized that even with such precautions, analytical laboratories cannot completely eliminate possible contamination from such sources as entering and leaving these areas or absorption on clothing. Therefore, the EPA has allowed, within the functional guidelines, a slightly relaxed criterion for very low-level contamination from these compounds.

As discussed in the OU 1295 NFA proposals, VOCs found in soil trip blanks submitted with VOC sample shipments are further evidence that most VOCs detected in the samples result from laboratory contamination.

The DOE/SNL use the following procedure to evaluate data for laboratory contamination:

- Sample results are qualified as undetected (U) if the sample concentration is less than ten times the concentration of the common laboratory contaminants in any blank or five times the concentration of any other contaminant in any blank.

- If other problems are encountered that result in any suspect blank data, the DOE/SNL notify the laboratory and further evaluation is conducted.

The comment suggesting that the DOE/SNL review its contract laboratories' quality assurance/quality control (QA/QC) programs is noted by the DOE/SNL. SNL's Sample Management Office has an ongoing audit program to evaluate the adequacy of QA/QC problems at the off-site contract laboratories; this program is supplemented by a similar program overseen by the DOE's Albuquerque Operations Office. When specific QA/QC concerns arise, the affected laboratory is contacted and corrective actions are defined and implemented.

The DOE/SNL would be pleased to arrange a dialogue with the NMED/HRMB and the DOE laboratory auditors to discuss this subject further.

10. **Explosives sampling - Method 8515 is an immunoassay screening tool for nitrotoluene compounds. Sensitivity of this method may be unacceptable (MDL's from 100-100,000 ppb) and reproducibility of results is erratic. To achieve more reliable and defensible results, Sandia must use Method 8330, which detects not only the Method 8515 compounds, but also detects nitroguanidine, ammonium nitrate, Composition C4, PBX-9404, PBX-9405, pentaerythritol tetranitrate (PETN), HMX and RDX; these explosive compounds were commonly used by Sandia.**

Response: Method 8515 was initially used by the DOE/SNL for qualitative analysis as a cost-saving measure with the intent to follow up with quantitative analysis if a "hit" occurred. The DOE/SNL believe that Method 8515 with a 1-ppm detection limit has been successfully used as a technique for identifying trinitrotoluene (TNT) given the risk-based action level for an industrial land-use scenario (79.7 ppm) or residential land-use scenario (20 ppm) for trinitrotoluene. Although the DOE/SNL recognize that the method is limited to detection of TNT, this screening approach was used because the DOE/SNL did not expect to find explosives at these sites.

The DOE/SNL agree that Method 8330 is the desired method for quantitative analytical results for 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane (HMX), 1,3,5-trinitro-1,3,5-triazacyclohexane (RDX), and pentaerythritol tetranonitrate (PETN), which were the most commonly used explosives at SNL after the mid-1960s. RDX and HMX, are both Method 8330 analytes; C-4 is 90 percent RDX, PBX-9404 is approximately 94 percent HMX and PBX-9405 is approximately 92 percent RDX each. However, none of the three compounds is specifically quantified by the method. Ammonium nitrate, nitroguanidine, and PETN are not specific analytes although their presence may be indicated by other compounds. The DOE/SNL will be using Method 8330 in future characterization activities.

11. **Positive results from the PETREX SVS indicate plumes of polychlorinated biphenyl (PCB), BTEX (benzene, toluene, ethylbenzene, and xylene - common fuel constituents), and aliphatics, or a combined plume potentially underlie some discharge areas. Soil/sediment sampling may have been insufficient to determine whether observed soil-vapor concentrations are the result of contaminated sediments, subsurface soil-vapor migration, or movement of contaminated ground water. Additional boreholes may be needed with active or passive soil-vapor monitoring systems installed at the surface and at the bottom. Also, boreholes must be of sufficient depth so as to determine the vertical profile of each soil-gas plume.**

Response: Because soil vapor in the vadose zone may be an indication of a VOC release, the DOE/SNL used the soil vapor results to help locate source areas or release points in the near and shallow subsurface soil during site characterization. The PETREX SVS will not identify solvents (or polychlorinated biphenyls [PCB]) in groundwater that is deep (greater than 100 feet below the ground surface [bgs]) (Attachment B). Because the VOC concentrations in groundwater at TA-II are barely above maximum contaminant levels, the scenario described by the NMED above is highly unlikely.

The DOE/SNL believe that it is not technically or financially feasible to attempt to characterize a "soil vapor" plume as the NMED suggests. The goal of the SVS was to use this screening technique to locate possible additional VOC sources in the shallow vadose zone sites.

Again, as stated in the response to General Comment 5 above, the DOE/SNL proposes that a meeting be arranged with the NMED to develop a common understanding, based upon the NERI studies, of the uses and limitations of SVSs.

ATTACHMENT A

NMED LETTER TO MICHAEL J. ZAMORSKI
JANUARY 29, 1998

GARY E. JOHNSON
GOVERNOR

Hazardous & Radioactive Materials Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-1557
Fax (505) 827-1544

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

January 29, 1998

Mr. Michael J. Zamorski
Acting Area Manager
Kirtland Area Office
US Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

RE: Sampling Protocol for Septic Systems

Dear Mr. Zamorski:

This letter responds to a meeting held in June 1997 in Santa Fe that was attended by the US Department of Energy, Sandia National Laboratories (SNL), and New Mexico Environment Department (NMED) personnel to discuss appropriate sampling protocol with respect to leachfields, drywells, and seepage pits. Following that meeting, NMED Hazardous and Radioactive Materials Bureau (HRMB) staff have determined that a test should be conducted to compare the different septic system sampling protocols presented by SNL and HRMB. This test consists of reinvestigating five Environmental Restoration (ER) sites at SNL. This matter is addressed more fully below, following a brief discussion of HRMB's septic system sampling protocol.

HRMB Septic System Sampling Protocol

HRMB believes that the core of the plume below drainfields (leachfields), drywells, and seepage pits will usually contain the highest concentrations of contaminants. The core of the plume is most likely located along a vertical axis beneath the center of the disposal structure. It is within the plume core that contaminants will most likely reach the greatest depths into the soil/sediment column, potentially extending even to ground water. Therefore, at minimum, a vertical borehole should be installed in the center of the discharge structure. Soil/sediment below the bottom of the discharge structure should be sampled for the pertinent organic and inorganic parameters to an appropriate depth. The sampling frequency in each borehole should not exceed five ft. and a minimum of two clean samples is necessary to delineate the vertical extent of any contamination that may be present.

FEB 13 1998

At any septic system site where shallow bedrock is encountered, samples should be collected at the bottom of the discharge structure and immediately above the bedrock surface. Depending on the analytical results of such samples, it may be necessary to drill additional borings along the alluvium/bedrock contact and/or into bedrock.

In general, this is the protocol HRMB will require for all future assessments of septic system components.

Septic System Reinvestigation
In contrast to the above, SNL's sampling protocol consists of drilling two boreholes *outside* the drainage structure.

To resolve this issue, five areas are to be reinvestigated. Depending on the results of this study. SNL may have to reinvestigate all, some, or none of the septic systems that have been previously sampled. The test procedure is described in more detail in Enclosure A.

Please contact William Moats of my staff at 841-9471 if you have any questions or comments.

Sincerely,

Robert S. (Stu) Dinwiddie, Ph. D., Manager
RCRA Permits Management Program

Enclosure

xc: Roger Kennett, NMED/DOE OB
Bill McDonald, NMED/DOE OB
Mark Jackson, DOE/KAO
Warren Cox, SNL
David Neleigh, EPA
file: hswa, snl ou1295, 98
track: snl, 1/29/98, doe/kao. hrmb/sk. re, file

ENCLOSURE A

TEST FOR ADEQUACY OF LEACHFIELD, DRYWELL AND SEEPAGE PIT SAMPLING PROTOCOL UTILIZED BY SANDIA NATIONAL LABORATORIES

Five Environmental Restoration (ER) septic system sites will be tested. Testing will consist of drilling a borehole through the center of each drainage structure. At the request of the US Department of Energy/Sandia National Laboratories/New Mexico (Sandia), the sampling frequency used for previous sampling will be maintained for this test; however, at least one sample must be collected immediately below the drainage structure. Selection of sites was based on potential impact to human health and the environment, and on suitability for meaningful comparison of protocols. Table 1 identifies the sites and summarizes the rationale for selection. Table 2 lists the various constituents to be analyzed for at each site.

ER Site	Name	Selection Criteria Rationale
101	Building 9926 Explosives Research Lab	Photochemicals, metals, solvents, HE, potentially high discharge
141	Building 9967 (High Explosives Assembly Building) Septic System	HE injected into the subsurface ~ 50-150 ft above the water table
151	Building 9940 NRC Testing Facility	Photochemicals, solvents, HE, metals, DU, potentially high discharge
154	Building 9960 (Explosives Preparation Facility) Septic System	HE and solvents injected into the subsurface ~ 50-150 ft above the water table
160	Building 9832 (Vehicle Assembly Building) Septic System	HE and DU injected into the subsurface ~ 50-150 ft above the water table

Table 1. Selected ER Sites for Septic System Test

The septic system sites selected are discussed in the Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plan for Operable Unit (OU) 1295, *Septic Tanks and Drainfields* (March 1993) and in the OU 1295 Decision Report (May 1996). Four of the ER sites (101, 141, 151, and 160) are included in the fourth round of No Further Action proposals (June 1996). According to the Decision Report, ER Site 154 requires additional characterization.

Laboratory analytical results will be compared to those obtained by the previous Sandia investigation protocol, i.e., two boreholes drilled *outside* of the seepage pit or drainage structure. Sandia may be required to redrill and resample some, all, or none of the septic systems that were previously sampled. The need to redrill and resample depends on whether results from the test indicate higher concentrations of contaminants beneath the centers of the drainage structures, or no appreciable difference, as determined by the Hazardous and Radioactive Materials Bureau.

ER Site	SVOCs	VOCs	HE (8330)	Metals	Soil pH	Soil nitrate	Cr^{+6}	Isotopic U	Cyanide	Tritium
101	N	Y	Y	Y	N	NA	NA	N	Y	N
141	N	Y	Y	Y	NA	NA	NA	N	NA	N
151	N	Y	Y	Y	N	N	Y	Y	N	N
154	Y	Y	Y	Y	NA	NA	Y	N	NA	N
160	N	Y	Y	Y	N	NA	NA	N	NA	NA

Notes:
Y - Analysis of the constituent will be done for the septic system test.
N - Analysis of the constituent will not be done for the septic system test.
NA - Not applicable. (Analysis of the constituent was not done in the original investigation).

Table 2. Selected Analytes for Septic System Test

ATTACHMENT B

NORTHWEST RESEARCH INSTITUTE LLC (NERI) PETREX SOIL GAS SURVEY RESULTS FOR SEPTIC TANKS AND DRAINFIELDS JUNE 1995

NERI
Northeast Research Institute LLC

Lakewood, Colorado 80215-5518
303-238-0090 • 800-845-5137
Fax 303-238-2522

PETREX SOIL GAS SURVEY RESULTS CONDUCTED AT VARIOUS SITES OF THE SEPTIC TANKS AND DRAINFIELDS OPERATING UNITS SANDIA NATIONAL LABORATORIES ALBUQUERQUE, NEW MEXICO

PREPARED BY: DATE:

Julia Olney Gullett, Project Manager 6/1/95

APPROVED BY: DATE:

Paul A. Harrington, Operations Manager 6/1/95

NORTHEAST RESEARCH INSTITUTE
605 PARFET STREET, SUITE 100
LAKEWOOD, COLORADO 80215
(303) 238-0090

0494-2096E

The analytical and interpretative results of the duplicate collectors are provided in Table 32, Appendix B.

8.0 DISCUSSION

The soil gas response levels discussed in the following section are described as high, intermediate or low relative to the entire data set. The ion count values that have been reported represent qualitative soil gas values that were evaluated relative to the other sampler locations.

The response values are reported in ion counts. Ion count values are the unit of measure assigned by the mass spectrometer to the relative intensities associated with each of the reported compounds. These intensity levels or response levels do not represent an actual concentration of the reported compounds; however, they are best utilized as a qualitative measurement. A difference in ion count values of an order of magnitude or more is considered significant when interpreting potential source areas and migration/dispersion pathways versus background areas.

The following sites, which had significant soil gas detections, are discussed in the orders that they were sampled. The sites that showed no significant soil gas detections are listed in Section 8.18.

In a majority of the soil gas samples used in this investigation, only low levels of the compounds identified were detected. In NERI's experience, levels below 100,000 ion counts for a single compound, and levels below 200,000 ion counts for mixtures, under normal site conditions, would not represent detectable levels by standard quantitative methods for soils and/or groundwater. Normal site conditions are considered to be sites in which the depth to groundwater is less than 100 feet below the surface, groundwater flow rates are undisturbed, and normal precipitation occurs during sampler exposure. Due to the unusual site conditions at SNL, and the influx of monsoon moisture during sampler exposure, values less than 100,000 ion counts for the chlorinated compounds, and values less than 200,000 ion counts for the hydrocarbon mixtures, were considered potentially significant for this investigation.

For a complete discussion of relative response map evaluation, please refer to the PETREX Protocol, Appendix A.

8.1 SITE 145

In most samples, the levels of VOCs detected at Site 145 are not normally associated with potential source areas, or potentially environmentally significant contaminant concentrations in the subsurface. The soil gas response for TCE at location 64 may represent detectable levels by standard EPA methods in the subsurface; however, in NERI's experience single point anomalies generally represent isolated surface spills and do not reflect chemical occurrences which may impact groundwater. The soil gas results for Site 145 are provided on Table 2, Appendix B. The sample locations for Site 145 were mapped and are shown on Plates 1 and 2, Appendix F.

Also, bedrock is exposed in the roadcut on the west side of the site. Therefore, additional sampling at 15 to 25 ft bgs can only be accomplished with equipment capable of drilling into hard rock. The DOE/SNL are willing to discuss additional sampling with the NMED but see no technical justification in attempting to sample in relatively impermeable bedrock.

4.0 Conclusions

29. **With the shallow depth to ground water, high volumes of contaminants discharged into the septic tank and the hydraulic loading which occurred at this site, there is an increased potential for ground-water contamination. Ground-water monitoring wells must be installed to determine whether any contamination has occurred. Samples must be analyzed for all constituents of concern.**

Response: Depth to groundwater was estimated to be 52 ft bgs in the Septic Tank and Drainfields RFI Work Plan (March 1993). Because the nearest monitoring well is located about 6,000 ft northwest of the site, the depth to groundwater beneath the site is unknown. As stated in the ER Site 116 NFA report, depth to groundwater at the site was estimated to be between 107 and 157 ft bgs, based upon a potentiometric surface map presented in the "Site Wide Hydrogeologic Characterization Project, Calendar Year 1995 Annual Report," published in March 1996. Also, there is no basis for saying that "high" volumes of contaminants were discharged to the Building 9990 septic system. Estimated volumes of effluent discharged to the septic system range from 60 to 600 gallons per day. However, this is only an estimate because actual discharge records do not exist for the site. Also, water was probably used sparingly at the facility because there is no water supply line to this remote site; water was hauled in and stored in an underground holding tank near the southwestern corner of Building 9990. Also, detectable or significant COC concentrations that could pose a threat to human health or the environment were not detected in confirmatory soil samples collected at this site. Therefore, the DOE/SNL do not believe that groundwater monitoring is justified or required at ER Site 116.

ER Site 138, Building 6630 Septic System

ER Site 138 comprises the septic tank, distribution box, and leachfield that serviced Building 6630, the Melting/Solidification Facility. Building 6630 was constructed in 1959 for melting and casting metal alloys of iron (steel), chromium, DU, nickel, copper and other metals (only corrosion tests are described). The facility is still in operation, although the septic system is no longer in use.

2.3 Historical Operation

30. **Figures 1-1 and 1-2 - see General Comment 1.**

Response: See response to General Comment 1.

3.4 The Results of Previous Sampling/Surveys

31. **The results of the PETREX SVS indicate plumes of TCE, BTEX, and aliphatics, or a combined plume may be migrating south and/or west from the leachfield. Sandia must complete boreholes at or near PETREX SVS locations 554 and 299, and install active or**

passive soil-vapor monitoring systems at the surface and at the bottom of the boreholes. Also, see General Comments 5 and 11.

Response: A confirmatory soil sample was collected on the south side of the septic tank, within about 8 ft of PETREX location 299, and no significant COC concentrations were detected in this sample. Also, the ion count values detected in the PETREX sampler at location 554 are less than the threshold levels that, in NERI's experience, would result in detectable COC concentrations in soil samples. As stated earlier, VOC concentrations in soil vapor are not regulated. VOC concentrations in conventionally analyzed soil samples are regulated to the extent that these data are used in risk assessment evaluations. Significant COC concentrations that could pose a threat to human health or the environment were not detected in any of the VOC or other samples collected from 14 separate sampling intervals at this site. The DOE/SNL, therefore, do not believe that additional soil vapor sampling is required at these locations.

3.6 Confirmatory Sampling

32. **Data collection - see General Comments 2, 6, 8, and 9.**

Response: See response to General Comments 2, 6, 8, and 9.

33. ***Table 3-3 indicates that the concentrations of nickel are increasing with depth in the majority of the leachfield boreholes, and the levels of nickel detected at the 16.5-ft depth in all but one of the boreholes are above the 95th UTL. Additional samples must be collected at depths greater than 16.5 ft to characterize the vertical extent of potential nickel contamination under the leachfield.***

Response: The majority of nickel concentrations detected in soil samples from the site are above the maximum background concentration of 11.5 milligrams per kilogram (mg/kg) for surface and subsurface samples collected in the Southwest and Coyote Test Field Supergroup areas. The maximum nickel concentration detected at the site was 108 mg/kg. However, the very conservative ecological risk preliminary remediation decision threshold calculated for nickel is an order of magnitude higher than the highest nickel concentration detected at this site. The DOE/SNL, therefore, believe that samples collected at the site are sufficient to demonstrate that nickel concentrations at the site do not pose a threat to human health or the environment and that additional sampling for nickel is unnecessary.

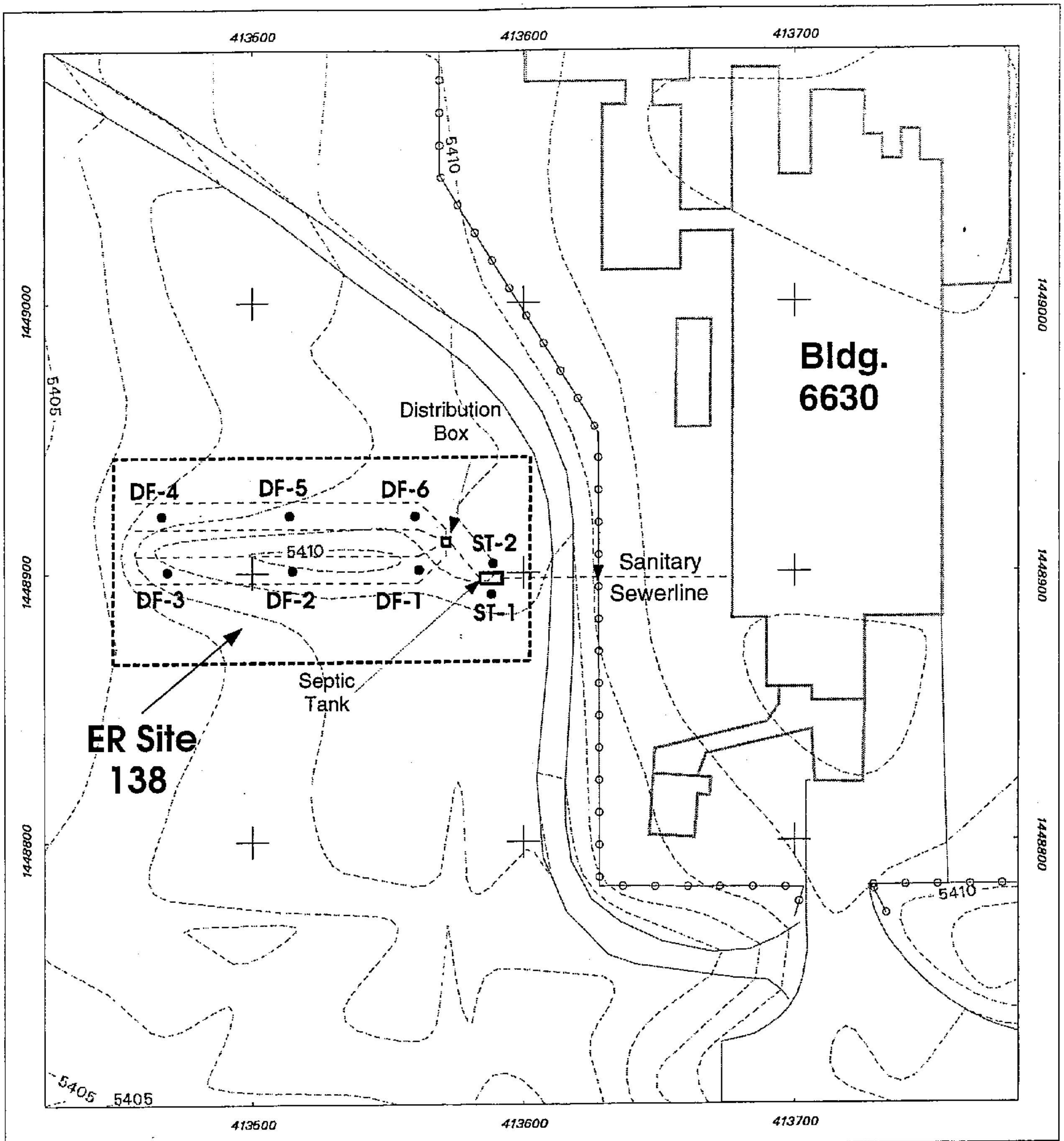
However, in order to bring the NFA approval process to a conclusion for ER Site 138, SNL will complete limited deeper additional sampling for nickel at two drainfield locations selected by the NMED. In each borehole, samples will be collected from depths of 10 and 20 ft below the top of the previous deepest sampling interval (16.5 ft). Samples would, therefore, be collected at 26.5 and 36.5 ft bgs.

ER Site 141, Building 9967 Septic System

ER Site 141 comprises an HE catch box, a seepage pit and a drywell that served Building 9967, the High Explosives Assembly Building. The facility was constructed in 1968 for the purpose of assembling HE configurations for explosives tests. The septic system is no longer

ATTACHMENT A

FINAL SITE MAPS FOR SWMUs 49, 101, 116, 138, 141, 149, 151, 160, AND 161



Legend

- Boring Location
- Fences
- KAFB Roads
- Surface Drainage
- 1-Foot Contour
- Septic Tank, Distribution Box
- Sanitary Sewerline, Drainline
- Buildings
- ER Site 138

Sandia National Laboratories, New Mexico
Environmental Restoration Geographic Information System

Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone
1927 North American Horizontal Datum, 1929 North American Vertical Datum

Scale in Feet: 0 30 60

Scale in Meters: 0 7.2 14.4

FIGURE 2
Site Map for ER Site 138
Sandia National Laboratories,
New Mexico

scmorri SNL GIS ORG. 6804 10/22/98 MAPID=990004

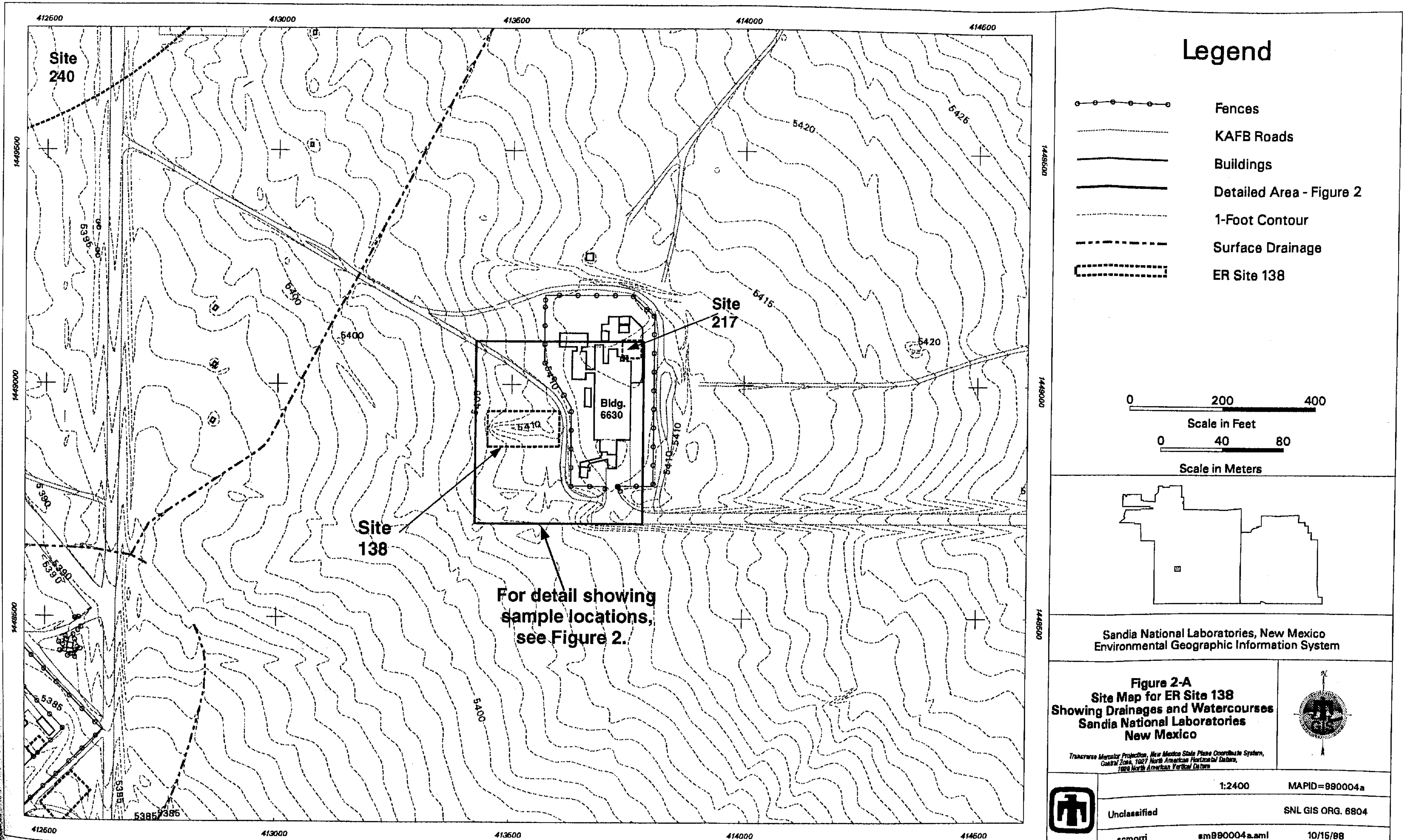


Figure 2-A
Site Map for ER Site 138
Showing Drainages and Watercourses
Sandia National Laboratories
New Mexico

RSI

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

JUN 2 9 2005

cc Dick Fate
Carolyn Daniel
ESHSEC

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 Request for Supplemental Information Responses and Proposals for Corrective Action Complete (CAC), Drain and Septic Systems (DSS) Solid Waste Management Unit (SWMU) 49, 101, 116, 138, 149,154, and 161 at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. These documents are compiled as DSS Round 9 and CAC (formerly No further Action [NFA]) Batch 27.

This submittal includes descriptions of the site characterization work and risk assessments for DSS SWMUs 49, 101, 116, 138, 149,154, and 161.
The risk assessments conclude that for six of the seven sites (SWMUs 49, 101, 116, 138, 149 and 161): (1) there is no significant risk to human health under both the industrial and residential land-use scenarios; and (2) that there are no ecological risks associated with these sites. For the remaining site (SWMU 154), the risk assessment concludes that: (1) there is no significant risk to human health under the industrial land-use scenario; and (2) that there is no ecological risk associated with the site.

Based on the information provided, DOE and Sandia are requesting a determination of Corrective Action Complete without controls for SWMUs 49, 101, 116, 138, 149 and 161, and a determination of Corrective Action Complete with controls is requested for SWMU 154.

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

Sincerely,

Patty Wagner

Patty Wagner
Manager

Enclosure

cc w/ enclosure:
L. King, EPA, Region 6 (Via Certified Mail)
W. Moats, NMED-HWB (Via Certified Mail)
M. Gardipe, NNSA/SC/ERD
D. Pepe , NMED-OB (Santa Fe)
J. Volkerding, DOE-NMED-OB

cc w/o enclosure:
J. Estrada, NNSA/SSO, MS 0184
F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
B. Langkopf, SNL, MS 1087
M. Sanders, SNL, MS 1087
R. Methvin, SNL MS 1087
J. Pavletich, SNL MS 1087
A. Villareal, SNL, MS 1035
A. Blumberg, SNL, MS 0141
M. J. Davis, SNL, MS 1089
ESHSEC Records Center, MS 1087

DSS SWMU 138

Sandia National Laboratories/New Mexico
Environmental Restoration Project

REQUEST FOR SUPPLEMENTAL INFORMATION RESPONSE AND PROPOSAL FOR CORRECTIVE ACTION COMPLETE FOR DRAIN AND SEPTIC SYSTEMS SWMU 138, BUILDING 6630 SEPTIC SYSTEM AT TECHNICAL AREA III

June 2005

United States Department of Energy
Sandia Site Office

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LIST OF FIGURES

Figure

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LIST OF TABLES

Table

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LIST OF ANNEXES

Annex

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ACRONYMS AND ABBREVIATIONS

AOC	Area(s) of Concern
AOP	Administrative Operating Procedure
bgs	below ground surface
CAC	Corrective Action Complete
COC	constituent of concern
COPEC	constituent of potential ecological concern
DCF	dose conversion factor
DOE	U.S. Department of Energy
DQO	data quality objective
DSS	Drain and Septic Systems
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HRMB	Hazardous and Radioactive Materials Bureau
HWB	Hazardous Waste Bureau
IRIS	Integrated Risk Information System
KAFB	Kirtland Air Force Base
MDA	minimum detectable activity
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
QES	Quanterra Environmental Services
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RME	reasonable maximum exposure
RPSD	Radiation Protection Sample Diagnostics
RSI	Request for Supplemental Information
SAP	Sampling and Analysis Plan
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TEDE	total effective dose equivalent
TMA	Thermo Analytical Inc./Eberline Laboratories
TOP	Technical Operating Procedure
VOC	volatile organic compound
yr	year

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1.0 INTRODUCTION

1.1 Investigation History

Solid Waste Management Unit (SWMU) 138 was originally one of 23 SWMUs designated as Operable Unit (OU) 1295 at Sandia National Laboratories/New Mexico (SNL/NM). This number was reduced to 22 when a petition for Administrative No Further Action (NFA) was approved by the New Mexico Environment Department (NMED) for SWMU 139 in 1995.

In June 1996, an NFA proposal was submitted to the NMED for SWMU 138 (SNL/NM June 1996). In June 1998, the NMED/Hazardous and Radioactive Materials Bureau (HRMB) responded with a Request for Supplemental Information (RSI) for the NFA proposal that required finalized location and site maps, updated data tables, the investigation of a potential soil-vapor plume indicated by PETREX™ passive soil-vapor survey data, providing a rationale for establishing PETREX™ soil-vapor survey action levels, and additional soil sampling for nickel at depths greater than 16.5 feet below ground surface (bgs) in the drainfield area (NMED June 1998).

SNL/NM responded to the RSI in November 1998, submitted revised maps and amended data tables, and committed to completing a revised risk assessment in accordance with current risk assessment procedures, after all required sampling had been completed at the site. SNL/NM stated that the PETREX™ soil-vapor data were used only for site screening purposes and that the data did not indicate evidence of a soil-vapor plume as the NMED suggested. SNL/NM then proposed a meeting to develop a common understanding of the uses and limitations of soil-vapor surveys. SNL/NM also committed to collecting additional, deeper soil samples for nickel analysis at two drainfield locations selected by the NMED, even though SNL/NM believed that the soil sampling already performed was sufficient to demonstrate that the elevated nickel concentrations did not pose a threat to human health or the environment (SNL/NM November 1998).

At that time, negotiations were being conducted to define a technical and decision-making approach to complete environmental assessment and characterization work at the 22 OU 1295 SWMUs, and at 61 other Drain and Septic Systems (DSS) Area of Concern (AOC) sites at SNL/NM. At the completion of the negotiations a Sampling and Analysis Plan (SAP) (SNL/NM October 1999) was written that documented investigations planned for completion at all OU 1295 SWMUs and AOC sites. The plan was approved by the NMED in January 2000 (Bearzi January 2000). In June 2000, the NMED responded to the RSI response (SNL/NM November 1998) and stated that the SWMU 138 RSI responses would be reviewed after the additional work at the DSS sites in general was completed pursuant to the SAP (NMED June 2000). Technical details on soil sampling procedures, soil sample locations, laboratory analytical methods, and passive soil-vapor sampling requirements at these sites were specified in a follow-up Field Implementation Plan (SNL/NM November 2001), which was also approved by the NMED (Moats February 2002).

Because of the physical similarity of the SWMUs with the AOC sites, and because the same characterization procedures were used for both, the 22 SWMU investigations were combined with the AOC site investigations outlined in the SAP (SNL/NM October 1999). Shallow subsurface soil and soil-vapor sampling investigations were completed at the SWMUs and AOC sites by November 2002. As discussed in the SAP, the data were evaluated and the candidate SWMU and AOC sites were ranked in order to select sites for deep soil-vapor well installation and sampling. SWMU 138 was not one of the sites selected for deep soil-vapor well sampling or any other additional work.

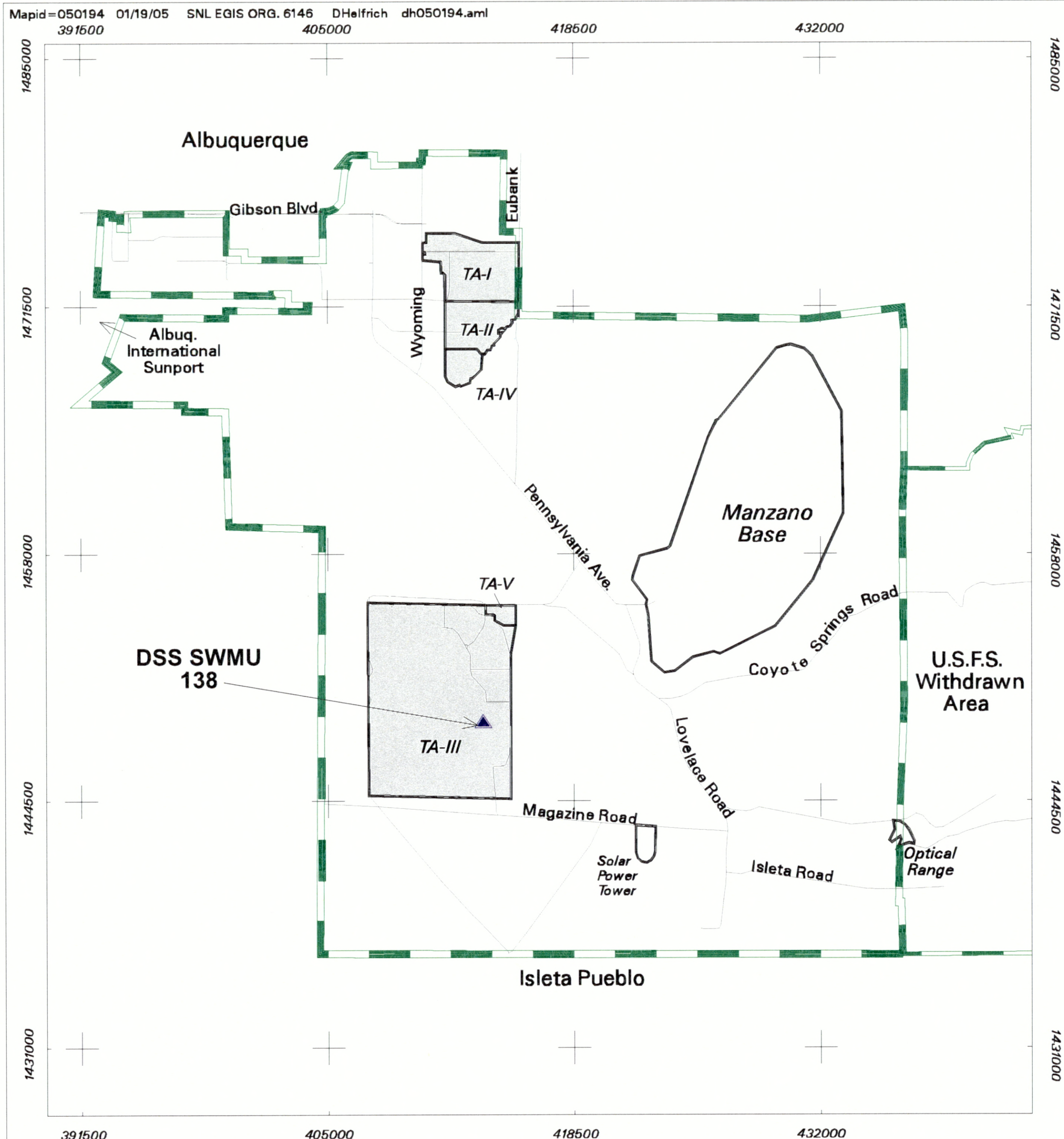
In January 2005, SNL/NM contacted the NMED/Hazardous Waste Bureau (HWB) regarding the need for collection of the additional deeper soil samples for nickel analysis at SWMU 138. The NMED/HWB responded that no additional sampling would be required (Cooper February 2005). Consequently, no additional soil sampling was performed at SWMU 138 after December 1994.

1.2 Remaining Requirements for DSS SWMU 138

The following remaining requirement to fulfill the June 1998 RSI for SWMU 138 is addressed in this RSI response:

- Submit a revised risk assessment using all available soil data.

An updated general location map (Figure 1.2-1), and an updated site location map showing the soil sampling locations at this site (Figure 1.2-2) are also provided in this response. Because the site description and operational history were presented in the initial NFA proposal (SNL/NM June 1996), the information is only briefly summarized in the risk assessment report in Chapter 2.0.



Legend

- DSS SWMU 138
- Major Road
- KAFB Boundary
- USFS Withdrawn Area Boundary
- SNL Technical Area

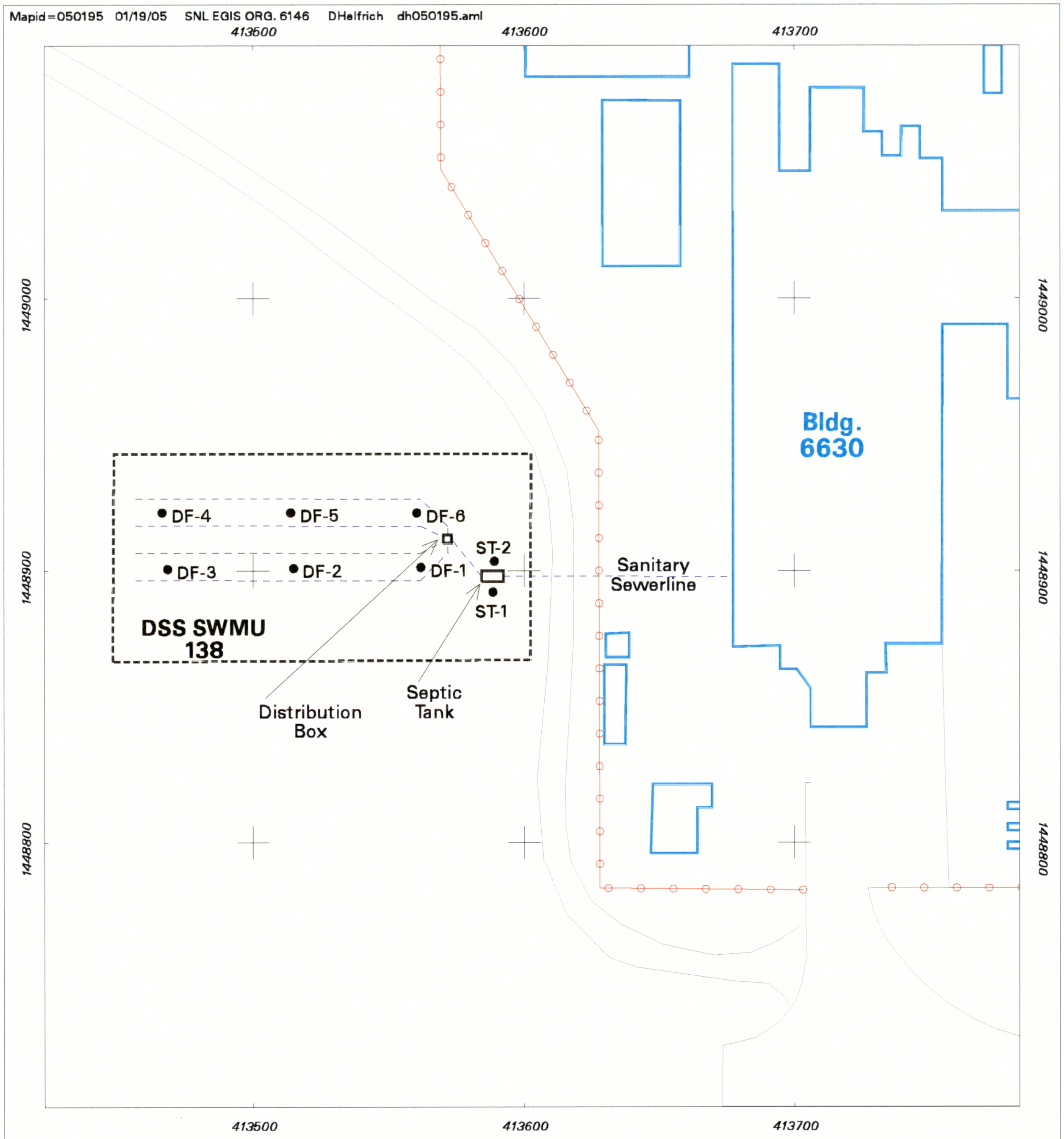
Figure 1.2-1
Location Map of Drain and Septic Systems (DSS) SWMU 138, Bldg. 6630 Septic System, TA-III

0 4500 9000
Scale in Feet

0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A350



Legend

- Soil Boring Location
- Septic Tank, Distribution Box
- Sanitary Sewer line, Drain line
- Fence
- Road
- Building / Structure
- DSS SWMU 138

Figure 1.2-2
Site Map of Drain and Septic Systems (DSS) SWMU 138, Bldg. 6630 Septic System, TA-III

0 30 60
Scale in Feet

0 7.2 14.4
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A351

2.0 RISK ASSESSMENT REPORT FOR DSS SWMU 138

2.1 Site Description and History

DSS SWMU 138, the Building 6630 Septic System at SNL/NM, is located in Technical Area-III on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (DOE). SWMU 138 consists of a 600-gallon septic tank that discharged to four, approximately 110-foot-long drain lines (Figure 1.2-2). Available information indicates that Building 6630 was constructed in 1959 (SNL/NM March 2003), and it is assumed that the septic system was constructed about the same time. In 1991, septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003). The empty and decontaminated septic tank was inspected by the NMED on November 7, 1995, and a closure form was signed (SNL/NM November 1995). The septic tank was then backfilled with clean, native soil from the area in late 1995.

Environmental concern for SWMU 138 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the septic system at this site. Because operational records were not available, the investigation was planned to be consistent with other DSS site investigations and to sample for possible COCs that may have been released during facility operations.

The ground surface in the vicinity of the site is flat or slopes slightly to the west. The closest drainage lies approximately 200 feet south of the site and terminates in the playa just west of KAFB. No springs or perennial surface-water bodies are located within 2.8 miles of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Surface-water runoff in the vicinity of the site is minor because the surface is nearly flat. Infiltration of precipitation is almost nonexistent as virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall (SNL/NM March 1996). Most of the area immediately surrounding SWMU 138 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

SWMU 138 lies at an average elevation of approximately 5,409 feet above mean sea level. The groundwater beneath the site occurs in unconfined conditions in essentially unconsolidated silts, sands, and gravels. The depth to groundwater is approximately 475 feet bgs. Groundwater flow is thought to be to the west-northwest in this area (SNL/NM April 2004). The nearest groundwater monitoring wells are approximately 3,300 feet northwest of the site at the Mixed Waste Landfill. The nearest production wells are northwest and northeast of the site and include KAFB-4 and KAFB-11, which are approximately 3.8 and 4.2 miles away, respectively.

2.2 Data Quality Objectives

Soil sampling was conducted in 1994 in accordance with the rationale and procedures described in the approved "Septic Tanks and Drainfields ADS [Activity Data Sheet]-1295 RCRA [Resource Conservation and Recovery Act] Facility Investigation [RFI] Work Plan" (SNL/NM

March 1993), the SAP for the RFI of the septic tanks and drainfields (IT March 1994), and subsequent site-specific addenda to the Work Plan and SAP based upon discussions with the NMED/HRMB.

The sampling conducted at this site was designed to:

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

Table 2.2-1 summarizes the rationale for determining the sampling locations at this site. The source of potential COCs at DSS SWMU 138 was effluent discharged to the environment from the septic tank and drainfield at this site.

Table 2.2-1
Summary of Sampling Performed to Meet Data Quality Objectives

DSS SWMU 138 Sampling Areas	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil beneath the septic system septic tank	Effluent discharged to the environment from the septic tank	2	NA	Evaluate potential COC releases to the environment from effluent discharged from the septic tank
Soil beneath the septic system drainfield	Effluent discharged to the environment from the drainfield	6	NA	Evaluate potential COC releases to the environment from effluent discharged from the drainfield

COC = Constituent of concern.
DSS = Drain and Septic Systems.
NA = Not applicable.
SWMU = Solid Waste Management Unit.

In December 1994, soil samples were collected using a Geoprobe™ from two 3- or 4-foot-long sampling intervals at eight borehole locations at DSS SWMU 138. Sampling intervals started at 6.5 and 16.5 feet bgs in each of the six drainfield boreholes, and at 10 feet bgs in the two boreholes adjacent to the septic tank. Soil samples were collected using procedures described in the RFI Work Plan (SNL/NM March 1993) and the SAP for the RFI of the septic tanks and drainfields (IT March 1994). Table 2.2-2 summarizes the types of confirmatory and quality assurance (QA)/quality control (QC) samples collected at the site and the laboratories that performed the analyses.

The soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), RCRA metals plus nickel, total cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The samples

Table 2.2-2
Number of Confirmatory Soil and Quality Assurance/Quality Control Samples Collected from DSS SWMU 138

Sample Type	VOCs	SVOCs	PCBs	RCRA Metals plus Nickel	Cyanide	Isotopic Uranium	Tritium	Gamma Spectroscopy Radionuclides
Confirmatory	14	14	14	14	14	3	3	3
Duplicates	1	1	1	1	1	0	0	0
EBs and TBs[a]	2	1	1	1	1	1	0	0
Total Samples	17	16	16	16	16	4	3	3
Analytical Laboratory	QES	QES	QES	QES	QES	TMA	TMA	RPSD

[a]TBs for VOCs only.
DSS = Drain and Septic Systems.
EB = Equipment blank.
PCB = Polychlorinated biphenyl.
QES = Quanterra Environmental Services.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
TMA = Thermo Analytical Inc./Eberline Laboratories.
VOC = Volatile organic compound.

were analyzed by off-site laboratories (Quanterra Environmental Services [QES] and Thermo Analytical Inc./Eberline Laboratories [TMA]) and at the on-site SNL/NM Radiation Protection Sample Diagnostics (RPSD) Laboratory. Table 2.2-3 summarizes the analytical methods and data quality requirements.

Table 2.2-3
Summary of Data Quality Requirements for DSS SWMU 138

Analytical Method[a]	Data Quality Level	QES	TMA	RPSD
VOCs EPA Method 8260	Defensible	14	None	None
SVOCs EPA Method 8270	Defensible	14	None	None
PCBs EPA Method 8082	Defensible	14	None	None
RCRA Metals plus Nickel EPA Method 6000/7000	Defensible	14	None	None
Total Cyanide EPA Method 9012A	Defensible	14	None	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	3
Isotopic Uranium HASL-300	Defensible	None	3	None
Tritium EPA-600 906.0	Defensible	None	3	None

Note: The number of samples does not include QA/QC samples such as duplicates, trip blanks, and equipment blanks.
[a]EPA methods from EPA (November 1986).
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
HASL = Health and Safety Laboratory New York (Environmental Measurements Laboratory).
PCB = Polychlorinated biphenyl.
QA/QC = Quality assurance/quality control.
QES = Quanterra Environmental Services.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TMA = Thermo Analytical Inc./Eberline Laboratories.
VOC = Volatile organic compound.

QA/QC samples were collected during the sampling effort according to the Environmental Restoration (ER) Project Quality Assurance Project Plan. The QA/QC samples consisted of one trip blank (for VOCs only), one set of field duplicate samples, and one set of equipment blanks. No significant QA/QC problems were identified in the QA/QC samples.

All of the DSS SWMU 138 soil sample results were verified/validated by SNL/NM. The off-site laboratory results from QES and TMA were reviewed according to "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or earlier ER Project Administrative Operating Procedures (AOPs). The gamma spectroscopy data from the RPSD Laboratory were reviewed according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996) or an earlier procedure. The reviews confirmed that the analytical data are defensible and therefore acceptable for use in this RSI response. Therefore, the data quality objectives (DQOs) outlined in the RFI Work Plan (SNL/NM March 1993) and the SAP for the RFI of septic tanks and drainfields (IT March 1994) have been fulfilled.

2.3 Determination of Nature, Rate, and Extent of Contamination

2.3.1 Introduction

The determination of the nature, migration rate, and extent of contamination at DSS SWMU 138 is based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from archival site research, site inspections, soil sampling, and passive soil-vapor sampling. The DQOs contained in the RFI Work Plan (SNL/NM March 1993), the SAP for the RFI of septic tanks and drainfields (IT March 1994), and subsequent negotiations with the NMED/HRMB identified the sample locations, sample density, sample depth, and analytical requirements. The sample data were subsequently used to develop the final conceptual site model for SWMU 138, which is presented in this risk assessment report. The quality of the data specifically used to determine the nature, migration rate, and extent of contamination is described in the following sections.

2.3.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at DSS SWMU 138 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, PCBs, RCRA metals plus nickel, cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The analytes and methods listed in Tables 2.2-2 and 2.2-3 are appropriate to characterize the COCs and potential degradation products at SWMU 138.

2.3.3 Rate of Contaminant Migration

The septic system at DSS SWMU 138 was deactivated in 1991 when Building 6630 was connected to an extension of the City of Albuquerque sanitary sewer system. The migration rate of COCs that may have been introduced into the subsurface via the septic system at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from this system when it was operational. Any migration of COCs from this site after use of the septic system was discontinued has been predominantly dependent upon precipitation. However, it is highly unlikely that sufficient precipitation has fallen on the site to reach the depth at which COCs may have been discharged to the subsurface from this system. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at SWMU 138.

2.3.4 Extent of Contamination

Subsurface soil samples were collected from eight sample locations beneath the effluent release areas (septic tank and drainfield) at the site to assess whether releases of effluent from the septic system caused any environmental contamination.

The soil samples were collected at sampling depths starting at 6.5 and 16.5 feet bgs in the drainfield boreholes, and 10 feet bgs in the boreholes adjacent to the septic tank. Sampling intervals started at the depths at which the effluent discharged from the drainfield drain lines and septic tank would have entered the subsurface environment at the site. This sampling procedure was required by NMED regulators, and similar sampling procedures have been used at numerous other DSS-type sites at SNL/NM. The soil samples are considered to be representative of the soil potentially contaminated with the COCs at this site and are sufficient to determine the vertical extent, if any, of COCs.

2.4 Comparison of COCs to Background Levels

Site history and characterization activities are used to identify potential COCs. Section 2.2 describes the sampling that was conducted in order to determine the concentration levels of COCs across the site. Generally, COCs evaluated in this risk assessment include all detected organic and all 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 2.4-1 and 2.4-2.

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 this risk assessment consist of both inorganic and organic compounds.

Table 2.4-1 lists the nonradiological COCs and Table 2.4-2 lists the radiological COCs for the human health risk assessment at DSS SWMU 138. All samples were collected from depths greater than 5 feet bgs; therefore, evaluation of ecological risk was not performed. Both tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section 2.6.4 discusses the results presented in Tables 2.4-1 and 2.4-2.

2.5 Fate and Transport

The primary releases of COCs at DSS SWMU 138 were to the subsurface soil resulting from the discharge of effluents from the Building 6630 septic system to the septic tank and drainfield. Wind, water, and biota are natural mechanisms of COC transport from the primary release point; however, because the discharge was to subsurface soil, none of these mechanisms are

Table 2.4-1
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 138 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	3.3	4.4	Yes	44[c]	--	**Yes**
Barium	497	214	**No**	170[d]	--	**Yes**
Cadmium	0.25[e]	0.9	Yes	64[c]	--	**Yes**
Chromium, total	13.0	15.9	Yes	16[c]	--	No
Cyanide	0.25[e]	NC	**Unknown**	NC	--	**Unknown**
Lead	7.5	11.8	Yes	49[c]	--	**Yes**
Mercury	0.05[e]	<0.1	Yes	5,500[c]	--	**Yes**
Nickel	108	11.5	**No**	47[c]	--	**Yes**
Selenium	0.25[e]	<1	Yes	800[f]	--	**Yes**
Silver	11.9	<1	**No**	0.5[c]	--	No
Organic						
Acetone	0.0079 J	NA	**NA**	0.69[g]	-0.24[g]	No
2-Chloronaphthalene	0.2 J	NA	**NA**	214[h]	2.15[h]	**Yes**
bis(2-Ethylhexyl) phthalate	0.165[e]	NA	**NA**	851[h]	7.6[i]	**Yes**
Methylene Chloride	0.0039 J	NA	**NA**	5[g]	1.25[g]	No
Phenol	0.165[e]	NA	**NA**	277[h]	1.46[h]	**Yes**
Toluene	0.0025[e]	NA	**NA**	10.7[c]	2.69[c]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998a.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).
[f]Callahan et al. 1979.
[g]Howard 1990.
[h]Howard 1989.
[i]Micromedex, Inc. 1998.

Table 2.4-1 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 138 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

BCF	= Bioconcentration factor.
COC	= Constituent of concern.
DSS	= Drain and Septic Systems.
J	= Estimated concentration.
K_{ow}	= Octanol-water partition coefficient.
Log	= Logarithm (base 10).
mg/kg	= Milligram(s) per kilogram.
NA	= Not applicable.
NC	= Not calculated.
NMED	= New Mexico Environment Department.
SNL/NM	= Sandia National Laboratories/New Mexico.
SWMU	= Solid Waste Management Unit.
--	= Information not available.

Table 2.4-2
Radiological COCs for Human Health Risk Assessment at DSS SWMU 138 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (All Samples) (pCi/g)[a]	SNL/NM Background Activity (pCi/g)[b]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[c] (BCF >40)
Cesium-137	ND (0.0150)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.658	1.01	Yes	3,000[d]	**Yes**
Tritium	**ND (0.125)**	0.021[e]	**No**	NA	No
Uranium-235	0.041	0.16	Yes	900[d]	**Yes**
Uranium-238	0.595	1.4	Yes	900[d]	**Yes**

Note: **Bold** indicates COCs that exceed the background screening values and/or are bioaccumulators.
[a]Value listed is the greater of either the maximum detection or the highest MDA.
[b]Dinwiddie September 1997, Southwest Area Supergroup.
[c]NMED March 1998a.
[d]Baker and Soldat 1992.
[e]Tharp February 1999, 420 pCi/L = 0.21 pCi/g assuming a soil density of 1 gram/cubic centimeter and a 5 percent soil moisture.

BCF = Bioconcentration factor.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

considered to be of potential significance as transport mechanisms at this site. Because the septic system is no longer active, additional infiltration of water is not expected. Infiltration of precipitation is essentially nonexistent at DSS SWMU 138, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 475 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

COCs at DSS SWMU 138 include both inorganic and organic constituents. The inorganic COCs are nonradiological and radiological analytes. With the exception of cyanide, the inorganic COCs 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). Cyanide can be metabolized by soil biota.

The organic COCs at DSS SWMU 138 include both VOCs and SVOCs. Organic COCs may be degraded through photolysis, hydrolysis, and biotransformation. Photolysis requires light and therefore takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and may occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) may occur; however, biological activity may be limited by the arid environment at this site. Because of the depth of the COCs in the soil, the loss of VOCs through volatilization is expected to be minimal.

Table 2.5-1 summarizes the fate and transport processes that can occur at DSS SWMU 138. The COCs at this site include nonradiological and radiological inorganic analytes and organic 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.

Table 2.5-1
Summary of Fate and Transport at DSS SWMU 138

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

DSS = Drain and Septic Systems.
SWMU = Solid Waste Management Unit.

2.6 Human Health Risk Assessment

2.6.1 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 estimated incremental 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 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.

2.6.2 Step 1. Site Data

Section 2.1 of this risk assessment provides the site description and history for DSS SWMU 138. Section 2.2 presents a comparison of results to DQOs. Section 2.3 discusses the nature, rate, and extent of contamination.

2.6.3 Step 2. Pathway Identification

DSS SWMU 138 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Annex A 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 and volatiles. 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 138 is approximately 475 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 2.6.3-1 shows the conceptual site model flow diagram for SWMU 138.

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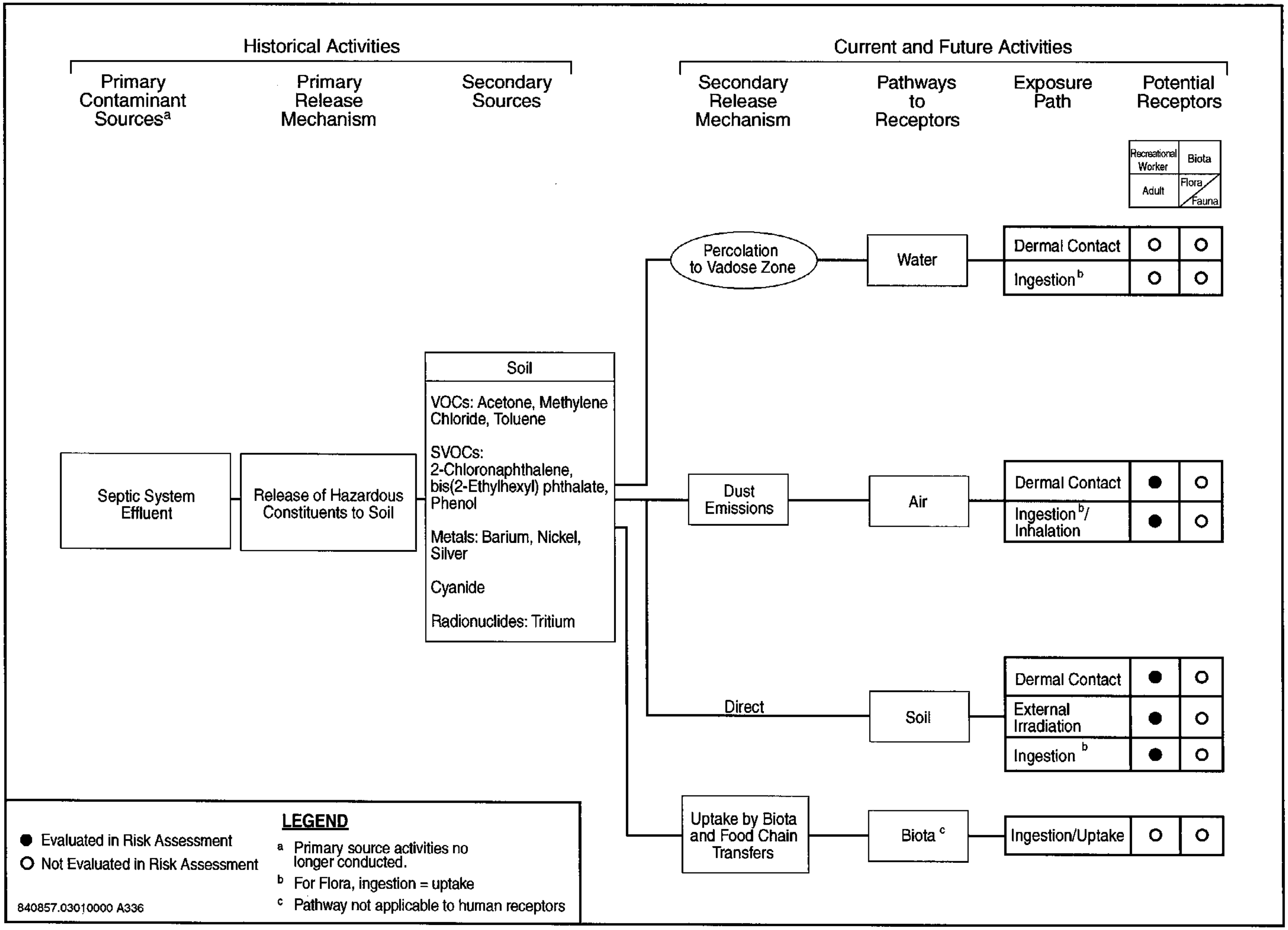

Figure 2.6.3-1
Conceptual Site Model Flow Diagram for DSS SWMU 138, Building 6630 Septic System

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust and volatiles)	Inhalation (dust)
Dermal contact	Direct gamma

2.6.4 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.

2.6.4.1 Methodology

Maximum concentrations of the nonradiological COCs are compared to the approved SNL/NM maximum screening levels for this area (Dinwiddie September 1997). The SNL/NM maximum background concentration was selected to provide the background screen in Table 2.4-1 and used to calculate risk attributable to background in Section 2.6.6.2. Only the COCs that were detected above the corresponding SNL/NM maximum background screening levels or that do not have either a quantifiable or calculated background screening level are considered in further risk assessment analyses.

For radiological COCs that exceed the SNL/NM background screening levels, background values are 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 a background value and were detected above the analytical minimum detectable activity (MDA) are carried through the risk assessment at the maximum activity levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

2.6.4.2 Results

Tables 2.4-1 and 2.4-2 show the DSS SWMU 138 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, three constituents were measured at concentrations greater than the background screening values. One constituent (cyanide) does not have a quantified background screening concentration; therefore, it is unknown whether this COC exceeds background. Six constituents are organic compounds that do not have corresponding background screening values.

For the radiological COCs, one constituent (tritium) exhibited an MDA value greater than the background screening level.

2.6.5 Step 4. Identification of Toxicological Parameters

Tables 2.6.5-1 (nonradiological) and 2.6.5-2 (radiological) 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 2.6.5-1 were obtained from the Integrated Risk Information System (IRIS) (EPA 2004a), the Technical Background Document for Development of Soil Screening Levels (NMED February 2004), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), Risk Assessment Information System (ORNL 2003), and EPA Regions 6 and 9 (EPA 2004b, EPA 2002a). 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 (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).
- 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).

2.6.6 Step 5. Exposure Assessment and Risk Characterization

Section 2.6.6.1 describes the exposure assessment for this risk assessment. Section 2.6.6.2 provides the risk characterization, including the HI and excess cancer risk for both the potential nonradiological COCs and associated background constituents for industrial and residential land-use scenarios.

2.6.6.1 Exposure Assessment

Annex A 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 annex shows parameters for both industrial and residential land-use scenarios. The equations for 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 February 2004), as well as other EPA and NMED guidance documents, and reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). Although the designated land-use scenario for this site is industrial, risk values for a residential land-use scenario are also presented.

Table 2.6.5-1
Toxicological Parameter Values for DSS SWMU 138 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
Inorganic								
Barium	7E-2[c]	M	1.4E-4[d]	--	--	--	D	0.01[e]
Cyanide	2E-2[c]	M	--	--	--	--	D	0.1[e]
Nickel	2E-2[c]	M	--	--	--	--	--	0.01[e]
Silver	5E-3[c]	L	--	--	--	--	D	0.01[e]
Organic								
Acetone	1E-1[c]	L	1E-1[f]	--	--	--	D	0.01[g]
2-Chloronaphthalene	8E-2[c]	L	8E-2[f]	--	--	--	--	0.01[g]
bis(2-Ethylhexyl) phthalate	2E-2[f]	--	2E-2[f]	--	1.4E-2[f]	1.4E-2[f]	--	0.01[g]
Methylene chloride	6E-2[c]	M	8.6E-1[d]	--	7.5E-3[c]	1.6E-3[c]	B2	0.1[e]
Phenol	3E-1[c]	M to H	6E-1[h]	--	--	--	D	0.1[e]
Toluene	2E-1[c]	M	1.1E-1[c]	M	--	--	D	0.1[e]

[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):

B2 = Probable human carcinogen. Sufficient evidence in animals and inadequate or no evidence in humans.

D = Not classifiable as to human carcinogenicity.

[c]Toxicological parameter values from IRIS electronic database (EPA 2004a).

[d]Toxicological parameter values from HEAST (EPA 1997a).

[e]Toxicological parameter values from NMED February 2004.

[f]Toxicological parameter values from EPA Region 6 electronic database (EPA 2004b).

[g]Toxicological parameter values from Risk Assessment Information System (ORNL 2003).

[h]Toxicological parameter values from EPA Region 9 (EPA 2002a).

ABS = Gastrointestinal absorption coefficient.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
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 2.6.5-2
Radiological Toxicological Parameter Values for DSS SWMU 138 COCs
Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Tritium	7.20E-14	9.60E-14	0	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.
DSS = Drain and Septic Systems.
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.

2.6.6.2 Risk Characterization

Table 2.6.6-1 shows an HI of 0.02 for the DSS SWMU 138 nonradiological COCs and an estimated excess cancer risk of 3E-8 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 2.6.6-2 shows an HI of 0.00 and no estimated excess cancer risk for the SWMU 138 associated background constituents under the designated industrial land-use scenario.

For the radiological COC, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario, a TEDE was calculated that results in an incremental TEDE of 5.3E-8 millirem (mrem)/year (yr). In accordance with EPA guidance found in Office 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 DSS SWMU 138 for the industrial land-use scenario is well below this guideline. The estimated excess cancer risk is 7.6E-14.

For the nonradiological COCs under the residential land-use scenario, the HI is 0.20 with an estimated excess cancer risk of 6E-8. The numbers in the table include exposure from soil ingestion, dermal contact, and dust and volatile 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. Because of the nature of the local soil, other exposure pathways are not considered (see Annex A). Table 2.6.6-2 shows an HI of 0.05 and no estimated excess cancer risk for the DSS SWMU 138 associated background constituents under the residential land-use scenario.

Table 2.6.6-1
Risk Assessment Values for DSS SWMU 138 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
Inorganic					
Barium	497	0.01	--	0.09	--
Cyanide	0.25[b]	0.00	--	0.00	--
Nickel	108	0.01	--	0.07	--
Silver	11.9	0.00	--	0.03	--
Organic					
Acetone	0.0079 J	0.00	--	0.00	--
2-Chloronaphthalene	0.2 J	0.00	--	0.00	--
bis(2-Ethylhexyl) phthalate	0.165[b]	0.00	9E-10	0.00	4E-9
Methylene Chloride	0.0039 J	0.00	3E-8	0.00	5E-8
Phenol	0.165[b]	0.00	--	0.00	--
Toluene	0.0025[b]	0.00	--	0.00	--
Total		**0.02**	**3E-8**	**0.20**	**6E-8**

[a]EPA 1989.
[b]Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 2.6.6-2
Risk Assessment Values for DSS SWMU 138 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
Barium	214	0.00	--	0.04	--
Cyanide	NC	--	--	--	--
Nickel	11.5	0.00	--	0.01	--
Silver	<1	--	--	--	--
Total		**0.00**	**--**	**0.05**	**--**

[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]EPA 1989.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
NC = Not calculated.
SWMU = Solid Waste Management Unit.
-- = Information not quantified.

For the radiological COC, the incremental TEDE for the residential land-use scenario is 3.6E-5 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 DSS SWMU 138 for the residential land-use scenario is well below this guideline. Consequently, SWMU 138 is eligible for unrestricted radiological release as 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 4.0E-11. 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 2.6.9.

2.6.7 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 0.02 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The estimated excess cancer risk is 3E-8. 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 considering 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 screening concentrations are assumed to have a hazard quotient of 0.00. The incremental HI is 0.02 and the estimated incremental excess cancer risk is 2.62E-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 the radiological COC under the industrial land-use scenario, the incremental TEDE is 5.3E-8 mrem/yr, which is significantly lower than the EPA's numerical guideline of 15 mrem/yr (EPA 1997b). The estimated incremental excess cancer risk is 7.6E-14.

The calculated HI is 0.20 for the nonradiological COCs under the residential land-use scenario, which is below the numerical guidance. The estimated excess cancer risk is 6E-8. 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 well below the suggested acceptable risk value. The incremental HI is 0.15 and the estimated incremental excess cancer risk is 5.76E-8 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under the residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological component is 3.6E-5 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 1998). The estimated excess cancer risk is 4.0E-11.

2.6.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS SWMU 138 is based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with procedures and DQOs in the RFI Work Plan (SNL/NM March 1993), the SAP for the RFI of septic tanks and drainfields (IT March 1994), and subsequent negotiations with the NMED/HRMB. The data from soil samples collected at effluent release points are representative of potential COC releases to the site. The analytical requirements and results satisfy the DQOs, and data quality was verified/validated in accordance with SNL/NM procedures in place at the time the sampling was conducted. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at SWMU 138.

Because of the location, history of the site, 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 the near-surface soil and the location and physical characteristics of the site, there is little 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 are probably overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table 2.6.5-1 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 Regions 6 and 9 (EPA 2004b, EPA 2002a), Risk Assessment Information System (ORNL 2003), and Technical Background Document for Development of Soil Screening Levels (NMED February 2004). Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2004a), Technical Background Document for Development of Soil Screening Levels (NMED February 2004), Risk Assessment Information System (ORNL 2003), or 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.

Risk assessment values for nonradiological COCs are within the acceptable range for human health under the industrial and residential land-use scenarios compared to established numerical guidance. For the radiological COC, the conclusion of the risk assessment is that potential effects on human health for both the industrial and residential land-use scenarios are below background and represent only a small fraction of the estimated 360 mrem/yr received by the average U.S. population (NCRP 1987). 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.

2.6.9 Summary

DSS SWMU 138 contains identified COCs consisting of some inorganic and organic 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 and volatile 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 (0.02) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 3E-8; thus, excess cancer risk is also well below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.02 and the estimated incremental excess cancer risk is 2.62E-8 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health under 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 (0.20) is below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 6E-8. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.15 and the estimated incremental excess cancer risk is 5.76E-8 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health under the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from the radiological COC are much less than EPA guidance values. The estimated TEDE is 5.3E-8 mrem/yr for the industrial land-use scenario, which is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding estimated incremental cancer risk value is 7.6E-14 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 3.6E-5 mrem/yr with an associated risk of 4.0E-11. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 138 is eligible for unrestricted radiological release.

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 (EPA 1997b). The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 2.6.9-1.

Table 2.6.9-1
Summation of Incremental Nonradiological and Radiological Risks from
DSS SWMU 138, Building 6630 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	2.62E-8	7.6E-14	2.62E-8
Residential	5.76E-8	4.0E-11	5.76E-8

DSS = Drain and Septic Systems.
SWMU = Solid Waste Management Unit.

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 both the industrial and residential land-use scenarios.

2.7 Ecological Risk Assessment

2.7.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS SWMU 138. A component of the NMED Risk-Based Decision Tree (NMED March 1998a) is to conduct an ecological risk assessment that corresponds with that presented in the EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment if warranted by the results of the scoping assessment. Initial components of the NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. At the end of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary.

2.7.2 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 with respect to the existence of complete ecological exposure pathways, an evaluation of bioaccumulation potential, and a summary of fate and transport potential. A scoping risk-management decision (Section 2.7.2.4) summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

2.7.2.1 Data Assessment

As indicated in Section 2.4, all COCs at DSS SWMU 138 are located at depths of 5 feet bgs or greater. Therefore, no complete ecological exposure pathways exist at this site and no COCs are considered to be COPECs.

2.7.2.2 Bioaccumulation

Because no COPECs are associated with this site, bioaccumulation potential is not evaluated.

2.7.2.3 Fate and Transport Potential

The potential for the COCs to migrate from the source of contamination to other media or biota is discussed in Section 2.5. As noted in Table 2.5-1, wind, surface water, and biota (food chain uptake) are expected to be of low significance as transport mechanisms for COCs at this site.

Degradation, transformation, and radiological decay of the COCs also are expected to be of low significance.

2.7.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it is concluded that complete ecological pathways are not associated with COCs at this site; therefore, no COPECs exist at the site, and a more detailed risk assessment was not deemed necessary to predict the potential level of ecological risk associated with the site.

3.0 RECOMMENDATION FOR CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS DETERMINATION

3.1 Rationale

Based upon field investigation data and the human health and ecological risk assessment analyses, a determination of Corrective Action Complete (CAC) without controls (NMED April 2004) is recommended for DSS SWMU 138 for the following reasons:

- The soil has been sampled for all potential COCs.
- No COCs are present in the soil at levels considered hazardous to human health for either an industrial or residential land-use scenario.
- None of the COCs warrant ecological concern because no complete pathways exist at the site.

3.2 Criterion

Based upon the evidence provided in the risk assessment, a determination of CAC without controls (NMED April 2004) is recommended for DSS SWMU 138. This is consistent with the NMED's NFA Criterion 5, which states, "the SWMU/AOC has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998b).

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ANNEX A
DSS SWMU 138
Exposure Pathway Discussion for Chemical and Radionuclide Contamination

ANNEX A
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)

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.

<u>Summary</u>

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) for Noncarcinogenic Compounds (= ED x 365 day/yr)	25,550[a,b] 9,125[a,b]	25,550[a,b] 10,950[a,b]	25,550[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 December 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	1.36E-5[d]	1.36E-5[d]	1.36E-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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